Exhibit F:

Group Exhibits



Index to Exhibit F - Group Exhibits

ID #	As Referenced in Respondent's MFPSJ	As Titled In Discovery	Bate Stamp Numbers:		
4.3	1/11/18 – CWLP notification to Illinois EPA of ceasing Part 620 sampling to follow Part 257	1.11.2018 CWLP letter	CWLP	00986	00987
4.4	6/21/13 –Andrews submits statistical backgrounds for ash pond network to Illinois EPA	1.21.2013 CWLP GW Report (should be 6.21.2013)	CWLP	00988	01100
4.6	2/20/2014 – CWLP receives Violation Notion ("VN") from Illinois EPA	2.20.2014 IEPA VN	CWLP	01110	01115
4.7	4/2/14 – CWLP proposes Compliance Commitment Agreement ("CCA") to Illinois EPA	4.2.2014 CWLP GW VN	CWLP	01116	01119
4.8	4/11/14 – Illinois EPA acknowledges receipt of CCA and proposes a 4/22/14 meeting	4.11.2014 IEPA letter	CWLP	01120	01120
4.10	5/12/2014 – CWLP proposes a revised CCA	5.12.2014 CWLP GW CCA VN	CWLP	01122	01125
4.11	5/29/2014 – CCA is rejected	5.29.2014 IEPA GW CCA Response	CWLP	01126	01126
4.12	5/30/2012 – Andrews Engineering submits logs, well reports and data for AP1, AP2 and AP3	5.30.2013 CWLP GW Request	CWLP	01127	01168
4.15	10/19/2011 – Illinois EPA requests backgrounds to be developed	10.19.2011 IEPA GW Response	CWLP	01174	01178
4.17	11/18/2011 – CWLP submits groundwater monitoring program to Illinois EPA	11.18.2011 CWLP GWMP	CWLP	01180	01208
4.28	8/3/2011 – Illinois EPA reviews June 2010 groundwater data and requests a meeting	2011 IEPA CWLP letters	CWLP	01328	01336
5.3	7/28/2010 - USEPA request to access property for inspection	7.20.2010 USEPA letter	CWLP	01508	01510
5.5	8/8/2011 – CWLP responds to USEPA inspection report and provides an action plan	CWLP Response Letter 8.8.2011	CWLP	01512	01516
5.12	5/10/2011 – USEPA ash pond inspection final report with recommendations	USEPA Site Assessment Final Report 5.10.2011	CWLP	01616	01693
6.1	9/22/2010 – CWLP submits hydrological assessment and well sampling data to Illinois EPA	2010 Ash Pond Impoundment Hydrogeological Assessment	CWLP	01694	01833
6.5	1/31/2018 – CWLP uploaded Annual Groundwater Monitoring and Corrective Action Reports for Dallman and Lakeside CCR Surface Impoundments and Landfill	Annual Groundwater Monitoring and Corrective Action Report Year Ending December 31, 2017	CWLP	02027	02036
6.13	May 2019 to July 2019 CWLP performed Assessment Investigation for well RW-3	Temporary Wells Arsenic Data	CWLP	27466	27517
10.15	10/17/2017 - CCR Surface Impoundment Groundwater Monitoring Program	CCR Surface Impoundments Groundwater Monitoring Program	CWLP	08643	08715
10.18	10/17/2017 - CCR Landfill Groundwater Monitoring System Certification	Groundwater Monitoring System Certification, April 2018	CWLP	26647	26648
10.19	7/11/2018 – CWLP established Groundwater Protection Standards	GWPS2018	CWLP	27435	27435

ID #	As Referenced in Respondent's MFPSJ	As Titled In Discovery	Bate Stamp Numbers:		
10.20	2/28/2018 – CWLP uploaded Assessment Monitoring Program notification	CWLP CCR Assessment Monitoring Notification 2018	CWLP	27436	27436
10.21	7/11/18 - CCR Surface Impoundments Notification of Statistically Significant Increase	July 2018 SSI Notification FINAL	CWLP	27437	27437
10.22	11/16/2018 - CCR Surface Impoundment Location Restrictions Demonstration	Location Requirements 10-2018	CWLP	27438	27440
10.28	5/6/2019 - Assessment of Corrective Measures Extension	CWLP Assessment of Corrective Measures Extension May 2019	CWLP	29236	29237
10.29	8/5/2019 – CWLP uploaded Completion of Corrective Measures	CWLP CCR Completion of Corrective Measures 2019	CWLP	29238	29239
10.30	4/5/2019 – CWLP uploaded Initiation of Assessment of Corrective Measures	CWLP CCR Initiation of Assessment of Corrective Measures	CWLP	29240	29240
10.31	5/6/2019 - Notification of Intent to Comply with Alternative Closure Requirements	CWLP Notification of Intent to Comply with 257.103(a)(1)	CWLP	29241	29243
11.1	10/17/2016 - Liner Status Report for Coal Combustion Residuals Surface Impoundments	03 - CWLP 2016 Surface Impoundment Liner Rpt	CWLP	09379	09382
11.2	10/17/2016 - History of Construction Report for CCR Surface Impoundments	04 - CWLP 2016 History of Const Rpt	CWLP	09383	09403
16.15	10/17/2017 - CCR Surface Impoundments Groundwater Statistical Method Certification	CCR Surface Impoundments Groundwater Monitoring Program	CWLP	12911	12983
24.9	10/17/2017 - CCR Surface Impoundments Groundwater Monitoring System Certification	CCR Surface Impoundments Groundwater Monitoring Program	CWLP	26331	26403
31.8	10/17/2016 - Initial Hazard Potential Classification Assessment Report for CCR Surface Impoundments	Initial Hazard Potential October 2016	CWLP	29616	29621
31.9	10/17/2016 - Initial Safety Factor Assessment for CCR Surface Impoundments	Initial Safety Factor October 2016	CWLP	29622	29854

4.3

4.3	1/11/18 – CWLP notification to Illinois EPA of ceasing Part 620 sampling to follow Part 257	1.11.2018 CWLP letter	CWLP	00986	00987

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OFFICE OF PUBLIC UTILITIES
CITY OF SPRINGFIELD, ILLINOIS

JAMES O. LANGFELDER, MAYOR
ENVIRONMENTAL HEALTH & SAFETY

January 11, 2018

Illinois Environmental Protection Agency
Bureau of Water
Attn. Darin LeCrone, Acting Manager
Permit Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

Dear Mr. LeCrone

This letter is to inform you that City Water, Light & Power (CWLP) intends to cease sampling the complete groundwater parameter lists from 35 Illinois Administrative Code Part 620.410 (a) Inorganic Chemical Constituents and (b) Organic Chemical Constituents, starting in the first quarter of 2018. As you know, CWLP has been voluntarily sampling these lists quarterly since the third quarter of 2011. On April 17, 2015 (effective October 19, 2015), USEPA finalized 40 CFR Part 257 Subpart D – Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments (CCR) rule.

In accordance with the CCR rule, CWLP has been and will continue to sample groundwater at our landfill and ash impoundments in accordance with our CCR Ground Water Monitoring Program, which includes Appendix III to Part 257 constituents (boron, calcium, chloride, fluoride, pH, sulfate, and total dissolved solids (TDS)) and Appendix IV to Part 257 constituents (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, selenium, thallium, and radium 226 and 228 combined).

The CCR Appendix III constituents have been chosen by USEPA since they are known to be leading indicators of releases of contaminants associated with coal combustion residuals and the USEPA strongly recommends that State Directors add these constituents to the list of indicator parameters to be monitored during detection monitoring of groundwater (Federal Register/Vol. 80, No. 74/Friday, April 17, 2015/Rules and Regulations, page 21342).

CWLP appreciates your understanding in this matter in order to streamline regulatory requirements. It is our understanding that the Board is still developing 35 Illinois Administrative

Response to 1st RTP
CWLP - 00986

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Code Part 841 Coal Combustion Waste (CCW) Ash and Surface Impoundments at Power Generating Facilities, once finalized CWLP will also diligently follow this regulation.

If you should have any questions or require further information, please feel free to contact me at your convenience at (217) 757-8610.

Sincerely,

P.J. Becker
Environmental Health and Safety Manager

cc: Bill Buscher, Groundwater Section
Deborah Williams, CWLP
Sue Corcoran, CWLP
Eric Staley, CWLP

4.4

4.4	6/21/13 –Andrews submits statistical backgrounds for ash pond network to Illinois EPA	1.21.2013 CWLP GW Report (should be 6.21.2013)	CWLP	00988	01100

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ANDREWS ENGINEERING, INC.

June 21, 2013

Alan Keller, P.E., Manager, Permit Section
Illinois Environmental Protection Agency
Division of Water Pollution Control
Compliance Assurance Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Re: City Water, Light and Power
Power Plant Ash Impoundment
Background Groundwater Concentrations

Dear Mr. Keller:

On behalf of City Water, Light and Power, City of Springfield, Illinois (CWLP), submitted herein are the statistical background concentrations for the groundwater monitoring wells pursuant to the Groundwater Monitoring Program submitted November 18, 2011 and subsequent Illinois EPA correspondence dated December 29, 2011.

The monitor well network consists of six wells, two upgradient (AP-4 and AP-5), and four downgradient wells (AW-3, AP-1, AP-2, and AP-3). Four quarters of data were collected from first quarter 2012 through fourth quarter 2012. The analytical results from each well were evaluated to ensure the data from the upgradient wells would represent background conditions. Based on variations in concentrations, it was determined the groundwater quality in the upgradient wells would represent background conditions. Therefore, four quarters of data from both wells AP-4 and AP-5 were combined for purposes of statistical derivation of the background concentrations.

The statistical method used in determining the background calculations was provided in Appendix A to the Groundwater Monitoring Program. The 95 percent confidence limit was calculated utilizing data collected from first quarter 2012 through fourth quarter 2012 from upgradient wells AP-4 and AP-5. The results from the two wells were pooled together in order to calculate the confidence limit. The statistical calculations are provided in Attachment 1 to this correspondence.

Several parameters in upgradient well AP-5 exhibited significant decreasing trends during the background sampling events. The parameters included cadmium, chromium, iron, lead, and nickel. Trend graphs for the subject parameters are provided in Attachment 2. Utilizing this data would artificially elevate the background concentrations due to a large standard deviation within the statistical formula. Since the groundwater quality in well AP-5 has not stabilized, additional quarterly data for the subject parameters shall be collected through fourth quarter 2013 in order to obtain data representative of background conditions. Once statistically valid

3300 Ginger Creek Drive, Springfield, Illinois 62711 ◆ 217.787.2334 fax 217.787.9495 www.andrews-eng.com

data has been collected, revised background concentrations for the referenced parameters shall be submitted to the Illinois EPA Bureau of Water.

The laboratory results for five quarters of data for all six wells are provided in Attachment 3. A compact disc containing a list of the background concentrations and quarterly results is provided in Attachment 4. There are two inorganic parameters, total cyanide and total silver, that have not been detected in five quarters of sampling. Therefore, it is requested to remove these parameters from the quarterly monitoring list for the facility. These parameters will only be tested on an annual frequency during second quarter of each year. Additionally, no organic parameters have been detected in any of the monitoring wells. A list of the organic parameters that have not been detected in the monitoring wells is provided in Attachment 5. It is requested to remove these parameters from the quarterly monitoring list and test them on an annual frequency during second quarter of each year.

If you have any questions or require further information, please contact me.

Sincerely,

Kim E. Van Pelt
Environmental Scientist

KEV:kev:slm

Enclosures

cc: Sue Corcoran – Environmental Health and Safety, City Water Light and Power, City of Springfield
Illinois EPA DWPC Springfield Region
Illinois EPA Hydrogeology and Compliance Unit

Attachment 1
Statistical Calculations

CWLP Ash Ponds
Interwell AGQS Statistics
Distribution Summary

Well	Parameter	Units	1Q12	2Q12	3Q12	4Q12	Distribution*	Proposed Interwell
AP-4	Antimony, total	mg/l	< 0.006	< 0.006	< 0.006	< 0.006	Not Normal - Propose Highest Detected Concentration as Interwell AGQS	0.0063
AP-5	Antimony, total	mg/l	< 0.006	< 0.006	0.0063	< 0.0096		
AP-4	Arsenic, total	mg/l	< 0.05	< 0.05	0.0294	0.0061	Normal - Calculate Interwell AGQS	0.16
AP-5	Arsenic, total	mg/l	< 0.05	0.076	0.102	0.0243		
AP-4	Barium, total	mg/l	< 2	< 2	0.366	< 2	Normal - Calculate Interwell AGQS	5.24
AP-5	Barium, total	mg/l	5.24	< 2	2.76	< 3.2		
AP-4	Beryllium, total	mg/l	< 0.004	< 0.004	< 0.004	< 0.004	Normal - Calculate Interwell AGQS	0.02
AP-5	Beryllium, total	mg/l	0.0142	0.0128	0.0092	0.0164		
AP-4	Boron, total	mg/l	0.119	0.123	0.787	< 2	Not Normal - Propose Highest Detected Concentration as Interwell AGQS	0.787
AP-5	Boron, total	mg/l	< 1	< 0.625	0.782	< 3.2		
AP-4	Cadmium, total	mg/l	< 0.005	< 0.005	< 0.005	< 0.005	Normal - Calculate Interwell AGQS	0.0128
AP-5	Cadmium, total	mg/l	0.0078	0.0128	0.0058	< 0.008		
AP-4	Chloride, total	mg/l	10.1	9.85	11	10.5	Not Normal - Propose Highest Detected Concentration as Interwell AGQS	24.2
AP-5	Chloride, total	mg/l	24.2	7.23	3.32	3.76		
AP-4	Chromium, total	mg/l	< 0.1	< 0.1	< 0.0175	< 0.1	Normal - Calculate Interwell AGQS	0.99
AP-5	Chromium, total	mg/l	0.811	0.328	0.449	0.42		
AP-4	Cobalt, total	mg/l	< 1	< 1	< 0.0175	< 1	Not Normal - Propose Highest Detected Concentration as Interwell AGQS	0.297
AP-5	Cobalt, total	mg/l	< 1	< 1	0.297	< 1.6		
AP-4	Copper, total	mg/l	< 0.65	< 0.65	< 0.01	< 0.65	Not Normal - Propose Highest Detected Concentration as Interwell AGQS	0.401
AP-5	Copper, total	mg/l	< 0.65	< 0.65	0.401	< 1.04		
AP-4	Cyanide, total	mg/l	< 0.01	< 0.2	< 0.2	< 0.01	100% ND - Propose PQL	0.01
AP-5	Cyanide, total	mg/l	< 0.01	< 0.2	< 0.01	< 0.01		
AP-4	Fluoride, total	mg/l	< 0.5	< 0.5	< 0.5	< 0.5	Not Normal - Propose Highest Detected Concentration as Interwell AGQS	0.62
AP-5	Fluoride, total	mg/l	0.62	< 0.5	< 0.5	< 0.5		
AP-4	Iron, total	mg/l	11	9.22	10.8	< 5	Normal - Calculate Interwell AGQS	1832
AP-5	Iron, total	mg/l	1140	435	430	576		
AP-4	Lead, total	mg/l	< 0.0075	< 0.0075	< 0.005	< 0.0075	Normal - Calculate Interwell AGQS	0.78
AP-5	Lead, total	mg/l	0.638	0.236	0.312	0.277		
AP-4	Manganese, total	mg/l	0.254	0.186	0.162	< 0.15	Normal - Calculate Interwell AGQS	44.6
AP-5	Manganese, total	mg/l	21.4	7.91	12.3	23.2		
AP-4	Mercury, total	mg/l	< 0.0005	< 0.0005	< 0.0005	< 0.0005	Not Normal - Propose Highest Detected Concentration as Interwell AGQS	0.0008
AP-5	Mercury, total	mg/l	0.0008	< 0.0005	0.0007	< 0.0005		
AP-4	Nickel, total	mg/l	< 0.1	< 0.1	< 0.01	< 0.1	Normal - Calculate Interwell AGQS	0.89
AP-5	Nickel, total	mg/l	0.358	0.539	0.7	0.321		
AP-4	Nitrate, total	mg/l	0.12	< 0.05	< 0.5	0.26	Normal - Calculate Interwell AGQS	0.4
AP-5	Nitrate, total	mg/l	0.15	< 0.05	< 0.5	0.25		
AP-4	pH (field)	units	6.81	7.07	7.63	7.09	Normal - Calculate Interwell AGQS	6.61 - 7.81
AP-5	pH (field)	units	7.33	7.19	7.27	7.29		
AP-4	Selenium, total	mg/l	< 0.05	< 0.05	0.005	< 0.05	Not Normal - Propose Highest Detected Concentration as Interwell AGQS	0.0059
AP-5	Selenium, total	mg/l	< 0.05	< 0.05	0.0059	< 0.08		
AP-4	Silver, total	mg/l	< 0.05	< 0.05	< 0.005	< 0.05	100% ND - Propose PQL	0.05
AP-5	Silver, total	mg/l	< 0.05	< 0.05	< 0.005	< 0.08		

CWLP Ash Ponds
Interwell AGQS Statistics
Distribution Summary

Well	Parameter	Units	1Q12	2Q12	3Q12	4Q12	Distribution*	Proposed Interwell
AP-4	Sulfate, total	mg/l	< 5	< 5	< 5	< 5	Normal - Calculate Interwell AGQS	125.8
AP-5	Sulfate, total	mg/l	82.3	43.5	76.8	84.5		
AP-4	Thallium, total	mg/l	< 0.002	< 0.002	< 0.002	< 0.002	Normal - Calculate Interwell AGQS	0.0056
AP-5	Thallium, total	mg/l	0.0056	0.0026	0.003	< 0.0032		
AP-4	Total Dissolved Solids	mg/l	490	560	448	574	Normal - Calculate Interwell AGQS	772.8
AP-5	Total Dissolved Solids	mg/l	414	404	316	404		
AP-4	Zinc, total	mg/l	< 0.0575	< 5	< 0.025	< 5	Not Normal - Propose Highest Detected Concentration as Interwell AGQS	1.35
AP-5	Zinc, total	mg/l	0.822	< 5	1.35	< 8		

Notes:
*Shapiro-Wilk utilized to test for normality

CWLP Ash Ponds
Interwell AGQS Statistics
Distribution Summary

Parameter Name	Units	AP-4 1Q12	AP-4 2Q12	AP-4 3Q12	AP-4 4Q12	AP-5 1Q12	AP-5 2Q12	AP-5 3Q12	AP-5 4Q12
pH (field)	units	6.81	7.07	7.63	7.09	7.33	7.19	7.27	7.29
Nitrate, total	mg/l	0.12	< 0.05	< 0.5	0.26	0.15	< 0.05	< 0.5	0.25
Sulfate, total	mg/l	< 5	< 5	< 5	< 5	82.3	43.5	76.8	84.5
Total Dissolved Solids	mg/l	490	560	448	574	414	404	316	404
Arsenic, total	mg/l	< 0.05	< 0.05	0.0294	0.00608	< 0.05	0.076	0.102	0.0243
Barium, total	mg/l	< 2	< 2	0.366	< 2	5.24	< 2	2.76	< 3.2
Beryllium, total	mg/l	< 0.004	< 0.004	< 0.004	< 0.004	0.0142	0.0128	0.0092	0.0164
Cadmium, total	mg/l	< 0.005	< 0.005	< 0.005	< 0.005	0.00776	0.0128	0.00575	< 0.008
Chromium, total	mg/l	< 0.1	< 0.1	< 0.0175	< 0.1	0.811	0.328	0.449	0.42
Iron, total	mg/l	11	9.22	10.8	< 5	1140	435	430	576
Lead, total	mg/l	< 0.0075	< 0.0075	< 0.005	< 0.0075	0.638	0.236	0.312	0.277
Manganese, total	mg/l	0.254	0.186	0.162	< 0.15	21.4	7.91	12.3	23.2
Nickel, total	mg/l	< 0.1	< 0.1	< 0.01	< 0.1	0.358	0.539	0.7	0.321
Thallium, total	mg/l	< 0.002	< 0.002	< 0.002	< 0.002	0.00556	0.00258	0.00302	< 0.0032

CWLP Ash Ponds
Interwell AGQS Statistics
Outlier Testing

Parameter Name	Units	AP-4 1Q12	AP-4 2Q12	AP-4 3Q12	AP-4 4Q12	AP-5 1Q12	AP-5 2Q12	AP-5 3Q12	AP-5 4Q12	Number of Samples	Mean	Standard Deviation	Critical Values
pH (field)	units	6.81	7.07	7.63	7.09	7.33	7.19	7.27	7.29	8	7.21	0.237607	2.221
Nitrate, total	mg/l	0.12	< 0.05	< 0.5	0.26	0.15	< 0.05	< 0.5	0.25	8	0.235	0.181344	2.221
Sulfate, total	mg/l	< 5	< 5	< 5	< 5	82.3	43.5	76.8	84.5	8	38.3875	37.82522	2.221
Total Dissolved Solids	mg/l	490	560	448	574	414	404	316	404	8	451.25	86.64501	2.221
Arsenic, total	mg/l	< 0.05	< 0.05	0.0294	0.00608	< 0.05	0.076	0.102	0.0243	8	0.048473	0.030178	2.221
Barium, total	mg/l	< 2	< 2	0.366	< 2	5.24	< 2	2.76	< 3.2	8	2.44575	1.393639	2.221
Beryllium, total	mg/l	< 0.004	< 0.004	< 0.004	< 0.004	0.0142	0.0128	0.0092	0.0164	8	0.008575	0.005276	2.221
Cadmium, total	mg/l	< 0.005	< 0.005	< 0.005	< 0.005	0.00776	0.0128	0.00575	< 0.008	8	0.006789	0.002737	2.221
Chromium, total	mg/l	< 0.1	< 0.1	< 0.0175	< 0.1	0.811	0.328	0.449	0.42	8	0.290688	0.266624	2.221
Iron, total	mg/l	11	9.22	10.8	< 5	1140	435	430	576	8	327.1275	405.2776	2.221
Lead, total	mg/l	< 0.0075	< 0.0075	< 0.005	< 0.0075	0.638	0.236	0.312	0.277	8	0.186313	0.226561	2.221
Manganese, total	mg/l	0.254	0.186	0.162	< 0.15	21.4	7.91	12.3	23.2	8	8.19525	9.804583	2.221
Nickle, total	mg/l	< 0.1	< 0.1	< 0.01	< 0.1	0.358	0.539	0.7	0.321	8	0.2785	0.245336	2.221
Thallium, total	mg/l	< 0.002	< 0.002	< 0.002	< 0.002	0.00556	0.00258	0.00302	< 0.0032	8	0.002795	0.001221	2.221

$T = (X-X_{mean})/SD$, where X = sample result

Parameter Name	Units	AP-4 1Q12	AP-4 2Q12	AP-4 3Q12	AP-4 4Q12	AP-5 1Q12	AP-5 2Q12	AP-5 3Q12	AP-5 4Q12
pH (field)	units	-1.68345	-0.58921	1.767624	-0.50504	0.505035	-0.08417	0.252518	0.33669
Nitrate, total	mg/l	-0.63415	-1.02016	1.46131	0.137859	-0.46872	-1.02016	1.46131	0.082716
Sulfate, total	mg/l	-0.88268	-0.88268	-0.88268	-0.88268	1.160932	0.135161	1.015526	1.219094
Total Dissolved Solids	mg/l	0.447227	1.255121	-0.03751	1.4167	-0.42992	-0.54533	-1.56097	-0.54533
Arsenic, total	mg/l	0.050616	0.050616	-0.63199	-1.40473	0.050616	0.912159	1.773702	-0.80099
Barium, total	mg/l	-0.31985	-0.31985	-1.49232	-0.31985	2.005002	-0.31985	0.225489	0.541209
Beryllium, total	mg/l	-0.86717	-0.86717	-0.86717	-0.86717	1.066198	0.800834	0.118466	1.483201
Cadmium, total	mg/l	-0.65364	-0.65364	-0.65364	-0.65364	0.35491	2.196608	-0.37958	0.44261
Chromium, total	mg/l	-0.71519	-0.71519	-1.02462	-0.71519	1.951484	0.139944	0.593767	0.484999
Iron, total	mg/l	-0.78003	-0.78442	-0.78052	-0.79483	2.005718	0.266169	0.253832	0.614079
Lead, total	mg/l	-0.78925	-0.78925	-0.80028	-0.78925	1.993672	0.219312	0.554763	0.400279
Manganese, total	mg/l	-0.80995	-0.81689	-0.81934	-0.82056	1.346794	-0.02909	0.418656	1.530381
Nickel, total	mg/l	-0.72757	-0.72757	-1.09442	-0.72757	0.324045	1.061809	1.718053	0.173232
Thallium, total	mg/l	-0.65116	-0.65116	-0.65116	-0.65116	2.26472	-0.1761	0.18429	0.331722

Outlier = $T > T_n$

Parameter Name	Units	AP-4 1Q12	AP-4 2Q12	AP-4 3Q12	AP-4 4Q12	AP-5 1Q12	AP-5 2Q12	AP-5 3Q12	AP-5 4Q12
pH (field)	units	--	--	--	--	--	--	--	--
Nitrate, total	mg/l	--	--	--	--	--	--	--	--
Sulfate, total	mg/l	--	--	--	--	--	--	--	--
Total Dissolved Solids	mg/l	--	--	--	--	--	--	--	--
Arsenic, total	mg/l	--	--	--	--	--	--	--	--
Barium, total	mg/l	--	--	--	--	--	--	--	--
Beryllium, total	mg/l	--	--	--	--	--	--	--	--
Cadmium, total	mg/l	--	--	--	--	--	--	--	--
Chromium, total	mg/l	--	--	--	--	--	--	--	--
Iron, total	mg/l	--	--	--	--	--	--	--	--
Lead, total	mg/l	--	--	--	--	--	--	--	--
Manganese, total	mg/l	--	--	--	--	--	--	--	--
Nickel, total	mg/l	--	--	--	--	--	--	--	--
Thallium, total	mg/l	--	--	--	--	X	--	--	--

Note: A shaded box indicates an outlier. The outlier was not removed from the dataset.

CWLP Ash Ponds
Interwell AGQS Statistics
Non Detect Analysis

Parameter Name	Units	AP-4 1Q12	AP-4 2Q12	AP-4 3Q12	AP-4 4Q12	AP-5 1Q12	AP-5 2Q12	AP-5 3Q12	AP-5 4Q12	Number of Samples	Number of ND's	% ND	ND Treatment
pH (field)	units	6.81	7.07	7.63	7.09	7.33	7.19	7.27	7.29	8	0	0.0%	NO ADJ
Nitrate, total	mg/l	0.12	< 0.05	< 0.5	0.26	0.15	< 0.05	< 0.5	0.25	8	4	50.0%	Cohen's ADJ / Kaplan-Meier
Sulfate, total	mg/l	< 5	< 5	< 5	< 5	82.3	43.5	76.8	84.5	8	4	50.0%	Cohen's ADJ / Kaplan-Meier
Total Dissolved Solids	mg/l	490	560	448	574	414	404	316	404	8	0	0.0%	NO ADJ
Arsenic, total	mg/l	< 0.05	< 0.05	0.0294	0.00608	< 0.05	0.076	0.102	0.0243	8	3	37.5%	Cohen's ADJ / Kaplan-Meier
Barium, total	mg/l	< 2	< 2	0.366	< 2	5.24	< 2	2.76	< 3.2	8	5	62.5%	Highest Conc.
Beryllium, total	mg/l	< 0.004	< 0.004	< 0.004	< 0.004	0.0142	0.0128	0.0092	0.0164	8	4	50.0%	Cohen's ADJ / Kaplan-Meier
Cadmium, total	mg/l	< 0.005	< 0.005	< 0.005	< 0.005	0.00776	0.0128	0.00575	< 0.008	8	5	62.5%	Highest Conc.
Chromium, total	mg/l	< 0.1	< 0.1	< 0.0175	< 0.1	0.811	0.328	0.449	0.42	8	4	50.0%	Cohen's ADJ / Kaplan-Meier
Iron, total	mg/l	11	9.22	10.8	< 5	1140	435	430	576	8	1	12.5%	½ MDL
Lead, total	mg/l	< 0.0075	< 0.0075	< 0.005	< 0.0075	0.638	0.236	0.312	0.277	8	4	50.0%	Cohen's ADJ / Kaplan-Meier
Manganese, total	mg/l	0.254	0.186	0.162	< 0.15	21.4	7.91	12.3	23.2	8	1	12.5%	½ MDL
Nickel, total	mg/l	< 0.1	< 0.1	< 0.01	< 0.1	0.358	0.539	0.7	0.321	8	4	50.0%	Cohen's ADJ / Kaplan-Meier
Thallium, total	mg/l	< 0.002	< 0.002	< 0.002	< 0.002	0.00556	0.00258	0.00302	< 0.0032	8	5	62.5%	Highest Conc.

Notes:
1. For datasets with a fraction of non-detect values from 25% to 50%, adjustments to the mean and standard deviation (SD) are required.
2. For datasets with a single censoring point (RL), Cohen's Ajustment may be used to adjust the mean and SD or a substitution of 1/2 the RL may be used for small datasets (<5) in accordance with Section 15.2 of the March 2009 Unified Guidance (Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities).
3. Kaplan-Meier may be used to adjust the mean and SD for datasets with single or multiple censoring points (RL). The Kaplan-Meier adjusted mean and SD were calculated using ProUCL 4.0.
2. For datasets that do not include non-detect values, no adjustment to the mean and standard deviation are required prior to calculating the prediction limit.

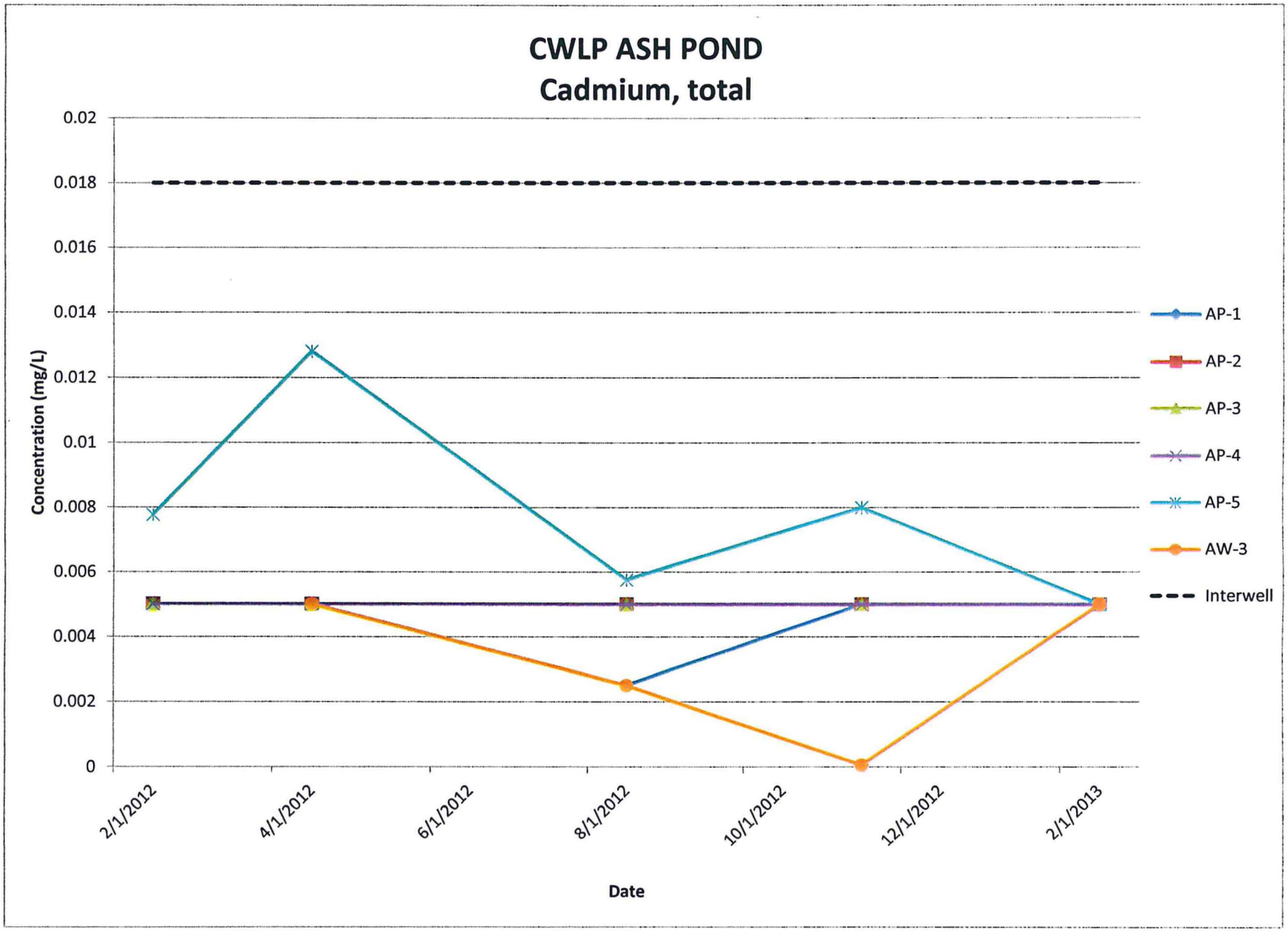
CWLP Ash Ponds
Interwell AGQS Statistics
Prediction Limits

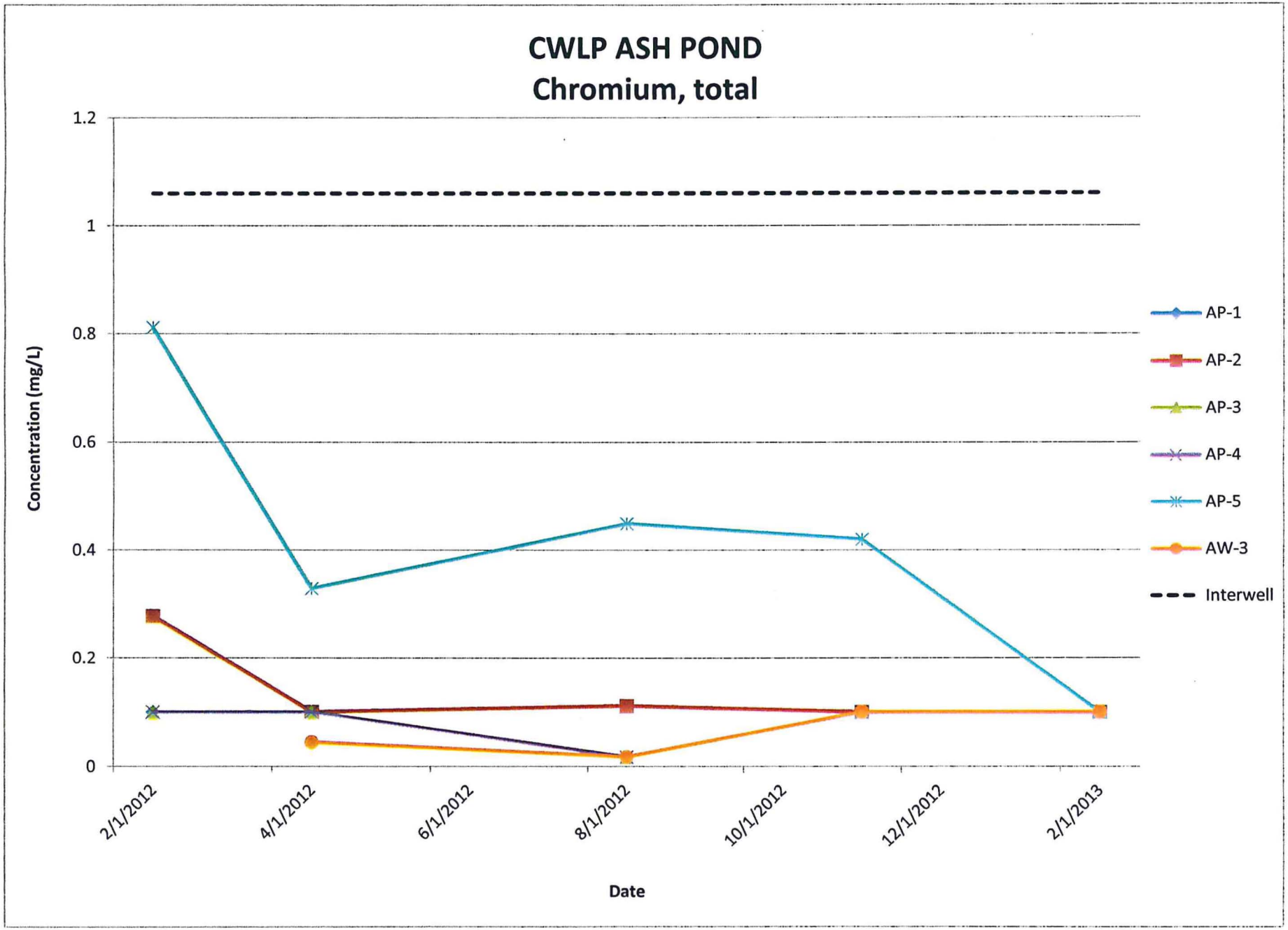
Confidence Limit = x + st[1+(1/n)]^^½
Confidence Level = 95%

Parameter Name	Units	AP-4 1Q12	AP-4 2Q12	AP-4 3Q12	AP-4 4Q12	AP-5 1Q12	AP-5 2Q12	AP-5 3Q12	AP-5 4Q12	ND Treatment	Mean	Standard Deviation	Number of Samples	T Value	Confidence Limit
pH (field)	units	6.81	7.07	7.63	7.09	7.33	7.19	7.27	7.29	NO ADJ	7.21	0.2376	8	2.3650	6.6140 | 7.8060
Nitrate, total	mg/l	0.12	< 0.05	< 0.5	0.26	0.15	< 0.05	< 0.5	0.25	Kaplan-Meier	0.17	0.0611	8	3.4990	0.3968
Sulfate, total	mg/l	< 5	< 5	< 5	< 5	82.3	43.5	76.8	84.5	Kaplan-Meier	57.65	18.3600	8	3.4990	125.7885
Total Dissolved Solids	mg/l	490	560	448	574	414	404	316	404	NO ADJ	451.25	86.6450	8	3.4990	772.8113
Arsenic, total	mg/l	< 0.05	< 0.05	0.0294	0.00608	< 0.05	0.076	0.102	0.0243	Kaplan-Meier	0.0372	0.0318	8	3.4990	0.1552
Beryllium, total	mg/l	< 0.004	< 0.004	< 0.004	< 0.004	0.0142	0.0128	0.0092	0.0164	Kaplan-Meier	0.0112	0.0027	8	3.4990	0.0213
Chromium, total	mg/l	< 0.1	< 0.1	< 0.0175	< 0.1	0.811	0.328	0.449	0.42	Kaplan-Meier	0.42	0.1560	8	3.4990	0.9940
Iron, total	mg/l	11	9.22	10.8	< 2.5	1140	435	430	576	½ MDL	326.82	405.5623	8	3.4990	1831.9581
Lead, total	mg/l	< 0.0075	< 0.0075	< 0.005	< 0.0075	0.638	0.236	0.312	0.277	Kaplan-Meier	0.30	0.1300	8	3.4990	0.7835
Manganese, total	mg/l	0.254	0.186	0.162	< 0.075	21.4	7.91	12.3	23.2	½ MDL	8.19	9.8134	8	3.4990	44.6059
Nickel, total	mg/l	< 0.1	< 0.1	< 0.01	< 0.1	0.358	0.539	0.7	0.321	Kaplan-Meier	0.40	0.1330	8	3.4990	0.8936

Note:
1. Multiple censoring points (RL's) were observed for several parameters. Therefore, Kaplan-Meier was utilized to adjust the mean and SD.

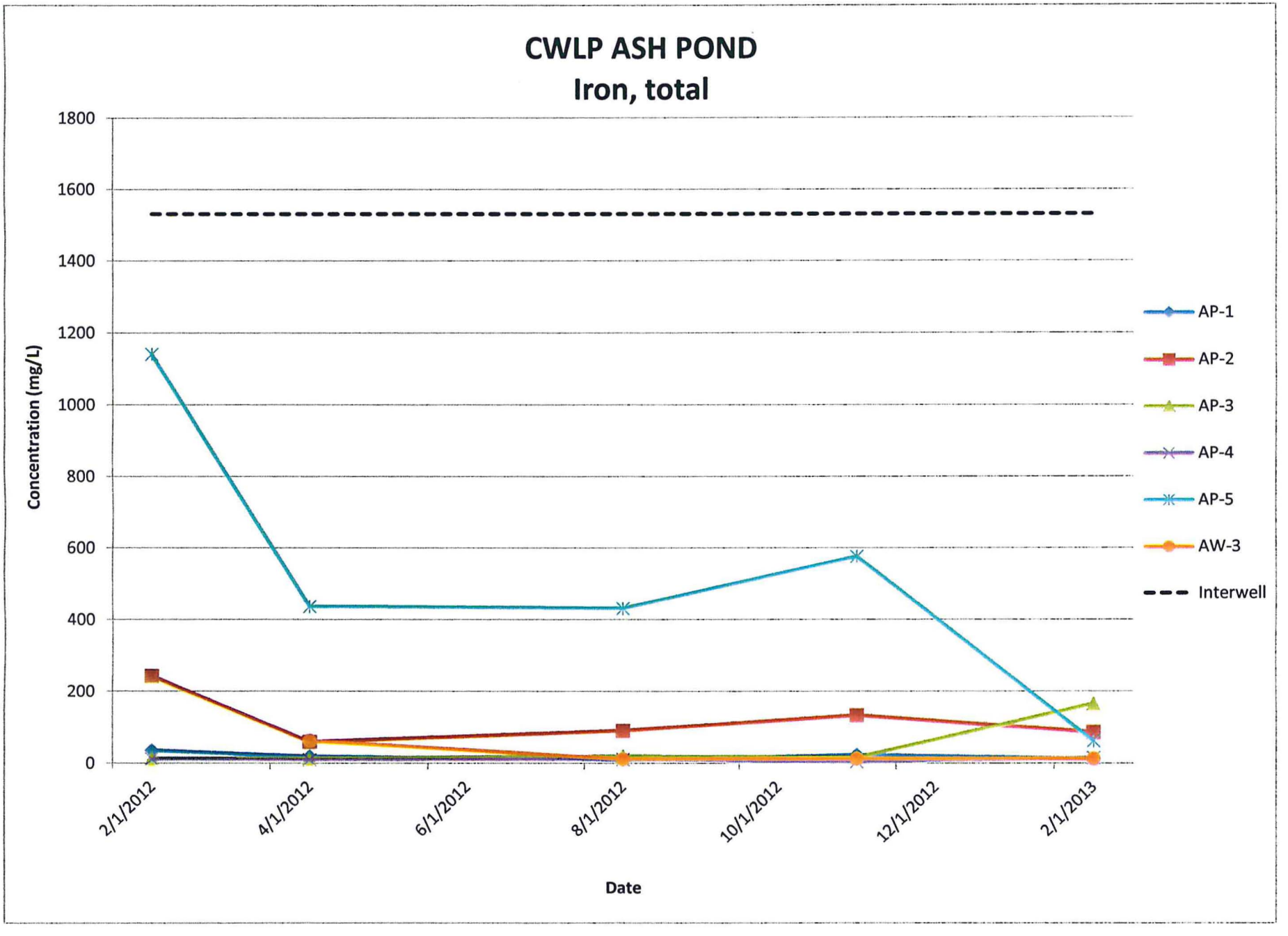
Attachment 2
Trend Graphs

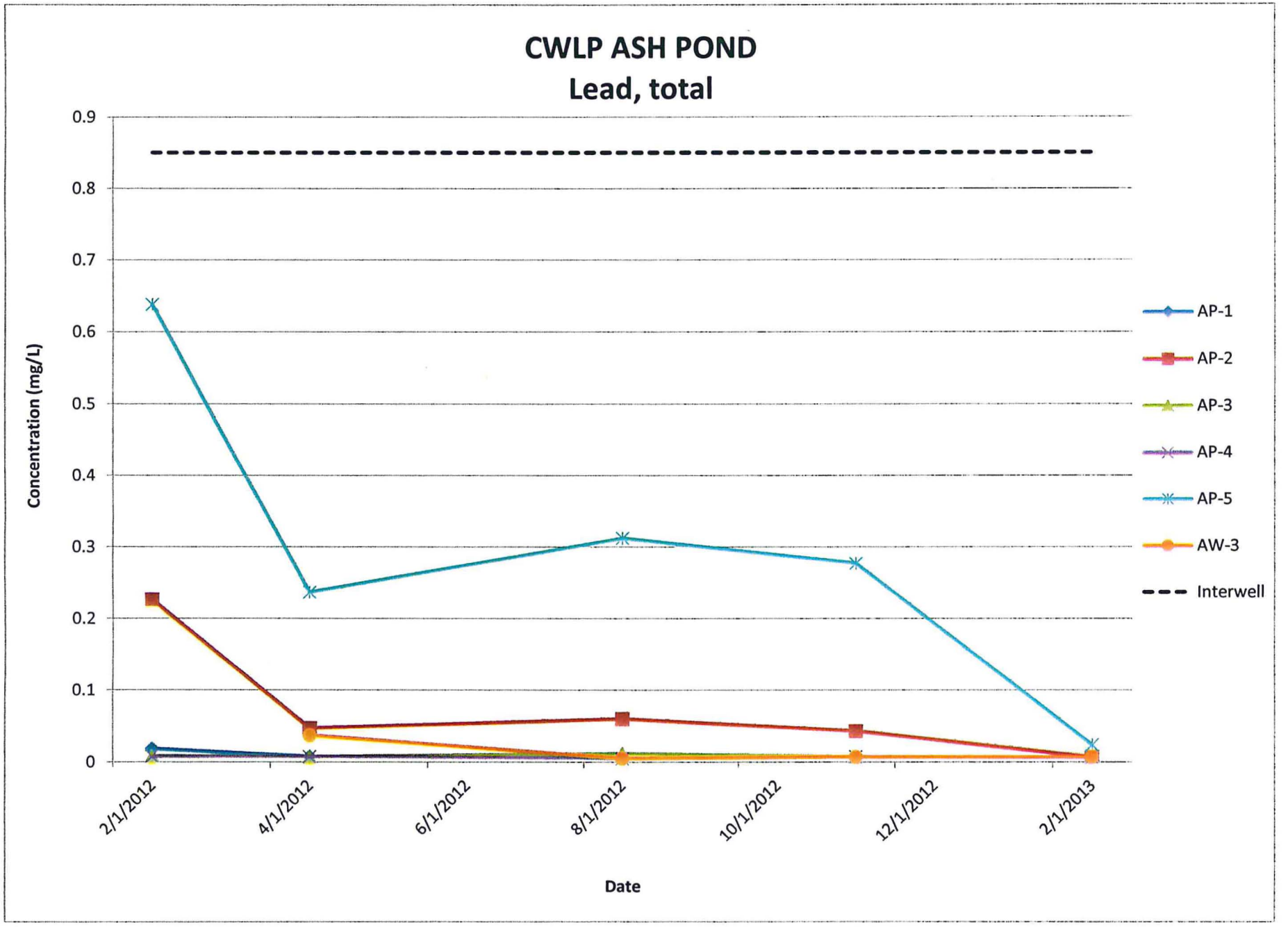

CWLP ASH POND
Cadmium, total
Concentration (mg/L)
0.02
0.018
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
2/1/2012
4/1/2012
6/1/2012
8/1/2012
10/1/2012
12/1/2012
2/1/2013
Date
AP-1
AP-2
AP-3
AP-4
AP-5
AW-3
Interwell

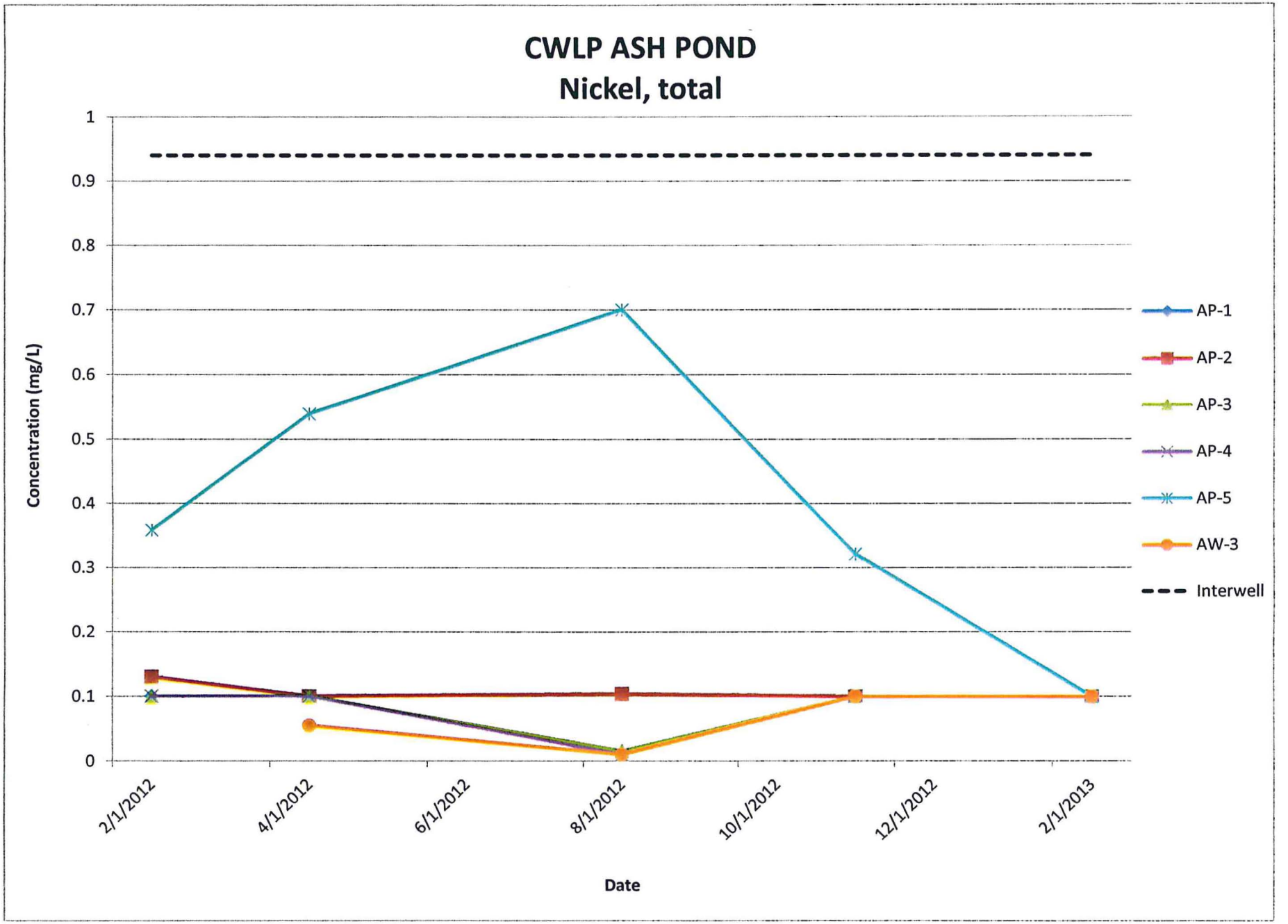


Andrews Engineering, Inc.

AP Well Summary
Cr (2)
Response to 1st RTP
CWLP - 00999


CWLP ASH POND
Iron, total
Concentration (mg/L)
1800
1600
1400
1200
1000
800
600
400
200
0
2/1/2012
4/1/2012
6/1/2012
8/1/2012
10/1/2012
12/1/2012
2/1/2013
Date
AP-1
AP-2
AP-3
AP-4
AP-5
AW-3
Interwell


CWLP ASH POND
Lead, total
Concentration (mg/L)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2/1/2012
4/1/2012
6/1/2012
8/1/2012
10/1/2012
12/1/2012
2/1/2013
Date
AP-1
AP-2
AP-3
AP-4
AP-5
AW-3
Interwell



Andrews Engineering, Inc.

AP Well Summary
Ni (2)

Attachment 3
Quarterly Laboratory Results

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Sue Corcoran
City, Water, Light & Power
201 East Lake Shore Drive
Springfield, IL 62707

April 12, 2012

RE CWLP AP Wells

Lab Orders:
12020654

Dear Sue Corcoran:

Enclosed are the analytical reports for the EMT Lab Order listed. Also included with this analytical report is a copy of the chain of custody associated with these samples. If you have any questions, please contact me at 847-967-6666.

Sincerely,

Joe Pavilonis
Project Manager

Approved by,

Mitchell Ostrowski
Laboratory Director

This Report Contains 18 pages

The Contents of this report apply to the sample(s) analyzed. No duplication is allowed except in its entirety.

State of Illinois Chemical Analysis in Drinking Water Accredited Lab. No. 100256
State of Wisconsin Wastewater and Hazardous Waste No. 999888890

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CLIENT: City, Water, Light & Power
Date: *4/12/2012*

Project: CWLP AP Wells

CASE NARRATIVE

Lab Order: 12020654

Unless otherwise noted, samples were analyzed using the methods outlined in the following references:
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition

Unless otherwise noted, all method blanks, laboratory spikes, and/or matrix spikes met quality assurance objectives.

Sample results relate only to the analytes of interest tested and to the sample received at the laboratory.

All results are reported on a wet weight basis, unless otherwise noted. Dry weight adjusted results, reporting limits, method detection limits and dilution factors are indicated by the notation "dry" in the Units column. If present, a dilution factor will adjust the method detection limits and reporting limits.

The test results contained in this report meet all of the requirements of NELAC. Accreditation by the State of Illinois or Wisconsin is not an endorsement or a guarantee of the validity of data generated. For specific information regarding EMT's scope of accreditation , please contact your EMT project manager.

The Reporting Limit listed on the Report of Laboratory Analysis is EMT's reporting limit for the analyte reported. For most test methods this reporting limit is primarily based upon the lowest point in the calibration curve.

Analyst's initials of "OUT" indicate that the analyte was analyzed by a subcontracted laboratory.

Method References:
SW=USEPA, Test Methods for Evaluating Solid Waste, SW-846.
E=USEPA Methods for the Determination of Inorganic Substances in Environmental Samples; Methods for Chemical Analysis of Water and Wastes; Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, 40 CFR Part 136, App A; methods for the Determination of Metals in Environmental Samples; Methods for the Determination of Organic Compounds in Drinking Water.
SM= APHA, Standard Methods for the Examination of Water and Wastewater.
D=ASTM, Annual Book of Standards

Batch numbers starting with a letter indicate an analytical batch while those that are exculsively numerals indicate a preparation batch.

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CLIENT: City, Water, Light & Power
Project: CWLP AP Wells
Lab Order: 12020654

Date: *4/12/2012*

CASE NARRATIVE

Analytical Comments for METHOD 7470A_GRNDWTR, 12020654-02EDUP: The sample was run in duplicate to confirm the mercury result.

Analytical Comments for METHOD 7470A_GRNDWTR, 12020654-05EDUP: The sample was run in duplicate to confirm the mercury result.

Analytical Comments for METHOD RADIATION, 12020654-01A, 02A, 03A, 04A, 05A: The Radium by Methods 7500-Ra B and 7500-Ra D was performed by the subcontracted laboratory Underwriters Laboratories, IL NELAC #200001.

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12020654
Project: CWLP AP Wells
Lab ID: 12020654-01

Client Sample ID: AP-1
Report Date: 4/12/2012
Collection Date: 2/22/2012 12:20:00 PM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
On-site pH by Ion Selective Electrode		**Method:**		**SM4500-H**			
pH	7.01			pH units	2/22/12 12:20	R168104	JC
Anions by Ion Chromatography		**Method:**		**SW9056**			
Chloride	42.7	2.		mg/L	2/23/12	R166064	GSB
Fluoride	< 0.5	0.5		mg/L	2/23/12	R166064	GSB
Nitrogen, Nitrate (As N)	< 0.05	0.05		mg/L	2/23/12	R166064	GSB
Sulfate	521.	50.		mg/L	2/23/12	R166064	GSB
Cyanide, Total		**Method:**		**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01		mg/L	2/24/12 10:24	72204	CS2
Total Dissolved Solids		**Method:**		**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	1070.	10.		mg/L	2/23/12 12:00	R166105	LS3
ICP Metals, Groundwater Total		**Method:**		**SW6010C / SW3015**			
Boron	14.6	0.063	C	mg/L	2/24/12 10:25	72216	AG
Iron	35.3	0.125		mg/L	2/24/12 10:25	72216	AG
Manganese	0.702	0.063		mg/L	2/24/12 10:25	72216	AG
Mercury, Total		**Method:**		**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005		mg/L	2/23/12 12:49	72231	IG
Metals, Total.		**Method:**		**SW6020A / SW3015**			
Antimony	< 0.006	0.006		mg/L	2/27/12 12:22	72216	AG
Arsenic	< 0.05	0.05		mg/L	2/27/12 12:22	72216	AG
Barium	< 2.	2.		mg/L	2/27/12 12:22	72216	AG
Beryllium	< 0.004	0.004		mg/L	2/27/12 12:22	72216	AG
Cadmium	< 0.005	0.005		mg/L	2/27/12 12:22	72216	AG
Chromium	< 0.1	0.1		mg/L	2/27/12 12:22	72216	AG
Cobalt	< 1.	1.		mg/L	2/27/12 12:22	72216	AG
Copper	< 0.65	0.65		mg/L	2/27/12 12:22	72216	AG
Lead	0.0184	0.0075		mg/L	2/27/12 12:22	72216	AG
Nickel	< 0.1	0.1		mg/L	2/27/12 12:22	72216	AG
Selenium	< 0.05	0.05		mg/L	2/27/12 12:22	72216	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12020654
Project: CWLP AP Wells
Lab ID: 12020654-01

Client Sample ID: AP-1
Report Date: 4/12/2012
Collection Date: 2/22/2012 12:20:00 PM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Silver	< 0.05	0.05	mg/L	2/27/12 12:22	72216	AG
Thallium	< 0.002	0.002	mg/L	2/27/12 12:22	72216	AG
Zinc	< 0.0575	0.0575	mg/L	2/28/12 12:06	72216	AG
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	1.2	0.5	pCi/L	3/21/12	R167933	OUT
Radium-228	1.9	0.9	pCi/L	3/21/12	R167933	OUT

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

Response to 1st RTP
CWLP - 01008

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-2
Lab Order:	12020654	**Report Date:**	4/12/2012
Project:	CWLP AP Wells	**Collection Date:**	2/22/2012 12:05:00 PM
Lab ID:	12020654-02	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
On-site pH by Ion Selective Electrode		**Method:**		**SM4500-H**			
pH	6.65			pH units	2/22/12 12:05	R168104	JC
Anions by Ion Chromatography		**Method:**		**SW9056**			
Chloride	19.3	2.		mg/L	2/23/12	R166064	GSB
Fluoride	< 5.	5.		mg/L	2/23/12	R166064	GSB
Nitrogen, Nitrate (As N)	< 0.05	0.05		mg/L	2/23/12	R166064	GSB
Sulfate	211.	50.		mg/L	2/23/12	R166064	GSB
Cyanide, Total		**Method:**		**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01		mg/L	2/24/12 10:24	72204	CS2
Total Dissolved Solids		**Method:**		**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	770.	10.		mg/L	2/23/12 12:00	R166105	LS3
ICP Metals, Groundwater Total		**Method:**		**SW6010C / SW3015**			
Boron	5.	0.625	C	mg/L	2/27/12 11:05	72216	CS2
Iron	242.	1.25		mg/L	2/27/12 11:05	72216	CS2
Manganese	21.4	0.063		mg/L	2/24/12 10:25	72216	AG
Mercury, Total		**Method:**		**SW7470A / HG PREP**			
Mercury	0.0006	0.0005		mg/L	2/23/12 12:49	72231	IG
Metals, Total.		**Method:**		**SW6020A / SW3015**			
Antimony	< 0.006	0.006		mg/L	2/27/12 12:22	72216	AG
Arsenic	< 0.05	0.05		mg/L	2/27/12 12:22	72216	AG
Barium	< 2.	2.		mg/L	2/27/12 12:22	72216	AG
Beryllium	0.00675	0.004		mg/L	2/27/12 12:22	72216	AG
Cadmium	< 0.005	0.005		mg/L	2/27/12 12:22	72216	AG
Chromium	0.277	0.1		mg/L	2/27/12 12:22	72216	AG
Cobalt	< 1.	1.		mg/L	2/27/12 12:22	72216	AG
Copper	< 0.65	0.65		mg/L	2/27/12 12:22	72216	AG
Lead	0.226	0.0075		mg/L	2/27/12 12:22	72216	AG
Nickel	0.13	0.1		mg/L	2/27/12 12:22	72216	AG
Selenium	< 0.05	0.05		mg/L	2/27/12 12:22	72216	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-2
Lab Order:	12020654	**Report Date:**	4/12/2012
Project:	CWLP AP Wells	**Collection Date:**	2/22/2012 12:05:00 PM
Lab ID:	12020654-02	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Silver	< 0.05	0.05	mg/L	2/27/12 12:22	72216	AG
Thallium	0.00225	0.002	mg/L	2/27/12 12:22	72216	AG
Zinc	0.408	0.0575	mg/L	2/28/12 12:06	72216	AG
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	2.7	0.4	pCi/L	3/21/12	R167933	OUT
Radium-228	7.3	1.5	pCi/L	3/21/12	R167933	OUT

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-3
Lab Order:	12020654	**Report Date:**	4/12/2012
Project:	CWLP AP Wells	**Collection Date:**	2/22/2012 11:45:00 AM
Lab ID:	12020654-03	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
On-site pH by Ion Selective Electrode		**Method:**		**SM4500-H**			
pH	6.58			pH units	2/22/12 11:45	R168104	JC
Anions by Ion Chromatography		**Method:**		**SW9056**			
Chloride	52.5	2.		mg/L	2/23/12	R166064	GSB
Fluoride	< 0.5	0.5		mg/L	2/23/12	R166064	GSB
Nitrogen, Nitrate (As N)	0.23	0.05		mg/L	2/23/12	R166064	GSB
Sulfate	281.	5.		mg/L	2/23/12	R166064	GSB
Cyanide, Total		**Method:**		**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01		mg/L	2/24/12 10:24	72204	CS2
Total Dissolved Solids		**Method:**		**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	852.	10.		mg/L	2/23/12 12:00	R166105	LS3
ICP Metals, Groundwater Total		**Method:**		**SW6010C / SW3015**			
Boron	17.7	0.063	C	mg/L	2/24/12 10:25	72216	AG
Iron	13.6	0.125		mg/L	2/24/12 10:25	72216	AG
Manganese	10.6	0.063		mg/L	2/24/12 10:25	72216	AG
Mercury, Total		**Method:**		**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005		mg/L	2/23/12 12:49	72231	IG
Metals, Total.		**Method:**		**SW6020A / SW3015**			
Antimony	< 0.006	0.006		mg/L	2/27/12 12:22	72216	AG
Arsenic	< 0.05	0.05		mg/L	2/27/12 12:22	72216	AG
Barium	< 2.	2.		mg/L	2/27/12 12:22	72216	AG
Beryllium	< 0.004	0.004		mg/L	2/27/12 12:22	72216	AG
Cadmium	< 0.005	0.005		mg/L	2/27/12 12:22	72216	AG
Chromium	< 0.1	0.1		mg/L	2/27/12 12:22	72216	AG
Cobalt	< 1.	1.		mg/L	2/27/12 12:22	72216	AG
Copper	< 0.65	0.65		mg/L	2/27/12 12:22	72216	AG
Lead	0.0084	0.0075		mg/L	2/27/12 12:22	72216	AG
Nickel	< 0.1	0.1		mg/L	2/27/12 12:22	72216	AG
Selenium	< 0.05	0.05		mg/L	2/27/12 12:22	72216	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-3
Lab Order:	12020654	**Report Date:**	4/12/2012
Project:	CWLP AP Wells	**Collection Date:**	2/22/2012 11:45:00 AM
Lab ID:	12020654-03	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Silver	< 0.05	0.05	mg/L	2/27/12 12:22	72216	AG
Thallium	< 0.002	0.002	mg/L	2/27/12 12:22	72216	AG
Zinc	< 0.0575	0.0575	mg/L	2/28/12 12:06	72216	AG
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	0.68	0.4	pCi/L	3/21/12	R167933	OUT
Radium-228	4.	1.1	pCi/L	3/21/12	R167933	OUT

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12020654
Project: CWLP AP Wells
Lab ID: 12020654-04

Client Sample ID: AP-4
Report Date: 4/12/2012
Collection Date: 2/22/2012 11:25:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
On-site pH by Ion Selective Electrode		**Method:**	**SM4500-H**				
pH	6.81			pH units	2/22/12 11:25	R168104	JC
Anions by Ion Chromatography		**Method:**	**SW9056**				
Chloride	10.1	2.		mg/L	2/23/12	R166064	GSB
Fluoride	< 0.5	0.5		mg/L	2/23/12	R166064	GSB
Nitrogen, Nitrate (As N)	0.12	0.05		mg/L	2/23/12	R166064	GSB
Sulfate	< 5.	5.		mg/L	2/23/12	R166064	GSB
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**				
Cyanide	< 0.01	0.01		mg/L	2/24/12 10:24	72204	CS2
Total Dissolved Solids		**Method:**	**SM2540C**				
Total Dissolved Solids (Residue, Filterable)	490.	10.		mg/L	2/23/12 12:00	R166105	LS3
ICP Metals, Groundwater Total		**Method:**	**SW6010C / SW3015**				
Boron	0.119	0.063	C	mg/L	2/24/12 10:25	72216	AG
Iron	11.	0.125		mg/L	2/24/12 10:25	72216	AG
Manganese	0.254	0.063		mg/L	2/24/12 10:25	72216	AG
Mercury, Total		**Method:**	**SW7470A / HG PREP**				
Mercury	< 0.0005	0.0005		mg/L	2/23/12 12:49	72231	IG
Metals, Total.		**Method:**	**SW6020A / SW3015**				
Antimony	< 0.006	0.006		mg/L	2/27/12 12:22	72216	AG
Arsenic	< 0.05	0.05		mg/L	2/27/12 12:22	72216	AG
Barium	< 2.	2.		mg/L	2/27/12 12:22	72216	AG
Beryllium	< 0.004	0.004		mg/L	2/27/12 12:22	72216	AG
Cadmium	< 0.005	0.005		mg/L	2/27/12 12:22	72216	AG
Chromium	< 0.1	0.1		mg/L	2/27/12 12:22	72216	AG
Cobalt	< 1.	1.		mg/L	2/27/12 12:22	72216	AG
Copper	< 0.65	0.65		mg/L	2/27/12 12:22	72216	AG
Lead	< 0.0075	0.0075		mg/L	2/27/12 12:22	72216	AG
Nickel	< 0.1	0.1		mg/L	2/27/12 12:22	72216	AG
Selenium	< 0.05	0.05		mg/L	2/27/12 12:22	72216	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-4
Lab Order:	12020654	**Report Date:**	4/12/2012
Project:	CWLP AP Wells	**Collection Date:**	2/22/2012 11:25:00 AM
Lab ID:	12020654-04	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Silver	< 0.05	0.05	mg/L	2/27/12 12:22	72216	AG
Thallium	< 0.002	0.002	mg/L	2/27/12 12:22	72216	AG
Zinc	< 0.0575	0.0575	mg/L	2/28/12 12:06	72216	AG
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	0.44	0.36	pCi/L	3/21/12	R167933	OUT
Radium-228	2.2	1.6	pCi/L	3/21/12	R167933	OUT

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-5
Lab Order:	12020654	**Report Date:**	4/12/2012
Project:	CWLP AP Wells	**Collection Date:**	2/22/2012 10:30:00 AM
Lab ID:	12020654-05	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
On-site pH by Ion Selective Electrode		**Method:**		**SM4500-H**			
pH	7.33			pH units	2/22/12 10:30	R168104	JC
Anions by Ion Chromatography		**Method:**		**SW9056**			
Chloride	24.2	2.		mg/L	2/23/12	R166064	GSB
Fluoride	0.62	0.5		mg/L	2/23/12	R166064	GSB
Nitrogen, Nitrate (As N)	0.15	0.05		mg/L	2/23/12	R166064	GSB
Sulfate	82.3	5.		mg/L	2/23/12	R166064	GSB
Cyanide, Total		**Method:**		**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01		mg/L	2/24/12 10:24	72204	CS2
Total Dissolved Solids		**Method:**		**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	414.	10.		mg/L	2/23/12 12:00	R166105	LS3
ICP Metals, Groundwater Total		**Method:**		**SW6010C / SW3015**			
Boron	< 1.	1.	C	mg/L	2/27/12 11:05	72216	CS2
Iron	1140.	2.		mg/L	2/27/12 11:05	72216	CS2
Manganese	21.4	0.1		mg/L	2/24/12 10:25	72216	AG
Mercury, Total		**Method:**		**SW7470A / HG PREP**			
Mercury	0.0008	0.0005		mg/L	2/23/12 12:49	72231	IG
Metals, Total.		**Method:**		**SW6020A / SW3015**			
Antimony	< 0.006	0.006		mg/L	2/27/12 12:22	72216	AG
Arsenic	< 0.05	0.05		mg/L	2/27/12 12:22	72216	AG
Barium	5.24	2.		mg/L	2/27/12 12:22	72216	AG
Beryllium	0.0142	0.004		mg/L	2/27/12 12:22	72216	AG
Cadmium	0.00776	0.005		mg/L	2/27/12 12:22	72216	AG
Chromium	0.811	0.1		mg/L	2/27/12 12:22	72216	AG
Cobalt	< 1.	1.		mg/L	2/27/12 12:22	72216	AG
Copper	< 0.65	0.65		mg/L	2/27/12 12:22	72216	AG
Lead	0.638	0.0075		mg/L	2/27/12 12:22	72216	AG
Nickel	0.358	0.1		mg/L	2/27/12 12:22	72216	AG
Selenium	< 0.05	0.05		mg/L	2/27/12 12:22	72216	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12020654
Project: CWLP AP Wells
Lab ID: 12020654-05

Client Sample ID: AP-5
Report Date: 4/12/2012
Collection Date: 2/22/2012 10:30:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Silver	< 0.05	0.05	mg/L	2/27/12 12:22	72216	AG
Thallium	0.00556	0.002	mg/L	2/27/12 12:22	72216	AG
Zinc	0.822	0.092	mg/L	2/28/12 12:06	72216	AG
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	5.2	0.5	pCi/L	3/21/12	R167933	OUT
Radium-228	8.8	1.4	pCi/L	3/21/12	R167933	OUT

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

Response to 1st RTP
CWLP - 01016

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Chain of Custody Record

Scheduled Sampling Date: 02/17/2012
Due Date: 02/24/2012

COC # 504462

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis
1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. Total RCRA Metals on a Liquid Sample

EMT USE ONLY
EMT WORKORDER #120204EA

Sample I.D.		Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-1	GRAB	12	1 liter	G	2	EJ	2/22/12	1220	7.01	1		X										A
AP-1	GRAB	12	1 liter	P	1	EJ	2/22/12	1220	7.01	1			X									B
AP-1	GRAB	12	500 ml	P	1	EJ	2/22/12	1220	7.01	4				X								C
AP-1	GRAB	12	500 ml	P	1	EJ	2/22/12	1220	7.01	1					X							D
AP-1	GRAB	12	500 ml	P	1	EJ	2/22/12	1220	7.01	3						X						E

Relinquished By:	Date: 2-22-12 Time: 12:45	Received By:	Date: 2-22-12 Time: 12:45	EMT USE ONLY
Relinquished By:	Date: 2-22-12 Time: 10:10	Received By:	Date: - - Time: :	ClientID: SPRING Client Contact: Joe Pavilonis EMT Project ID: CWLP AP Wells
Relinquished By:	Date: - - Time: :	Received By:	Date: 2-22-12 Time: 10 :	Jar Lot No.

☐ SAMPLE RECEIVED ON ICE
☐ TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs prior to sample receipt)

SPECIAL INSTRUCTIONS:

2/17/2012 1:53:48 PM

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Chain of Custody Record

Scheduled Sampling Date: 02/17/2012
Due Date: 02/24/2012

COC # 504462

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis
1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. Total RCRA Metals on a Liquid Sample

EMT USE ONLY
EMT WORKORDER # 1202054

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-2 GRAB	12	1 liter	G	2		2/22/12	12:05	6.65	1		X										A
AP-2 GRAB	12	1 liter	P	1		2/22/12	12:05	6.65	1			X									B
AP-2 GRAB	12	500 ml	P	1		2/22/12	12:05	6.65	4				X								C
AP-2 GRAB	12	500 ml	P	1		2/22/12	12:05	6.65	1					X							D
AP-2 GRAB	12	500 ml	P	1		2/22/12	12:05	6.65	3						X						E

Relinquished By:	Date: 2-22-12 Time: 16:10	Received By:	Date: - - Time: : :	EMT USE ONLY
Relinquished By:	Date: - - Time: : :	Received By:	Date: - - Time: : :	ClientID: SPRING Client Contact: Joe Puvilonis EMT Project ID: CWLP AP Wells
Relinquished By:	Date: - - Time: : :	Received By:	Date: 2/22/12 Time: 16:10	Jar Lot No.

☐ SAMPLE RECEIVED ON ICE
☐ TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs prior to sample receipt)
3C

SPECIAL INSTRUCTIONS:

2/17/2012 1:53:48 PM

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Chain of Custody Record

Scheduled Sampling Date: 02/17/2012
Due Date: 02/24/2012

COC # 504462

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis
1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. Total RCRA Metals on a Liquid Sample

EMT USE ONLY
EMT WORKORDER # 120054

Sample I.D.		Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-3	GRAB	12	1 liter	G	2		2/22/12	11:45	6.58	1		X										A
AP-3	GRAB	12	1 liter	P	1		2/22/12	11:45	6.58	1			X									B
AP-3	GRAB	12	500 ml	P	1		2/22/12	11:45	6.58	4				X								C
AP-3	GRAB	12	500 ml	P	1		2/22/12	11:45	6.58	1					X							D
AP-3	GRAB	12	500 ml	P	1		2/22/12	11:45	6.58	3						X						E

Relinquished By:	Date: 2-22-12 Time: 16:10	Received By:	Date: - - Time: : :	EMT USE ONLY ClientID: SPRING Client Contact: Joe Pavilonis EMT Project ID: CWLP AP Wells Jar Lot No.
Relinquished By:	Date: - - Time: : :	Received By:	Date: - - Time: : :	☐ SAMPLE RECEIVED ON ICE ☐ TEMPERATURE (Must be recorded if sampling was greater than 6 hrs. prior to sample receipt)
Relinquished By:	Date: - - Time: : :	Received By:	Date: 2-22-12 Time: (e) C	

SPECIAL INSTRUCTIONS:

Response to 1st RTP
CWLP - 01019

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Chain of Custody Record

Scheduled Sampling Date: 02/17/2012
Due Date: 02/24/2012

COC # 504462

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis
1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. Total RCRA Metals on a Liquid Sample

EMT USE ONLY
EMT WORKORDER #1207004

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-4 GRAB	12	1 liter	G	2		2/22/12	11:25	6.81	1		X										A
AP-4 GRAB	12	1 liter	P	1		2/22/12	11:25	6.81	1			X									B
AP-4 GRAB	12	500 ml	P	1		2/22/12	11:25	6.81	4				X								C
AP-4 GRAB	12	500 ml	P	1		2/22/12	11:25	6.81	1					X							D
AP-4 GRAB	12	500 ml	P	1		2/22/12	11:25	6.81	3						X						E

Relinquished By:	Date: 2-22-12 Time: 16:10	Received By:	Date: - - Time: : :	EMT USE ONLY
Relinquished By:	Date: - - Time: : :	Received By:	Date: - - Time: : :	ClientID: SPRING Client Contact: Joe Pavilonis EMT Project ID: CWLP AP Wells
Relinquished By:	Date: - - Time: : :	Received By:	Date: 2-22-12 Time: 16:10	Jar Lot No.

☐ SAMPLE RECEIVED ON ICE
TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)
3C

SPECIAL INSTRUCTIONS:

2/17/2012 1:53:49 PM
Page 4

Response to 1st RTP
CWLP - 01020

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Chain of Custody Record

Scheduled Sampling Date: 02/17/2012
Due Date: 02/24/2012

COC # 504462

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis
1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. Total RCRA Metals on a Liquid Sample

EMT USE ONLY
EMT WORKORDER # 128004

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-5	GRAB	1 liter	G	2		2/22/12	10:30	7.33	1		X										A
AP-5	GRAB	1 liter	P	1		2/22/12	10:30	7.33	1			X									B
AP-5	GRAB	500 ml	P	1		2/22/12	10:30	7.33	4				X								C
AP-5	GRAB	500 ml	P	1		2/22/12	10:30	7.33	1					X							D
AP-5	GRAB	500 ml	P	1		2/22/12	10:30	7.33	3						X						E

Relinquished By:	Date: 2-22-12 Time: 16:10	Received By:	Date: - - Time: :	EMT USE ONLY
Relinquished By:	Date: - - Time: :	Received By:	Date: - - Time: :	ClientID: SPRING Client Contact: Joe Pavilonis EMT Project ID: CWLP AP Wells
Relinquished By:	Date: - - Time: :	Received By:	Date: 2-22-12 Time: 16:10	Jar Lot No.

☐ SAMPLE RECEIVED ON ICE
☐ TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)

SPECIAL INSTRUCTIONS:

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Sue Corcoran
City, Water, Light & Power
201 East Lake Shore Drive
Springfield, IL 62707

June 04, 2012

RE CWLP AP Wells

Lab Orders:
12040727

Dear Sue Corcoran:

Enclosed are the analytical reports for the EMT Lab Order listed. Also included with this analytical report is a copy of the chain of custody associated with these samples. If you have any questions, please contact me at 847-967-6666.

Sincerely,

Joe Pavilonis
Project Manager

Approved by,

Mitchell Ostrowski
Laboratory Director

This Report Contains 18 pages

The Contents of this report apply to the sample(s) analyzed. No duplication is allowed except in its entirety.

State of Illinois Chemical Analysis in Drinking Water Accredited Lab. No. 100256
State of Wisconsin Wastewater and Hazardous Waste No. 999888890

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CLIENT: City, Water, Light & Power
Date: *6/4/2012*

Project: CWLP AP Wells
CASE NARRATIVE

Lab Order: 12040727

Unless otherwise noted, samples were analyzed using the methods outlined in the following references:
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition

Unless otherwise noted, all method blanks, laboratory spikes, and/or matrix spikes met quality assurance objectives.

Sample results relate only to the analytes of interest tested and to the sample received at the laboratory.

All results are reported on a wet weight basis, unless otherwise noted. Dry weight adjusted results, reporting limits, method detection limits and dilution factors are indicated by the notation "dry" in the Units column. If present, a dilution factor will adjust the method detection limits and reporting limits.

The test results contained in this report meet all of the requirements of NELAC. Accreditation by the State of Illinois or Wisconsin is not an endorsement or a guarantee of the validity of data generated. For specific information regarding EMT's scope of accreditation , please contact your EMT project manager.

The Reporting Limit listed on the Report of Laboratory Analysis is EMT's reporting limit for the analyte reported. For most test methods this reporting limit is primarily based upon the lowest point in the calibration curve.

Analyst's initials of "OUT" indicate that the analyte was analyzed by a subcontracted laboratory.

Method References:
SW=USEPA, Test Methods for Evaluating Solid Waste, SW-846.
E=USEPA Methods for the Determination of Inorganic Substances in Environmental Samples; Methods for Chemical Analysis of Water and Wastes; Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, 40 CFR Part 136, App A; methods for the Determination of Metals in Environmental Samples; Methods for the Determination of Organic Compounds in Drinking Water.
SM= APHA, Standard Methods for the Examination of Water and Wastewater.
D=ASTM, Annual Book of Standards

Batch numbers starting with a letter indicate an analytical batch while those that are exculsively numerals indicate a preparation batch.

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CLIENT: City, Water, Light & Power
Project: CWLP AP Wells
Lab Order: 12040727

Date: *6/4/2012*

CASE NARRATIVE

Analytical Comments for METHOD RADIATION, 12040727-01A, 02A, 03A, 04A, 05A: The Radium-226/228 analysis by Method 7500-Ra B and D was performed by the subcontracted laboratory Underwriters Laboratories, IL NELAC #200001.

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12040727
Project: CWLP AP Wells
Lab ID: 12040727-01

Client Sample ID: AP-1
Report Date: 6/4/2012
Collection Date: 4/25/2012 7:30:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Anions by Ion Chromatography		**Method:**	**SW9056**				
Chloride	38.2	0.2		mg/L	4/27/12	R168754	GSB
Fluoride	< 0.5	0.5		mg/L	5/5/12	R169125	GSB
Nitrogen, Nitrate (As N)	< 0.05	0.05		mg/L	4/27/12	R168754	GSB
Sulfate	463.	50.		mg/L	4/27/12	R168754	GSB
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**				
Cyanide	< 0.01	0.01		mg/L	4/30/12 11:15	73572	CS2
Total Dissolved Solids		**Method:**	**SM2540C**				
Total Dissolved Solids (Residue, Filterable)	1080.	10.		mg/L	4/30/12 23:40	R168916	LS3
ICP Metals, Groundwater Total		**Method:**	**SW6010C / SW3015**				
Boron	10.4	0.063	C	mg/L	4/30/12 15:56	73525	AG
Iron	18.3	0.125		mg/L	4/30/12 15:56	73525	AG
Mercury, Total		**Method:**	**SW7470A / HG PREP**				
Mercury	< 0.0005	0.0005		mg/L	4/27/12 11:44	73563	IG
Metals, Total.		**Method:**	**SW6020A / SW3015**				
Antimony	< 0.006	0.006		mg/L	4/30/12 15:00	73525	AG
Arsenic	< 0.05	0.05		mg/L	4/27/12 18:13	73525	AG
Barium	< 2.	2.		mg/L	4/27/12 18:13	73525	AG
Beryllium	< 0.004	0.004		mg/L	4/27/12 18:13	73525	AG
Cadmium	< 0.005	0.005		mg/L	4/27/12 18:13	73525	AG
Chromium	< 0.1	0.1		mg/L	4/27/12 18:13	73525	AG
Cobalt	< 1.	1.		mg/L	4/27/12 18:13	73525	AG
Copper	< 0.65	0.65		mg/L	4/27/12 18:13	73525	AG
Lead	< 0.0075	0.0075		mg/L	4/27/12 18:13	73525	AG
Manganese	0.864	0.15		mg/L	4/27/12 18:13	73525	AG
Nickel	< 0.1	0.1		mg/L	4/27/12 18:13	73525	AG
Selenium	< 0.05	0.05		mg/L	4/27/12 18:13	73525	AG
Silver	< 0.05	0.05		mg/L	4/27/12 18:13	73525	AG
Thallium	< 0.002	0.002		mg/L	4/27/12 18:13	73525	AG
Zinc	< 0.0575	0.0575		mg/L	4/27/12 18:13	73525	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-1
Lab Order:	12040727	**Report Date:**	6/4/2012
Project:	CWLP AP Wells	**Collection Date:**	4/25/2012 7:30:00 AM
Lab ID:	12040727-01	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	2.4	0.4	pCi/L	5/17/12	R170280	OUT
Radium-228	2.	0.6	pCi/L	5/17/12	R170280	OUT

Qualifiers:

- B - Analyte detected in the associated Method Blank
- E - Estimated
- H - Holding Time Exceeded
- C - Laboratory not accredited for this parameter
- S - Spike Recovery outside accepted recovery limits
- R - RPD outside accepted recovery limits
- J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12040727
Project: CWLP-AP Wells
Lab ID: 12040727-02

Client Sample ID: AP-2
Report Date: 6/4/2012
Collection Date: 4/25/2012 12:25:00 PM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Anions by Ion Chromatography		**Method:**		**SW9056**			
Chloride	13.	0.2		mg/L	4/27/12	R168754	GSB
Fluoride	< 0.5	0.5		mg/L	5/5/12	R169125	GSB
Nitrogen, Nitrate (As N)	< 0.05	0.05		mg/L	4/27/12	R168754	GSB
Sulfate	201.	5.		mg/L	4/27/12	R168754	GSB
Cyanide, Total		**Method:**		**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01		mg/L	4/30/12 11:15	73572	CS2
Total Dissolved Solids		**Method:**		**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	866.	10.		mg/L	4/30/12 23:40	R168916	LS3
ICP Metals, Groundwater Total		**Method:**		**SW6010C / SW3015**			
Boron	5.51	0.063	C	mg/L	4/30/12 15:56	73525	AG
Iron	59.2	0.125		mg/L	4/30/12 15:56	73525	AG
Mercury, Total		**Method:**		**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005		mg/L	4/27/12 11:44	73563	IG
Metals, Total.		**Method:**		**SW6020A / SW3015**			
Antimony	< 0.006	0.006		mg/L	4/30/12 15:00	73525	AG
Arsenic	< 0.05	0.05		mg/L	4/27/12 18:19	73525	AG
Barium	< 2.	2.		mg/L	4/27/12 18:19	73525	AG
Beryllium	< 0.004	0.004		mg/L	4/27/12 18:19	73525	AG
Cadmium	< 0.005	0.005		mg/L	4/27/12 18:19	73525	AG
Chromium	< 0.1	0.1		mg/L	4/27/12 18:19	73525	AG
Cobalt	< 1.	1.		mg/L	4/27/12 18:19	73525	AG
Copper	< 0.65	0.65		mg/L	4/27/12 18:19	73525	AG
Lead	0.047	0.0075		mg/L	4/27/12 18:19	73525	AG
Manganese	20.7	0.15		mg/L	4/27/12 18:19	73525	AG
Nickel	< 0.1	0.1		mg/L	4/27/12 18:19	73525	AG
Selenium	< 0.05	0.05		mg/L	4/27/12 18:19	73525	AG
Silver	< 0.05	0.05		mg/L	4/27/12 18:19	73525	AG
Thallium	< 0.002	0.002		mg/L	4/27/12 18:19	73525	AG
Zinc	0.228	0.0575		mg/L	4/27/12 18:19	73525	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
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R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-2
Lab Order:	12040727	**Report Date:**	6/4/2012
Project:	CWLP AP Wells	**Collection Date:**	4/25/2012 12:25:00 PM
Lab ID:	12040727-02	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	1.5	0.1	pCi/L	5/17/12	R170280	OUT
Radium-228	2.5	0.6	pCi/L	5/17/12	R170280	OUT

Qualifiers:

- B - Analyte detected in the associated Method Blank
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- S - Spike Recovery outside accepted recovery limits
- R - RPD outside accepted recovery limits
- J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12040727
Project: CWLP AP Wells
Lab ID: 12040727-03

Client Sample ID: AP-3
Report Date: 6/4/2012
Collection Date: 4/25/2012 12:05:00 PM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Anions by Ion Chromatography		**Method:**		**SW9056**			
Chloride	46.2	0.2		mg/L	4/27/12	R168754	GSB
Fluoride	< 0.5	0.5		mg/L	5/5/12	R169125	GSB
Nitrogen, Nitrate (As N)	< 0.05	0.05		mg/L	4/27/12	R168754	GSB
Sulfate	274.	5.		mg/L	4/27/12	R168754	GSB
Cyanide, Total		**Method:**		**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01		mg/L	4/30/12 11:15	73572	CS2
Total Dissolved Solids		**Method:**		**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	926.	10.		mg/L	5/1/12 14:00	R168985	LS3
ICP Metals, Groundwater Total		**Method:**		**SW6010C / SW3015**			
Boron	18.4	0.063	C	mg/L	4/30/12 15:56	73525	AG
Iron	14.	0.125		mg/L	4/30/12 15:56	73525	AG
Mercury, Total		**Method:**		**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005		mg/L	4/27/12 11:44	73563	IG
Metals, Total.		**Method:**		**SW6020A / SW3015**			
Antimony	< 0.006	0.006		mg/L	4/30/12 15:00	73525	AG
Arsenic	< 0.05	0.05		mg/L	4/27/12 18:24	73525	AG
Barium	< 2.	2.		mg/L	4/27/12 18:24	73525	AG
Beryllium	< 0.004	0.004		mg/L	4/27/12 18:24	73525	AG
Cadmium	< 0.005	0.005		mg/L	4/27/12 18:24	73525	AG
Chromium	< 0.1	0.1		mg/L	4/27/12 18:24	73525	AG
Cobalt	< 1.	1.		mg/L	4/27/12 18:24	73525	AG
Copper	< 0.65	0.65		mg/L	4/27/12 18:24	73525	AG
Lead	< 0.0075	0.0075		mg/L	4/27/12 18:24	73525	AG
Manganese	7.24	0.15		mg/L	4/27/12 18:24	73525	AG
Nickel	< 0.1	0.1		mg/L	4/27/12 18:24	73525	AG
Selenium	< 0.05	0.05		mg/L	4/27/12 18:24	73525	AG
Silver	< 0.05	0.05		mg/L	4/27/12 18:24	73525	AG
Thallium	< 0.002	0.002		mg/L	4/27/12 18:24	73525	AG
Zinc	< 0.0575	0.0575		mg/L	4/27/12 18:24	73525	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-3
Lab Order:	12040727	**Report Date:**	6/4/2012
Project:	CWLP AP Wells	**Collection Date:**	4/25/2012 12:05:00 PM
Lab ID:	12040727-03	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	0.7	0.37	pCi/L	5/17/12	R170280	OUT
Radium-228	1.1	0.7	pCi/L	5/17/12	R170280	OUT

Qualifiers:

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R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12040727
Project: CWLP AP Wells
Lab ID: 12040727-04

Client Sample ID: AP-4
Report Date: 6/4/2012
Collection Date: 4/25/2012 11:25:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Anions by Ion Chromatography		**Method:**	**SW9056**				
Chloride	9.85	0.2		mg/L	4/27/12	R168754	GSB
Fluoride	< 0.5	0.5		mg/L	5/5/12	R169125	GSB
Nitrogen, Nitrate (As N)	< 0.05	0.05		mg/L	4/27/12	R168754	GSB
Sulfate	< 5.	5.		mg/L	5/5/12	R169125	GSB
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**				
Cyanide	< 0.01	0.01		mg/L	4/30/12 11:15	73572	CS2
Total Dissolved Solids		**Method:**	**SM2540C**				
Total Dissolved Solids (Residue, Filterable)	560.	10.		mg/L	5/1/12 14:00	R168985	LS3
ICP Metals, Groundwater Total		**Method:**	**SW6010C / SW3015**				
Boron	0.123	0.063	C	mg/L	4/30/12 15:56	73525	AG
Iron	9.22	0.125		mg/L	4/30/12 15:56	73525	AG
Mercury, Total		**Method:**	**SW7470A / HG PREP**				
Mercury	< 0.0005	0.0005		mg/L	4/27/12 11:44	73563	IG
Metals, Total.		**Method:**	**SW6020A / SW3015**				
Antimony	< 0.006	0.006		mg/L	4/30/12 15:00	73525	AG
Arsenic	< 0.05	0.05		mg/L	4/27/12 18:30	73525	AG
Barium	< 2.	2.		mg/L	4/27/12 18:30	73525	AG
Beryllium	< 0.004	0.004		mg/L	4/27/12 18:30	73525	AG
Cadmium	< 0.005	0.005		mg/L	4/27/12 18:30	73525	AG
Chromium	< 0.1	0.1		mg/L	4/27/12 18:30	73525	AG
Cobalt	< 1.	1.		mg/L	4/27/12 18:30	73525	AG
Copper	< 0.65	0.65		mg/L	4/27/12 18:30	73525	AG
Lead	< 0.0075	0.0075		mg/L	4/27/12 18:30	73525	AG
Manganese	0.186	0.15		mg/L	4/27/12 18:30	73525	AG
Nickel	< 0.1	0.1		mg/L	4/27/12 18:30	73525	AG
Selenium	< 0.05	0.05		mg/L	4/27/12 18:30	73525	AG
Silver	< 0.05	0.05		mg/L	4/27/12 18:30	73525	AG
Thallium	< 0.002	0.002		mg/L	4/27/12 18:30	73525	AG
Zinc	< 0.0575	0.0575		mg/L	4/27/12 18:30	73525	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-4
Lab Order:	12040727	**Report Date:**	6/4/2012
Project:	CWLP AP Wells	**Collection Date:**	4/25/2012 11:25:00 AM
Lab ID:	12040727-04	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	0.59	0.52	pCi/L	5/17/12	R170280	OUT
Radium-228	ND	0.73	pCi/L	5/17/12	R170280	OUT

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-5
Lab Order:	12040727	**Report Date:**	6/4/2012
Project:	CWLP AP Wells	**Collection Date:**	4/25/2012 10:40:00 AM
Lab ID:	12040727-05	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Anions by Ion Chromatography		**Method:**	**SW9056**				
Chloride	7.23	0.2		mg/L	5/1/12	R168937	GSB
Fluoride	< 0.5	0.5		mg/L	5/5/12	R169125	GSB
Nitrogen, Nitrate (As N)	< 0.05	0.05		mg/L	4/27/12	R168754	GSB
Sulfate	43.5	5.		mg/L	4/27/12	R168754	GSB
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**				
Cyanide	< 0.01	0.01		mg/L	4/30/12 11:15	73572	CS2
Total Dissolved Solids		**Method:**	**SM2540C**				
Total Dissolved Solids (Residue, Filterable)	404.	10.		mg/L	5/1/12 14:00	R168985	LS3
ICP Metals, Groundwater Total		**Method:**	**SW6010C / SW3015**				
Boron	< 0.625	0.625	C	mg/L	5/2/12 09:38	73525	CS2
Iron	435.	1.25		mg/L	5/2/12 09:38	73525	CS2
Mercury, Total		**Method:**	**SW7470A / HG PREP**				
Mercury	< 0.0005	0.0005		mg/L	4/30/12 13:01	73601	IG
Metals, Total.		**Method:**	**SW6020A / SW3015**				
Antimony	< 0.006	0.006		mg/L	4/30/12 15:00	73525	AG
Arsenic	0.076	0.05		mg/L	4/27/12 18:35	73525	AG
Barium	< 2.	2.		mg/L	4/27/12 18:35	73525	AG
Beryllium	0.0128	0.004		mg/L	4/27/12 18:35	73525	AG
Cadmium	0.0128	0.005		mg/L	4/27/12 18:35	73525	AG
Chromium	0.328	0.1		mg/L	4/27/12 18:35	73525	AG
Cobalt	< 1.	1.		mg/L	4/27/12 18:35	73525	AG
Copper	< 0.65	0.65		mg/L	4/27/12 18:35	73525	AG
Lead	0.236	0.0075		mg/L	4/27/12 18:35	73525	AG
Manganese	7.91	0.15		mg/L	4/27/12 18:35	73525	AG
Nickel	0.539	0.1		mg/L	4/27/12 18:35	73525	AG
Selenium	< 0.05	0.05		mg/L	4/27/12 18:35	73525	AG
Silver	< 0.05	0.05		mg/L	4/27/12 18:35	73525	AG
Thallium	0.00258	0.002		mg/L	4/27/12 18:35	73525	AG
Zinc	1.09	0.0575		mg/L	4/27/12 18:35	73525	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-5
Lab Order:	12040727	**Report Date:**	6/4/2012
Project:	CWLP AP Wells	**Collection Date:**	4/25/2012 10:40:00 AM
Lab ID:	12040727-05	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	1.5	0.5	pCi/L	5/17/12	R170280	OUT
Radium-228	1.4	0.7	pCi/L	5/17/12	R170280	OUT

Qualifiers:

- B - Analyte detected in the associated Method Blank
- E - Estimated
- H - Holding Time Exceeded
- C - Laboratory not accredited for this parameter
- S - Spike Recovery outside accepted recovery limits
- R - RPD outside accepted recovery limits
- J - Analyte detected below quanititation limits

Electronic Filing: Received, Clerk's Office 02/13/2020

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Chain of Custody Record

Scheduled Sampling Date: 04/25/2012
Due Date: 05/02/2012

COC # 504526

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis
1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. pH, Field tested
6. Total RCRA Metals on a Liquid Sample

EMT USE ONLY
EMT WORKORDER #1204072 7

Sample I.D.		Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-1	GRAB	12	1 liter	G	2	DD	4-25-12	7:30	7.10	1												A
AP-1	GRAB	12	1 liter	P	1	DD	4-25-12	7:30	7.10	1												B
AP-1	GRAB	12	500 ml	P	1	DD	4-25-12	7:30	7.10	4												C
AP-1	GRAB	12	500 ml	P	1	DD	4-25-12	7:30	7.10	1												D
AP-1	GRAB	12	500 ml	P	1	DD	4-25-12	7:30	7.10	3												E

Relinquished By:	Date: - - Time: :	Received By: DD	Date: 4 -25 -12 Time: 6 :30 :
Relinquished By: DD	Date: 4 -25 -12 Time: 19 :15 :	Received By:	Date: - - Time: :
Relinquished By:	Date: - - Time: :	Received By: DD	Date: 4 -25-12 Time: 19 :18 :

EMT USE ONLY
ClientID: SPRING
Client Contact: Joe Pavilonis
EMT Project ID: CWLP AP Wells
Jar Lot No.

☐ SAMPLE RECEIVED ON ICE
☐ TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)

SPECIAL INSTRUCTIONS:

PH Cal=7.01 @ 7:40

4/17/2012 2:50:10 PM

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Chain of Custody Record

Scheduled Sampling Date: 04/25/2012
Due Date: 05/02/2012

COC # 504526

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis
1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. pH, Field tested
6. Total RCRA Metals on a Liquid Sample

EMT USE ONLY
EMT WORKORDER # 12040727

Sample I.D.		Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-2	GRAB	12	1 liter	G	2		4/25/12	12:25	7.65	1		X										A
AP-2	GRAB	12	1 liter	P	1		4/25/12	12:25	7.65	1			X									B
AP-2	GRAB	12	500 ml	P	1		4/25/12	12:25	7.65	4				X								C
AP-2	GRAB	12	500 ml	P	1		4/25/12	12:25	7.65	1					X	X						D
AP-2	GRAB	12	500 ml	P	1		4/25/12	12:25	7.65	3							X					E

Relinquished By:	Date: 4-25-12 Time: 19:30	Received By:	Date: - - Time: : :	EMT USE ONLY
Relinquished By:	Date: - - Time: : :	Received By:	Date: - - Time: : :	ClientID: SPRING Client Contact: Joe Pavilonis EMT Project ID: CWLP AP Wells
Relinquished By:	Date: - - Time: : :	Received By:	Date: 4 25 12 Time: 19:30	Jar Lot No.

SAMPLE RECEIVED ON ICE
TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs prior to sample receipt)

SPECIAL INSTRUCTIONS:
cal pH = 7.00 @ 68.4°F

4/17/2012 2:50:11 PM
Page 2

Response to 1st RTP
CWLP - 01036

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Chain of Custody Record

Scheduled Sampling Date: 04/25/2012
Due Date: 05/02/2012

COC # 504526

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis
1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. pH, Field tested
6. Total RCRA Metals on a Liquid Sample

EMT USE ONLY
EMT WORKORDER #1204027

Sample I.D.		Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-3	GRAB	12	1 liter	G	2		4/25/12	12:05	7.31	1		X										3A
AP-3	GRAB	12	1 liter	P	1		4/25/12	12:05	7.31	1			X									B
AP-3	GRAB	12	500 ml	P	1		4/25/12	12:05	7.31	4				X								C
AP-3	GRAB	12	500 ml	P	1		4/25/12	12:06	7.31	1					X	X						D
AP-3	GRAB	12	500 ml	P	1		4/25/12	12:06	7.31	3							X					E

Relinquished By:	Date: 4-25-12 Time: 19:30	Received By:	Date: - - Time: :	EMT USE ONLY
Relinquished By:	Date: - - Time: :	Received By:	Date: - - Time: :	ClientID: SPRING Client Contact: Joe Pavilonis EMT Project ID: CWLP AP Wells
Relinquished By:	Date: - - Time: :	Received By:	Date: 4 25 12 Time: 19:30	Jar Lot No.

☐ SAMPLE RECEIVED ON ICE
☐ TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs prior to sample receipt)

SPECIAL INSTRUCTIONS:
cal pH = 6.99 @ 68.4°F

Electronic Filing: Received, Clerk's Office 02/13/2020

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Chain of Custody Record

Scheduled Sampling Date: 04/25/2012
Due Date: 05/02/2012

COC # 504526

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis
1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. pH, Field tested
6. Total RCRA Metals on a Liquid Sample

EMT USE ONLY
EMT WORKORDER # 12040127

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-4	GRAB	1 liter	G	2		4/25/12	11:25	7.07	1		X										41A
AP-4	GRAB	1 liter	P	1		4/25/12	11:25	7.07	1			X									B
AP-4	GRAB	500 ml	P	1		4/25/12	11:25	7.07	4				X								C
AP-4	GRAB	500 ml	P	1		4/25/12	11:25	7.07	1					X	X						D
AP-4	GRAB	500 ml	P	1		4/25/12	11:25	7.07	3							X					E

Relinquished By:	Date: 4-25-12 Time: 19:30	Received By:	Date: - - Time: : :
Relinquished By:	Date: - - Time: : :	Received By:	Date: - - Time: : :
Relinquished By:	Date: - - Time: : :	Received By:	Date: 4-25-12 Time: 19:30

EMT USE ONLY
ClientID: SPRING
Client Contact: Joe Pavilonis
EMT Project ID: CWLP AP Wells
Jar Lot No.

SAMPLE RECEIVED ON ICE
TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)

SPECIAL INSTRUCTIONS:
cal pH = 6.99 @ 68.4°F

4/17/2012 2:50:12 PM
Page 4

Response to 1st RTP
CWLP - 01038

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Chain of Custody Record

Scheduled Sampling Date: 04/25/2012
Due Date: 05/02/2012

COC # 504526

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis
1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. pH, Field tested
6. Total RCRA Metals on a Liquid Sample

EMT USE ONLY
EMT WORKORDER 12004027

Sample I.D.		Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-5	GRAB	12	1 liter	G	2		04/25/12	10:40	7.19	1		X										A
AP-5	GRAB	12	1 liter	P	1		04/25/12	10:40	7.19	1			X									B
AP-5	GRAB	12	500 ml	P	1		04/25/12	10:40	7.19	4				X								C
AP-5	GRAB	12	500 ml	P	1		04/25/12	10:40	7.19	1					X	X						D
AP-5	GRAB	12	500 ml	P	1		04/25/12	10:40	7.19	3							X					E

Relinquished By:	Date: 4-25-12 Time: 19:30	Received By:	Date: - - Time: :	EMT USE ONLY
Relinquished By:	Date: - - Time: :	Received By:	Date: - - Time: :	ClientID: SPRING Client Contact: Joe Pavilonis EMT Project ID: CWLP AP Wells
Relinquished By:	Date: - - Time: :	Received By:	Date: 4-25-12 Time: 19:30	Jar Lot No.

☐ SAMPLE RECEIVED ON ICE
☐ TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)
2c

SPECIAL INSTRUCTIONS:
cal pH=6.99 @ 68.4°F

4/17/2012 2:50:12 PM

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Sue Corcoran
City, Water, Light & Power
201 East Lake Shore Drive
Springfield, IL 62707

October 10, 2012

RE CWLP AP Wells

Lab Orders:
12080743 12080764

Dear Sue Corcoran:

Enclosed are the analytical reports for the EMT Lab Orders listed. Also included with this analytical report is a copy of the chain of custody associated with these samples. If you have any questions, please contact me at 847-967-6666.

Sincerely,

Joe Pavilonis
Project Manager

Approved by,

Marilyn Krueding
Laboratory Director

This Report Contains 21 pages

The Contents of this report apply to the sample(s) analyzed. No duplication is allowed except in its entirety.

State of Illinois, NELAC Accredited Lab. No. 100256
State of Wisconsin, WDNR Accredited Lab No. 999888890

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CLIENT: City, Water, Light & Power **Date:** *10/10/2012*

Project: CWLP AP Wells **CASE NARRATIVE**

Lab Orders: 12080743 12080764

Unless otherwise noted, samples were analyzed using the methods outlined in the following references:
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition

Unless otherwise noted, all method blanks, laboratory spikes, and/or matrix spikes met quality assurance objectives.

Sample results relate only to the analytes of interest tested and to the sample received at the laboratory.

All results are reported on a wet weight basis, unless otherwise noted. Dry weight adjusted results, reporting limits, method detection limits and dilution factors are indicated by the notation "dry" in the Units column. If present, a dilution factor will adjust the method detection limits and reporting limits.

The test results contained in this report meet all of the requirements of NELAC. Accreditation by the State of Illinois or Wisconsin is not an endorsement or a guarantee of the validity of data generated. For specific information regarding EMT's scope of accreditation , please contact your EMT project manager.

The Reporting Limit listed on the Report of Laboratory Analysis is EMT's reporting limit for the analyte reported. For most test methods this reporting limit is primarily based upon the lowest point in the calibration curve.

Analyst's initials of "OUT" indicate that the analyte was analyzed by a subcontracted laboratory.

Method References:
SW=USEPA, Test Methods for Evaluating Solid Waste, SW-846.
E=USEPA Methods for the Determination of Inorganic Substances in Environmental Samples; Methods for Chemical Analysis of Water and Wastes; Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, 40 CFR Part 136, App A; methods for the Determination of Metals in Environmental Samples; Methods for the Determination of Organic Compounds in Drinking Water.
SM= APHA, Standard Methods for the Examination of Water and Wastewater.
D=ASTM, Annual Book of Standards

Batch numbers starting with a letter indicate an analytical batch while those that are exculsively numerals indicate a preparation batch.

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847.967.6666 • 800.246.0663 • fax: 847.967.6735 • www.emt.com

CLIENT: City, Water, Light & Power
Date: *10/10/2012*

Project: CWLP AP Wells

CASE NARRATIVE

Lab Orders: 12080743 12080764

Analytical Comments for METHOD 6020_GRNDWTR_LIST, LCSLLMS-76306: The low level LCS recoveris for As, B,Cr, Fe, and Se were outside of the lab control limits (where applicable).

Analytical Comments for METHOD 6020_GRNDWTR_LIST, LCSLOES-76318: The low level LCS recoveris for As, Ni, Se, and Ag were outside of the lab control limits (where applicable).

Analytical Comments for METHOD 6020_GRNDWTR_LIST, LCSLLMS-76306: The low level LCS recoveris for As, B,Cr, Fe, and Se were outside of the lab control limits (where applicable).

Analytical Comments for METHOD 6020_GRNDWTR_LIST, MB-76318: The Ni CCB was just below the lab control limits.

Analytical Comments for METHOD 6020_GRNDWTR_LIST, LCSLOES-76318: The low level LCS recoveris for As, Ni, Se, and Ag were outside of the lab control limits (where applicable).

Analytical Comments for METHOD RADIATION, 12080764-01A, 02A, 03A: The Radium-226/228 analysis by Method 7500-Ra B and D was performed by the subcontracted laboratory Underwriters Laboratories, IL NELAC #200001.

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12080743
Project: CWLP AP Wells
Lab ID: 12080743-01

Client Sample ID: AP-1
Report Date: 10/10/2012
Collection Date: 8/23/2012 11:05:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	39.3	2.	mg/L	8/24/12	R174166	GSB
Fluoride	< 0.5	0.5	mg/L	8/24/12	R174166	GSB
Nitrogen, Nitrate (As N)	0.65	0.5	mg/L	8/24/12	R174166	GSB
Sulfate	469.	50.	mg/L	8/28/12	R174260	GSB
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01	mg/L	8/29/12 15:37	76375	CS2
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	788.	10.	mg/L	8/28/12 11:30	R174349	SW
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	8/30/12 11:36	76413	ML3
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Antimony	0.0073	0.006	mg/L	8/29/12 02:19	76306	AG
Arsenic	0.0141	0.0125	mg/L	8/29/12 02:19	76306	AG
Barium	0.255	0.0125	mg/L	8/29/12 02:19	76306	AG
Beryllium	< 0.004	0.004	mg/L	8/29/12 02:19	76306	AG
Boron	15.2	0.275	mg/L	8/29/12 12:19	76306	AG
Cadmium	< 0.0025	0.0025	mg/L	8/29/12 02:19	76306	AG
Chromium	< 0.0175	0.0175	mg/L	8/29/12 02:19	76306	AG
Cobalt	< 0.0175	0.0175	mg/L	8/29/12 02:19	76306	AG
Copper	< 0.01	0.01	mg/L	8/29/12 02:19	76306	AG
Iron	9.22	0.14	mg/L	8/29/12 02:19	76306	AG
Lead	< 0.005	0.005	mg/L	8/29/12 02:19	76306	AG
Manganese	0.564	0.0375	mg/L	8/29/12 02:19	76306	AG
Nickel	< 0.01	0.01	mg/L	8/29/12 02:19	76306	AG
Selenium	< 0.0025	0.0025	mg/L	8/29/12 02:19	76306	AG
Silver	< 0.005	0.005	mg/L	8/29/12 02:19	76306	AG
Thallium	< 0.002	0.002	mg/L	8/29/12 02:19	76306	AG
Zinc	< 0.025	0.025	mg/L	8/29/12 02:19	76306	AG
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-1
Lab Order:	12080743	**Report Date:**	10/10/2012
Project:	CWLP AP Wells	**Collection Date:**	8/23/2012 11:05:00 AM
Lab ID:	12080743-01	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Radium-226	1.2	0.9	pCi/L	9/10/12	R175958	OUT
Radium-228	ND	0.7	pCi/L	9/10/12	R175958	OUT

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

Response to 1st RTP
CWLP - 01044

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AW-3
Lab Order:	12080743	**Report Date:**	10/10/2012
Project:	CWLP AP Wells	**Collection Date:**	8/23/2012 10:25:00 AM
Lab ID:	12080743-02	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	23.7	2.	mg/L	8/24/12	R174166	GSB
Fluoride	< 0.5	0.5	mg/L	8/24/12	R174166	GSB
Nitrogen, Nitrate (As N)	< 0.5	0.5	mg/L	8/24/12	R174166	GSB
Sulfate	5.99	5.	mg/L	8/24/12	R174166	GSB
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01	mg/L	8/29/12 15:37	76375	CS2
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	422.	10.	mg/L	8/28/12 11:30	R174349	SW
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	8/30/12 11:36	76413	ML3
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Antimony	0.0067	0.006	mg/L	8/29/12 02:25	76306	AG
Arsenic	0.131	0.0125	mg/L	8/29/12 02:25	76306	AG
Barium	0.202	0.0125	mg/L	8/29/12 02:25	76306	AG
Beryllium	< 0.004	0.004	mg/L	8/29/12 02:25	76306	AG
Boron	0.689	0.275	mg/L	8/29/12 12:19	76306	AG
Cadmium	< 0.0025	0.0025	mg/L	8/29/12 02:25	76306	AG
Chromium	< 0.0175	0.0175	mg/L	8/29/12 02:25	76306	AG
Cobalt	< 0.0175	0.0175	mg/L	8/29/12 02:25	76306	AG
Copper	< 0.01	0.01	mg/L	8/29/12 02:25	76306	AG
Iron	11.5	0.14	mg/L	8/29/12 02:25	76306	AG
Lead	< 0.005	0.005	mg/L	8/29/12 02:25	76306	AG
Manganese	0.329	0.0375	mg/L	8/29/12 02:25	76306	AG
Nickel	< 0.01	0.01	mg/L	8/29/12 02:25	76306	AG
Selenium	< 0.0025	0.0025	mg/L	8/29/12 02:25	76306	AG
Silver	< 0.005	0.005	mg/L	8/29/12 02:25	76306	AG
Thallium	< 0.002	0.002	mg/L	8/29/12 02:25	76306	AG
Zinc	< 0.025	0.025	mg/L	8/29/12 02:25	76306	AG
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12080743
Project: CWLP AP Wells
Lab ID: 12080743-02

Client Sample ID: AW-3
Report Date: 10/10/2012
Collection Date: 8/23/2012 10:25:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Radium-226	ND	0.89	pCi/L	9/10/12	R175958	OUT
Radium-228	ND	0.6	pCi/L	9/10/12	R175958	OUT

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

Response to 1st RTP
CWLP - 01046

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-5
Lab Order:	12080743	**Report Date:**	10/10/2012
Project:	CWLP AP Wells	**Collection Date:**	8/23/2012 10:55:00 AM
Lab ID:	12080743-03	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	3.32	2.	mg/L	8/24/12	R174166	GSB
Fluoride	< 0.5	0.5	mg/L	8/24/12	R174166	GSB
Nitrogen, Nitrate (As N)	< 0.5	0.5	mg/L	8/24/12	R174166	GSB
Sulfate	76.8	5.	mg/L	8/24/12	R174166	GSB
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01	mg/L	8/29/12 15:37	76375	CS2
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	316.	10.	mg/L	8/28/12 11:30	R174349	SW
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	0.0007	0.0005	mg/L	9/4/12 00:22	76492	ML3
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Antimony	0.0063	0.006	mg/L	8/29/12 02:30	76306	AG
Arsenic	0.102	0.0125	mg/L	8/29/12 02:30	76306	AG
Barium	2.76	0.0125	mg/L	8/29/12 02:30	76306	AG
Beryllium	0.0092	0.004	mg/L	8/29/12 02:30	76306	AG
Boron	0.782	0.687	mg/L	8/29/12 12:19	76306	AG
Cadmium	0.00575	0.0025	mg/L	8/29/12 02:30	76306	AG
Chromium	0.449	0.0175	mg/L	8/29/12 02:30	76306	AG
Cobalt	0.297	0.0175	mg/L	8/29/12 02:30	76306	AG
Copper	0.401	0.01	mg/L	8/29/12 02:30	76306	AG
Iron	430.	3.5	mg/L	8/29/12 12:19	76306	AG
Lead	0.312	0.005	mg/L	8/29/12 02:30	76306	AG
Manganese	12.3	0.0375	mg/L	8/29/12 02:30	76306	AG
Nickel	0.7	0.01	mg/L	8/29/12 02:30	76306	AG
Selenium	0.00585	0.0025	mg/L	8/29/12 02:30	76306	AG
Silver	< 0.005	0.005	mg/L	8/29/12 02:30	76306	AG
Thallium	0.00302	0.002	mg/L	8/29/12 02:30	76306	AG
Zinc	1.35	0.025	mg/L	8/29/12 02:30	76306	AG
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-5
Lab Order:	12080743	**Report Date:**	10/10/2012
Project:	CWLP AP Wells	**Collection Date:**	8/23/2012 10:55:00 AM
Lab ID:	12080743-03	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Radium-226	7.1	0.2	pCi/L	9/10/12	R175958	OUT
Radium-228	5.1	0.7	pCi/L	9/10/12	R175958	OUT

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

Response to 1st RTP
CWLP - 01048

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-2
Lab Order:	12080764	**Report Date:**	10/10/2012
Project:	CWLP AP Wells	**Collection Date:**	8/24/2012 12:35:00 PM
Lab ID:	12080764-01	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
On-site pH by Ion Selective Electrode		**Method:**	**SM4500-H**			
pH	7.		pH units	8/24/12 12:35	R174101	EP1
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	19.9	2.	mg/L	8/24/12	R174166	GSB
Fluoride	< 0.5	0.5	mg/L	8/24/12	R174166	GSB
Nitrogen, Nitrate (As N)	< 0.5	0.5	mg/L	8/24/12	R174166	GSB
Sulfate	250.	5.	mg/L	8/24/12	R174166	GSB
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01	mg/L	8/29/12 15:37	76375	CS2
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	836.	10.	mg/L	8/28/12 11:30	R174349	SW
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	8/30/12 11:36	76413	ML3
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Antimony	< 0.006	0.006	mg/L	8/28/12 23:08	76318	AG
Arsenic	0.0331	0.0125	mg/L	8/28/12 23:08	76318	AG
Barium	0.731	0.0125	mg/L	8/28/12 23:08	76318	AG
Beryllium	< 0.004	0.004	mg/L	8/28/12 23:08	76318	AG
Boron	6.88	0.275	mg/L	8/29/12 12:19	76318	AG
Cadmium	< 0.005	0.005	mg/L	8/28/12 23:08	76318	AG
Chromium	0.111	0.0175	mg/L	8/28/12 23:08	76318	AG
Cobalt	0.0528	0.0175	mg/L	8/28/12 23:08	76318	AG
Copper	0.0942	0.01	mg/L	8/28/12 23:08	76318	AG
Iron	90.8	1.4	mg/L	8/29/12 12:19	76318	AG
Lead	0.0599	0.005	mg/L	8/28/12 23:08	76318	AG
Manganese	22.5	0.0375	mg/L	8/28/12 23:08	76318	AG
Nickel	0.104	0.01	mg/L	8/28/12 23:08	76318	AG
Selenium	< 0.0025	0.0025	mg/L	8/28/12 23:08	76318	AG
Silver	< 0.005	0.005	mg/L	8/28/12 23:08	76318	AG
Thallium	< 0.002	0.002	mg/L	8/28/12 23:08	76318	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-2
Lab Order:	12080764	**Report Date:**	10/10/2012
Project:	CWLP AP Wells	**Collection Date:**	8/24/2012 12:35:00 PM
Lab ID:	12080764-01	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Zinc	0.281	0.025	mg/L	8/28/12 23:08	76318	AG
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	1.6	0.8	pCi/L	9/10/12	R176218	OUT
Radium-228	1.3	0.7	pCi/L	9/10/12	R176218	OUT

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12080764
Project: CWLP AP Wells
Lab ID: 12080764-02

Client Sample ID: AP-3
Report Date: 10/10/2012
Collection Date: 8/24/2012 12:20:00 PM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
On-site pH by Ion Selective Electrode		**Method:**	**SM4500-H**			
pH	6.88		pH units	8/24/12 12:20	R174101	EP1
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	47.7	2.	mg/L	8/24/12	R174166	GSB
Fluoride	< 0.5	0.5	mg/L	8/24/12	R174166	GSB
Nitrogen, Nitrate (As N)	< 0.5	0.5	mg/L	8/24/12	R174166	GSB
Sulfate	315.	50.	mg/L	8/28/12	R174260	GSB
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.2	0.2	mg/L	8/30/12 13:23	76403	CS2
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	1000.	10.	mg/L	8/28/12 11:30	R174349	SW
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	8/30/12 11:36	76413	ML3
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Antimony	< 0.006	0.006	mg/L	8/28/12 23:13	76318	AG
Arsenic	0.0254	0.0125	mg/L	8/28/12 23:13	76318	AG
Barium	0.16	0.0125	mg/L	8/28/12 23:13	76318	AG
Beryllium	< 0.004	0.004	mg/L	8/28/12 23:13	76318	AG
Boron	20.9	0.275	mg/L	8/29/12 12:19	76318	AG
Cadmium	< 0.005	0.005	mg/L	8/28/12 23:13	76318	AG
Chromium	< 0.0175	0.0175	mg/L	8/28/12 23:13	76318	AG
Cobalt	< 0.0175	0.0175	mg/L	8/28/12 23:13	76318	AG
Copper	0.0274	0.01	mg/L	8/28/12 23:13	76318	AG
Iron	19.2	0.14	mg/L	8/28/12 23:13	76318	AG
Lead	0.0118	0.005	mg/L	8/28/12 23:13	76318	AG
Manganese	8.15	0.0375	mg/L	8/28/12 23:13	76318	AG
Nickel	0.0156	0.01	mg/L	8/28/12 23:13	76318	AG
Selenium	< 0.0025	0.0025	mg/L	8/28/12 23:13	76318	AG
Silver	< 0.005	0.005	mg/L	8/28/12 23:13	76318	AG
Thallium	< 0.002	0.002	mg/L	8/28/12 23:13	76318	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-3
Lab Order:	12080764	**Report Date:**	10/10/2012
Project:	CWLP AP Wells	**Collection Date:**	8/24/2012 12:20:00 PM
Lab ID:	12080764-02	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Zinc	0.0326	0.025	mg/L	8/28/12 23:13	76318	AG
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	1.3	1.	pCi/L	9/10/12	R176218	OUT
Radium-228	ND	0.73	pCi/L	9/10/12	R176218	OUT

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12080764
Project: CWLP AP Wells
Lab ID: 12080764-03

Client Sample ID: AP-4
Report Date: 10/10/2012
Collection Date: 8/24/2012 12:10:00 PM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
On-site pH by Ion Selective Electrode		**Method:**	**SM4500-H**			
pH	7.63		pH units	8/24/12 12:10	R174101	EP1
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	11.	2.	mg/L	8/24/12	R174166	GSB
Fluoride	< 0.5	0.5	mg/L	8/24/12	R174166	GSB
Nitrogen, Nitrate (As N)	< 0.5	0.5	mg/L	8/24/12	R174166	GSB
Sulfate	< 5.	5.	mg/L	8/24/12	R174166	GSB
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.2	0.2	mg/L	8/30/12 13:23	76403	CS2
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	448.	10.	mg/L	8/28/12 11:30	R174349	SW
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	8/30/12 11:36	76413	ML3
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Antimony	< 0.006	0.006	mg/L	8/28/12 23:19	76318	AG
Arsenic	0.0294	0.0125	mg/L	8/28/12 23:19	76318	AG
Barium	0.366	0.0125	mg/L	8/28/12 23:19	76318	AG
Beryllium	< 0.004	0.004	mg/L	8/28/12 23:19	76318	AG
Boron	0.787	0.275	mg/L	8/29/12 12:19	76318	AG
Cadmium	< 0.005	0.005	mg/L	8/28/12 23:19	76318	AG
Chromium	< 0.0175	0.0175	mg/L	8/28/12 23:19	76318	AG
Cobalt	< 0.0175	0.0175	mg/L	8/28/12 23:19	76318	AG
Copper	< 0.01	0.01	mg/L	8/28/12 23:19	76318	AG
Iron	10.8	0.14	mg/L	8/28/12 23:19	76318	AG
Lead	< 0.005	0.005	mg/L	8/28/12 23:19	76318	AG
Manganese	0.162	0.0375	mg/L	8/28/12 23:19	76318	AG
Nickel	< 0.01	0.01	mg/L	8/28/12 23:19	76318	AG
Selenium	0.00497	0.0025	mg/L	8/28/12 23:19	76318	AG
Silver	< 0.005	0.005	mg/L	8/28/12 23:19	76318	AG
Thallium	< 0.002	0.002	mg/L	8/28/12 23:19	76318	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-4
Lab Order:	12080764	**Report Date:**	10/10/2012
Project:	CWLP AP Wells	**Collection Date:**	8/24/2012 12:10:00 PM
Lab ID:	12080764-03	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Zinc	< 0.025	0.025	mg/L	8/28/12 23:19	76318	AG
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	ND	0.97	pCi/L	9/10/12	R176218	OUT
Radium-228	ND	0.71	pCi/L	9/10/12	R176218	OUT

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

Electronic Filing: Received, Clerk's Office 02/13/2020

ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.

Chain of Custody Record

Scheduled Sampling Date: 08/14/2012
Due Date: 08/28/2012

8100 North Austin Avenue Morton Grove, IL 60053-3203 (847) 967-6666 FAX:(847) 967-6735 www.emt.com

COC # 504719

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis
1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. pH, Field tested
6. Total RCRA Metals on a Liquid Sample

EMT USE ONLY

EMT WORKORDER #208743

Sample I.D.		Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-1	GRAB	12	1 liter	G	2	EM	8/23/12	1105	6.20	1		X										A
AP-1	GRAB	12	1 liter	P	1	EM	8/23/12	1105	6.20	1			X									B
AP-1	GRAB	12	500 ml	P	1	EM	8/23/12	1105	6.20	4				X								C
AP-1	GRAB	12	500 ml	P	1	EM	8/23/12	1105	6.20	1					X	X						D
AP-1	GRAB	12	500 ml	P	1	EM	8/23/12	1105	6.20	3							X					E

Relinquished By:	Date: - - Time: :	Received By:	Date: - - Time: :
Relinquished By:	Date: 8-23-12 Time: 11:30	Received By:	Date: 8-23-12 Time: 11:30
Relinquished By:	Date: 8-23-12 Time: 15:30	Received By:	Date: 8/23/12 Time: 15:30

EMT USE ONLY
ClientID: SPRING
Client Contact: Joe Pavilonis
EMT Project ID: CWLP AP Wells
Jar Lot No.

☐ SAMPLE RECEIVED ON ICE
☐ TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)
4c

SPECIAL INSTRUCTIONS:

pH: 7.00 = 7.00 @ 0935

8/14/2012 1:49:23 PM

Electronic Filing: Received, Clerk's Office 02/13/2020

ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.
8100 North Austin Avenue Morton Grove, IL 60053-3203 (847) 967-6666 FAX:(847) 967-6735 www.emt.com

Chain of Custody Record

Scheduled Sampling Date: 08/14/2012
Due Date: 08/28/2012

COC # 504719

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis
1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. pH, Field tested
6. Total RCRA Metals on a Liquid Sample

EMT USE ONLY
EMT WORKORDER # 12080703

Sample I.D.		Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AW-3	GRAB	12	1 liter	G	2	SJ	8/23/12	1025	6.29	1		X										12080703-A
AW-3	GRAB	12	1 liter	P	1	SJ	8/23/12	1025	6.29	1			X									B
AW-3	GRAB	12	500 ml	P	1	SJ	8/23/12	1025	6.29	4				X								C
AW-3	GRAB	12	500 ml	P	1	SJ	8/23/12	1025	6.29	1					X	X						D
AW-3	GRAB	12	500 ml	P	1	SJ	8/23/12	1025	6.29	3							X					E

Relinquished By:	Date: - -	Received By:	Date: - -
	Time: :		Time: :
Relinquished By:	Date: 8-23-12	Received By:	Date: 8-23-12
	Time: 11:30		Time: 11:30
Relinquished By:	Date: 8-23-12	Received By:	Date: 8/23/12
	Time: 5:20		Time: 1520

EMT USE ONLY
ClientID: SPRING
Client Contact: Joe Pavilonis
EMT Project ID: CWLP AP Wells
Jar Lot No.

☐ SAMPLE RECEIVED ON ICE
☐ TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)
4C

SPECIAL INSTRUCTIONS:
pH: 7.00 = 7.60 @ 0935

8/14/2012 1:49:25 PM
Page 6

Response to 1st RTP
CWLP - 01056

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ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.
8100 North Austin Avenue Morton Grove, IL 60053-3203 (847) 967-6666 FAX:(847) 967-6735 www.emt.com

Chain of Custody Record

Scheduled Sampling Date: 08/14/2012
Due Date: 08/28/2012

COC # 504719

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis
1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. pH, Field tested
6. Total RCRA Metals on a Liquid Sample

EMT USE ONLY
EMT WORKORDER # 12080423

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-5 GRAB	12	1 liter	G	2		8/23/12	10:55	7.27	1		X										A
AP-5 GRAB	12	1 liter	P	1		8/23/12	10:55	7.27	1			X									B
AP-5 GRAB	12	500 ml	P	1		8/23/12	10:55	7.27	4				X								C
AP-5 GRAB	12	500 ml	P	1		8/23/12	10:55	7.27	1					X	X						D
AP-5 GRAB	12	500 ml	P	1		8/23/12	10:55	7.27	3							X					E

Relinquished By:	Date: 8-23-12 Time: 15:30	Received By:	Date: - - Time: :	EMT USE ONLY
Relinquished By:	Date: - - Time: :	Received By:	Date: - - Time: :	ClientID: SPRING Client Contact: Joe Pavilonis EMT Project ID: CWLP AP Wells
Relinquished By:	Date: - - Time: :	Received By:	Date: 8/23/12 Time: 15:35	Jar Lot No.

☐ SAMPLE RECEIVED ON ICE
☐ TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)

SPECIAL INSTRUCTIONS:

pH cal 7.00 = 7.00 @ 73.1 °F
Time = 09:30

Electronic Filing: Received, Clerk's Office 02/13/2020

ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.
8100 North Austin Avenue Morton Grove, IL 60053-3203 (847) 967-6666 FAX:(847) 967-6735 www.emt.com

Chain of Custody Record

Scheduled Sampling Date: 08/14/2012
Due Date: 08/28/2012

COC # 504719

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis
1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. pH, Field tested
6. Total RCRA Metals on a Liquid Sample

EMT USE ONLY

EMT WORKORDER # 12080764

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-2 GRAB	12	1 liter	G	2	[illegible]	8/23/12	1235	7.00	1		X										01A
AP-2 GRAB	12	1 liter	P	1	[illegible]	8/23/12	1235	7.00	1			X									01B
AP-2 GRAB	12	500 ml	P	1	[illegible]	8/23/12	1235	7.00	4				X								01C
AP-2 GRAB	12	500 ml	P	1	[illegible]	8/23/12	1235	7.00	1					X	X						01D
AP-2 GRAB	12	500 ml	P	1	[illegible]	8/23/12	1235	7.00	3							X					01E

Relinquished By:	Date:	Time:	Received By:	Date:	Time:
	- -	: :		- -	: :
[illegible]	8-23-12	17:30	[illegible]	8-23-12	17:30
Relinquished By:	Date:	Time:	Received By:	Date:	Time:
	- -	: :		- -	: :

EMT USE ONLY
ClientID: SPRING
Client Contact: Joe Pavilonis
EMT Project ID: CWLP AP Wells
Jar Lot No.

X SAMPLE RECEIVED ON ICE
X TEMPERATURE 3°C
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)

SPECIAL INSTRUCTIONS:

pH: 7.00 = 7.00 @ 0935

8/14/2012 1:49:23 PM
Page 2

Response to 1st RTP
CWLP - 01058

Electronic Filing: Received, Clerk's Office 02/13/2020

ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.
8100 North Austin Avenue Morton Grove, IL 60053-3203 (847) 967-6666 FAX:(847) 967-6735 www.emt.com

Chain of Custody Record

Scheduled Sampling Date: 08/14/2012
Due Date: 08/28/2012

COC # 504719

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis
1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. pH, Field tested
6. Total RCRA Metals on a Liquid Sample

EMT USE ONLY

EMT WORKORDER # 12080764

Sample I.D.		Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-3	GRAB	12	1 liter	G	2	DD	8-23-12	12:20	6.88	1		X										~~01A~~ 02A
AP-3	GRAB	12	1 liter	P	1	DD	8-23-12	12:20	6.88	1			X									~~01B~~ 02B
AP-3	GRAB	12	500 ml	P	1	DD	8-23-12	12:20	6.88	4				X								~~01C~~ 02C
AP-3	GRAB	12	500 ml	P	1	DD	8-23-12	12:20	6.88	1					X	X						~~01D~~ 02D
AP-3	GRAB	12	500 ml	P	1	DD	8-23-12	12:20	6.88	3							X					~~01E~~ 02E
																						MH 8/14

Relinquished By:	Date: 8-23-12 Time: 13:00	Received By:	Date: 8-23-12 Time: 13:00
Relinquished By:	Date: 8-23-12 Time: 17:30	Received By:	Date: 8-23-12 Time: 17:30
Relinquished By:	Date: - - Time: : :	Received By:	Date: - - Time: : :

EMT USE ONLY
ClientID: SPRING
Client Contact: Joe Pavilonis
EMT Project ID: CWLP AP Wells
Jar Lot No.

X SAMPLE RECEIVED ON ICE
X TEMPERATURE 3°C
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)

SPECIAL INSTRUCTIONS: pH cal @ 9:30
T.cal 8

Response to 1st RTP
CWLP - 01059

Electronic Filing: Received, Clerk's Office 02/13/2020

ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.
8100 North Austin Avenue Morton Grove, IL 60053-3203 (847) 967-6666 FAX:(847) 967-6735 www.emt.com

Chain of Custody Record

Scheduled Sampling Date: 08/14/2012
Due Date: 08/28/2012

COC # 504719

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis
1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. pH, Field tested
6. Total RCRA Metals on a Liquid Sample

EMT USE ONLY

EMT WORKORDER # 12080764

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-4 GRAB	12	1 liter	G	2	CP	8/23/12	1210	7.63	1		X										~~01A~~ 03A
AP-4 GRAB	12	1 liter	P	1	CP	8/23/12	1210	7.63	1			X								3/27	~~01B~~ 03B
AP-4 GRAB	12	500 ml	P	1	CP	8/23/12	1210	7.63	4				X								~~01~~ 03C
AP-4 GRAB	12	500 ml	P	1	CP	8/23/12	1210	7.63	1					X	X						03D
AP-4 GRAB	12	500 ml	P	1	CP	8/23/12	1210	7.63	3							X					03E
~~AP~~ AP-1 GRAB	12	500ml	P	1	CP	8/23/12	1105	6.20	1					X	X						04A

Relinquished By:	Date: - -	Received By:	Date: - -
	Time: :		Time: :
Relinquished By:	Date: 8-23-12	Received By:	Date: 8-23-12
	Time: 17:30		Time: 17:30
Relinquished By:	Date: - -	Received By:	Date: - -
	Time: :		Time: :

EMT USE ONLY
ClientID: SPRING
Client Contact: Joe Pavilonis
EMT Project ID: CWLP AP Wells
Jar Lot No.

☒ SAMPLE RECEIVED ON ICE
☒ TEMPERATURE 3 °C
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)

SPECIAL INSTRUCTIONS:

pH: 7.00 = 7.00 @ 0935

8/14/2012 1:49:24 PM

Response to 1st RTP
CWLP - 01060

Electronic Filing: Received, Clerk's Office 02/13/2020

ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin • Morton Grove, IL 60053-3203
847.967.6666 • 800.246.0663 • fax: 847.967.6735 • www.emt.com

Sue Corcoran
City, Water, Light & Power
201 East Lake Shore Drive
Springfield, IL 62707

January 31, 2013

RE CWLP List G20

Lab Orders:
12110767

Dear Sue Corcoran:

Enclosed are the analytical reports for the EMT Lab Order listed. Also included with this analytical report is a copy of the chain of custody associated with these samples. If you have any questions, please contact me at 847-967-6666.

Sincerely,

Joe Pavilonis
Project Manager

Approved by,

Marilyn Krueding
Laboratory Director

This Report Contains 39 pages

The Contents of this report apply to the sample(s) analyzed. No duplication is allowed except in its entirety.

State of Illinois, NELAC Accredited Lab. No. 100256
State of Wisconsin, WDNR Accredited Lab No. 999888890

ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin • Morton Grove, IL 60053-3203
847.967.6666 • 800.246.0663 • fax: 847.967.6735 • www.emt.com

CLIENT: City, Water, Light & Power
Date: *1/31/2013*

Project: CWLP List G20
CASE NARRATIVE

Lab Order: 12110767

Unless otherwise noted, samples were analyzed using the methods outlined in the following references:
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition

Unless otherwise noted, all method blanks, laboratory spikes, and/or matrix spikes met quality assurance objectives.

Sample results relate only to the analytes of interest tested and to the sample received at the laboratory.

All results are reported on a wet weight basis, unless otherwise noted. Dry weight adjusted results, reporting limits, method detection limits and dilution factors are indicated by the notation "dry" in the Units column. If present, a dilution factor will adjust the method detection limits and reporting limits.

The test results contained in this report meet all of the requirements of NELAC. Accreditation by the State of Illinois or Wisconsin is not an endorsement or a guarantee of the validity of data generated. For specific information regarding EMT's scope of accreditation , please contact your EMT project manager.

The Reporting Limit listed on the Report of Laboratory Analysis is EMT's reporting limit for the analyte reported. For most test methods this reporting limit is primarily based upon the lowest point in the calibration curve.

Analyst's initials of "OUT" indicate that the analyte was analyzed by a subcontracted laboratory.

Method References:
SW=USEPA, Test Methods for Evaluating Solid Waste, SW-846.
E=USEPA Methods for the Determination of Inorganic Substances in Environmental Samples; Methods for Chemical Analysis of Water and Wastes; Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, 40 CFR Part 136, App A; methods for the Determination of Metals in Environmental Samples; Methods for the Determination of Organic Compounds in Drinking Water.
SM= APHA, Standard Methods for the Examination of Water and Wastewater.
D=ASTM, Annual Book of Standards

Batch numbers starting with a letter indicate an analytical batch while those that are exculsively numerals indicate a preparation batch.

ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin • Morton Grove, IL 60053-3203
847.967.6666 • 800.246.0663 • fax: 847.967.6735 • www.emt.com

CLIENT: City, Water, Light & Power
Date: *1/31/2013*

Project: CWLP List G20

CASE NARRATIVE

Lab Order: 12110767

Analytical Comments for METHOD 8270_WNEW, 12110767-01A, 03A, 04A, 05A, 06A: Acid surrogate recovery was below the limit.

For the Radium analysis on splits 03A and 06A, the sample was decanted to remove the sediment so the analysis could be performed.

Analytical Comments for METHOD RADIATION, 12110767-01A, 02A, 04A, 05A: The Radium-226/228 analysis by Method 7500-Ra B and D was performed by the subcontracted laboratory Underwriters Laboratories, IL NELAC #200001.

Analytical Comments for METHOD RADIATION, 12110767-03A, 06A: The Radium-226/228 analysis by Method 7500-Ra B and D was performed by the subcontracted laboratory Underwriters Laboratories, IL NELAC #200001. The sample was decanted to remove sediment prior to analysis.

ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

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847.967.6666 • 800.246.0663 • fax: 847.967.6735 • www.emt.com

Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AW-3
Lab Order:	12110767	**Report Date:**	1/31/2013
Project:	CWLP List G20	**Collection Date:**	11/28/2012 8:25:00 AM
Lab ID:	12110767-01	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
On-site pH by Ion Selective Electrode		**Method:**	**SM4500-H**			
pH	7.05		pH units	11/28/12 08:25	R179410	DD1
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	23.5	0.2	mg/L	11/30/12	R178588	GSB
Fluoride	< 0.5	0.5	mg/L	11/30/12	R178588	GSB
Nitrogen, Nitrate (As N)	0.22	0.05	mg/L	11/30/12	R178588	GSB
Sulfate	< 5.	5.	mg/L	11/30/12	R178588	GSB
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01	mg/L	12/4/12 12:34	78543	CS2
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	570.	10.	mg/L	11/30/12 13:50	R178673	LS3
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	12/3/12 13:08	78542	IG
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Antimony	< 0.006	0.006	mg/L	12/12/12 13:20	78529	AG
Arsenic	0.121	0.005	mg/L	12/12/12 13:20	78529	AG
Barium	< 2.	2.	mg/L	12/12/12 13:20	78529	AG
Beryllium	< 0.004	0.004	mg/L	12/12/12 13:20	78529	AG
Boron	< 2.	2.	mg/L	12/12/12 13:20	78529	AG
Cadmium	< 0.0005	0.0005	mg/L	12/12/12 13:20	78529	AG
Chromium	< 0.1	0.1	mg/L	12/12/12 13:20	78529	AG
Cobalt	< 1.	1.	mg/L	12/12/12 13:20	78529	AG
Copper	< 0.65	0.65	mg/L	12/12/12 13:20	78529	AG
Iron	12.3	5.	mg/L	12/12/12 13:20	78529	AG
Lead	< 0.0075	0.0075	mg/L	12/12/12 13:20	78529	AG
Manganese	0.334	0.15	mg/L	12/12/12 13:20	78529	AG
Nickel	< 0.1	0.1	mg/L	12/12/12 13:20	78529	AG
Selenium	< 0.05	0.05	mg/L	12/12/12 13:20	78529	AG
Silver	< 0.05	0.05	mg/L	12/12/12 13:20	78529	AG
Thallium	< 0.002	0.002	mg/L	12/12/12 13:20	78529	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AW-3
Lab Order:	12110767	**Report Date:**	1/31/2013
Project:	CWLP List G20	**Collection Date:**	11/28/2012 8:25:00 AM
Lab ID:	12110767-01	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Zinc	< 5.	5.		mg/L	12/12/12 13:20	78529	AG
Carbamates		**Method:**	**E531.1**				
Aldicarb	< 2.	2.	C	µg/L	12/4/12	R178715	LBI
Carbofuran	< 2.	2.	C	µg/L	12/4/12	R178715	LBI
EDB, DBCP and 123TCP by GC/ECD		**Method:**	**E504.1 / E504.1**				
1,2-Dibromo-3-chloropropane	< 0.0399	0.0399	C	µg/L	12/11/12 10:27	78746	LP
1,2-Dibromoethane	< 0.0558	0.0558	C	µg/L	12/11/12 10:27	78746	LP
Endothal		**Method:**	**E548.1 / E548.1**				
Endothal	< 15.5	15.5	C	µg/L	12/10/12 06:14	78562	RYL
Haloacetic Acids		**Method:**	**E552.2 / E552.1**				
Dalapon	< 0.5	0.5	C	µg/L	12/12/12 09:43	78751	LP
Organochlorine Pesticides		**Method:**	**SW8081A / SW3510C**				
Alachlor	< 0.13	0.13		µg/L	12/3/12 19:15	78503	LP
Atrazine	< 0.17	0.17		µg/L	12/3/12 19:15	78503	LP
Chlordane	< 0.08	0.08		µg/L	12/3/12 19:15	78503	LP
Endrin	< 0.01	0.01		µg/L	12/3/12 19:15	78503	LP
Heptachlor	< 0.01	0.01		µg/L	12/3/12 19:15	78503	LP
Heptachlor epoxide	< 0.01	0.01		µg/L	12/3/12 19:15	78503	LP
Methoxychlor	< 0.01	0.01		µg/L	12/3/12 19:15	78503	LP
Simazine	< 0.17	0.17		µg/L	12/3/12 19:15	78503	LP
Toxaphene	< 0.53	0.53		µg/L	12/3/12 19:15	78503	LP
Polychlorinated biphenyls (PCBs)		**Method:**	**SW8082 / SW3510C**				
Aroclor 1016	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1221	< 0.17	0.17		µg/L	12/4/12	78504	NCH
Aroclor 1232	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1242	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1248	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1254	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1260	< 0.08	0.08		µg/L	12/4/12	78504	NCH
PCB, Total	< 0.66	0.66		µg/L	12/4/12	78504	NCH

Qualifiers:

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12110767
Project: CWLP List G20
Lab ID: 12110767-01

Client Sample ID: AW-3
Report Date: 1/31/2013
Collection Date: 11/28/2012 8:25:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Semivolatile Organic Compounds GC/MS		**Method:**		**SW8270D / SW3510C**			
Benzo(a)pyrene	< 0.13	0.13		µg/L	12/6/12 04:12	78450	RYL
Bis(2-ethylhexyl)phthalate	< 1.33	1.33		µg/L	12/6/12 04:12	78450	RYL
Hexachlorocyclopentadiene	< 0.67	0.67		µg/L	12/6/12 04:12	78450	RYL
Phenol	< 1.33	1.33		µg/L	12/6/12 04:12	78450	RYL
Solvent Extractable Compounds by HPLC		**Method:**		**SW8321A / SW3510C**			
2,4,5-TP (Silvex)	< 0.25	0.25		µg/L	12/3/12	78467	DLO
2,4-D	< 0.23	0.23		µg/L	12/3/12	78467	DLO
Dinoseb	< 0.22	0.22		µg/L	12/3/12	78467	DLO
Pentachlorophenol	< 0.26	0.26	C	µg/L	12/3/12	78467	DLO
Picloram	< 0.22	0.22	C	µg/L	12/3/12	78467	DLO
Volatile Organic Compounds by GC/MS		**Method:**		**SW8260B / SW5030A**			
1,1,1-Trichloroethane	< 2.	2.		µg/L	12/3/12 20:45	78559	XN
1,1,2-Trichloroethane	< 2.	2.		µg/L	12/3/12 20:45	78559	XN
1,1-Dichloroethene	< 2.	2.		µg/L	12/3/12 20:45	78559	XN
1,2,4-Trichlorobenzene	< 2.	2.		µg/L	12/3/12 20:45	78559	XN
1,2-Dichlorobenzene	< 2.	2.		µg/L	12/3/12 20:45	78559	XN
1,2-Dichloroethane	< 2.	2.		µg/L	12/3/12 20:45	78559	XN
1,2-Dichloropropane	< 2.	2.		µg/L	12/3/12 20:45	78559	XN
1,4-Dichlorobenzene	< 2.	2.		µg/L	12/3/12 20:45	78559	XN
Benzene	< 2.	2.		µg/L	12/3/12 20:45	78559	XN
Carbon tetrachloride	< 2.	2.		µg/L	12/3/12 20:45	78559	XN
Chlorobenzene	< 2.	2.		µg/L	12/3/12 20:45	78559	XN
cis-1,2-Dichloroethene	< 3.72	3.72		µg/L	12/3/12 20:45	78559	XN
Ethylbenzene	< 2.	2.		µg/L	12/3/12 20:45	78559	XN
Methyl tert-butyl ether	< 2.	2.		µg/L	12/3/12 20:45	78559	XN
Methylene chloride	< 2.	2.		µg/L	12/3/12 20:45	78559	XN
Styrene	< 2.	2.		µg/L	12/3/12 20:45	78559	XN
Tetrachloroethene	< 10.	10.		µg/L	12/3/12 20:45	78559	XN
Toluene	< 2.	2.		µg/L	12/3/12 20:45	78559	XN
trans-1,2-Dichloroethene	< 2.	2.		µg/L	12/3/12 20:45	78559	XN
Trichloroethene	< 2.	2.		µg/L	12/3/12 20:45	78559	XN
Vinyl chloride	< 2.	2.		µg/L	12/3/12 20:45	78559	XN

Qualifiers:

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12110767
Project: CWLP List G20
Lab ID: 12110767-01

Client Sample ID: AW-3
Report Date: 1/31/2013
Collection Date: 11/28/2012 8:25:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Xylenes, Total	< 6.	6.	µg/L	12/3/12 20:45	78559	XN
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	0.48	0.3	pCi/L	1/11/13	R180319	OUT
Radium-228	1.3	0.7	pCi/L	1/11/13	R180319	OUT

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12110767
Project: CWLP List G20
Lab ID: 12110767-02

Client Sample ID: AP-1
Report Date: 1/31/2013
Collection Date: 11/28/2012 10:45:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
On-site pH by Ion Selective Electrode		**Method:**	**SM4500-H**			
pH	7.23		pH units	11/28/12 10:45	R179410	DD1
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	40.3	0.2	mg/L	11/30/12	R178588	GSB
Fluoride	< 0.5	0.5	mg/L	11/30/12	R178588	GSB
Nitrogen, Nitrate (As N)	0.22	0.05	mg/L	11/30/12	R178588	GSB
Sulfate	488.	50.	mg/L	12/3/12	R178685	GSB
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01	mg/L	12/4/12 12:34	78543	CS2
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	1160.	10.	mg/L	11/30/12 13:50	R178673	LS3
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	12/3/12 13:08	78542	IG
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Antimony	< 0.006	0.006	mg/L	12/12/12 13:26	78529	AG
Arsenic	0.00572	0.005	mg/L	12/12/12 13:26	78529	AG
Barium	< 2.	2.	mg/L	12/12/12 13:26	78529	AG
Beryllium	< 0.004	0.004	mg/L	12/12/12 13:26	78529	AG
Boron	4.3	2.	mg/L	12/12/12 13:26	78529	AG
Cadmium	< 0.005	0.005	mg/L	12/12/12 13:26	78529	AG
Chromium	< 0.1	0.1	mg/L	12/12/12 13:26	78529	AG
Cobalt	< 1.	1.	mg/L	12/12/12 13:26	78529	AG
Copper	< 0.65	0.65	mg/L	12/12/12 13:26	78529	AG
Iron	23.4	5.	mg/L	12/12/12 13:26	78529	AG
Lead	< 0.0075	0.0075	mg/L	12/12/12 13:26	78529	AG
Manganese	0.744	0.15	mg/L	12/12/12 13:26	78529	AG
Nickel	< 0.1	0.1	mg/L	12/12/12 13:26	78529	AG
Selenium	< 0.05	0.05	mg/L	12/12/12 13:26	78529	AG
Silver	< 0.05	0.05	mg/L	12/12/12 13:26	78529	AG
Thallium	< 0.002	0.002	mg/L	12/12/12 13:26	78529	AG

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12110767
Project: CWLP List G20
Lab ID: 12110767-02

Client Sample ID: AP-1
Report Date: 1/31/2013
Collection Date: 11/28/2012 10:45:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Zinc	< 5.	5.		mg/L	12/12/12 13:26	78529	AG
Carbamates		**Method:**	**E531.1**				
Aldicarb	< 2.	2.	C	µg/L	12/4/12	R178715	LBI
Carbofuran	< 2.	2.	C	µg/L	12/4/12	R178715	LBI
EDB, DBCP and 123TCP by GC/ECD		**Method:**	**E504.1 / E504.1**				
1,2-Dibromo-3-chloropropane	< 0.0401	0.0401	C	µg/L	12/11/12 11:30	78746	LP
1,2-Dibromoethane	< 0.0562	0.0562	C	µg/L	12/11/12 11:30	78746	LP
Endothal		**Method:**	**E548.1 / E548.1**				
Endothal	< 15.5	15.5	C	µg/L	12/10/12 06:58	78562	RYL
Haloacetic Acids		**Method:**	**E552.2 / E552.1**				
Dalapon	< 0.5	0.5	C	µg/L	12/12/12 11:10	78751	LP
Organochlorine Pesticides		**Method:**	**SW8081A / SW3510C**				
Alachlor	< 0.13	0.13		µg/L	12/3/12 20:02	78503	LP
Atrazine	< 0.17	0.17		µg/L	12/3/12 20:02	78503	LP
Chlordane	< 0.08	0.08		µg/L	12/3/12 20:02	78503	LP
Endrin	< 0.01	0.01		µg/L	12/3/12 20:02	78503	LP
Heptachlor	< 0.01	0.01		µg/L	12/3/12 20:02	78503	LP
Heptachlor epoxide	< 0.01	0.01		µg/L	12/3/12 20:02	78503	LP
Methoxychlor	< 0.01	0.01		µg/L	12/3/12 20:02	78503	LP
Simazine	< 0.17	0.17		µg/L	12/3/12 20:02	78503	LP
Toxaphene	< 0.53	0.53		µg/L	12/3/12 20:02	78503	LP
Polychlorinated biphenyls (PCBs)		**Method:**	**SW8082 / SW3510C**				
Aroclor 1016	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1221	< 0.17	0.17		µg/L	12/4/12	78504	NCH
Aroclor 1232	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1242	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1248	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1254	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1260	< 0.08	0.08		µg/L	12/4/12	78504	NCH
PCB, Total	< 0.66	0.66		µg/L	12/4/12	78504	NCH

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-1
Lab Order:	12110767	**Report Date:**	1/31/2013
Project:	CWLP List G20	**Collection Date:**	11/28/2012 10:45:00 AM
Lab ID:	12110767-02	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Semivolatile Organic Compounds GC/MS		**Method:**		**SW8270D / SW3510C**			
Benzo(a)pyrene	< 0.13	0.13		µg/L	12/6/12 04:56	78450	RYL
Bis(2-ethylhexyl)phthalate	< 1.33	1.33		µg/L	12/6/12 04:56	78450	RYL
Hexachlorocyclopentadiene	< 0.67	0.67		µg/L	12/6/12 04:56	78450	RYL
Phenol	< 1.33	1.33		µg/L	12/6/12 04:56	78450	RYL
Solvent Extractable Compounds by HPLC		**Method:**		**SW8321A / SW3510C**			
2,4,5-TP (Silvex)	< 0.25	0.25		µg/L	12/3/12	78467	DLO
2,4-D	< 0.23	0.23		µg/L	12/3/12	78467	DLO
Dinoseb	< 0.22	0.22		µg/L	12/3/12	78467	DLO
Pentachlorophenol	< 0.27	0.27	C	µg/L	12/3/12	78467	DLO
Picloram	< 0.22	0.22	C	µg/L	12/3/12	78467	DLO
Volatile Organic Compounds by GC/MS		**Method:**		**SW8260B / SW5030A**			
1,1,1-Trichloroethane	< 2.	2.		µg/L	12/6/12 16:18	78646	JL
1,1,2-Trichloroethane	< 2.	2.		µg/L	12/4/12 02:14	78559	XN
1,1-Dichloroethene	< 2.	2.		µg/L	12/6/12 16:18	78646	JL
1,2,4-Trichlorobenzene	< 2.	2.		µg/L	12/4/12 02:14	78559	XN
1,2-Dichlorobenzene	< 2.	2.		µg/L	12/4/12 02:14	78559	XN
1,2-Dichloroethane	< 2.	2.		µg/L	12/4/12 02:14	78559	XN
1,2-Dichloropropane	< 2.	2.		µg/L	12/4/12 02:14	78559	XN
1,4-Dichlorobenzene	< 2.	2.		µg/L	12/4/12 02:14	78559	XN
Benzene	< 2.	2.		µg/L	12/4/12 02:14	78559	XN
Carbon tetrachloride	< 2.	2.		µg/L	12/4/12 02:14	78559	XN
Chlorobenzene	< 2.	2.		µg/L	12/6/12 16:18	78646	JL
cis-1,2-Dichloroethene	< 3.72	3.72		µg/L	12/4/12 02:14	78559	XN
Ethylbenzene	< 2.	2.		µg/L	12/4/12 02:14	78559	XN
Methyl tert-butyl ether	< 2.	2.		µg/L	12/4/12 02:14	78559	XN
Methylene chloride	< 2.	2.		µg/L	12/4/12 02:14	78559	XN
Styrene	< 2.	2.		µg/L	12/4/12 02:14	78559	XN
Tetrachloroethene	< 10.	10.		µg/L	12/6/12 16:18	78646	JL
Toluene	< 2.	2.		µg/L	12/6/12 16:18	78646	JL
trans-1,2-Dichloroethene	< 2.	2.		µg/L	12/4/12 02:14	78559	XN
Trichloroethene	< 2.	2.		µg/L	12/6/12 16:18	78646	JL
Vinyl chloride	< 2.	2.		µg/L	12/4/12 02:14	78559	XN

Qualifiers:

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-1
Lab Order:	12110767	**Report Date:**	1/31/2013
Project:	CWLP List G20	**Collection Date:**	11/28/2012 10:45:00 AM
Lab ID:	12110767-02	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Xylenes, Total	< 6.	6.	µg/L	12/4/12 02:14	78559	XN
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	1.1	0.2	pCi/L	1/11/13	R180319	OUT
Radium-228	1.4	0.8	pCi/L	1/11/13	R180319	OUT

Qualifiers:

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12110767
Project: CWLP List G20
Lab ID: 12110767-03

Client Sample ID: AP-2
Report Date: 1/31/2013
Collection Date: 11/28/2012 10:00:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
On-site pH by Ion Selective Electrode		**Method:**	**SM4500-H**			
pH	7.58		pH units	11/28/12 10:00	R179410	DD1
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	22.8	0.2	mg/L	11/30/12	R178588	GSB
Fluoride	< 0.5	0.5	mg/L	11/30/12	R178588	GSB
Nitrogen, Nitrate (As N)	0.22	0.05	mg/L	11/30/12	R178588	GSB
Sulfate	293.	5.	mg/L	11/30/12	R178588	GSB
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01	mg/L	12/4/12 12:34	78543	CS2
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	1100.	10.	mg/L	11/30/12 13:50	R178673	LS3
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	12/3/12 13:08	78542	IG
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Antimony	< 0.006	0.006	mg/L	12/12/12 13:31	78529	AG
Arsenic	0.0156	0.005	mg/L	12/12/12 13:31	78529	AG
Barium	< 2.	2.	mg/L	12/12/12 13:31	78529	AG
Beryllium	< 0.004	0.004	mg/L	12/12/12 13:31	78529	AG
Boron	6.24	2.	mg/L	12/12/12 13:31	78529	AG
Cadmium	< 0.005	0.005	mg/L	12/12/12 13:31	78529	AG
Chromium	< 0.1	0.1	mg/L	12/12/12 13:31	78529	AG
Cobalt	< 1.	1.	mg/L	12/12/12 13:31	78529	AG
Copper	< 0.65	0.65	mg/L	12/12/12 13:31	78529	AG
Iron	134.	50.	mg/L	12/12/12 11:03	78529	AG
Lead	0.0433	0.0075	mg/L	12/12/12 13:31	78529	AG
Manganese	46.	1.5	mg/L	12/12/12 11:03	78529	AG
Nickel	< 0.1	0.1	mg/L	12/12/12 13:31	78529	AG
Selenium	< 0.05	0.05	mg/L	12/12/12 13:31	78529	AG
Silver	< 0.05	0.05	mg/L	12/12/12 13:31	78529	AG
Thallium	< 0.002	0.002	mg/L	12/12/12 13:31	78529	AG

Qualifiers:

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R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-2
Lab Order:	12110767	**Report Date:**	1/31/2013
Project:	CWLP List G20	**Collection Date:**	11/28/2012 10:00:00 AM
Lab ID:	12110767-03	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Zinc	< 5.	5.		mg/L	12/12/12 13:31	78529	AG
Carbamates		**Method:**	**E531.1**				
Aldicarb	< 2.	2.	C	µg/L	12/4/12	R178715	LBI
Carbofuran	< 2.	2.	C	µg/L	12/4/12	R178715	LBI
EDB, DBCP and 123TCP by GC/ECD		**Method:**	**E504.1 / E504.1**				
1,2-Dibromo-3-chloropropane	< 0.0403	0.0403	C	µg/L	12/11/12 12:33	78746	LP
1,2-Dibromoethane	< 0.0565	0.0565	C	µg/L	12/11/12 12:33	78746	LP
Endothal		**Method:**	**E548.1 / E548.1**				
Endothal	< 15.5	15.5	C	µg/L	12/10/12 07:42	78562	RYL
Haloacetic Acids		**Method:**	**E552.2 / E552.1**				
Dalapon	< 0.5	0.5	C	µg/L	12/12/12 11:54	78751	LP
Organochlorine Pesticides		**Method:**	**SW8081A / SW3510C**				
Alachlor	< 0.13	0.13		µg/L	12/4/12 22:22	78503	LP
Atrazine	< 0.17	0.17		µg/L	12/4/12 22:22	78503	LP
Chlordane	< 0.08	0.08		µg/L	12/3/12 20:49	78503	LP
Endrin	< 0.01	0.01		µg/L	12/3/12 20:49	78503	LP
Heptachlor	< 0.01	0.01		µg/L	12/3/12 20:49	78503	LP
Heptachlor epoxide	< 0.01	0.01		µg/L	12/3/12 20:49	78503	LP
Methoxychlor	< 0.01	0.01		µg/L	12/3/12 20:49	78503	LP
Simazine	< 0.17	0.17		µg/L	12/4/12 22:22	78503	LP
Toxaphene	< 0.53	0.53		µg/L	12/3/12 20:49	78503	LP
Polychlorinated biphenyls (PCBs)		**Method:**	**SW8082 / SW3510C**				
Aroclor 1016	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1221	< 0.17	0.17		µg/L	12/4/12	78504	NCH
Aroclor 1232	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1242	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1248	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1254	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1260	< 0.08	0.08		µg/L	12/4/12	78504	NCH
PCB, Total	< 0.66	0.66		µg/L	12/4/12	78504	NCH

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-2
Lab Order:	12110767	**Report Date:**	1/31/2013
Project:	CWLP List G20	**Collection Date:**	11/28/2012 10:00:00 AM
Lab ID:	12110767-03	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Semivolatile Organic Compounds GC/MS		**Method:**		**SW8270D / SW3510C**			
Benzo(a)pyrene	< 0.13	0.13		µg/L	12/6/12 05:40	78450	RYL
Bis(2-ethylhexyl)phthalate	< 1.33	1.33		µg/L	12/6/12 05:40	78450	RYL
Hexachlorocyclopentadiene	< 0.67	0.67		µg/L	12/6/12 05:40	78450	RYL
Phenol	< 1.33	1.33		µg/L	12/6/12 05:40	78450	RYL
Solvent Extractable Compounds by HPLC		**Method:**		**SW8321A / SW3510C**			
2,4,5-TP (Silvex)	< 0.25	0.25		µg/L	12/3/12	78467	DLO
2,4-D	< 0.23	0.23		µg/L	12/3/12	78467	DLO
Dinoseb	< 0.22	0.22		µg/L	12/3/12	78467	DLO
Pentachlorophenol	< 0.26	0.26	C	µg/L	12/3/12	78467	DLO
Picloram	< 0.22	0.22	C	µg/L	12/3/12	78467	DLO
Volatile Organic Compounds by GC/MS		**Method:**		**SW8260B / SW5030A**			
1,1,1-Trichloroethane	< 2.	2.		µg/L	12/6/12 16:51	78646	JL
1,1,2-Trichloroethane	< 2.	2.		µg/L	12/4/12 02:47	78559	XN
1,1-Dichloroethene	< 2.	2.		µg/L	12/6/12 16:51	78646	JL
1,2,4-Trichlorobenzene	< 2.	2.		µg/L	12/4/12 02:47	78559	XN
1,2-Dichlorobenzene	< 2.	2.		µg/L	12/4/12 02:47	78559	XN
1,2-Dichloroethane	< 2.	2.		µg/L	12/4/12 02:47	78559	XN
1,2-Dichloropropane	< 2.	2.		µg/L	12/4/12 02:47	78559	XN
1,4-Dichlorobenzene	< 2.	2.		µg/L	12/4/12 02:47	78559	XN
Benzene	< 2.	2.		µg/L	12/4/12 02:47	78559	XN
Carbon tetrachloride	< 2.	2.		µg/L	12/4/12 02:47	78559	XN
Chlorobenzene	< 2.	2.		µg/L	12/6/12 16:51	78646	JL
cis-1,2-Dichloroethene	< 3.72	3.72		µg/L	12/4/12 02:47	78559	XN
Ethylbenzene	< 2.	2.		µg/L	12/4/12 02:47	78559	XN
Methyl tert-butyl ether	< 2.	2.		µg/L	12/4/12 02:47	78559	XN
Methylene chloride	< 2.	2.		µg/L	12/4/12 02:47	78559	XN
Styrene	< 2.	2.		µg/L	12/4/12 02:47	78559	XN
Tetrachloroethene	< 10.	10.		µg/L	12/6/12 16:51	78646	JL
Toluene	< 2.	2.		µg/L	12/6/12 16:51	78646	JL
trans-1,2-Dichloroethene	< 2.	2.		µg/L	12/4/12 02:47	78559	XN
Trichloroethene	< 2.	2.		µg/L	12/6/12 16:51	78646	JL
Vinyl chloride	< 2.	2.		µg/L	12/4/12 02:47	78559	XN

Qualifiers:

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12110767
Project: CWLP List G20
Lab ID: 12110767-03

Client Sample ID: AP-2
Report Date: 1/31/2013
Collection Date: 11/28/2012 10:00:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Xylenes, Total	< 6.	6.	µg/L	12/4/12 02:47	78559	XN
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	ND	0.74	pCi/L	1/29/13	R180984	OUT
Radium-228	0.92	0.85	pCi/L	1/29/13	R180984	OUT

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12110767
Project: CWLP List G20
Lab ID: 12110767-04

Client Sample ID: AP-3
Report Date: 1/31/2013
Collection Date: 11/28/2012 9:15:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
On-site pH by Ion Selective Electrode		**Method:**	**SM4500-H**			
pH	7.35		pH units	11/28/12 08:25	R179410	DD1
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	54.6	0.2	mg/L	11/30/12	R178588	GSB
Fluoride	< 0.5	0.5	mg/L	11/30/12	R178588	GSB
Nitrogen, Nitrate (As N)	< 0.05	0.05	mg/L	11/30/12	R178588	GSB
Sulfate	318.	50.	mg/L	12/3/12	R178685	GSB
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01	mg/L	12/4/12 12:34	78543	CS2
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	928.	10.	mg/L	11/30/12 13:50	R178673	LS3
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	12/3/12 13:08	78542	IG
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Antimony	< 0.006	0.006	mg/L	12/12/12 13:36	78529	AG
Arsenic	0.0136	0.005	mg/L	12/12/12 13:36	78529	AG
Barium	< 2.	2.	mg/L	12/12/12 13:36	78529	AG
Beryllium	< 0.004	0.004	mg/L	12/12/12 13:36	78529	AG
Boron	8.03	2.	mg/L	12/12/12 13:36	78529	AG
Cadmium	< 0.005	0.005	mg/L	12/12/12 13:36	78529	AG
Chromium	< 0.1	0.1	mg/L	12/12/12 13:36	78529	AG
Cobalt	< 1.	1.	mg/L	12/12/12 13:36	78529	AG
Copper	< 0.65	0.65	mg/L	12/12/12 13:36	78529	AG
Iron	15.5	5.	mg/L	12/12/12 13:36	78529	AG
Lead	< 0.0075	0.0075	mg/L	12/12/12 13:36	78529	AG
Manganese	8.64	0.15	mg/L	12/12/12 13:36	78529	AG
Nickel	< 0.1	0.1	mg/L	12/12/12 13:36	78529	AG
Selenium	< 0.05	0.05	mg/L	12/12/12 13:36	78529	AG
Silver	< 0.05	0.05	mg/L	12/12/12 13:36	78529	AG
Thallium	< 0.002	0.002	mg/L	12/12/12 13:36	78529	AG

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12110767
Project: CWLP List G20
Lab ID: 12110767-04

Client Sample ID: AP-3
Report Date: 1/31/2013
Collection Date: 11/28/2012 9:15:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Zinc	< 5.	5.		mg/L	12/12/12 13:36	78529	AG
Carbamates		**Method:**	**E531.1**				
Aldicarb	< 2.	2.	C	µg/L	12/4/12	R178715	LBI
Carbofuran	< 2.	2.	C	µg/L	12/4/12	R178715	LBI
EDB, DBCP and 123TCP by GC/ECD		**Method:**	**E504.1 / E504.1**				
1,2-Dibromo-3-chloropropane	< 0.0406	0.0406	C	µg/L	12/11/12 13:05	78746	LP
1,2-Dibromoethane	< 0.0568	0.0568	C	µg/L	12/11/12 13:05	78746	LP
Endothal		**Method:**	**E548.1 / E548.1**				
Endothal	< 15.5	15.5	C	µg/L	12/10/12 08:25	78562	RYL
Haloacetic Acids		**Method:**	**E552.2 / E552.1**				
Dalapon	< 0.5	0.5	C	µg/L	12/12/12 12:37	78751	LP
Organochlorine Pesticides		**Method:**	**SW8081A / SW3510C**				
Alachlor	< 0.13	0.13		µg/L	12/4/12 20:00	78503	LP
Atrazine	< 0.17	0.17		µg/L	12/4/12 20:00	78503	LP
Chlordane	< 0.08	0.08		µg/L	12/3/12 20:02	78503	LP
Endrin	< 0.01	0.01		µg/L	12/3/12 20:02	78503	LP
Heptachlor	< 0.01	0.01		µg/L	12/3/12 20:02	78503	LP
Heptachlor epoxide	< 0.01	0.01		µg/L	12/3/12 20:02	78503	LP
Methoxychlor	< 0.01	0.01		µg/L	12/3/12 20:02	78503	LP
Simazine	< 0.17	0.17		µg/L	12/4/12 20:00	78503	LP
Toxaphene	< 0.53	0.53		µg/L	12/3/12 20:02	78503	LP
Polychlorinated biphenyls (PCBs)		**Method:**	**SW8082 / SW3510C**				
Aroclor 1016	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1221	< 0.17	0.17		µg/L	12/4/12	78504	NCH
Aroclor 1232	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1242	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1248	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1254	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1260	< 0.08	0.08		µg/L	12/4/12	78504	NCH
PCB, Total	< 0.67	0.67		µg/L	12/4/12	78504	NCH

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12110767
Project: CWLP List G20
Lab ID: 12110767-04

Client Sample ID: AP-3
Report Date: 1/31/2013
Collection Date: 11/28/2012 9:15:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Semivolatile Organic Compounds GC/MS		**Method:**		**SW8270D / SW3510C**			
Benzo(a)pyrene	< 0.13	0.13		µg/L	12/6/12 06:23	78450	RYL
Bis(2-ethylhexyl)phthalate	< 1.33	1.33		µg/L	12/6/12 06:23	78450	RYL
Hexachlorocyclopentadiene	< 0.67	0.67		µg/L	12/6/12 06:23	78450	RYL
Phenol	< 1.33	1.33		µg/L	12/6/12 06:23	78450	RYL
Solvent Extractable Compounds by HPLC		**Method:**		**SW8321A / SW3510C**			
2,4,5-TP (Silvex)	< 0.25	0.25		µg/L	12/3/12	78467	DLO
2,4-D	< 0.23	0.23		µg/L	12/3/12	78467	DLO
Dinoseb	< 0.22	0.22		µg/L	12/3/12	78467	DLO
Pentachlorophenol	< 0.26	0.26	C	µg/L	12/3/12	78467	DLO
Picloram	< 0.22	0.22	C	µg/L	12/3/12	78467	DLO
Volatile Organic Compounds by GC/MS		**Method:**		**SW8260B / SW5030A**			
1,1,1-Trichloroethane	< 2.	2.		µg/L	12/6/12 17:23	78646	JL
1,1,2-Trichloroethane	< 2.	2.		µg/L	12/4/12 03:20	78559	XN
1,1-Dichloroethene	< 2.	2.		µg/L	12/6/12 17:23	78646	JL
1,2,4-Trichlorobenzene	< 2.	2.		µg/L	12/4/12 03:20	78559	XN
1,2-Dichlorobenzene	< 2.	2.		µg/L	12/4/12 03:20	78559	XN
1,2-Dichloroethane	< 2.	2.		µg/L	12/4/12 03:20	78559	XN
1,2-Dichloropropane	< 2.	2.		µg/L	12/4/12 03:20	78559	XN
1,4-Dichlorobenzene	< 2.	2.		µg/L	12/4/12 03:20	78559	XN
Benzene	< 2.	2.		µg/L	12/4/12 03:20	78559	XN
Carbon tetrachloride	< 2.	2.		µg/L	12/4/12 03:20	78559	XN
Chlorobenzene	< 2.	2.		µg/L	12/6/12 17:23	78646	JL
cis-1,2-Dichloroethene	< 3.72	3.72		µg/L	12/4/12 03:20	78559	XN
Ethylbenzene	< 2.	2.		µg/L	12/4/12 03:20	78559	XN
Methyl tert-butyl ether	< 2.	2.		µg/L	12/4/12 03:20	78559	XN
Methylene chloride	< 2.	2.		µg/L	12/4/12 03:20	78559	XN
Styrene	< 2.	2.		µg/L	12/4/12 03:20	78559	XN
Tetrachloroethene	< 10.	10.		µg/L	12/6/12 17:23	78646	JL
Toluene	< 2.	2.		µg/L	12/6/12 17:23	78646	JL
trans-1,2-Dichloroethene	< 2.	2.		µg/L	12/4/12 03:20	78559	XN
Trichloroethene	< 2.	2.		µg/L	12/6/12 17:23	78646	JL
Vinyl chloride	< 2.	2.		µg/L	12/4/12 03:20	78559	XN

Qualifiers:

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-3
Lab Order:	12110767	**Report Date:**	1/31/2013
Project:	CWLP List G20	**Collection Date:**	11/28/2012 9:15:00 AM
Lab ID:	12110767-04	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Xylenes, Total	< 6.	6.	µg/L	12/4/12 03:20	78559	XN
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	0.45	0.19	pCi/L	1/11/13	R180319	OUT
Radium-228	1.6	0.9	pCi/L	1/11/13	R180319	OUT

Qualifiers:

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- J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-4
Lab Order:	12110767	**Report Date:**	1/31/2013
Project:	CWLP List G20	**Collection Date:**	11/28/2012 8:25:00 AM
Lab ID:	12110767-05	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
On-site pH by Ion Selective Electrode		**Method:**	**SM4500-H**			
pH	7.09		pH units	11/28/12 08:25	R179410	DD1
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	10.5	0.2	mg/L	11/30/12	R178588	GSB
Fluoride	< 0.5	0.5	mg/L	11/30/12	R178588	GSB
Nitrogen, Nitrate (As N)	0.26	0.05	mg/L	11/30/12	R178588	GSB
Sulfate	< 5.	5.	mg/L	11/30/12	R178588	GSB
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01	mg/L	12/4/12 12:34	78543	CS2
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	574.	10.	mg/L	11/30/12 13:50	R178673	LS3
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	12/3/12 13:08	78542	IG
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Antimony	< 0.006	0.006	mg/L	12/12/12 13:42	78529	AG
Arsenic	0.00608	0.005	mg/L	12/12/12 13:42	78529	AG
Barium	< 2.	2.	mg/L	12/12/12 13:42	78529	AG
Beryllium	< 0.004	0.004	mg/L	12/12/12 13:42	78529	AG
Boron	< 2.	2.	mg/L	12/12/12 13:42	78529	AG
Cadmium	< 0.005	0.005	mg/L	12/12/12 13:42	78529	AG
Chromium	< 0.1	0.1	mg/L	12/12/12 13:42	78529	AG
Cobalt	< 1.	1.	mg/L	12/12/12 13:42	78529	AG
Copper	< 0.65	0.65	mg/L	12/12/12 13:42	78529	AG
Iron	< 5.	5.	mg/L	12/12/12 13:42	78529	AG
Lead	< 0.0075	0.0075	mg/L	12/12/12 13:42	78529	AG
Manganese	< 0.15	0.15	mg/L	12/12/12 13:42	78529	AG
Nickel	< 0.1	0.1	mg/L	12/12/12 13:42	78529	AG
Selenium	< 0.05	0.05	mg/L	12/12/12 13:42	78529	AG
Silver	< 0.05	0.05	mg/L	12/12/12 13:42	78529	AG
Thallium	< 0.002	0.002	mg/L	12/12/12 13:42	78529	AG

Qualifiers:

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J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12110767
Project: CWLP List G20
Lab ID: 12110767-05

Client Sample ID: AP-4
Report Date: 1/31/2013
Collection Date: 11/28/2012 8:25:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Zinc	< 5.	5.		mg/L	12/12/12 13:42	78529	AG
Carbamates		**Method:**	**E531.1**				
Aldicarb	< 2.	2.	C	µg/L	12/4/12	R178715	LBI
Carbofuran	< 2.	2.	C	µg/L	12/4/12	R178715	LBI
EDB, DBCP and 123TCP by GC/ECD		**Method:**	**E504.1 / E504.1**				
1,2-Dibromo-3-chloropropane	< 0.0399	0.0399	C	µg/L	12/11/12 13:36	78746	LP
1,2-Dibromoethane	< 0.0558	0.0558	C	µg/L	12/11/12 13:36	78746	LP
Endothal		**Method:**	**E548.1 / E548.1**				
Endothal	< 15.5	15.5	C	µg/L	12/10/12 09:08	78562	RYL
Haloacetic Acids		**Method:**	**E552.2 / E552.1**				
Dalapon	< 0.5	0.5	C	µg/L	12/12/12 14:03	78751	LP
Organochlorine Pesticides		**Method:**	**SW8081A / SW3510C**				
Alachlor	< 0.13	0.13		µg/L	12/4/12 20:47	78503	LP
Atrazine	< 0.17	0.17		µg/L	12/4/12 20:47	78503	LP
Chlordane	< 0.08	0.08		µg/L	12/3/12 20:49	78503	LP
Endrin	< 0.01	0.01		µg/L	12/3/12 20:49	78503	LP
Heptachlor	< 0.01	0.01		µg/L	12/3/12 20:49	78503	LP
Heptachlor epoxide	< 0.01	0.01		µg/L	12/3/12 20:49	78503	LP
Methoxychlor	< 0.01	0.01		µg/L	12/3/12 20:49	78503	LP
Simazine	< 0.17	0.17		µg/L	12/4/12 20:47	78503	LP
Toxaphene	< 0.53	0.53		µg/L	12/3/12 20:49	78503	LP
Polychlorinated biphenyls (PCBs)		**Method:**	**SW8082 / SW3510C**				
Aroclor 1016	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1221	< 0.17	0.17		µg/L	12/4/12	78504	NCH
Aroclor 1232	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1242	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1248	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1254	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1260	< 0.08	0.08		µg/L	12/4/12	78504	NCH
PCB, Total	< 0.66	0.66		µg/L	12/4/12	78504	NCH

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12110767
Project: CWLP List G20
Lab ID: 12110767-05

Client Sample ID: AP-4
Report Date: 1/31/2013
Collection Date: 11/28/2012 8:25:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Semivolatile Organic Compounds GC/MS		**Method:**		**SW8270D / SW3510C**			
Benzo(a)pyrene	< 0.13	0.13		µg/L	12/6/12 07:07	78450	RYL
Bis(2-ethylhexyl)phthalate	< 1.33	1.33		µg/L	12/6/12 07:07	78450	RYL
Hexachlorocyclopentadiene	< 0.67	0.67		µg/L	12/6/12 07:07	78450	RYL
Phenol	< 1.33	1.33		µg/L	12/6/12 07:07	78450	RYL
Solvent Extractable Compounds by HPLC		**Method:**		**SW8321A / SW3510C**			
2,4,5-TP (Silvex)	< 0.25	0.25		µg/L	12/3/12	78467	DLO
2,4-D	< 0.23	0.23		µg/L	12/3/12	78467	DLO
Dinoseb	< 0.22	0.22		µg/L	12/3/12	78467	DLO
Pentachlorophenol	< 0.26	0.26	C	µg/L	12/3/12	78467	DLO
Picloram	< 0.22	0.22	C	µg/L	12/3/12	78467	DLO
Volatile Organic Compounds by GC/MS		**Method:**		**SW8260B / SW5030A**			
1,1,1-Trichloroethane	< 2.	2.		µg/L	12/6/12 17:56	78646	JL
1,1,2-Trichloroethane	< 2.	2.		µg/L	12/4/12 03:52	78559	XN
1,1-Dichloroethene	< 2.	2.		µg/L	12/6/12 17:56	78646	JL
1,2,4-Trichlorobenzene	< 2.	2.		µg/L	12/4/12 03:52	78559	XN
1,2-Dichlorobenzene	< 2.	2.		µg/L	12/4/12 03:52	78559	XN
1,2-Dichloroethane	< 2.	2.		µg/L	12/4/12 03:52	78559	XN
1,2-Dichloropropane	< 2.	2.		µg/L	12/4/12 03:52	78559	XN
1,4-Dichlorobenzene	< 2.	2.		µg/L	12/4/12 03:52	78559	XN
Benzene	< 2.	2.		µg/L	12/4/12 03:52	78559	XN
Carbon tetrachloride	< 2.	2.		µg/L	12/4/12 03:52	78559	XN
Chlorobenzene	< 2.	2.		µg/L	12/6/12 17:56	78646	JL
cis-1,2-Dichloroethene	< 3.72	3.72		µg/L	12/4/12 03:52	78559	XN
Ethylbenzene	< 2.	2.		µg/L	12/4/12 03:52	78559	XN
Methyl tert-butyl ether	< 2.	2.		µg/L	12/4/12 03:52	78559	XN
Methylene chloride	< 2.	2.		µg/L	12/4/12 03:52	78559	XN
Styrene	< 2.	2.		µg/L	12/4/12 03:52	78559	XN
Tetrachloroethene	< 10.	10.		µg/L	12/6/12 17:56	78646	JL
Toluene	< 2.	2.		µg/L	12/6/12 17:56	78646	JL
trans-1,2-Dichloroethene	< 2.	2.		µg/L	12/4/12 03:52	78559	XN
Trichloroethene	< 2.	2.		µg/L	12/6/12 17:56	78646	JL
Vinyl chloride	< 2.	2.		µg/L	12/4/12 03:52	78559	XN

Qualifiers:

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-4
Lab Order:	12110767	**Report Date:**	1/31/2013
Project:	CWLP List G20	**Collection Date:**	11/28/2012 8:25:00 AM
Lab ID:	12110767-05	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Xylenes, Total	< 6.	6.	µg/L	12/4/12 03:52	78559	XN
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	0.41	0.3	pCi/L	1/11/13	R180319	OUT
Radium-228	2.3	0.8	pCi/L	1/11/13	R180319	OUT

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-5
Lab Order:	12110767	**Report Date:**	1/31/2013
Project:	CWLP List G20	**Collection Date:**	11/28/2012 11:35:00 AM
Lab ID:	12110767-06	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
On-site pH by Ion Selective Electrode		**Method:**	**SM4500-H**			
pH	7.29		pH units	11/28/12 11:35	R179410	DD1
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	3.76	0.2	mg/L	11/30/12	R178588	GSB
Fluoride	< 0.5	0.5	mg/L	11/30/12	R178588	GSB
Nitrogen, Nitrate (As N)	0.25	0.05	mg/L	11/30/12	R178588	GSB
Sulfate	84.5	5.	mg/L	11/30/12	R178588	GSB
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01	mg/L	12/4/12 12:34	78543	CS2
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	404.	10.	mg/L	11/30/12 13:50	R178673	LS3
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	12/3/12 13:08	78542	IG
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Antimony	< 0.0096	0.0096	mg/L	12/12/12 13:47	78529	AG
Arsenic	0.0243	0.008	mg/L	12/12/12 13:47	78529	AG
Barium	< 3.2	3.2	mg/L	12/12/12 13:47	78529	AG
Beryllium	0.0164	0.0064	mg/L	12/12/12 13:47	78529	AG
Boron	< 3.2	3.2	mg/L	12/12/12 13:47	78529	AG
Cadmium	< 0.008	0.008	mg/L	12/12/12 13:47	78529	AG
Chromium	0.42	0.16	mg/L	12/12/12 13:47	78529	AG
Cobalt	< 1.6	1.6	mg/L	12/12/12 13:47	78529	AG
Copper	< 1.04	1.04	mg/L	12/12/12 13:47	78529	AG
Iron	576.	11.2	mg/L	12/12/12 11:03	78529	AG
Lead	0.277	0.012	mg/L	12/12/12 13:47	78529	AG
Manganese	23.2	0.6	mg/L	12/12/12 11:03	78529	AG
Nickel	0.321	0.16	mg/L	12/12/12 13:47	78529	AG
Selenium	< 0.08	0.08	mg/L	12/12/12 13:47	78529	AG
Silver	< 0.08	0.08	mg/L	12/12/12 13:47	78529	AG
Thallium	< 0.0032	0.0032	mg/L	12/12/12 13:47	78529	AG

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12110767
Project: CWLP List G20
Lab ID: 12110767-06

Client Sample ID: AP-5
Report Date: 1/31/2013
Collection Date: 11/28/2012 11:35:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Zinc	< 8.	8.		mg/L	12/12/12 13:47	78529	AG
Carbamates		**Method:**	**E531.1**				
Aldicarb	< 2.	2.	C	µg/L	12/4/12	R178715	LBI
Carbofuran	< 2.	2.	C	µg/L	12/4/12	R178715	LBI
EDB, DBCP and 123TCP by GC/ECD		**Method:**	**E504.1 / E504.1**				
1,2-Dibromo-3-chloropropane	< 0.0394	0.0394	C	µg/L	12/11/12 14:08	78746	LP
1,2-Dibromoethane	< 0.0552	0.0552	C	µg/L	12/11/12 14:08	78746	LP
Endothal		**Method:**	**E548.1 / E548.1**				
Endothal	< 15.5	15.5	C	µg/L	12/10/12 09:52	78562	RYL
Haloacetic Acids		**Method:**	**E552.2 / E552.1**				
Dalapon	< 0.5	0.5	C	µg/L	12/12/12 13:20	78751	LP
Organochlorine Pesticides		**Method:**	**SW8081A / SW3510C**				
Alachlor	< 0.13	0.13		µg/L	12/4/12 21:34	78503	LP
Atrazine	< 0.17	0.17		µg/L	12/4/12 21:34	78503	LP
Chlordane	< 0.08	0.08		µg/L	12/3/12 21:37	78503	LP
Endrin	< 0.01	0.01		µg/L	12/3/12 21:37	78503	LP
Heptachlor	< 0.01	0.01		µg/L	12/3/12 21:37	78503	LP
Heptachlor epoxide	< 0.01	0.01		µg/L	12/3/12 21:37	78503	LP
Methoxychlor	< 0.01	0.01		µg/L	12/3/12 21:37	78503	LP
Simazine	< 0.17	0.17		µg/L	12/4/12 21:34	78503	LP
Toxaphene	< 0.53	0.53		µg/L	12/3/12 21:37	78503	LP
Polychlorinated biphenyls (PCBs)		**Method:**	**SW8082 / SW3510C**				
Aroclor 1016	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1221	< 0.17	0.17		µg/L	12/4/12	78504	NCH
Aroclor 1232	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1242	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1248	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1254	< 0.08	0.08		µg/L	12/4/12	78504	NCH
Aroclor 1260	< 0.08	0.08		µg/L	12/4/12	78504	NCH
PCB, Total	< 0.66	0.66		µg/L	12/4/12	78504	NCH

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-5
Lab Order:	12110767	**Report Date:**	1/31/2013
Project:	CWLP List G20	**Collection Date:**	11/28/2012 11:35:00 AM
Lab ID:	12110767-06	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Semivolatile Organic Compounds GC/MS		**Method:**		**SW8270D / SW3510C**			
Benzo(a)pyrene	< 0.13	0.13		µg/L	12/6/12 07:51	78450	RYL
Bis(2-ethylhexyl)phthalate	< 1.33	1.33		µg/L	12/6/12 07:51	78450	RYL
Hexachlorocyclopentadiene	< 0.67	0.67		µg/L	12/6/12 07:51	78450	RYL
Phenol	< 1.33	1.33		µg/L	12/6/12 07:51	78450	RYL
Solvent Extractable Compounds by HPLC		**Method:**		**SW8321A / SW3510C**			
2,4,5-TP (Silvex)	< 0.25	0.25		µg/L	12/3/12	78467	DLO
2,4-D	< 0.23	0.23		µg/L	12/3/12	78467	DLO
Dinoseb	< 0.22	0.22		µg/L	12/3/12	78467	DLO
Pentachlorophenol	< 0.27	0.27	C	µg/L	12/3/12	78467	DLO
Picloram	< 0.22	0.22	C	µg/L	12/3/12	78467	DLO
Volatile Organic Compounds by GC/MS		**Method:**		**SW8260B / SW5030A**			
1,1,1-Trichloroethane	< 2.	2.		µg/L	12/6/12 18:29	78646	JL
1,1,2-Trichloroethane	< 2.	2.		µg/L	12/4/12 04:25	78559	XN
1,1-Dichloroethene	< 2.	2.		µg/L	12/6/12 18:29	78646	JL
1,2,4-Trichlorobenzene	< 2.	2.		µg/L	12/4/12 04:25	78559	XN
1,2-Dichlorobenzene	< 2.	2.		µg/L	12/4/12 04:25	78559	XN
1,2-Dichloroethane	< 2.	2.		µg/L	12/4/12 04:25	78559	XN
1,2-Dichloropropane	< 2.	2.		µg/L	12/4/12 04:25	78559	XN
1,4-Dichlorobenzene	< 2.	2.		µg/L	12/4/12 04:25	78559	XN
Benzene	< 2.	2.		µg/L	12/4/12 04:25	78559	XN
Carbon tetrachloride	< 2.	2.		µg/L	12/4/12 04:25	78559	XN
Chlorobenzene	< 2.	2.		µg/L	12/6/12 18:29	78646	JL
cis-1,2-Dichloroethene	< 3.72	3.72		µg/L	12/4/12 04:25	78559	XN
Ethylbenzene	< 2.	2.		µg/L	12/4/12 04:25	78559	XN
Methyl tert-butyl ether	< 2.	2.		µg/L	12/4/12 04:25	78559	XN
Methylene chloride	< 2.	2.		µg/L	12/4/12 04:25	78559	XN
Styrene	< 2.	2.		µg/L	12/4/12 04:25	78559	XN
Tetrachloroethene	< 10.	10.		µg/L	12/6/12 18:29	78646	JL
Toluene	< 2.	2.		µg/L	12/6/12 18:29	78646	JL
trans-1,2-Dichloroethene	< 2.	2.		µg/L	12/4/12 04:25	78559	XN
Trichloroethene	< 2.	2.		µg/L	12/6/12 18:29	78646	JL
Vinyl chloride	< 2.	2.		µg/L	12/4/12 04:25	78559	XN

Qualifiers:

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C - Laboratory not accredited for this parameter
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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-5
Lab Order:	12110767	**Report Date:**	1/31/2013
Project:	CWLP List G20	**Collection Date:**	11/28/2012 11:35:00 AM
Lab ID:	12110767-06	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Xylenes, Total	< 6.	6.	µg/L	12/4/12 04:25	78559	XN
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	ND	0.74	pCi/L	1/29/13	R180984	OUT
Radium-228	ND	1.28	pCi/L	1/29/13	R180984	OUT

Qualifiers:

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Chain of Custody Record

Scheduled Sampling Date: 11/15/2012
Due Date: 11/29/2012

COC # 504844

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP List G20

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 13. Solid 14. Groundwater(Filter)
15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis

1. Endothal
2. Dalapon
3. Herbicides
4. PCBs in Groundwater, Method 8082
5. Pesticides in Groundwater by Method 8081
6. Radiation Testing, Subcontracted
7. Semivolatile Organic Compounds by GCMS
8. Solids, Total Dissolved (TDS)
9. pH, Field tested
10. Anions by Ion Chromatography

EMT USE ONLY

EMT WORKORDER # 211076

Sample I.D.		Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AW-3	GRAB	12	1 liter	G	10	DD	11-28-12	8:25	7.05	1		X	X	X	X	X	X	X				A
AW-3	GRAB	12	1 liter	P	1	DD	11-28-12	8:25	7.05	1									X	X	X	B

Relinquished By:	Date: 11-28-12 Time: 11:50	Received By:	Date: 11-28-12 Time: 11:50	EMT USE ONLY ClientID: SPRING Client Contact: Joe Pavilonis EMT Project ID: CWLP List G20
Relinquished By:	Date: 11-28-12 Time: 16:15	Received By:	Date: - - Time: : :	
Relinquished By:	Date: - - Time: : :	Received By:	Date: 11-28-12 Time: 16:15	Jar Lot No.

☐ SAMPLE RECEIVED ON ICE
☐ TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)

SPECIAL INSTRUCTIONS:

Response to 1st RTP
CWLP - 01088

Electronic Filing: Received, Clerk's Office 02/13/2020

ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.

Chain of Custody Record

Scheduled Sampling Date: 11/15/2012
Due Date: 11/29/2012

8100 North Austin Avenue Morton Grove, IL 60053-3203 (847) 967-6666 FAX:(847) 967-6735 www.emt.com

COC # 504844

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP List G20

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 13. Solid 14. Groundwater(Filter)
15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis

1. Carbamates
2. Cyanide, Total
3. Total RCRA Metals on a Liquid Sample
4. Volatile Organic Compounds, Method 8260
5. EDB, DBCP and 123TCP by GC/ECD

EMT USE ONLY

EMT WORKORDER # 210747

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AW-3 GRAB	12	4 oz	G	1	DD	11-28-12	8:25	7.05	8		X										C
AW-3 GRAB	12	500 ml	P	1	DD	11-28-12	8:25	7.05	4			X									D
AW-3 GRAB	12	500 ml	P	1	DD	11-28-12	8:25	7.05	3				X								E
AW-3 GRAB	12	44 ml	V	3	DD	11-28-12	8:25	7.05	5					X							F
AW-3 GRAB	12	44 ml	V	2	DD	11-28-12	8:25	7.05	1						X						G

Relinquished By:	Date: 11-28-12 Time: 11:50	Received By:	Date: 11-28-12 Time: 11:50	EMT USE ONLY ClientID: SPRING Client Contact: Joe Pavilonis EMT Project ID: CWLP List G20
Relinquished By:	Date: 11-28-12 Time: 16:15	Received By:	Date: - - Time: : :	
Relinquished By:	Date: - - Time: : :	Received By:	Date: 11-28-12 Time: 16:15	Jar Lot No.

SAMPLE RECEIVED ON ICE
TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)

SPECIAL INSTRUCTIONS:

Electronic Filing: Received, Clerk's Office 02/13/2020

ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.
8100 North Austin Avenue Morton Grove, IL 60053-3203 (847) 967-6666 FAX:(847) 967-6735 www.emt.com

Chain of Custody Record

Scheduled Sampling Date: 11/15/2012
Due Date: 11/29/2012

COC # 504844

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP List G20

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 13. Solid 14. Groundwater(Filter)
15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis

1. Endothal
2. Dalapon
3. Herbicides
4. PCBs in Groundwater, Method 8082
5. Pesticides in Groundwater by Method 8081
6. Radiation Testing, Subcontracted
7. Semivolatile Organic Compounds by GCMS
8. Solids, Total Dissolved (TDS)
9. pH, Field tested
10. Anions by Ion Chromatography

EMT USE ONLY

EMT WORKORDER # 121016

Sample I.D.		Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-1	GRAB	12	1 liter	G	10	GP	11/28/12	1045	7.22	1		X	X	X	X	X	X	X				2A
AP-1	GRAB	12	1 liter	P	1	GP	11/28/12	1045	7.22	1									X	X	X	B

Relinquished By:	Date: 11-28-12 Time: 16:15	Received By: CWLP	Date: 11-28-12 Time: 16:15	EMT USE ONLY ClientID: SPRING Client Contact: Joe Pavilonis EMT Project ID: CWLP List G20
Relinquished By:	Date: - - Time: : :	Received By:	Date: - - Time: : :	
Relinquished By:	Date: - - Time: : :	Received By:	Date: 11/28/12 Time: 1605	Jar Lot No.

☐ SAMPLE RECEIVED ON ICE
TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs. prior to sample receipt)

SPECIAL INSTRUCTIONS:

pH 7.00 => 7.00 @ 0800

Electronic Filing: Received, Clerk's Office 02/13/2020

ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.

Chain of Custody Record

Scheduled Sampling Date: 11/15/2012
Due Date: 11/29/2012

8100 North Austin Avenue Morton Grove, IL 60053-3203 (847) 967-6666 FAX:(847) 967-6735 www.emt.com

COC # 504844

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP List G20

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 13. Solid 14. Groundwater(Filter)
15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. NaHSO4
10. Other

Analysis

1. Carbamates
2. Cyanide, Total
3. Total RCRA Metals on a Liquid Sample
4. Volatile Organic Compounds, Method 8260
5. EDB, DBCP and 123TCP by GC/ECD

EMT USE ONLY

EMT WORKORDER # 12110767

Sample I.D.		Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-1	GRAB	12	4 oz	G	1	SP	11/28/12	1045	7.22	8		X										C
AP-1	GRAB	12	500 ml	P	1	SP	11/28/12	1045	7.22	4			X									D
AP-1	GRAB	12	500 ml	P	1	SP	11/28/12	1045	7.22	3				X								E
AP-1	GRAB	12	44 ml	V	3	SP	11/28/12	1045	7.22	5					X							F
AP-1	GRAB	12	44 ml	V	2	SP	11/28/12	1045	7.22	1						X						G

Relinquished By:	Date: 11-28-12 Time: 16:15	Received By: LAB	Date: 11-28-12 Time: 16:15
Relinquished By:	Date: - - Time: : :	Received By:	Date: - - Time: : :
Relinquished By:	Date: - - Time: : :	Received By: Martinez	Date: 11-29-12 Time: 1015

EMT USE ONLY
ClientID: SPRING
Client Contact: Joe Pavilonis
EMT Project ID: CWLP List G20
Jar Lot No.

SAMPLE RECEIVED ON ICE
TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)
SC

SPECIAL INSTRUCTIONS:
pH=7.00 => 7.00 @ 0900

Electronic Filing: Received, Clerk's Office 02/13/2020

ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.
8100 North Austin Avenue Morton Grove, IL 60053-3203 (847) 967-6666 FAX:(847) 967-6735 www.emt.com

Chain of Custody Record

Scheduled Sampling Date: 11/15/2012
Due Date: 11/29/2012

COC # 504844

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP List G20

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 13. Solid 14. Groundwater(Filter)
15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis

1. Endothal
2. Dalapon
3. Herbicides
4. PCBs in Groundwater, Method 8082
5. Pesticides in Groundwater by Method 8081
6. Radiation Testing, Subcontracted
7. Semivolatile Organic Compounds by GCMS
8. Solids, Total Dissolved (TDS)
9. pH, Field tested
10. Anions by Ion Chromatography

EMT USE ONLY
EMT WORKORDER #12110107

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-2 GRAB	12	1 liter	G	10	CP	11/28/12	1000	7.58	1		X	X	X	X	X	X	X				31A
AP-2 GRAB	12	1 liter	P	1	CP	11/28/12	1000	7.58	1									X	X	X	B

Relinquished By:	Date: 11-28-12 Time: 16:15	Received By:	Date: 11-28-12 Time: 16:15	EMT USE ONLY	☐ SAMPLE RECEIVED ON ICE ☑ TEMPERATURE (Must be recorded if sampling was greater than 6 hrs prior to sample receipt)
Relinquished By:	Date: - - Time: : :	Received By:	Date: - - Time: : :	ClientID: SPRING Client Contact: Joe Pavilonis EMT Project ID: CWLP List G20	
Relinquished By:	Date: - - Time: : :	Received By: Marshall	Date: 11 28 12 Time: 1615	Jar Lot No.	

SPECIAL INSTRUCTIONS:

PH: 7.00 => 7.00 @ 0800

11/15/2012 9:51:54 AM

32

Electronic Filing: Received, Clerk's Office 02/13/2020

ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.

Chain of Custody Record

Scheduled Sampling Date: 11/15/2012
Due Date: 11/29/2012

8100 North Austin Avenue Morton Grove, IL 60053-3203 (847) 967-6666 FAX:(847) 967-6735 www.emt.com

COC # 504844

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP List G20

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 13. Solid 14. Groundwater(Filter)
15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis

1. Carbamates
2. Cyanide, Total
3. Total RCRA Metals on a Liquid Sample
4. Volatile Organic Compounds, Method 8260
5. EDB, DBCP and 123TCP by GC/ECD

EMT USE ONLY

EMT WORKORDER #121074

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-2	GRAB	4 oz	G	1	SP	11/28/12	1000	7.58	8		X										C
AP-2	GRAB	500 ml	P	1	SP	11/28/12	1000	7.58	4			X									D
AP-2	GRAB	500 ml	P	1	SP	11/28/12	1000	7.58	3				X								E
AP-2	GRAB	44 ml	V	3	SP	11/28/12	1000	7.58	5					X							F
AP-2	GRAB	44 ml	V	2	SP	11/28/12	1000	7.58	1						X						G

Relinquished By:	Date: 11-28-12	Received By: LAB	Date: 11-28-12	EMT USE ONLY
	Time: 16:15		Time: 16:15	ClientID: SPRING
Relinquished By:	Date: - -	Received By:	Date: - -	Client Contact: Joe Pavilonis
	Time: :		Time: :	EMT Project ID: CWLP List G20
Relinquished By:	Date: - -	Received By:	Date: 11/29/12	Jar Lot No.
	Time: :		Time: 0815	

☐ SAMPLE RECEIVED ON ICE
☐ TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)

SPECIAL INSTRUCTIONS:

PH : 7.00 => 7.00 @ 0800

11/15/2012 9:51:54 AM

Electronic Filing: Received, Clerk's Office 02/13/2020

ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.

Chain of Custody Record

Scheduled Sampling Date: 11/15/2012
Due Date: 11/29/2012

8100 North Austin Avenue Morton Grove, IL 60053-3203 (847) 967-6666 FAX:(847) 967-6735 www.emt.com

COC # 504844

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP List G20

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 13. Solid 14. Groundwater(Filter)
15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H_2SO_4 3. HNO_3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. $Na_2S_2O_3$ 9. Na_2HSO_4
10. Other

Analysis

1. Endothal
2. Dalapon
3. Herbicides
4. PCBs in Groundwater, Method 8082
5. Pesticides in Groundwater by Method 8081
6. Radiation Testing, Subcontracted
7. Semivolatile Organic Compounds by GCMS
8. Solids, Total Dissolved (TDS)
9. pH, Field tested
10. Anions by Ion Chromatography

EMT USE ONLY

EMT WORKORDER # 211076

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-3 GRAB	12	1 liter	G	10	SP	11/28/12	0825	7.35	1		X	X	X	X	X	X	X				11A
AP-3 GRAB	12	1 liter	P	1	SP	11/28/12	0825	7.35	1									X	X	X	B

Relinquished By:	Date:	Time:	Received By:	Date:	Time:
SP	11-28-12	16:15	[signature]	11-28-12	16:15
Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By: Marina H	Date: 11/29/12	Time: 10:10

EMT USE ONLY
ClientID: SPRING
Client Contact: Joe Pavilonis
EMT Project ID: CWLP List G20
Jar Lot No.

☐ SAMPLE RECEIVED ON ICE
TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)

SPECIAL INSTRUCTIONS: pH: 7.00 = 7. 7.00 @ 0800

11/15/2012 9:51:55 AM

Electronic Filing: Received, Clerk's Office 02/13/2020

ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.

8100 North Austin Avenue Morton Grove, IL 60053-3203 (847) 967-6666 FAX:(847) 967-6735 www.emt.com

Chain of Custody Record

Scheduled Sampling Date: 11/15/2012
Due Date: 11/29/2012

COC # 504844

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP List G20

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 13. Solid 14. Groundwater(Filter)
15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. NaHSO4
10. Other

Analysis

1. Carbamates
2. Cyanide, Total
3. Total RCRA Metals on a Liquid Sample
4. Volatile Organic Compounds, Method 8260
5. EDB, DBCP and 123TCP by GC/ECD

EMT USE ONLY

EMT WORKORDER #121107C7

Sample I.D.		Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-3	GRAB	12	4 oz	G	1	SP	11/28/12	0915 0825	7.35	8		X										A C
AP-3	GRAB	12	500 ml	P	1	SP	11/28/12	0915 0825	7.35	4			X									D
AP-3	GRAB	12	500 ml	P	1	SP	11/28/12	0915 0825	7.35	3				X								E
AP-3	GRAB	12	44 ml	V	3	SP	11/28/12	0915 0825	7.35	5					X							F
AP-3	GRAB	12	44 ml	V	2	SP	11/28/12	0915 0825	7.35	1						X						G

Relinquished By	Date/Time	Received By	Date/Time
[signature]	Date: 11-28-12 Time: 16:15	[signature]	Date: 11-28-12 Time: 16:15
Relinquished By:	Date: - - Time: : :	Received By:	Date: - - Time: : :
Relinquished By:	Date: - - Time: : :	Received By: [signature]	Date: 11/28/12 Time: 16:15

EMT USE ONLY
ClientID: SPRING
Client Contact: Joe Pavilonis
EMT Project ID: CWLP List G20
Jar Lot No.

☐ SAMPLE RECEIVED ON ICE
☐ TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)

SPECIAL INSTRUCTIONS: PH: 7.00 => 7.00 @ 0800

11/15/2012 9:51:55 AM

Electronic Filing: Received, Clerk's Office 02/13/2020

ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.

Chain of Custody Record

Scheduled Sampling Date: 11/15/2012
Due Date: 11/29/2012

8100 North Austin Avenue Morton Grove, IL 60053-3203 (847) 967-6666 FAX:(847) 967-6735 www.emt.com

COC # 504844

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP List G20

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 13. Solid 14. Groundwater(Filter)
15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis

1. Endothal
2. Dalapon
3. Herbicides
4. PCBs in Groundwater, Method 8082
5. Pesticides in Groundwater by Method 8081
6. Radiation Testing, Subcontracted
7. Semivolatile Organic Compounds by GCMS
8. Solids, Total Dissolved (TDS)
9. pH, Field tested
10. Anions by Ion Chromatography

EMT USE ONLY

EMT WORKORDER #(2110760)

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-4 GRAB	12	1 liter	G	10	SP	11/28/12	0825	7.09	1		X	X	X	X	X	X	X				SA
AP-4 GRAB	12	1 liter	P	1	SP	11/28/12	0825	7.09	1									X	X	X	B

Relinquished By:	Date: 11-28-12 Time: 16:15	Received By:	Date: 11-28-12 Time: 16:15	EMT USE ONLY ClientID: SPRING Client Contact: Joe Pavilonis EMT Project ID: CWLP List G20
Relinquished By:	Date: - - Time: : :	Received By:	Date: - - Time: : :	
Relinquished By:	Date: - - Time: : :	Received By:	Date: 11/28/12 Time: 1601	Jar Lot No.

SAMPLE RECEIVED ON ICE
TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)

SPECIAL INSTRUCTIONS:

ph: 7.00 => 7.00 @ 0800

Electronic Filing: Received, Clerk's Office 02/13/2020

ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.

Chain of Custody Record

Scheduled Sampling Date: 11/15/2012
Due Date: 11/29/2012

8100 North Austin Avenue Morton Grove, IL 60053-3203 (847) 967-6666 FAX:(847) 967-6735 www.emt.com

COC # 504844

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP List G20

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 13. Solid 14. Groundwater(Filter)
15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis

1. Carbamates
2. Cyanide, Total
3. Total RCRA Metals on a Liquid Sample
4. Volatile Organic Compounds, Method 8260
5. EDB, DBCP and 123TCP by GC/ECD

EMT USE ONLY

EMT WORKORDER #12110767

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-4 GRAB	12	4 oz	G	1	SP	11/28/12	0825	7.09	8		X										SC
AP-4 GRAB	12	500 ml	P	1	SP	11/28/12	0825	7.09	4			X									D
AP-4 GRAB	12	500 ml	P	1	SP	11/28/12	0825	7.09	3				X								E
AP-4 GRAB	12	44 ml	V	3	SP	11/28/12	0825	7.09	5					X							F
AP-4 GRAB	12	44 ml	V	2	SP	11/28/12	0825	7.01	1						X						G

Relinquished By:	Date:	Received By:	Date:
	Time: 16 : 15 :		Time: 16 : 15 :
Relinquished By:	Date: - -	Received By:	Date: - -
	Time: : :		Time: : :
Relinquished By:	Date: - -	Received By: Marhnatt	Date: 11/28/12
	Time: : :		Time: 1615

EMT USE ONLY
ClientID: SPRING
Client Contact: Joe Pavilonis
EMT Project ID: CWLP List G20
Jar Lot No:

SAMPLE RECEIVED ON ICE
TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)

SPECIAL INSTRUCTIONS:

pH: 7.00 => 7.00 @ 0800

Electronic Filing: Received, Clerk's Office 02/13/2020

ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.
8100 North Austin Avenue Morton Grove, IL 60053-3203 (847) 967-6666 FAX:(847) 967-6735 www.emt.com

Chain of Custody Record

Scheduled Sampling Date: 11/15/2012
Due Date: 11/29/2012

COC # 504844

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP List G20

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 13. Solid 14. Groundwater(Filter)
15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H_2SO_4 3. HNO_3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. $Na_2S_2O_3$ 9. $NaHSO_4$
10. Other

Analysis

1. Endothal
2. Dalapon
3. Herbicides
4. PCBs in Groundwater, Method 8082
5. Pesticides in Groundwater by Method 8081
6. Radiation Testing, Subcontracted
7. Semivolatile Organic Compounds by GCMS
8. Solids, Total Dissolved (TDS)
9. pH, Field tested
10. Anions by Ion Chromatography

EMT USE ONLY

EMT WORKORDER #1211076

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-5 GRAB	12	1 liter	G	10	SP	11/28/12	1135	7.29	1		X	X	X	X	X	X	X				QA
AP-5 GRAB	12	1 liter	P	1	SP	11/28/12	1135	7.29	1									X	X	X	B

Relinquished By:	Date: 11-28-12 Time: 16:15	Received By: LAB	Date: 11-28-12 Time: 16:15
Relinquished By:	Date: - - Time: : :	Received By:	Date: - - Time: : :
Relinquished By:	Date: - - Time: : :	Received By: Martinati	Date: 11 28 12 Time: 1615

EMT USE ONLY
ClientID: SPRING
Client Contact: Joe Pavilonis
EMT Project ID: CWLP List G20
Jar Lot No.

☐ SAMPLE RECEIVED ON ICE
☑ TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)

SPECIAL INSTRUCTIONS:
pH: 7.00 => 7.00 @ 0800

11/15/2012 9:51:56 AM

Electronic Filing: Received, Clerk's Office 02/13/2020

ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.

Chain of Custody Record

Scheduled Sampling Date: 11/15/2012
Due Date: 11/29/2012

8100 North Austin Avenue Morton Grove, IL 60053-3203 (847) 967-6666 FAX:(847) 967-6735 www.emt.com

COC # 504844

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP List G20

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 13. Solid 14. Groundwater(Filter)
15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis

1. Carbamates
2. Cyanide, Total
3. Total RCRA Metals on a Liquid Sample
4. Volatile Organic Compounds, Method 8260
5. EDB, DBCP and 123TCP by GC/ECD

EMT USE ONLY

EMT WORKORDER # (12107)

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-5 GRAB	12	4 oz	G	1	SD	11/28/12	1135	7.29	8		1										QC
AP-5 GRAB	12	500 ml	P	1	SD	11/28/12	1135	7.29	4			1									D
AP-5 GRAB	12	500 ml	P	1	SD	11/28/12	1135	7.29	3				X								E
AP-5 GRAB	12	44 ml	V	3	SD	11/28/12	1135	7.29	5					X							F
AP-5 GRAB	12	44 ml	V	2	SD	11/28/12	1135	7.29	1						1						G

Relinquished By:	Date: 11-28-12 Time: 16:15	Received By:	Date: 11-28-12 Time: 16:15	EMT USE ONLY
Relinquished By:	Date: - - Time: : :	Received By:	Date: - - Time: : :	ClientID: SPRING Client Contact: Joe Pavilonis EMT Project ID: CWLP List G20
Relinquished By:	Date: - - Time: : :	Received By:	Date: 11/28/12 Time: 1615	Jar Lot No.

☐ SAMPLE RECEIVED ON ICE
TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)

SPECIAL INSTRUCTIONS: pH: 7.00 = 7.00 @ 0800

11/15/2012 9:51:56 AM
Page 10

Attachment 4
Electronic Data

4.6

4.6	2/20/2014 – CWLP receives Violation Notion ("VN") from Illinois EPA	2.20.2014 IEPA VN	CWLP	01110	01115

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

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

PAT QUINN, GOVERNOR LISA BONNETT, DIRECTOR

cy: PJ Christine

217/785-0561

February 20, 2014

CERTIFIED MAIL # 7011 1150 0001 0861 4228
RETURN RECEIPT REQUESTED

J. Michael Houston
800 East Monroe Street
Municipal Center West
Springfield, IL 62701

Re: Violation Notice: SPRINGFIELD – CITY WATER, LIGHT, AND POWER
Facility No.: IL1671200
Violation Notice No.: W-2014-00002

Dear Mr. Houston:

This constitutes a Violation Notice pursuant to Section 31(a)(1) of the Illinois Environmental Protection Act ("Act"), 415 ILCS 5/31(a)(1), and is based upon a review of available information and an investigation by representatives of the Illinois Environmental Protection Agency ("Illinois EPA").

The Illinois EPA hereby provides notice of alleged violations of environmental laws, regulations, or permits as set forth in Attachment A to this notice. Attachment A includes an explanation of the activities that the Illinois EPA believes may resolve the specified alleged violations, including an estimate of a reasonable time period to complete the necessary activities. Due to the nature and seriousness of the alleged violations, please be advised that resolution of the violations may also require the involvement of a prosecutorial authority for purposes that may include, among others, the imposition of statutory penalties.

A written response, which may include a request for a meeting with representatives of the Illinois EPA, must be submitted via certified mail to the Illinois EPA within 45 days of receipt of this letter. If a meeting is requested, it shall be held within 60 days of receipt of this notice. The response must include information in rebuttal, explanation, or justification of each alleged violation and a statement indicating whether or not the facility wishes to enter into a Compliance Commitment Agreement ("CCA") pursuant to Section 31(a) of the Act. If the facility wishes to enter into a CCA, the written response must also include proposed terms for the CCA that includes dates for achieving each commitment and may include a statement that compliance has been achieved for some or all of the alleged violations. The proposed terms of the CCA should contain sufficient detail and must include steps to be taken to achieve compliance and the necessary dates by which compliance will be achieved.

Electronic Filing: Received, Clerk's Office 02/13/2020

The Illinois EPA will review the proposed terms for a CCA provided by the facility and, within 30 days of receipt, will respond with either a proposed CCA or a notice that no CCA will be issued by the Illinois EPA. If the Illinois EPA sends a proposed CCA, the facility must respond in writing by either agreeing to and signing the proposed CCA or by notifying the Illinois EPA that the facility rejects the terms of the proposed CCA.

If a timely written response to this Violation Notice is not provided, it shall be considered a waiver of the opportunity to respond and meet, and the Illinois EPA may proceed with referral to a prosecutorial authority.

Written communications should be directed to:

Illinois EPA – Division of Public Water Supplies
Attn: Andrea Rhodes, CAS #19
P.O. BOX 19276
Springfield, IL 62794-9276

All communications must include reference to this Violation Notice number, W-2014-00002.

Questions regarding this Violation Notice should be directed to Andrea Rhodes at 217/785-0561.

Sincerely,

Michael Crumly
Manager, Compliance Assurance Section
Division of Public Water Supplies
Bureau of Water

Attachments

cc: Sue Corcoran

BOW ID: W1678050005

ATTACHMENT A

SPRINGFIELD CITY WATER, LIGHT, AND POWER, IL1671200
VIOLATION NOTICE NO. W-2014-00002:

Questions regarding the violations identified in this attachment should be referred to Andrea Rhodes at (217) 785-0561.

A review of information available to the Illinois EPA indicates the following violations of statutes, regulations, or permits. Included with each type of violation is an explanation of the activities that the Illinois EPA believes may resolve the violation including an estimated time period for resolution.

Groundwater Quality

No person shall cause, threaten or allow the release of any contaminant to a resource groundwater such that: treatment or additional treatment is necessary to continue an existing use or to assure a potential use of such groundwater; or an existing or potential use of such groundwater is precluded. No person shall cause, threaten or allow the release of any contaminant to groundwater so as to cause a groundwater quality standard to be exceeded. City Water, Light, and Power must take actions to mitigate existing contamination and prevent the continuing release of contaminants into the environment.

Violation Description

Operations at ash impoundments have resulted in violations of the Groundwater Quality Standards at monitoring well AP-1R for the following constituents:

Parameter	Sample Value	GW Standard	Collection Date
Boron	18.9 mg/L	2.0 mg/L	11/20/2013
Boron	14.7 mg/L	2.0 mg/L	08/28/2013
Boron	7.76 mg/L	2.0 mg/L	05/23/2013
Boron	3.9 mg/L	2.0 mg/L	02/21/2013
Boron	4.3 mg/L	2.0 mg/L	11/28/2012
Boron	15.2 mg/L	2.0 mg/L	08/23/2012
Boron	10.4 mg/L	2.0 mg/L	04/25/2012
Boron	14.6 mg/L	2.0 mg/L	02/22/2012
Sulfate	581 mg/L	400 mg/L	11/20/2013
Sulfate	597 mg/L	400 mg/L	08/28/2013
Sulfate	603 mg/L	400 mg/L	05/23/2013
Sulfate	506 mg/L	400 mg/L	02/21/2013
Sulfate	488 mg/L	400 mg/L	11/28/2012
Sulfate	469 mg/L	400 mg/L	08/23/2012
Sulfate	463 mg/L	400 mg/L	04/25/2012
Sulfate	521 mg/L	400 mg/L	02/22/2012
TDS	1250 mg/L	1200 mg/L	11/20/2013
TDS	1380 mg/L	1200 mg/L	08/28/2013
TDS	1390 mg/L	1200 mg/L	05/23/2013

Rule/Reg. Section 12 of the Act, 415 ILCS 5/12, 35 Ill. Adm. Code 620.115, 620.301, 620.401, 620.405, and 620.410.

ATTACHMENT A

SPRINGFIELD CITY WATER, LIGHT, AND POWER, IL1671200
VIOLATION NOTICE NO. W-2014-00002:

Violation Description

Operations at ash impoundments have resulted in violations of the Groundwater Quality Standards at monitoring well AP-2 for the following constituents:

Parameter	Sample Value	GW Standard	Collection Date
Boron	2.63 mg/L	2.0 mg/L	06/01/2010

Rule/Reg. Section 12 of the Act, 415 ILCS 5/12, 35 Ill. Adm. Code 620.115, 620.301, 620.401, 620.405, and 620.410.

Violation Description

Operations at ash impoundments have resulted in violations of the Groundwater Quality Standards at monitoring well AP-2R for the following constituents:

Parameter	Sample Value	GW Standard	Collection Date
Boron	4.78 mg/L	2.0 mg/L	11/20/2013
Boron	5.46 mg/L	2.0 mg/L	08/28/2013
Boron	5.01 mg/L	2.0 mg/L	05/23/2013
Boron	10.0 mg/L	2.0 mg/L	02/21/2013
Boron	6.24 mg/L	2.0 mg/L	11/28/2012
Boron	6.88 mg/L	2.0 mg/L	08/24/2012
Boron	5.51 mg/L	2.0 mg/L	04/25/2012
Boron	5.0 mg/L	2.0 mg/L	02/22/2012

Rule/Reg. Section 12 of the Act, 415 ILCS 5/12, 35 Ill. Adm. Code 620.115, 620.301, 620.401, 620.405, and 620.410.

Violation Description

Operations at ash impoundments have resulted in violations of the Groundwater Quality Standards at monitoring well AP-3 for the following constituents:

Parameter	Sample Value	GW Standard	Collection Date
Boron	20.6 mg/L	2.0 mg/L	11/20/2013
Boron	21.3 mg/L	2.0 mg/L	08/28/2013
Boron	18.7 mg/L	2.0 mg/L	05/23/2013
Boron	29.1 mg/L	2.0 mg/L	02/21/2013
Boron	8.03 mg/L	2.0 mg/L	11/28/2012
Boron	20.9 mg/L	2.0 mg/L	08/24/2012
Boron	18.4 mg/L	2.0 mg/L	04/25/2012

ATTACHMENT A

SPRINGFIELD CITY WATER, LIGHT, AND POWER, IL1671200
VIOLATION NOTICE NO. W-2014-00002:

Violation
Description
AP-3 continued

Parameter	Sample Value	GW Standard	Collection Date
Boron	17.7 mg/L	2.0 mg/L	02/22/2012
Boron	11.9 mg/L	2.0 mg/L	06/01/2010

Rule/Reg. Section 12 of the Act, 415 ILCS 5/12, 35 Ill. Adm. Code 620.115, 620.301, 620.401, 620.405, and 620.410.

4.7

4.7	4/2/14 – CWLP proposes Compliance Commitment Agreement (“CCA”) to Illinois EPA	4.2.2014 CWLP GW VN	CWLP	01116	01119

Electronic Filing: Received, Clerk's Office 02/13/2020

OFFICE OF PUBLIC UTILITIES
CITY OF SPRINGFIELD, ILLINOIS

J. MICHAEL HOUSTON, MAYOR

VIA CERTIFIED MAIL

April 2, 2014

Ms. Andrea Rhodes
Mr. Michael Crumly
Illinois Environmental Protection Agency
Division of Public Water Supplies, CAS #19
P.O. Box 19276
Springfield, IL 62794-9276

Re: Violation Notice No.: W-2014-00002
Facility No.: IL 1671200
(Springfield—City Water, Light & Power)

Dear Ms. Rhodes and Mr. Crumly,

This is written on behalf of the City of Springfield, Office of Public Utilities, City Water, Light & Power (CWLP) regarding the above-referenced Violation Notice (VN) received by Mayor Houston on February 25, 2014.

The VN alleges that operations at CWLP's ash impoundments have resulted in exceedances of Groundwater Quality Standards in four (4) groundwater monitoring wells; more particularly that the Groundwater Quality Standard for boron has been exceeded in four (4) of these wells, and that one (1) well (AP-1R) also has exceeded the Groundwater Quality Standards for Sulfate and for TDS for sampling conducted by CWLP in 2012 and 2013. Boron is alleged to have exceeded the standard of 2.0 mg/L in well AP-2 with a sample value of 2.63 mg/L once (1x) in 2010. Well AP-2R is alleged to have eight (8) exceedances for boron in 2012 and 2013, with well AP-3 alleged to have eight (8) exceedances for boron in 2012 and 2013, and one in 2010.

As you know, these monitoring wells were voluntarily installed and sampled, and the results submitted to the Agency by CWLP pursuant to a groundwater monitoring plan voluntarily filed with the IEPA for approval (and approved) pursuant to the Agency's request to CWLP as part of its Ash Impoundment Strategy. CWLP engaged Andrews Engineering, Inc., which designed a plan to characterize the local hydrogeologic conditions specific to the impoundments, evaluate the potential for migration from the impoundments and identify potable water supply wells within 2,500 feet of the impoundments. Results were submitted to the Agency in August 2010 (with no potable water supply wells found within 2,500 feet). Thereafter, Andrews proposed locations for the installation of an additional background well, replacement of two downgradient wells, and collection of data and derivation of statistical background concentrations for groundwater quality evaluation, which was submitted and approved by the Agency, with statistical derivation of background concentrations underway. However, when

several parameters in an upgradient well exhibited significant decreasing trends during background sampling events, it was determined that utilizing these data would artificially elevate the background concentrations, and since the groundwater quality in that well did not stabilize, additional quarterly data were being collected. Once statistically valid data were collected, revised background concentrations were planned to be submitted to the Agency.

CWLP appreciates the Agency's efforts both before the VN and in the future to work with CWLP toward an acceptable and as cost-effective solution as possible to the issue of groundwater exceedances, which appear to have resulted from CWLP's operation of its ash impoundments, consistent with the steps of a scientific process to ensure that the groundwater and hydrogeologic conditions are properly investigated and assessed, to determine appropriate mitigation activities. As explained above, CWLP had been voluntarily engaged with the Agency in that process when the VN was issued.

Toward that end and consistent with Section 31(a)(2) of the Environmental Protection Act (Act), CWLP proposes and hopes to enter into a Compliance Commitment Agreement (CCA) with the Agency (as suggested in more detail below) and requests a meeting with the Agency to discuss the VN and CWLP's CCA proposal. As you know, CWLP has been participating in the rulemaking proceeding underway before the Illinois Pollution Control Board (IPCB) that would formalize a process for ash impoundment assessments for the protection of groundwater. CWLP's CCA proposal takes into consideration our Groundwater Monitoring Program already approved by the Agency and the steps that have been underway, proposing additional investigation in a manner that we hope would not require CWLP to engage in unnecessary costly duplicative consulting services once the regulations in R14-10 become final. CWLP notes that the VN did not set forth suggested mitigation activities or a suggested timeline toward compliance, and therefore suggests the next steps as follows:

Proposed CCA: Complete additional activities to investigate and assess the extent of concentrations exceeding the applicable standards and/or the background concentrations to the groundwater, based on available and ongoing groundwater monitoring results, potentially addressing the conditions in 35 Ill. Adm. Code 620.250. Within 45 days of the Agency's acceptance of CWLP's CCA, CWLP will submit an approvable assessment monitoring plan to the Agency for review which defines the subject activities.

- The approvable assessment monitoring plan will identify what parameters must be tested, by identifying the constituents of concern (COC).
- CWLP expects that the assessment monitoring plan would require approximately 8-10 Geoprobe borings located along the periphery of the specific affected monitoring wells, which may include areas across the creek (north and/or west).
- Discreet groundwater samples will be collected and analyzed from each borehole for each COC.
- One-inch piezometers may also be placed in borings where such data are deemed necessary or relevant for possible subsequent work.
- The next steps depend upon the results of these tasks; another phase of such activities may be necessary if the extent of elevated concentrations has not been determined.

Therefore, further steps or the timetable for additional activities is difficult to set forth, until the extent is determined.

Pursuant to Section 31 of the Act and the VN, because of the complexity of the issues presented, CWLP requests to meet with the Illinois EPA. CWLP reserves its right under Section 31 to amend or add to this response, following our meeting with the Illinois EPA. Please contact me with suggested dates to meet. I can be reached at: (217)789-2116 (ext. 2628) or at: Christine.zeman@cwlp.com. Thank you.

Sincerely,

Christine Zeman
Regulatory Affairs Director

Cy: PJ Becker
Sue Corcoran

4.8

4.8	4/11/14 – Illinois EPA acknowledges receipt of CCA and proposes a 4/22/14 meeting	4.11.2014 IEPA letter	CWLP	01120	01120

Electronic Filing: Received, Clerk's Office 02/13/2020

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

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

217/785-0561

April 11, 2014

CERTIFIED MAIL # 7011 1150 0001 0859 1963
RETURN RECEIPT REQUESTED

J. Michael Houston
800 East Monroe Street
Municipal Center West
Springfield, IL 62701

Re: IL1671200, SPRINGFIELD – CITY WATER, LIGHT, AND POWER
Meeting Scheduled
Violation Notice No.: W-2014-00002

Dear Mr. Houston:

The Illinois Environmental Protection Agency ("Illinois EPA") acknowledges your request for a meeting, which is currently scheduled for April 22, 2014, at 1:30 pm, in the Sangamon River conference room at the Illinois Environmental Protection Agency offices located at 1021 North Grand Avenue East, Springfield, Illinois. A party that meets with the Illinois EPA is given 21 days after the meeting to submit proposed terms for a Compliance Commitment Agreement ("CCA") pursuant to Section 31(a)(5) of the Illinois Environmental Protection Act ("Act"), 415 ILCS 5/31(a)(5).

The Illinois EPA also acknowledges receiving a response dated April 2, 2014. Section 31(a)(5) requires you to submit a written response within 21 days following the meeting. Because you have requested a meeting, the Illinois EPA will make its decision regarding issuance of a proposed CCA within 30 days of receipt of the meeting response. See Section 31(a)(7).

Questions regarding this matter should be directed to Andrea Rhodes at the 217/785-0561. Written communications should be directed to Andrea Rhodes at the Illinois Environmental Protection Agency, Bureau of Water, CAS #19, P.O. Box 19276, Springfield, Illinois 62794-9726 and all communications shall include reference to your Violation Notice number, W-2014-00002.

Sincerely,

Michael Crumly
Manager, Compliance Assurance Section
Division of Public Water Supplies
Bureau of Water

cc: Sue Corcoran

4302 N. Main St., Rockford, IL 61103 (815)987-7760
595 S. State, Elgin, IL 60123 (847)608-3131
2125 S. First St., Champaign, IL 61820 (217)278-5800
2009 Mall St., Collinsville, IL 62234 (618)346-5120
9511 Harrison St., Des Plaines, IL 60016 (847)294-4000
5407 N. University St., Arbor 113, Peoria, IL 61614 (309)693-5462
2309 W. Main St., Suite 116, Marion, IL 62959 (618)993-7200
100 W. Randolph, Suite 10-300, Chicago, IL 60601 (312)814-6026

PLEASE PRINT ON RECYCLED PAPER

4.10

4.10	5/12/2014 – CWLP proposes a revised CCA	5.12.2014 CWLP GW CCA VN	CWLP	01122	01125

OFFICE OF PUBLIC UTILITIES
CITY OF SPRINGFIELD, ILLINOIS

J. MICHAEL HOUSTON, MAYOR

VIA CERTIFIED MAIL

May 12, 2014

Ms. Andrea Rhodes
Mr. Michael Crumly
Illinois Environmental Protection Agency
Division of Public Water Supplies, CAS #19
P.O. Box 19276
Springfield, IL 62794-9276

Re: Violation Notice No.: W-2014-00002
Facility No.: IL 1671200
(Springfield—City Water, Light & Power)

Dear Ms. Rhodes and Mr. Crumly,

This is written on behalf of the City of Springfield, Office of Public Utilities, City Water, Light & Power (CWLP) regarding the above-referenced Violation Notice (VN) received by Mayor Houston on February 25, 2014.

CWLP submitted a response to the VN on April 2, 2014 that included a proposed Compliance Commitment Agreement (CAA) and requested a meeting with the Agency to discuss. As you know, the meeting with the Agency was held on April 22, 2014 and CWLP received additional correspondence on the VN on April 23, 2014. This letter is the proposed terms for the CCA and meeting response as requested by the Agency per the April 23, 2014 letter.

The VN alleges that operations at CWLP's ash impoundments have resulted in exceedances of Groundwater Quality Standards in four (4) groundwater monitoring wells; more particularly that the Groundwater Quality Standard for boron has been exceeded in four (4) of these wells, and that one (1) well (AP-1R) also has exceeded the Groundwater Quality Standards for Sulfate and for TDS for sampling conducted by CWLP in 2012 and 2013. Boron is alleged to have exceeded the standard of 2.0 mg/L in well AP-2 with a sample value of 2.63 mg/L once (1x) in 2010. Well AP-2R is alleged to have eight (8) exceedances for boron in 2012 and 2013, with well AP-3 alleged to have eight (8) exceedances for boron in 2012 and 2013, and one in 2010.

As you know, these monitoring wells were voluntarily installed and sampled, and the results submitted to the Agency by CWLP pursuant to a groundwater monitoring plan voluntarily filed with the IEPA for approval (and approved) pursuant to the Agency's request to CWLP as part of its Ash Impoundment Strategy. CWLP engaged Stabilize, Inc., which designed a plan to characterize the local hydrogeologic conditions specific to the impoundments, evaluate the potential for migration from the impoundments and identify potable water supply wells with

2,500 feet of the impoundments. Results were submitted to the Agency in August 2010 (with no potable water supply wells found within 2,500 feet). Subsequently, the Illinois EPA required the submittal of a Groundwater Monitoring Program, which included the proposed locations for the installation of an additional background well and replacement of two downgradient wells. The subject Groundwater Monitoring Program was designed by Andrews Engineering, Inc. and submitted to the Illinois EPA on November 18, 2011. The Groundwater Monitoring Program was approved December 29, 2011.

CWLP appreciates the Agency's efforts both before the VN and in the future to work with CWLP toward an acceptable and as cost-effective solution as possible to the issue of groundwater exceedences. The solution will be consistent with the steps of a scientific process to ensure that the groundwater and hydrogeologic conditions are properly investigated and assessed, and to determine appropriate mitigation activities. As explained above, CWLP had been voluntarily engaged with the Agency in that process when the VN was issued.

Toward that end and consistent with Section 31(a)(2) of the Environmental Protection Act (Act), CWLP proposed to enter into a Compliance Commitment Agreement (CCA) with the Agency (as suggested in more detail below) and requested a meeting with the Agency to discuss the VN and CWLP's CCA proposal. As you know, CWLP has been participating in the rulemaking proceeding underway before the Illinois Pollution Control Board (IPCB) that would formalize a process for ash impoundment assessments for the protection of groundwater. CWLP's CCA proposal takes into consideration our Groundwater Monitoring Program already approved by the Agency and the steps that have been underway, proposing additional investigation in a manner that would not require CWLP to engage in unnecessary costly duplicative consulting services once the regulations in R14-10 become final. CWLP notes that the VN did not set forth suggested mitigation activities or a suggested timeline toward compliance, and therefore suggests the next steps as follows:

Proposed CCA: Complete additional activities to investigate and assess the extent of concentrations exceeding the applicable standards and/or the background concentrations to the groundwater, based on available and ongoing groundwater monitoring results, potentially addressing the conditions in 35 Ill. Adm. Code 620.250. Within 45 days of the Agency's acceptance of CWLP's CCA, CWLP will submit an approvable assessment monitoring plan to the Agency for review which defines the subject activities. It is assumed the Illinois EPA will provide a response to the assessment plan within 30 days.

Phase 1

- The approvable assessment monitoring plan will identify what parameters must be tested, by identifying the constituents of concern (COC);
- CWLP expects that the assessment monitoring plan would require approximately 8-10 Geoprobe borings located along the periphery of the specific affected monitoring wells, which may include areas across the creek (north and/or west);
- Discreet groundwater samples will be collected and analyzed from each borehole for each COC;
- One-inch piezometers may also be placed in borings where such data are deemed necessary or relevant for possible subsequent work;
- If the extent of concentrations exceeding the applicable limits is not defined during the first phase of drilling, additional phases shall be conducted until the extent is defined;

- CWLP will provide a written report to the Bureau of Water detailing the results of the assessment activities.

Phase 2

- Subsequent to identifying the extent of COC exceedences attributable to the impoundment(s), a Groundwater Management Zone (GMZ) shall be established within one (1) year of the Agency's acceptance of CWLP's CCA.
- As part of the establishment of the GMZ, potential corrective actions will be evaluated for implementation to control and/or mitigate the COC exceedences. Potential compliance options that may be considered after the extent of elevated concentrations has been determined are set forth below. The timetable for the potential compliance options listed below is difficult to set forth at this time; however, CWLP has estimated the time needed to perform each activity upon initiating.
    - Establishing a CWLP site-specific rule or an adjusted standard (Illinois Pollution Control Board) for alternative groundwater standards for COC(s) (timetable – one (1) year from initiating). An adjusted standard pursuant to 415 ILCS 5/28.1 may not require corrective action, dependent upon the content of the Adjusted Standard Petition;
    - Groundwater extraction and discharge via outfall 004 and/or to the Springfield Metro Sanitary District (timetable – two (2) years from initiating);
    - Installing a dry fly-ash handling system on Dallman Unit 33 (timetable – four (4) years from initiating);
    - Dredge portion of the Dallman ash impoundment and retrofit with compliant liner. Close and cap unused portion of Dallman ash impoundment (timetable – six (6) years from initiating).

Pursuant to statements by Illinois EPA personnel during the April 22, 2014 meeting, Phase I activities as originally proposed (and re-proposed here) are acceptable toward the CCA, but required follow-up activities to address the exceedances. At that meeting Illinois EPA personnel also stated that active remediation (pump and treat or the installation of a barrier wall) will not be required unless elevated concentrations are migrating off site or impacting a water supply. Neither appears to be occurring at the subject facility. The Phase 1 assessment monitoring will provide additional data on these issues.

CWLP will assess the effectiveness of the above referenced potential corrective actions for the ability of the action to improve the groundwater quality with respect to the identified COCs. CWLP shall provide the Bureau of Water written notification of the selected corrective action with accompanying justification for such selection. The Bureau of Water will provide approval of the selection prior to corrective action implementation by CWLP. A construction report shall be submitted upon completion of the corrective action.

Summary

Following is a summary of the anticipated tasks and related timelines leading up to implementation of corrective action. Dates that are dependent upon fieldwork may vary.

1. May 13, 2014 – submittal of the CCA to the Illinois EPA.
2. June 12, 2014 – Illinois EPA approval of the CCA.
3. July 27, 2014 or 45 days from Illinois EPA approval of CCA – CWLP submits the assessment plan to the Illinois EPA for approval.

4. August 26, 2014 – Illinois EPA approves the assessment plan.
5. November 15, 2014 or 80 days from Illinois EPA approval of the assessment plan – CWLP provides results of the assessment to the Illinois EPA.
6. April 15, 2015 or 150 days from the above referenced task – CWLP provides notification of selection of corrective action and accompanying information to the Illinois EPA.
7. Timetable for implementation and completion of corrective action dependent upon the results of the foregoing assessment monitoring and other activities.

CWLP may request meetings with the Bureau of Water during the process to discuss preliminary findings and possible conclusions. CWLP believes that it has provided an aggressive timetable here for addressing the groundwater exceedances discovered through its voluntary participation in the Illinois EPA's Ash Impoundment Strategy. As explained at the meeting, CWLP is disappointed and believes it unrealistic and outside the terms and intent of Section 31 of the Act to require corrective action for groundwater exceedances to be complete within one (1) year, in order to avoid referral to the Attorney General, as the Illinois EPA appeared to say is the only timetable in which a CCA will be accepted. CWLP respectfully requests reconsideration of such limitation.

CWLP reserves its right under Section 31 to amend or add to this response. Please contact me if you have any questions or need additional information. I can be reached at: (217)789-2116 (ext. 2628) or at: Christine.zeman@cwlp.com. Thank you.

Sincerely,

Christine Zeman
Regulatory Affairs Director

Cy: PJ Becker
Sue Corcoran

4.11

4.11	5/29/2014 – CCA is rejected	5.29.2014 IEPA GW CCA Response	CWLP	01126	01126

Electronic Filing: Received, Clerk's Office 02/13/2020

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

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

PAT QUINN, GOVERNOR LISA BONNETT, DIRECTOR

217-785-0561

May 29, 2014

CERTIFIED MAIL # 7011 1150 0001 0859 2144
RETURN RECEIPT REQUESTED

J. Michael Houston
800 East Monroe Street
Municipal Center West
Springfield, IL 62701

Re: Notice of Non-Issuance of Compliance Commitment Agreement
Violation Notice: W-2014-00002
SPRINGFIELD, IL1671200

Dear Mr. Houston:

The Illinois Environmental Protection Agency ("Illinois EPA") has reviewed the proposed Compliance Commitment Agreement ("CCA") terms submitted by Springfield in a letter dated April 2, 2014 and a meeting response dated May 12, 2014, in response to the Violation Notice dated February 20, 2014, and has decided not to issue a proposed CCA for these violations. Due to the nature and seriousness of the violations and the extended time requested to achieve compliance, the Illinois EPA has determined that these violations may not be able to be resolved without the involvement of the Office of the Attorney General or the State's Attorney.

Because the violations remain the subject of disagreement between the Illinois EPA and Springfield, this matter will be considered for referral to the above-referenced prosecutorial authorities for formal enforcement action and the imposition of penalties.

Questions regarding this matter should be directed to Andrea Rhodes at 217/785-0561. Written communications should be directed to Illinois EPA, Attn. Andrea Rhodes, MC#19, 1021 North Grand Ave East, Springfield, IL 62702.

Sincerely,

W. David McMillan
Manager, Division of Public Water Supplies
Bureau of Water

RECEIVED
MAY 30 2014
ENVIRONMENTAL HEALTH & SAFETY

cc: Sue Corcoran

4302 N. Main St., Rockford, IL 61103 (815) 987-7760
595 S. State, Elgin, IL 60123 (847) 608-3131
2125 S. First St., Champaign, IL 61820 (217) 278-5800
2009 Mall St., Collinsville, IL 62234 (618) 346-5120
9511 Harrison St., Des Plaines, IL 60016 (847) 294-4000
412 SW Washington St., Suite D, Peoria, IL 61602 (309) 671-3022
2309 W. Main St., Suite 116, Marion, IL 62959 (618) 993-7200
100 W. Randolph, Suite 10-300, Chicago, IL 60601 (312) 814-6026

Response to 1st RTP
CWLP - 01126

4.12

4.12	5/30/2012 – Andrews Engineering submits logs, well reports and data for AP1, AP2 and AP3	5.30.2013 CWLP GW Request	CWLP	01127	01168

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ANDREWS ENGINEERING, INC.

RECEIVED
JUN - 4 2012
ENVIRONMENTAL HEALTH & SAFETY

May 30, 2012

Alan Keller, P.E., Manager, Permit Section
Illinois Environmental Protection Agency
Division of Water Pollution Control
Compliance Assurance Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Re: City Water, Light and Power – Power Plant Ash Impoundment
NPDES Permit No. IL0024767

Dear Mr. Keller:

On behalf of City Water, Light and Power, City of Springfield, Illinois (CWLP), Andrews Engineering, Inc. has prepared a response to Item No. 2 of the Illinois EPA's October 19, 2011 correspondence to CWLP. Item No. 2 specifically states:

> *Additionally, CWLP should establish a quarterly monitoring program for the designated monitoring wells. The monitoring wells should be sampled for Class I groundwater chemical parameters listed in 35 IAC 620.410(a) and (d). Both background and replacement monitoring wells should be screened in the upper most water bearing materials. Provide the monitoring well driller's logs and completion reports to the Illinois EPA once well completion work is finished. Two rounds of groundwater sampling should be completed at each designated monitoring well by April 30, 2012, with results provided to the Illinois EPA by May 30, 2012.*

As requested, the monitoring well driller's logs and completion reports are provided in Appendix A for replacement wells AP-1R, AP-2R, and new background well AP-5. Monitoring wells AP-1 and AP-2 were inspected and determined replacement was necessary due to damage caused by flooding. Debris from flooding was flushed from wells AP-1 and AP-2 prior to abandonment. The subject wells were abandoned pursuant to 77 IAC 920.120. Abandonment forms were submitted to the Sangamon County Health Department is accordance with the referenced regulations. Well installation and abandonment was completed by Terra Drill Inc. on January 30 and 31, 2012 and was observed by an Andrews Engineering professional geologist.

Groundwater sampling at upgradient wells AP-4 and AP-5, as well as four downgradient wells AP-1, AP-2, AP-3, and AW-3, was conducted on February 22 and April 25, 2012. Monitoring results for the groundwater chemical parameters listed in 35 IAC 620.410(a) and (d) are provided in Appendix B. A summary of the data is provided in tabular format at the front of the Appendix. Analysis for Radium-226 and Radium-228 are not yet complete for the April 25, 2012 monitoring event and will be submitted when they become available. Statistical analysis will be

3300 Ginger Creek Drive, Springfield, Illinois 62711 ◆ 217.787.2334 fax 217.787.9495 www.andrews-eng.com

completed in accordance with Item No. 1 of the Illinois EPA's October 19, 2011 correspondence once four quarters of data have been collected.

If you have any questions or require further information, please contact me.

Sincerely,

Kim E. Van Pelt
Environmental Scientist

KEV:kev:slm

Enclosures

cc: Sue Corcoran – Environmental Health and Safety, City Water Light and Power, City of Springfield
Illinois EPA DWPC Springfield Region
Illinois EPA Hydrogeology and Compliance Unit

Appendix A
Boring Logs and Well Completion Reports

Electronic Filing: Received, Clerk's Office 02/13/2020

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Sangamon Well #: AP-1R

Site Name: City Water, Light, & Power Borehole #: AP-1R

Coordinates: X 831.70 Y 5132.40 (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___"

Surveyed by: _____ IL Registration #: _____

Drilling Contractor: Terra Drill, Inc. Consulting Firm: Andrews Engineering, Inc.

Driller: J. Brown Geologist: M. Hewitt

Drilling Method: 4¼" HSA w/ 5' Continuous Barrel Logged by: M. Hewitt

Drilling Fluids (type): _____ Report Form Completed by: J. Rhoades

Date Well Started: 1/30/2012 Date Well Finished: 1/30/2012 Date Form Completed: 2/27/2012

ANNULAR SPACE DETAILS

Type of surface seal: Concrete

Type of annular sealant: Bentonite Grout

Installation method: Tremie

Setting time: 2 Hours

Type of bentonite seal – Bentonite Chips (circle one)

Installation method: Free drop

Setting time: 2 Hours

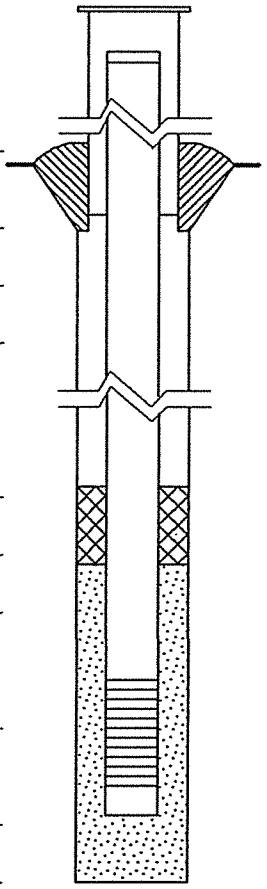
Type of sand pack: Unimin Sand

Grain size: 10/20 (sieve size)

Installation method: Free drop

Type of backfill material: _____ (if applicable)

Installation method: _____



ELEVATION (MSL)*	DEPTH (BGS)*	(0.01 ft)
535.60	-2.50	Top of Protective Casing
535.60	-2.50	Top of Riser Pipe
533.10	.00	Ground Surface
530.10	3.00	Top of Annular Sealant
n/a	n/a	Static Water Level Measured on (after completion)
517.00	16.10	Top of Seal
513.51	19.59	Top of Sandpack
514.01	19.09	Top of Screen
504.63	28.47	Bottom of Screen
504.10	29.00	Bottom of Well
500.60	32.50	Bottom of Borehole

* Referenced to a National Geodetic Vertical Datum
• positive (+) values below GS, negitive (-) values above GS

WELL CONSTRUCTION MATERIALS (circle one)

Protective Casing	SS304, SS316, PTFE, PVC or *Other:Steel*
Riser Pipe Above W.T.	SS304, SS316, PTFE, *PVC*, or Other:
Riser Pipe Below W.T.	SS304, SS316, PTFE, *PVC*, or Other:
Screen	SS304, SS316, PTFE, *PVC*, or Other:

CASING MEASUREMENTS

Diameter of Borehole (in)	8.0
ID of Riser Pipe (in)	2.0
Protective Casing Length (ft)	5.0
Riser Pipe Length (ft)	21.59
Bottom of Screen to End Cap (ft)	.53
Screen Length [1st slot to last slot] (ft)	9.38
Total Length of Casing (ft)	31.50
Screen Slot Size*	0.01"

*Hand-slotted well screens are unacceptable.

(AE950315)

Electronic Filing: Received, Clerk's Office 02/13/2020

Andrews Engineering, Inc.

3300 Ginger Creek Drive, Springfield, IL 62711 (217) 787-2334

Field Boring Log

Site Information:
Name: City Water, Light, & Power
Location: Springfield, IL
County: Sangamon
Site No.:
AEEI No.: 2011-127

Location:
Coord. System: Site Grid
Northing: 5132.40
Easting: 831.70

Weather:
Cloudy; 38° F; West 10-15 MPH

Boring Information:
Boring No.: AP-1R
Well No.: AP-1R
Surf. Elev.: 533.10

Depth Information:
Total: 32.50
Auger: 32.50
Core:

Dates:
Start: 1/30/2012
Finish: 1/30/2012

Drilling Contractor:
Name: Terra Drill, Inc.
City: Dupo, IL
Equipment: CME 550 with 4¼" I.D. HSA and 5' CB

Personnel:
Geologist: M. Hewitt
Driller: J. Brown
Helper (s): J. Horn

Sample Type: ▮ - Continuous Barrel ☒ - Split Spoon ⧄ - Shelby Tube ▮ - Core ☐ - Blind Drill

Depth (ft.)	Run No.	Sample Type	Sample No.	Sample Recov.	Blow Count	q_p [q_s] (in tsf)	% Moisture	Borehole Detail	Lithology	Description/*Comments*	USC	Elev. (MSL)
								Stickup = 2.50'				
	1			NA				Concrete		Dark brown silty CLAY; very stiff; slightly moist	CL	
										Dark brown clayey SILT; stiff; slightly moist	ML	530
5	2			NA						Gray clayey SILT; trace brown; firm; moist	ML	525
10	3			NA				Bentonite Grout				
												520
										Gray silty CLAY; few brown sand; firm; saturated	CL	
15	4			NA				Bentonite Chips		Gray sandy CLAY; stiff; saturated	SC	515
										Blue-gray clayey SILT; soft to very stiff; moist to saturated	ML	
20	5							Silica Sand				

NOTES: AP-1R blind-drilled to 19.0 ft bgs
Geology from 0-19.0 ft bgs based on AP-1 log

Response to 1st RTP
CWLP - 01133

Electronic Filing: Received, Clerk's Office 02/13/2020

Andrews Engineering, Inc.

3300 Ginger Creek Drive, Springfield, IL 62711 (217) 787-2334

Field Boring Log

Site Information:
Name: City Water, Light, & Power
Location: Springfield, IL
County: Sangamon
Site No.:
AEEI No.: 2011-127

Location:
Coord. System: Site Grid
Northing: 5132.40
Easting: 831.70

Weather:
Cloudy; 38° F; West 10-15 MPH

Boring Information:
Boring No.: AP-1R
Well No.: AP-1R
Surf. Elev.: 533.10

Depth Information:
Total: 32.50
Auger: 32.50
Core:

Dates:
Start: 1/30/2012
Finish: 1/30/2012

Drilling Contractor:
Name: Terra Drill, Inc.
City: Dupo, IL
Equipment: CME 550 with 4¼" I.D. HSA and 5' CB

Personnel:
Geologist: M. Hewitt
Driller: J. Brown
Helper (s): J. Horn

Sample Type: Continuous Barrel | Split Spoon | Shelby Tube | Core | Blind Drill

Depth (ft.)	Run No.	Sample Type	Sample No.	Sample Recov.	Blow Count	q_p [q_s] (in tsf)	% Moisture	Borehole Detail	Lithology	Description/*Comments*	USC	Elev. (MSL)
										(Cont'd) Blue-gray clayey SILT; soft to very stiff; moist to saturated		
	5			100%							ML	510
25								Silica Sand		Gray SAND with silt; medium dense; saturated	SM	
	6			100%						Dark gray SAND and GRAVEL; loose; saturated	SW	505
30	7			100%								
										Dark gray SHALE; weathered; dense; moist	CL	
										End of Boring = 32.5 '		500
35												495
40												

NOTES: AP-1R blind-drilled to 19.0 ft bgs
Geology from 0-19.0 ft bgs based on AP-1 log

Response to 1st RTP
CWLP - 01134

Electronic Filing: Received, Clerk's Office 02/13/2020

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Sangamon Well #: AP-2R

Site Name: City Water, Light, & Power Borehole #: AP-2R

Coordinates: X 725.50 Y 4184.70 (or) Latitude: ___ ° ___ ' ___ " Longitude: ___ ° ___ ' ___ "

Surveyed by: _____ IL Registration #: _____

Drilling Contractor: Terra Drill, Inc. Consulting Firm: Andrews Engineering, Inc.

Driller: J. Brown Geologist: M. Hewitt

Drilling Method: 4¼" HSA w/ 5' Continuous Barrel Logged by: M. Hewitt

Drilling Fluids (type): _____ Report Form Completed by: J. Rhoades

Date Well Started: 1/31/2012 Date Well Finished: 1/31/2012 Date Form Completed: 2/27/2012

ANNULAR SPACE DETAILS

Type of surface seal: Concrete

Type of annular sealant: Bentonite Grout

Installation method: Tremie

Setting time: 2 Hours

Type of bentonite seal – Bentonite Chips (circle one)

Installation method: Free drop

Setting time: 2 Hours

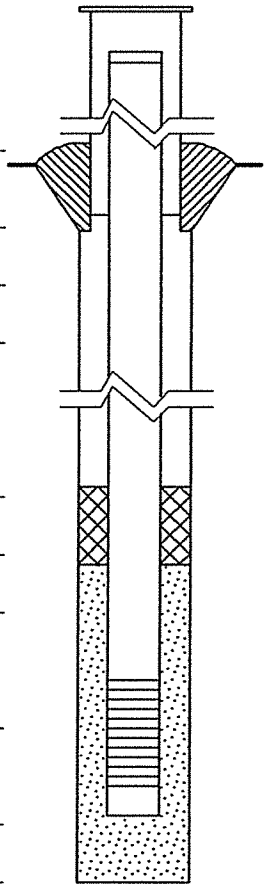
Type of sand pack: Unimin Sand

Grain size: 10/20 (sieve size)

Installation method: Free drop

Type of backfill material: _____ (if applicable)

Installation method: _____



ELEVATION (MSL)*	DEPTH (BGS)*	(0.01 ft)
535.60	-2.50	Top of Protective Casing
535.60	-2.50	Top of Riser Pipe
533.10	.00	Ground Surface
530.10	3.00	Top of Annular Sealant
n/a	n/a	Static Water Level Measured on (after completion)
528.96	4.14	Top of Seal
526.96	6.14	Top of Sandpack
527.46	5.64	Top of Screen
518.13	14.97	Bottom of Screen
517.60	15.50	Bottom of Well
514.60	18.50	Bottom of Borehole

* Referenced to a National Geodetic Vertical Datum
• positive (+) values below GS, negitive (-) values above GS

WELL CONSTRUCTION MATERIALS (circle one)

Protective Casing	SS304, SS316, PTFE, PVC or *Other:Steel*
Riser Pipe Above W.T.	SS304, SS316, PTFE, *PVC*, or Other:
Riser Pipe Below W.T.	SS304, SS316, PTFE, *PVC*, or Other:
Screen	SS304, SS316, PTFE, *PVC*, or Other:

(AE950315)

CASING MEASUREMENTS

Diameter of Borehole (in)	8.0
ID of Riser Pipe (in)	2.0
Protective Casing Length (ft)	5.0
Riser Pipe Length (ft)	8.14
Bottom of Screen to End Cap (ft)	.53
Screen Length [1st slot to last slot] (ft)	9.33
Total Length of Casing (ft)	18.00
Screen Slot Size*	0.01"

*Hand-slotted well screens are unacceptable.

Electronic Filing: Received, Clerk's Office 02/13/2020

Andrews Engineering, Inc.

3300 Ginger Creek Drive, Springfield, IL 62711 (217) 787-2334

Field Boring Log

Site Information:
Name: City Water, Light, & Power
Location: Springfield, IL
County: Sangamon
Site No.:
AEEI No.: 2011-127

Location:
Coord. System: Site Grid
Northing: 4184.70
Easting: 725.50

Weather:
Cloudy; 38° F; West 10-15 MPH

Boring Information:
Boring No.: AP-2R
Well No.: AP-2R
Surf. Elev.: 533.10

Depth Information:
Total: 18.50
Auger: 18.50
Core:

Dates:
Start: 1/31/2012
Finish: 1/31/2012

Drilling Contractor:
Name: Terra Drill, Inc.
City: Dupo, IL
Equipment: CME 550 with 4¼" I.D. HSA and 5' CB

Personnel:
Geologist: M. Hewitt
Driller: J. Brown
Helper (s): J. Horn

Sample Type: ▮ - Continuous Barrel ⊠ - Split Spoon ⧄ - Shelby Tube ▮ - Core ☐ - Blind Drill

Depth (ft.)	Run No.	Sample Type	Sample No.	Sample Recov.	Blow Count	q_p [q_s] (in tsf)	% Moisture	Borehole Detail	Lithology	Description/*Comments*	USC	Elev. (MSL)
0								Stickup = 2.50'				
	1			NA				Concrete		Dark brown silty CLAY; some sand; stiff; slightly moist		
								Grout		Dark brown silty CLAY; soft to firm; moist	CL	530
5								Bentonite Chips				
	2			NA						Gray silty CLAY; soft to firm; moist	CL	525
10										Gray clayey SILT; very soft; moist to wet	ML	520
	3			70%				Silica Sand				
15										Light gray SAND; dense; saturated	SP	
	4			100%						Gray SHALE; hard; slightly moist	CL	515
20										*End of Boring = 18.5 '*		

NOTES: AP-2R blind-drilled to 10.0 ft bgs
Geology from 0-10.0 ft bgs based on AP-1 log

Response to 1st RTP
CWLP - 01136

Illinois Environmental Protection Agency — Well Completion Report

Electronic Filing: Received, Clerk's Office 02/13/2020

Site #: _____ County: Sangamon Well #: AP-5

Site Name: City Water, Light, & Power Borehole #: AP-5

Coordinates: X 3203.10 Y 3164.10 (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___"

Surveyed by: _____ IL Registration #: _____

Drilling Contractor: Terra Drill, Inc. Consulting Firm: Andrews Engineering, Inc.

Driller: J. Brown Geologist: M. Hewitt

Drilling Method: 4¼" HSA w/ 5' CB & 2' SS Logged by: M. Hewitt

Drilling Fluids (type): _____ Report Form Completed by: J. Rhoades

Date Well Started: 2/1/2012 Date Well Finished: 2/1/2012 Date Form Completed: 2/27/2012

ANNULAR SPACE DETAILS

Type of surface seal: Concrete

Type of annular sealant: Bentonite Grout

Installation method: Tremie

Setting time: 2 Hours

Type of bentonite seal: Bentonite Chips

Installation method: Free drop

Setting time: 2 Hours

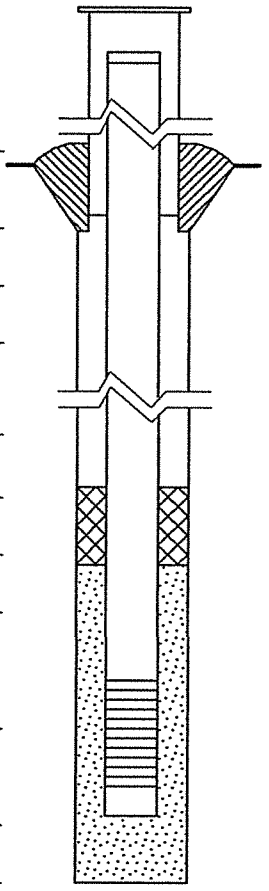
Type of sand pack: Unimin Sand

Grain size: 10/20 (sieve size)

Installation method: Free drop

Type of backfill material: Bentonite Chips (if applicable)

Installation method: Free drop



ELEVATION (MSL)*	DEPTH (BGS)*	(0.01 ft)
584.30	-2.70	Top of Protective Casing
583.90	-2.30	Top of Riser Pipe
581.60	.00	Ground Surface
578.60	3.00	Top of Annular Sealant
n/a	n/a	Static Water Level Measured on (after completion)
565.48	16.12	Top of Seal
563.48	18.12	Top of Sandpack
563.78	17.82	Top of Screen
554.44	27.16	Bottom of Screen
553.90	27.70	Bottom of Well
551.10	30.50	Bottom of Borehole

* Referenced to a National Geodetic Vertical Datum
♦ positive (+) values below GS, negitive (-) values above GS

NOTES:

•Borehole AP-5 sampled to 49.0 feet below ground surface (BGS) and backfilled with bentonite chips to 30.5 feet BGS

WELL CONSTRUCTION MATERIALS

Protective Casing	SS304, SS316, PTFE, PVC or *Other:Steel*
Riser Pipe Above W.T.	SS304, SS316, PTFE, *PVC*, or Other:
Riser Pipe Below W.T.	SS304, SS316, PTFE, *PVC*, or Other:
Screen	SS304, SS316, PTFE, *PVC*, or Other:

CASING MEASUREMENTS

Diameter of Borehole (in)	8.0
ID of Riser Pipe (in)	2.0
Protective Casing Length (ft)	5.0
Riser Pipe Length (ft)	20.12
Bottom of Screen to End Cap (ft)	.54
Screen Length [1st slot to last slot] (ft)	9.34
Total Length of Casing (ft)	30.00
Screen Slot Size¥	0.01"

¥Hand-slotted well screens are unacceptable.

(AE950315)

Electronic Filing: Received, Clerk's Office 02/13/2020

Andrews Engineering, Inc.

3300 Ginger Creek Drive, Springfield, IL 62711

Field Boring Log

Site Information:
Name: City Water, Light, & Power
Location: Springfield, IL
County: Sangamon
Site No.:
AEEI No.: 2011-127

Location:
Coord. System: Site Grid
Northing: 3164.10
Easting: 3203.10

Weather:
Cloudy; 38° F; West 10-15 MPH

Boring Information:
Boring No.: AP-5
Well No.: AP-5
Surf. Elev.:

Depth Information:
Total: 49.0
Auger: 49.0
Core:

Dates:
Start: 2/1/2012
Finish: 2/1/2012

Drilling Contractor:
Name: Terra Drill, Inc.
City: Dupo, IL
Equipment: CME 550 with 4¼" I.D. HSA
5' CB and 2' SS

Personnel:
Geologist: M. Hewitt
Driller: J. Brown
Helper (s): J. Horn

Sample Type: ▯ - Continuous Barrel ⊠ - Split Spoon ▨ - Shelby Tube ▮ - Core ☐ - Blind Drill

Depth (ft.)	Run No.	Sample Type	Sample No.	Sample Recov.	Blow Count	q_p [q_s] (in tsf)	% Moisture	Borehole Detail	Lithology	Description/*Comments*	USC	Elev. (MSL)
0								Stickup = 2.50'				0
	1	▯		100%				Concrete		Dark yellowish brown silty CLAY; very firm; moist; some dark brown mottling; trace organics	CL	
5												-5
	2	▯		76%						Olive brown clayey SILT; moderately soft; moist; some dark yellowish brown mottling		
										grades dark yellowish brown; clay content increasing	ML	
10												-10
	3	▯		100%				Bentonite Grout		Olive brown silty CLAY; very firm; moist; trace coarse sand; few iron concretions; some dark yellowish brown mottling	CL	
15												-15
	4	▯		100%				Bentonite Chips		some gravel		
										Dark yellowish brown sandy CLAY; some gravel; very soft; moist to wet	SC	
	5	⊠		100%				Silica Sand				
20										Dark yellowish brown clayey SILT with sand and gravel; firm; moist	ML-SM	-20

NOTES:

Response to 1st RTP
CWLP - 01138

Field Boring Log

Site Information:
Name: City Water, Light, & Power
Location: Springfield, IL
County: Sangamon
Site No.:
AEEI No.: 2011-127

Location:
Coord. System: Site Grid
Northing: 3164.10
Easting: 3203.10

Weather:
Cloudy; 38° F; West 10-15 MPH

Boring Information:
Boring No.: AP-5
Well No.: AP-5
Surf. Elev.:

Depth Information:
Total: 49.0
Auger: 49.0
Core:

Dates:
Start: 2/1/2012
Finish: 2/1/2012

Drilling Contractor:
Name: Terra Drill, Inc.
City: Dupo, IL
Equipment: CME 550 with 4¼" I.D. HSA
5' CB and 2' SS

Personnel:
Geologist: M. Hewitt
Driller: J. Brown
Helper (s): J. Horn

Sample Type: - Continuous Barrel - Split Spoon - Shelby Tube - Core - Blind Drill

Depth (ft.)	Run No.	Sample Type	Sample No.	Sample Recov.	Blow Count	q_p [q_s] (in tsf)	% Moisture	Borehole Detail	Lithology	Description/*Comments*	USC	Elev. (MSL)
	5							Silica Sand		(Cont'd) Dark yellowish brown clayey SILT with sand and gravel; firm; moist	ML-SM	20
	6			100%						Dark yellowish brown SAND; coarse-grained; loose; wet	SP	
25	7			100%						Yellowish gray clayey SILT with sand; trace gravel; very hard; moist	ML	25
										Gray silty SAND with clay; some gravel; soft; wet	SM	
	8			100%						Gray clayey SILT; some gravel; very hard; moist		
30	9			90%						some shale and coal fragments	ML	30
35	10			100%				Bentonite Chips				35
	11									Light gray silty SAND; some gravel; trace chert; rounded; moderately firm; moist	SM	
40												40

NOTES:

Response to 1st RTP
CWLP - 01139

Field Boring Log

Electronic Filing: Received, Clerk's Office 02/13/2020

Site Information:
Name: City Water, Light, & Power
Location: Springfield, IL
County: Sangamon
Site No.:
AEEI No.: 2011-127

Location:
Coord. System: Site Grid
Northing: 3164.10
Easting: 3203.10

Weather:
Cloudy; 38° F; West 10-15 MPH

Boring Information:
Boring No.: AP-5
Well No.: AP-5
Surf. Elev.:

Depth Information:
Total: 49.0
Auger: 49.0
Core:

Dates:
Start: 2/1/2012
Finish: 2/1/2012

Drilling Contractor:
Name: Terra Drill, Inc.
City: Dupo, IL
Equipment: CME 550 with 4¼" I.D. HSA
5' CB and 2' SS

Personnel:
Geologist: M. Hewitt
Driller: J. Brown
Helper (s): J. Horn

Sample Type: ▮ - Continuous Barrel ☒ - Split Spoon ▨ - Shelby Tube ▮ - Core ☐ - Blind Drill

Depth (ft.)	Run No.	Sample Type	Sample No.	Sample Recov.	Blow Count	q_p [q_s] (in tsf)	% Moisture	Borehole Detail	Lithology	Description/*Comments*	USC	Elev. (MSL)
												40
	11									Dark gray silty CLAY; some gravel; some shale fragments; trace coal fragments; very firm; moist	SM / CL	
45	12			100%				Bentonite Chips		Gray SHALE; hard; moist	CL	45
	13			55%								
										End of Boring = 49.0 '		
50												50
55												55
60												60

NOTES:

Response to 1st RTP
CWLP - 01140

Appendix B
Laboratory Results

City Water, Light and Power
Power Plant Ash Impoundment
NPDES Permit No. IL0024767

Parameter	Units	AP-1		AP-2		AP-3		AP-4		AP-5		AW-3	
		2/22/2012	4/25/2012	2/22/2012	4/25/2012	2/22/2012	4/25/2012	2/22/2012	4/25/2012	2/22/2012	4/25/2012	2/22/2012	4/25/2012
pH (field)	units	7.01	7.10	6.65	7.65	6.58	7.31	6.81	7.07	7.33	7.19	7.89	7.15
Chloride, total	mg/l	42.7	38.2	19.3	13	52.5	46.2	10.1	9.85	24.2	7.23		23
Fluoride, total	mg/l	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.62	< 0.5		0.43
Nitrate, total	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	0.23	< 0.05	0.12	< 0.05	0.15	< 0.05	< 0.5	< 0.2
Sulfate, total	mg/l	521	463	211	201	281	274	< 5	< 5	82.3	43.5		10.9
Cyanide, total	mg/l	< 0.01	< 0.2	< 0.01	< 0.2	< 0.01	< 0.2	< 0.01	< 0.2	< 0.01	< 0.2	< 0.01	< 0.01
Total Dissolved Solids	mg/l	1070	1020	770	866	852	926	490	560	414	404	314	470
Boron, total	mg/l	14.6	10.4	5	5.51	17.7	18.4	0.119	0.123	< 1	< 0.625	0.104	0.162
Iron, total	mg/l	35.3	18.3	242	59.2	13.6	14	11	9.22	1140	435		62.5
Manganese, total	mg/l	0.702	0.864	21.4	20.7	10.6	7.24	0.254	0.186	21.4	7.91		2.02
Mercury, total	mg/l	< 0.0005	< 0.0005	0.0006	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0008	< 0.0005		< 0.0005
Antimony, total	mg/l	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006		< 0.0075
Arsenic, total	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.076		0.149
Barium, total	mg/l	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	5.24	< 2		0.376
Beryllium, total	mg/l	< 0.004	< 0.004	0.00675	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.0142	0.0128		< 0.0075
Cadmium, total	mg/l	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.00776	0.0128		< 0.005
Chromium, total	mg/l	< 0.1	< 0.1	0.277	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.811	0.328		0.0443
Cobalt, total	mg/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1		0.0278
Copper, total	mg/l	< 0.65	< 0.65	< 0.65	< 0.65	< 0.65	< 0.65	< 0.65	< 0.65	< 0.65	< 0.65		0.0446
Lead, total	mg/l	0.0184	< 0.0075	0.226	0.047	0.0084	< 0.0075	< 0.0075	< 0.0075	0.638	0.236		0.0371
Nickle, total	mg/l	< 0.1	< 0.1	0.13	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.358	0.539		0.0549
Selenium, total	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05		< 0.0025
Silver, total	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05		< 0.005
Thallium, total	mg/l	< 0.002	< 0.002	0.00225	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.00556	0.00258		< 0.0025
Zinc, total	mg/l	< 0.0575	< 5	0.408	< 5	< 0.0575	< 5	< 0.0575	< 5	0.822	< 5		0.139
Radium-226	pCi/l	1.2		2.7		0.68		0.44		5.2			
Radium-228	pCi/l	1.9		7.3		4		2.2		8.8			

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Sue Corcoran
City, Water, Light & Power
201 East Lake Shore Drive
Springfield, IL 62707

April 12, 2012

RE CWLP AP Wells

Lab Orders:
12020654

Dear Sue Corcoran:

Enclosed are the analytical reports for the EMT Lab Order listed. Also included with this analytical report is a copy of the chain of custody associated with these samples. If you have any questions, please contact me at 847-967-6666.

Sincerely,

Joe Pavilonis
Project Manager

Approved by,

Mitchell Ostrowski
Laboratory Director

This Report Contains 18 pages

The Contents of this report apply to the sample(s) analyzed. No duplication is allowed except in its entirety.

State of Illinois Chemical Analysis in Drinking Water Accredited Lab. No. 100256
State of Wisconsin Wastewater and Hazardous Waste No. 999888890

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CLIENT: City, Water, Light & Power
Project: CWLP AP Wells
Lab Order: 12020654

Date: *4/12/2012*

CASE NARRATIVE

Unless otherwise noted, samples were analyzed using the methods outlined in the following references:
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition

Unless otherwise noted, all method blanks, laboratory spikes, and/or matrix spikes met quality assurance objectives.

Sample results relate only to the analytes of interest tested and to the sample received at the laboratory.

All results are reported on a wet weight basis, unless otherwise noted. Dry weight adjusted results, reporting limits, method detection limits and dilution factors are indicated by the notation "dry" in the Units column. If present, a dilution factor will adjust the method detection limits and reporting limits.

The test results contained in this report meet all of the requirements of NELAC. Accreditation by the State of Illinois or Wisconsin is not an endorsement or a guarantee of the validity of data generated. For specific information regarding EMT's scope of accreditation , please contact your EMT project manager.

The Reporting Limit listed on the Report of Laboratory Analysis is EMT's reporting limit for the analyte reported. For most test methods this reporting limit is primarily based upon the lowest point in the calibration curve.

Analyst's initials of "OUT" indicate that the analyte was analyzed by a subcontracted laboratory.

Method References:
SW=USEPA, Test Methods for Evaluating Solid Waste, SW-846.
E=USEPA Methods for the Determination of Inorganic Substances in Environmental Samples; Methods for Chemical Analysis of Water and Wastes; Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, 40 CFR Part 136, App A; methods for the Determination of Metals in Environmental Samples; Methods for the Determination of Organic Compounds in Drinking Water.
SM= APHA, Standard Methods for the Examination of Water and Wastewater.
D=ASTM, Annual Book of Standards

Batch numbers starting with a letter indicate an analytical batch while those that are exculsively numerals indicate a preparation batch.

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CLIENT: City, Water, Light & Power
Project: CWLP AP Wells
Lab Order: 12020654

Date: *4/12/2012*

CASE NARRATIVE

Analytical Comments for METHOD 7470A_GRNDWTR, 12020654-02EDUP : The sample was run in duplicate to confirm the mercury result.

Analytical Comments for METHOD 7470A_GRNDWTR, 12020654-05EDUP : The sample was run in duplicate to confirm the mercury result.

Analytical Comments for METHOD RADIATION, 12020654-01A, 02A, 03A, 04A, 05A: The Radium by Methods 7500-Ra B and 7500-Ra D was performed by the subcontracted laboratory Underwriters Laboratories, IL NELAC #200001.

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12020654
Project: CWLP AP Wells
Lab ID: 12020654-01

Client Sample ID: AP-1
Report Date: 4/12/2012
Collection Date: 2/22/2012 12:20:00 PM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
On-site pH by Ion Selective Electrode		**Method:**		**SM4500-H**			
pH	7.01			pH units	2/22/12 12:20	R168104	JC
Anions by Ion Chromatography		**Method:**		**SW9056**			
Chloride	42.7	2.		mg/L	2/23/12	R166064	GSB
Fluoride	< 0.5	0.5		mg/L	2/23/12	R166064	GSB
Nitrogen, Nitrate (As N)	< 0.05	0.05		mg/L	2/23/12	R166064	GSB
Sulfate	521.	50.		mg/L	2/23/12	R166064	GSB
Cyanide, Total		**Method:**		**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01		mg/L	2/24/12 10:24	72204	CS2
Total Dissolved Solids		**Method:**		**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	1070.	10.		mg/L	2/23/12 12:00	R166105	LS3
ICP Metals, Groundwater Total		**Method:**		**SW6010C / SW3015**			
Boron	14.6	0.063	C	mg/L	2/24/12 10:25	72216	AG
Iron	35.3	0.125		mg/L	2/24/12 10:25	72216	AG
Manganese	0.702	0.063		mg/L	2/24/12 10:25	72216	AG
Mercury, Total		**Method:**		**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005		mg/L	2/23/12 12:49	72231	IG
Metals, Total.		**Method:**		**SW6020A / SW3015**			
Antimony	< 0.006	0.006		mg/L	2/27/12 12:22	72216	AG
Arsenic	< 0.05	0.05		mg/L	2/27/12 12:22	72216	AG
Barium	< 2.	2.		mg/L	2/27/12 12:22	72216	AG
Beryllium	< 0.004	0.004		mg/L	2/27/12 12:22	72216	AG
Cadmium	< 0.005	0.005		mg/L	2/27/12 12:22	72216	AG
Chromium	< 0.1	0.1		mg/L	2/27/12 12:22	72216	AG
Cobalt	< 1.	1.		mg/L	2/27/12 12:22	72216	AG
Copper	< 0.65	0.65		mg/L	2/27/12 12:22	72216	AG
Lead	0.0184	0.0075		mg/L	2/27/12 12:22	72216	AG
Nickel	< 0.1	0.1		mg/L	2/27/12 12:22	72216	AG
Selenium	< 0.05	0.05		mg/L	2/27/12 12:22	72216	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12020654
Project: CWLP AP Wells
Lab ID: 12020654-01

Client Sample ID: AP-1
Report Date: 4/12/2012
Collection Date: 2/22/2012 12:20:00 PM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Silver	< 0.05	0.05	mg/L	2/27/12 12:22	72216	AG
Thallium	< 0.002	0.002	mg/L	2/27/12 12:22	72216	AG
Zinc	< 0.0575	0.0575	mg/L	2/28/12 12:06	72216	AG
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	1.2	0.5	pCi/L	3/21/12	R167933	OUT
Radium-228	1.9	0.9	pCi/L	3/21/12	R167933	OUT

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12020654
Project: CWLP AP Wells
Lab ID: 12020654-02

Client Sample ID: AP-2
Report Date: 4/12/2012
Collection Date: 2/22/2012 12:05:00 PM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
On-site pH by Ion Selective Electrode		**Method:**		**SM4500-H**			
pH	6.65			pH units	2/22/12 12:05	R168104	JC
Anions by Ion Chromatography		**Method:**		**SW9056**			
Chloride	19.3	2.		mg/L	2/23/12	R166064	GSB
Fluoride	< 5.	5.		mg/L	2/23/12	R166064	GSB
Nitrogen, Nitrate (As N)	< 0.05	0.05		mg/L	2/23/12	R166064	GSB
Sulfate	211.	50.		mg/L	2/23/12	R166064	GSB
Cyanide, Total		**Method:**		**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01		mg/L	2/24/12 10:24	72204	CS2
Total Dissolved Solids		**Method:**		**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	770.	10.		mg/L	2/23/12 12:00	R166105	LS3
ICP Metals, Groundwater Total		**Method:**		**SW6010C / SW3015**			
Boron	5.	0.625	C	mg/L	2/27/12 11:05	72216	CS2
Iron	242.	1.25		mg/L	2/27/12 11:05	72216	CS2
Manganese	21.4	0.063		mg/L	2/24/12 10:25	72216	AG
Mercury, Total		**Method:**		**SW7470A / HG PREP**			
Mercury	0.0006	0.0005		mg/L	2/23/12 12:49	72231	IG
Metals, Total.		**Method:**		**SW6020A / SW3015**			
Antimony	< 0.006	0.006		mg/L	2/27/12 12:22	72216	AG
Arsenic	< 0.05	0.05		mg/L	2/27/12 12:22	72216	AG
Barium	< 2.	2.		mg/L	2/27/12 12:22	72216	AG
Beryllium	0.00675	0.004		mg/L	2/27/12 12:22	72216	AG
Cadmium	< 0.005	0.005		mg/L	2/27/12 12:22	72216	AG
Chromium	0.277	0.1		mg/L	2/27/12 12:22	72216	AG
Cobalt	< 1.	1.		mg/L	2/27/12 12:22	72216	AG
Copper	< 0.65	0.65		mg/L	2/27/12 12:22	72216	AG
Lead	0.226	0.0075		mg/L	2/27/12 12:22	72216	AG
Nickel	0.13	0.1		mg/L	2/27/12 12:22	72216	AG
Selenium	< 0.05	0.05		mg/L	2/27/12 12:22	72216	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12020654
Project: CWLP AP Wells
Lab ID: 12020654-02

Client Sample ID: AP-2
Report Date: 4/12/2012
Collection Date: 2/22/2012 12:05:00 PM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Silver	< 0.05	0.05	mg/L	2/27/12 12:22	72216	AG
Thallium	0.00225	0.002	mg/L	2/27/12 12:22	72216	AG
Zinc	0.408	0.0575	mg/L	2/28/12 12:06	72216	AG
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	2.7	0.4	pCi/L	3/21/12	R167933	OUT
Radium-228	7.3	1.5	pCi/L	3/21/12	R167933	OUT

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

Response to 1st RTP
CWLP - 01150

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-3
Lab Order:	12020654	**Report Date:**	4/12/2012
Project:	CWLP AP Wells	**Collection Date:**	2/22/2012 11:45:00 AM
Lab ID:	12020654-03	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
On-site pH by Ion Selective Electrode		**Method:**		**SM4500-H**			
pH	6.58			pH units	2/22/12 11:45	R168104	JC
Anions by Ion Chromatography		**Method:**		**SW9056**			
Chloride	52.5	2.		mg/L	2/23/12	R166064	GSB
Fluoride	< 0.5	0.5		mg/L	2/23/12	R166064	GSB
Nitrogen, Nitrate (As N)	0.23	0.05		mg/L	2/23/12	R166064	GSB
Sulfate	281.	5.		mg/L	2/23/12	R166064	GSB
Cyanide, Total		**Method:**		**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01		mg/L	2/24/12 10:24	72204	CS2
Total Dissolved Solids		**Method:**		**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	852.	10.		mg/L	2/23/12 12:00	R166105	LS3
ICP Metals, Groundwater Total		**Method:**		**SW6010C / SW3015**			
Boron	17.7	0.063	C	mg/L	2/24/12 10:25	72216	AG
Iron	13.6	0.125		mg/L	2/24/12 10:25	72216	AG
Manganese	10.6	0.063		mg/L	2/24/12 10:25	72216	AG
Mercury, Total		**Method:**		**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005		mg/L	2/23/12 12:49	72231	IG
Metals, Total.		**Method:**		**SW6020A / SW3015**			
Antimony	< 0.006	0.006		mg/L	2/27/12 12:22	72216	AG
Arsenic	< 0.05	0.05		mg/L	2/27/12 12:22	72216	AG
Barium	< 2.	2.		mg/L	2/27/12 12:22	72216	AG
Beryllium	< 0.004	0.004		mg/L	2/27/12 12:22	72216	AG
Cadmium	< 0.005	0.005		mg/L	2/27/12 12:22	72216	AG
Chromium	< 0.1	0.1		mg/L	2/27/12 12:22	72216	AG
Cobalt	< 1.	1.		mg/L	2/27/12 12:22	72216	AG
Copper	< 0.65	0.65		mg/L	2/27/12 12:22	72216	AG
Lead	0.0084	0.0075		mg/L	2/27/12 12:22	72216	AG
Nickel	< 0.1	0.1		mg/L	2/27/12 12:22	72216	AG
Selenium	< 0.05	0.05		mg/L	2/27/12 12:22	72216	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12020654
Project: CWLP AP Wells
Lab ID: 12020654-03

Client Sample ID: AP-3
Report Date: 4/12/2012
Collection Date: 2/22/2012 11:45:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Silver	< 0.05	0.05	mg/L	2/27/12 12:22	72216	AG
Thallium	< 0.002	0.002	mg/L	2/27/12 12:22	72216	AG
Zinc	< 0.0575	0.0575	mg/L	2/28/12 12:06	72216	AG
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	0.68	0.4	pCi/L	3/21/12	R167933	OUT
Radium-228	4.	1.1	pCi/L	3/21/12	R167933	OUT

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 12020654
Project: CWLP AP Wells
Lab ID: 12020654-04

Client Sample ID: AP-4
Report Date: 4/12/2012
Collection Date: 2/22/2012 11:25:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
On-site pH by Ion Selective Electrode		**Method:**	**SM4500-H**				
pH	6.81			pH units	2/22/12 11:25	R168104	JC
Anions by Ion Chromatography		**Method:**	**SW9056**				
Chloride	10.1	2.		mg/L	2/23/12	R166064	GSB
Fluoride	< 0.5	0.5		mg/L	2/23/12	R166064	GSB
Nitrogen, Nitrate (As N)	0.12	0.05		mg/L	2/23/12	R166064	GSB
Sulfate	< 5.	5.		mg/L	2/23/12	R166064	GSB
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**				
Cyanide	< 0.01	0.01		mg/L	2/24/12 10:24	72204	CS2
Total Dissolved Solids		**Method:**	**SM2540C**				
Total Dissolved Solids (Residue, Filterable)	490.	10.		mg/L	2/23/12 12:00	R166105	LS3
ICP Metals, Groundwater Total		**Method:**	**SW6010C / SW3015**				
Boron	0.119	0.063	C	mg/L	2/24/12 10:25	72216	AG
Iron	11.	0.125		mg/L	2/24/12 10:25	72216	AG
Manganese	0.254	0.063		mg/L	2/24/12 10:25	72216	AG
Mercury, Total		**Method:**	**SW7470A / HG PREP**				
Mercury	< 0.0005	0.0005		mg/L	2/23/12 12:49	72231	IG
Metals, Total.		**Method:**	**SW6020A / SW3015**				
Antimony	< 0.006	0.006		mg/L	2/27/12 12:22	72216	AG
Arsenic	< 0.05	0.05		mg/L	2/27/12 12:22	72216	AG
Barium	< 2.	2.		mg/L	2/27/12 12:22	72216	AG
Beryllium	< 0.004	0.004		mg/L	2/27/12 12:22	72216	AG
Cadmium	< 0.005	0.005		mg/L	2/27/12 12:22	72216	AG
Chromium	< 0.1	0.1		mg/L	2/27/12 12:22	72216	AG
Cobalt	< 1.	1.		mg/L	2/27/12 12:22	72216	AG
Copper	< 0.65	0.65		mg/L	2/27/12 12:22	72216	AG
Lead	< 0.0075	0.0075		mg/L	2/27/12 12:22	72216	AG
Nickel	< 0.1	0.1		mg/L	2/27/12 12:22	72216	AG
Selenium	< 0.05	0.05		mg/L	2/27/12 12:22	72216	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-4
Lab Order:	12020654	**Report Date:**	4/12/2012
Project:	CWLP AP Wells	**Collection Date:**	2/22/2012 11:25:00 AM
Lab ID:	12020654-04	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Silver	< 0.05	0.05	mg/L	2/27/12 12:22	72216	AG
Thallium	< 0.002	0.002	mg/L	2/27/12 12:22	72216	AG
Zinc	< 0.0575	0.0575	mg/L	2/28/12 12:06	72216	AG
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	0.44	0.36	pCi/L	3/21/12	R167933	OUT
Radium-228	2.2	1.6	pCi/L	3/21/12	R167933	OUT

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-5
Lab Order:	12020654	**Report Date:**	4/12/2012
Project:	CWLP AP Wells	**Collection Date:**	2/22/2012 10:30:00 AM
Lab ID:	12020654-05	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
On-site pH by Ion Selective Electrode		**Method:**		**SM4500-H**			
pH	7.33			pH units	2/22/12 10:30	R168104	JC
Anions by Ion Chromatography		**Method:**		**SW9056**			
Chloride	24.2	2.		mg/L	2/23/12	R166064	GSB
Fluoride	0.62	0.5		mg/L	2/23/12	R166064	GSB
Nitrogen, Nitrate (As N)	0.15	0.05		mg/L	2/23/12	R166064	GSB
Sulfate	82.3	5.		mg/L	2/23/12	R166064	GSB
Cyanide, Total		**Method:**		**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01		mg/L	2/24/12 10:24	72204	CS2
Total Dissolved Solids		**Method:**		**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	414.	10.		mg/L	2/23/12 12:00	R166105	LS3
ICP Metals, Groundwater Total		**Method:**		**SW6010C / SW3015**			
Boron	< 1.	1.	C	mg/L	2/27/12 11:05	72216	CS2
Iron	1140.	2.		mg/L	2/27/12 11:05	72216	CS2
Manganese	21.4	0.1		mg/L	2/24/12 10:25	72216	AG
Mercury, Total		**Method:**		**SW7470A / HG PREP**			
Mercury	0.0008	0.0005		mg/L	2/23/12 12:49	72231	IG
Metals, Total.		**Method:**		**SW6020A / SW3015**			
Antimony	< 0.006	0.006		mg/L	2/27/12 12:22	72216	AG
Arsenic	< 0.05	0.05		mg/L	2/27/12 12:22	72216	AG
Barium	5.24	2.		mg/L	2/27/12 12:22	72216	AG
Beryllium	0.0142	0.004		mg/L	2/27/12 12:22	72216	AG
Cadmium	0.00776	0.005		mg/L	2/27/12 12:22	72216	AG
Chromium	0.811	0.1		mg/L	2/27/12 12:22	72216	AG
Cobalt	< 1.	1.		mg/L	2/27/12 12:22	72216	AG
Copper	< 0.65	0.65		mg/L	2/27/12 12:22	72216	AG
Lead	0.638	0.0075		mg/L	2/27/12 12:22	72216	AG
Nickel	0.358	0.1		mg/L	2/27/12 12:22	72216	AG
Selenium	< 0.05	0.05		mg/L	2/27/12 12:22	72216	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-5
Lab Order:	12020654	**Report Date:**	4/12/2012
Project:	CWLP AP Wells	**Collection Date:**	2/22/2012 10:30:00 AM
Lab ID:	12020654-05	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Silver	< 0.05	0.05	mg/L	2/27/12 12:22	72216	AG
Thallium	0.00556	0.002	mg/L	2/27/12 12:22	72216	AG
Zinc	0.822	0.092	mg/L	2/28/12 12:06	72216	AG
Radiation Testing		**Method:**	**EPA 900/903.1/904/905/906**			
Radium-226	5.2	0.5	pCi/L	3/21/12	R167933	OUT
Radium-228	8.8	1.4	pCi/L	3/21/12	R167933	OUT

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Chain of Custody Record

Scheduled Sampling Date: 02/17/2012
Due Date: 02/24/2012

COC # 504462

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis
1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. Total RCRA Metals on a Liquid Sample

EMT USE ONLY
EMT WORKORDER #120206EA

Sample I.D.		Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-1	GRAB	12	1 liter	G	2	EJ	2/22/12	1220	7.01	1		X										1A
AP-1	GRAB	12	1 liter	P	1	EJ	2/22/12	1220	7.01	1			X									B
AP-1	GRAB	12	500 ml	P	1	EJ	2/22/12	1220	7.01	4				X								C
AP-1	GRAB	12	500 ml	P	1	EJ	2/22/12	1220	7.01	1					X							D
AP-1	GRAB	12	500 ml	P	1	EJ	2/22/12	1220	7.01	3						X						E

Relinquished By:	Date: 2-22-12 Time: 12:45	Received By:	Date: 2-22-12 Time: 12:45
Relinquished By:	Date: 2-22-12 Time: 10:10	Received By:	Date: - - Time: : :
Relinquished By:	Date: - - Time: : :	Received By:	Date: 2-22-12 Time: 10 :

EMT USE ONLY
ClientID: SPRING
Client Contact: Joe Pavilonis
EMT Project ID: CWLP AP Wells
Jar Lot No.

☐ SAMPLE RECEIVED ON ICE
TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs prior to sample receipt)

SPECIAL INSTRUCTIONS:

2/17/2012 1:53:48 PM
Page 1

Response to 1st RTP
CWLP - 01157

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ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.

Chain of Custody Record

Scheduled Sampling Date: 02/17/2012
Due Date: 02/24/2012

8100 North Austin Avenue Morton Grove, IL 60053-3203 (847) 967-6666 FAX:(847) 967-6735 www.emt.com

COC # 504462

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis

1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. Total RCRA Metals on a Liquid Sample

EMT USE ONLY

EMT WORKORDER # 1202065A

Sample I.D.		Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-2	GRAB	12	1 liter	G	2		2/22/12	12:05	6.65	1		X										A
AP-2	GRAB	12	1 liter	P	1		2/22/12	12:05	6.65	1			X									B
AP-2	GRAB	12	500 ml	P	1		2/22/12	12:05	6.65	4				X								C
AP-2	GRAB	12	500 ml	P	1		2/22/12	12:05	6.65	1					X							D
AP-2	GRAB	12	500 ml	P	1		2/22/12	12:05	6.65	3						X						E

Relinquished By:	Date: 2-22-12 Time: 16:10	Received By:	Date: - - Time: :	EMT USE ONLY
Relinquished By:	Date: - - Time: :	Received By:	Date: - - Time: :	ClientID: SPRING Client Contact: Joe Pavilonis EMT Project ID: CWLP AP Wells
Relinquished By:	Date: - - Time: :	Received By:	Date: 2-22-12 Time: 16:10	Jar Lot No.

SAMPLE RECEIVED ON ICE
TEMPERATURE 3C
(Must be recorded if sampling was greater than 6 hrs prior to sample receipt)

SPECIAL INSTRUCTIONS:

2/17/2012 1:53:48 PM
Page 2

Response to 1st RTP
CWLP - 01158

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Chain of Custody Record

Scheduled Sampling Date: 02/17/2012
Due Date: 02/24/2012

COC # 504462

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis
1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. Total RCRA Metals on a Liquid Sample

EMT USE ONLY
EMT WORKORDER #1202004

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-3	GRAB	12	1 liter	G	2		2/22/12	11:45	6.58	1		X									A
AP-3	GRAB	12	1 liter	P	1		2/22/12	11:45	6.58	1			X								B
AP-3	GRAB	12	500 ml	P	1		2/22/12	11:45	6.58	4				X							C
AP-3	GRAB	12	500 ml	P	1		2/22/12	11:45	6.58	1					X						D
AP-3	GRAB	12	500 ml	P	1		2/22/12	11:45	6.58	3						X					E

Relinquished By:	Date: 2-22/12 Time: 16:10	Received By:	Date: - - Time: : :	EMT USE ONLY
Relinquished By:	Date: - - Time: : :	Received By:	Date: - - Time: : :	ClientID: SPRING Client Contact: Joe Pavilonis EMT Project ID: CWLP AP Wells
Relinquished By:	Date: - - Time: : :	Received By:	Date: 2/22/12 Time: 16:10	Jar Lot No.

☐ SAMPLE RECEIVED ON ICE
TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)

SPECIAL INSTRUCTIONS:

Electronic Filing: Received, Clerk's Office 02/13/2020

ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.

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Chain of Custody Record

Scheduled Sampling Date: 02/17/2012
Due Date: 02/24/2012

COC # 504462

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis
1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. Total RCRA Metals on a Liquid Sample

EMT USE ONLY
EMT WORKORDER #1202054

Sample I.D.		Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-4	GRAB	12	1 liter	G	2		2/22/12	11:25	6.81	1		X										4A
AP-4	GRAB	12	1 liter	P	1		2/22/12	11:25	6.81	1			X									4B
AP-4	GRAB	12	500 ml	P	1		2/22/12	11:25	6.81	4				X								C
AP-4	GRAB	12	500 ml	P	1		2/22/12	11:25	6.81	1					X							D
AP-4	GRAB	12	500 ml	P	1		2/22/12	11:25	6.81	3						X						E

Relinquished By:	Date: 2-22-12 Time: 16:10	Received By:	Date: - - Time: :	EMT USE ONLY
Relinquished By:	Date: - - Time: :	Received By:	Date: - - Time: :	ClientID: SPRING Client Contact: Joe Pavilonis EMT Project ID: CWLP AP Wells
Relinquished By:	Date: - - Time: :	Received By:	Date: 2-22-12 Time: 16:10	Jar Lot No.

SAMPLE RECEIVED ON ICE
TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs.prior to sample receipt)

SPECIAL INSTRUCTIONS:

2/17/2012 1:53:49 PM
Page 4

Response to 1st RTP
CWLP - 01160

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Chain of Custody Record

Scheduled Sampling Date: 02/17/2012
Due Date: 02/24/2012

COC # 504462

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP AP Wells

SAMPLE TYPE:
1. DI Water 2. Drinking Water 3. Soil
4. Extract 5. Wastewater 6. Oil
7. Sludge 8. Solid 9. Air
10. Chemical Waste 11. Wipe 12. Groundwater
13. eProduct 14. Groundwater(Filter) 15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Na2S2O3 9. Na2HSO4
10. Other

Analysis
1. Radiation Testing, Subcontracted
2. Anions by Ion Chromatography
3. Cyanide, Total
4. Solids, Total Dissolved (TDS)
5. Total RCRA Metals on a Liquid Sample

EMT USE ONLY

EMT WORKORDER # T0800[illegible]

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP-5 GRAB	12	1 liter	G	2	[illegible]	2/22/12	10:30	7.33	1		X										A
AP-5 GRAB	12	1 liter	P	1	[illegible]	2/22/12	10:30	7.33	1			X									B
AP-5 GRAB	12	500 ml	P	2	[illegible]	2/22/12	10:30	7.33	4				X								C
AP-5 GRAB	12	500 ml	P	1	[illegible]	2/22/12	10:30	7.33	1					X							D
AP-5 GRAB	12	500 ml	P	1	[illegible]	2/22/12	10:30	7.33	3						X						E

Relinquished By: [signature]	Date: 2-22-12 Time: 16:10	Received By:	Date: - - Time: : :	EMT USE ONLY
Relinquished By:	Date: - - Time: : :	Received By:	Date: - - Time: : :	ClientID: SPRING Client Contact: Joe Pavilonis EMT Project ID: CWLP AP Wells
Relinquished By:	Date: - - Time: : :	Received By: [signature]	Date: 2-22-12 Time: 16:10	Jar Lot No.

SAMPLE RECEIVED ON ICE
TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs prior to sample receipt)

SPECIAL INSTRUCTIONS:

Electronic Filing: Received, Clerk's Office 02/13/2020

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Sue Corcoran
City, Water, Light & Power
201 East Lake Shore Drive
Springfield, IL 62707

May 22, 2012

RE CWLP AP Wells

Lab Orders:
12040727

Dear Sue Corcoran:

Enclosed are the analytical reports for the EMT Lab Order listed. Also included with this analytical report is a copy of the chain of custody associated with these samples. If you have any questions, please contact me at 847-967-6666.

This is a preliminary report that contains incomplete data or data that has not been fully validated. Caution should be exercised in the use of any data presented as final reported results may not reflect the values presented.

Sincerely,

Joe Pavilonis
Project Manager

Approved by,

Mitchell Ostrowski
Laboratory Director

This Report Contains 7 pages

The Contents of this report apply to the sample(s) analyzed. No duplication is allowed except in its entirety.

State of Illinois Chemical Analysis in Drinking Water Accredited Lab. No. 100256
State of Wisconsin Wastewater and Hazardous Waste No. 999888890

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CLIENT: City, Water, Light & Power
Project: CWLP AP Wells
Lab Order: 12040727

Date: *5/22/2012*

CASE NARRATIVE

Unless otherwise noted, samples were analyzed using the methods outlined in the following references:
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition

Unless otherwise noted, all method blanks, laboratory spikes, and/or matrix spikes met quality assurance objectives.

Sample results relate only to the analytes of interest tested and to the sample received at the laboratory.

All results are reported on a wet weight basis, unless otherwise noted. Dry weight adjusted results, reporting limits, method detection limits and dilution factors are indicated by the notation "dry" in the Units column. If present, a dilution factor will adjust the method detection limits and reporting limits.

The test results contained in this report meet all of the requirements of NELAC. Accreditation by the State of Illinois or Wisconsin is not an endorsement or a guarantee of the validity of data generated. For specific information regarding EMT's scope of accreditation , please contact your EMT project manager.

The Reporting Limit listed on the Report of Laboratory Analysis is EMT's reporting limit for the analyte reported. For most test methods this reporting limit is primarily based upon the lowest point in the calibration curve.

Analyst's initials of "OUT" indicate that the analyte was analyzed by a subcontracted laboratory.

Method References:
SW=USEPA, Test Methods for Evaluating Solid Waste, SW-846.
E=USEPA Methods for the Determination of Inorganic Substances in Environmental Samples; Methods for Chemical Analysis of Water and Wastes; Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, 40 CFR Part 136, App A; methods for the Determination of Metals in Environmental Samples; Methods for the Determination of Organic Compounds in Drinking Water.
SM= APHA, Standard Methods for the Examination of Water and Wastewater.
D=ASTM, Annual Book of Standards

Batch numbers starting with a letter indicate an analytical batch while those that are exculsively numerals indicate a preparation batch.

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-1
Lab Order:	12040727	**Report Date:**	5/22/2012
Project:	CWLP AP Wells	**Collection Date:**	4/25/2012 7:30:00 AM
Lab ID:	12040727-01	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Anions by Ion Chromatography		**Method:**		**SW9056**			
Chloride	38.2	0.2		mg/L	4/27/12	R168754	GSB
Fluoride	< 0.5	0.5		mg/L	5/5/12	R169125	GSB
Nitrogen, Nitrate (As N)	< 0.05	0.05		mg/L	4/27/12	R168754	GSB
Sulfate	463.	50.		mg/L	4/27/12	R168754	GSB
Cyanide, Total		**Method:**		**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.2	0.2		mg/L	4/30/12 11:15	73572	CS2
Total Dissolved Solids		**Method:**		**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	1080.	10.		mg/L	4/30/12 23:40	R168916	LS3
ICP Metals, Groundwater Total		**Method:**		**SW6010C / SW3015**			
Boron	10.4	0.063	C	mg/L	4/30/12 15:56	73525	AG
Iron	18.3	0.125		mg/L	4/30/12 15:56	73525	AG
Mercury, Total		**Method:**		**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005		mg/L	4/27/12 11:44	73563	IG
Metals, Total.		**Method:**		**SW6020A / SW3015**			
Antimony	< 0.006	0.006		mg/L	4/30/12 15:00	73525	AG
Arsenic	< 0.05	0.05		mg/L	4/27/12 18:13	73525	AG
Barium	< 2.	2.		mg/L	4/27/12 18:13	73525	AG
Beryllium	< 0.004	0.004		mg/L	4/27/12 18:13	73525	AG
Cadmium	< 0.005	0.005		mg/L	4/27/12 18:13	73525	AG
Chromium	< 0.1	0.1		mg/L	4/27/12 18:13	73525	AG
Cobalt	< 1.	1.		mg/L	4/27/12 18:13	73525	AG
Copper	< 0.65	0.65		mg/L	4/27/12 18:13	73525	AG
Lead	< 0.0075	0.0075		mg/L	4/27/12 18:13	73525	AG
Manganese	0.864	0.15		mg/L	4/27/12 18:13	73525	AG
Nickel	< 0.1	0.1		mg/L	4/27/12 18:13	73525	AG
Selenium	< 0.05	0.05		mg/L	4/27/12 18:13	73525	AG
Silver	< 0.05	0.05		mg/L	4/27/12 18:13	73525	AG
Thallium	< 0.002	0.002		mg/L	4/27/12 18:13	73525	AG
Zinc	< 5.	5.		mg/L	4/27/12 18:13	73525	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quantitation limits

PRELIMINARY

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-2
Lab Order:	12040727	**Report Date:**	5/22/2012
Project:	CWLP AP Wells	**Collection Date:**	4/25/2012 12:25:00 PM
Lab ID:	12040727-02	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Anions by Ion Chromatography		**Method:**	**SW9056**				
Chloride	13.	0.2		mg/L	4/27/12	R168754	GSB
Fluoride	< 0.5	0.5		mg/L	5/5/12	R169125	GSB
Nitrogen, Nitrate (As N)	< 0.05	0.05		mg/L	4/27/12	R168754	GSB
Sulfate	201.	5.		mg/L	4/27/12	R168754	GSB
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**				
Cyanide	< 0.2	0.2		mg/L	4/30/12 11:15	73572	CS2
Total Dissolved Solids		**Method:**	**SM2540C**				
Total Dissolved Solids (Residue, Filterable)	866.	10.		mg/L	4/30/12 23:40	R168916	LS3
ICP Metals, Groundwater Total		**Method:**	**SW6010C / SW3015**				
Boron	5.51	0.063	C	mg/L	4/30/12 15:56	73525	AG
Iron	59.2	0.125		mg/L	4/30/12 15:56	73525	AG
Mercury, Total		**Method:**	**SW7470A / HG PREP**				
Mercury	< 0.0005	0.0005		mg/L	4/27/12 11:44	73563	IG
Metals, Total.		**Method:**	**SW6020A / SW3015**				
Antimony	< 0.006	0.006		mg/L	4/30/12 15:00	73525	AG
Arsenic	< 0.05	0.05		mg/L	4/27/12 18:19	73525	AG
Barium	< 2.	2.		mg/L	4/27/12 18:19	73525	AG
Beryllium	< 0.004	0.004		mg/L	4/27/12 18:19	73525	AG
Cadmium	< 0.005	0.005		mg/L	4/27/12 18:19	73525	AG
Chromium	< 0.1	0.1		mg/L	4/27/12 18:19	73525	AG
Cobalt	< 1.	1.		mg/L	4/27/12 18:19	73525	AG
Copper	< 0.65	0.65		mg/L	4/27/12 18:19	73525	AG
Lead	0.047	0.0075		mg/L	4/27/12 18:19	73525	AG
Manganese	20.7	0.15		mg/L	4/27/12 18:19	73525	AG
Nickel	< 0.1	0.1		mg/L	4/27/12 18:19	73525	AG
Selenium	< 0.05	0.05		mg/L	4/27/12 18:19	73525	AG
Silver	< 0.05	0.05		mg/L	4/27/12 18:19	73525	AG
Thallium	< 0.002	0.002		mg/L	4/27/12 18:19	73525	AG
Zinc	< 5.	5.		mg/L	4/27/12 18:19	73525	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimate
H - Holding time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quantitation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-3
Lab Order:	12040727	**Report Date:**	5/22/2012
Project:	CWLP AP Wells	**Collection Date:**	4/25/2012 12:05:00 PM
Lab ID:	12040727-03	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Anions by Ion Chromatography		**Method:**		**SW9056**			
Chloride	46.2	0.2		mg/L	4/27/12	R168754	GSB
Fluoride	< 0.5	0.5		mg/L	5/5/12	R169125	GSB
Nitrogen, Nitrate (As N)	< 0.05	0.05		mg/L	4/27/12	R168754	GSB
Sulfate	274.	5.		mg/L	4/27/12	R168754	GSB
Cyanide, Total		**Method:**		**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.2	0.2		mg/L	4/30/12 11:15	73572	CS2
Total Dissolved Solids		**Method:**		**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	926.	10.		mg/L	5/1/12 14:00	R168985	LS3
ICP Metals, Groundwater Total		**Method:**		**SW6010C / SW3015**			
Boron	18.4	0.063	C	mg/L	4/30/12 15:56	73525	AG
Iron	14.	0.125		mg/L	4/30/12 15:56	73525	AG
Mercury, Total		**Method:**		**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005		mg/L	4/27/12 11:44	73563	IG
Metals, Total.		**Method:**		**SW6020A / SW3015**			
Antimony	< 0.006	0.006		mg/L	4/30/12 15:00	73525	AG
Arsenic	< 0.05	0.05		mg/L	4/27/12 18:24	73525	AG
Barium	< 2.	2.		mg/L	4/27/12 18:24	73525	AG
Beryllium	< 0.004	0.004		mg/L	4/27/12 18:24	73525	AG
Cadmium	< 0.005	0.005		mg/L	4/27/12 18:24	73525	AG
Chromium	< 0.1	0.1		mg/L	4/27/12 18:24	73525	AG
Cobalt	< 1.	1.		mg/L	4/27/12 18:24	73525	AG
Copper	< 0.65	0.65		mg/L	4/27/12 18:24	73525	AG
Lead	< 0.0075	0.0075		mg/L	4/27/12 18:24	73525	AG
Manganese	7.24	0.15		mg/L	4/27/12 18:24	73525	AG
Nickel	< 0.1	0.1		mg/L	4/27/12 18:24	73525	AG
Selenium	< 0.05	0.05		mg/L	4/27/12 18:24	73525	AG
Silver	< 0.05	0.05		mg/L	4/27/12 18:24	73525	AG
Thallium	< 0.002	0.002		mg/L	4/27/12 18:24	73525	AG
Zinc	< 5.	5.		mg/L	4/27/12 18:24	73525	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimate
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quantitation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-4
Lab Order:	12040727	**Report Date:**	5/22/2012
Project:	CWLP AP Wells	**Collection Date:**	4/25/2012 11:25:00 AM
Lab ID:	12040727-04	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Anions by Ion Chromatography		**Method:**		**SW9056**			
Chloride	9.85	0.2		mg/L	4/27/12	R168754	GSB
Fluoride	< 0.5	0.5		mg/L	5/5/12	R169125	GSB
Nitrogen, Nitrate (As N)	< 0.05	0.05		mg/L	4/27/12	R168754	GSB
Sulfate	< 5.	5.		mg/L	5/5/12	R169125	GSB
Cyanide, Total		**Method:**		**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.2	0.2		mg/L	4/30/12 11:15	73572	CS2
Total Dissolved Solids		**Method:**		**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	560.	10.		mg/L	5/1/12 14:00	R168985	LS3
ICP Metals, Groundwater Total		**Method:**		**SW6010C / SW3015**			
Boron	0.123	0.063	C	mg/L	4/30/12 15:56	73525	AG
Iron	9.22	0.125		mg/L	4/30/12 15:56	73525	AG
Mercury, Total		**Method:**		**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005		mg/L	4/27/12 11:44	73563	IG
Metals, Total.		**Method:**		**SW6020A / SW3015**			
Antimony	< 0.006	0.006		mg/L	4/30/12 15:00	73525	AG
Arsenic	< 0.05	0.05		mg/L	4/27/12 18:30	73525	AG
Barium	< 2.	2.		mg/L	4/27/12 18:30	73525	AG
Beryllium	< 0.004	0.004		mg/L	4/27/12 18:30	73525	AG
Cadmium	< 0.005	0.005		mg/L	4/27/12 18:30	73525	AG
Chromium	< 0.1	0.1		mg/L	4/27/12 18:30	73525	AG
Cobalt	< 1.	1.		mg/L	4/27/12 18:30	73525	AG
Copper	< 0.65	0.65		mg/L	4/27/12 18:30	73525	AG
Lead	< 0.0075	0.0075		mg/L	4/27/12 18:30	73525	AG
Manganese	0.186	0.15		mg/L	4/27/12 18:30	73525	AG
Nickel	< 0.1	0.1		mg/L	4/27/12 18:30	73525	AG
Selenium	< 0.05	0.05		mg/L	4/27/12 18:30	73525	AG
Silver	< 0.05	0.05		mg/L	4/27/12 18:30	73525	AG
Thallium	< 0.002	0.002		mg/L	4/27/12 18:30	73525	AG
Zinc	< 5.	5.		mg/L	4/27/12 18:30	73525	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimate
H - Holding time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quantitation limits

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AP-5
Lab Order:	12040727	**Report Date:**	5/22/2012
Project:	CWLP AP Wells	**Collection Date:**	4/25/2012 10:40:00 AM
Lab ID:	12040727-05	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Anions by Ion Chromatography		**Method:**		**SW9056**			
Chloride	7.23	0.2		mg/L	5/1/12	R168937	GSB
Fluoride	< 0.5	0.5		mg/L	5/5/12	R169125	GSB
Nitrogen, Nitrate (As N)	< 0.05	0.05		mg/L	4/27/12	R168754	GSB
Sulfate	43.5	5.		mg/L	4/27/12	R168754	GSB
Cyanide, Total		**Method:**		**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.2	0.2		mg/L	4/30/12 11:15	73572	CS2
Total Dissolved Solids		**Method:**		**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	404.	10.		mg/L	5/1/12 14:00	R168985	LS3
ICP Metals, Groundwater Total		**Method:**		**SW6010C / SW3015**			
Boron	< 0.625	0.625	C	mg/L	5/2/12 09:38	73525	CS2
Iron	435.	1.25		mg/L	5/2/12 09:38	73525	CS2
Mercury, Total		**Method:**		**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005		mg/L	4/30/12 13:01	73601	IG
Metals, Total.		**Method:**		**SW6020A / SW3015**			
Antimony	< 0.006	0.006		mg/L	4/30/12 15:00	73525	AG
Arsenic	0.076	0.05		mg/L	4/27/12 18:35	73525	AG
Barium	< 2.	2.		mg/L	4/27/12 18:35	73525	AG
Beryllium	0.0128	0.004		mg/L	4/27/12 18:35	73525	AG
Cadmium	0.0128	0.005		mg/L	4/27/12 18:35	73525	AG
Chromium	0.328	0.1		mg/L	4/27/12 18:35	73525	AG
Cobalt	< 1.	1.		mg/L	4/27/12 18:35	73525	AG
Copper	< 0.65	0.65		mg/L	4/27/12 18:35	73525	AG
Lead	0.236	0.0075		mg/L	4/27/12 18:35	73525	AG
Manganese	7.91	0.15		mg/L	4/27/12 18:35	73525	AG
Nickel	0.539	0.1		mg/L	4/27/12 18:35	73525	AG
Selenium	< 0.05	0.05		mg/L	4/27/12 18:35	73525	AG
Silver	< 0.05	0.05		mg/L	4/27/12 18:35	73525	AG
Thallium	0.00258	0.002		mg/L	4/27/12 18:35	73525	AG
Zinc	< 5.	5.		mg/L	4/27/12 18:35	73525	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimate
H - Holding time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quantitation limits

PRELIMINARY

4.15

4.15	10/19/2011 – Illinois EPA requests backgrounds to be developed	10.19.2011 IEPA GW Response	CWLP	01174	01178

Electronic Filing: Received, Clerk's Office 02/13/2020

cy: PJ Sue Christine

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 North Grand Avenue East, P.O. Box 19276, Springfield, Illinois 62794-9276 • (217) 782-2829
James R. Thompson Center, 100 West Randolph, Suite 11-300, Chicago, IL 60601 • (312) 814-6026

PAT QUINN, GOVERNOR

October 19, 2011

RECEIVED
OCT 24 2011
ENVIRONMENTAL HEALTH & SAFETY

Ms. Sue Corcoran
Environmental Health & Safety
City Water, Light, and Power
East Lake Shore Drive
Springfield, Illinois 62712

Re: City, Water, Light, and Power - Power Plant Ash Impoundment Meeting Response - NPDES Permit No. IL0024767

Dear Ms. Corcoran:

This letter is in response to the September 7, 2011 meeting with City, Water, Light, and Power (CWLP) and the Illinois Environmental Protection Agency (Illinois EPA) concerning power plant ash impoundment impacts to groundwater. On-site groundwater sampling near the ash impoundments completed in June of 2010, indicated elevated concentrations of boron, arsenic, iron and manganese. The Illinois EPA determined that additional groundwater sampling is necessary to confirm the initial sampling results, and provide background groundwater quality at the site. Also, a groundwater monitoring program plan should be established, with a quarterly monitoring plan and a background determination plan for monitoring wells AP-1, AP-2, AP-3, AP-4, AW-3, and background well. The following items are provided for your review and appropriate action:

1. Statistical background groundwater sampling was discussed during the meeting. At least six groundwater samples should be collected from each monitoring well within one year to establish a statistically valid representation of existing groundwater quality. A statistically valid representation of water quality can be determined using the method in Attachment 1 or other approved method. The method should be used to determine the upper 95 percent confidence limit for each of the Class I groundwater monitoring parameters listed in 35 IAC 620.410(a) and (d). Groundwater quality information should be provided in both a paper and electronic format.

2. Additionally, CWLP should establish a quarterly monitoring program for the designated, monitoring wells. The monitoring wells should be sampled for Class I groundwater chemical parameters listed in 35 IAC 620.410(a) and (d). Both background and replacement monitoring wells should be screened in the upper most water bearing materials. Provide the monitoring well drillers logs and completion reports, to the Illinois EPA once well completion work is finished. Two rounds of groundwater sampling should be completed at each designated monitoring well by April 30, 2012, with results provided to the Illinois EPA by May 30, 2012.

3. Once adequate data has been collected to provide a statistically valid representation of groundwater quality, CWLP may request that analytes, which have been consistently below detectable levels, be dropped from the monitoring program.

4. The Illinois EPA may require the completion of additional activities to fully assess the extent and nature of impacts to groundwater, based on available and on-going groundwater monitoring results.

5. Please send the drillers logs, well completion reports, and the annual groundwater monitoring reports to the following addresses:

Illinois Environmental Protection Agency
Division of Water Pollution Control
Compliance Assurance Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

Illinois Environmental Protection Agency
DWPC - Springfield Region
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

Illinois Environmental Protection Agency
Hydrogeology and Compliance Unit
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

A groundwater monitoring program plan with a schedule for completing the above work and a map locating the monitoring wells, must be submitted to the Illinois EPA for review and approval within 30 days of the date this letter. Thank you for your attention to these matters. If you have any questions concerning this letter, please contact Carl Kamp of the Hydrogeology and Compliance Unit at 217-785-4787.

Sincerely,

Alan Keller P.E.
Manager, Permit Section
Division of Water Pollution Control

cc:
Rick Cobb
Bill Buscher
Carl Kamp
Shu-Mei Tsai
BOW Records

Sangamon County GW General File

ATTACHMENT 1

A. This method should be used to predict the confidence limit when single groundwater samples are taken from each monitoring (test) well.

1. Determine the arithmetic mean $(\overline{X}_b)$ of each indicator parameter for the background sampling period. If more than one background (upgradient) well is used, an equal number of samples must be taken from each well.

$$\overline{X}_b = \frac{X_1 + X_2 + \ldots X_n}{n}$$

Where:

$\overline{X}_b$ = Average background value for a given chemical parameter

X_n = Background values for each upgradient sample

n = the number of background samples taken

2. Calculate the background variance (S_b^2) and standard deviation (S_b) for each parameter using the values (X_n) from each background sample of the upgradient well(s) as follows:

$$S_b^2 = \frac{(X_1 - \overline{X}_b)^2 + (X_2 - \overline{X}_b)^2 + \ldots + (X_n - \overline{X}_b)^2}{n-1}$$

$$S_b = \sqrt{S_b^2}$$

3. Calculate the upper confidence limit using the following formula:

$$CL = \overline{X}_b \pm t\sqrt{1+1/n}\ (S_b)$$

Where:

CL = upper confidence limit prediction
(upper and lower limits should be calculated for pH)

t = one-tailed t value at the required significance level and at n-1 degrees of freedom from Table 1
(a two-tailed t value should be used for pH)

4. If the values of any routine parameter for any monitoring well exceed the upper confidence limit for that parameter, the permittee shall conclude that a statistically significant change has occurred at that well.

5. When some of the background (upgradient) values are less than the Method Detection Limit (MDL), a value of one-half (1/2) the MDL shall be substituted for each background value that is reported as less than the MDL. All other computations shall be calculated as given above.

B. If all the background (upgradient) values are less than the MDL for a given parameter, the Practical Quantitation Limit (PQL), for the analytical method utilized, shall be used to evaluate data from monitoring wells. If the analytical results from any monitoring well exceed two (2) times the PQL for any single parameter, or if they exceed the PQLs for two or more parameters, the permittee shall conclude that a statistically significant change has occurred.

Table 1

Standard t-Tables Level of Significance

Degrees of freedom	t-values (one-tail)		t-values (two-tail)*	
	99%	95%	99%	95%
4	3.747	2.132	4.604	2.776
5	3.365	2.015	4.032	2.571
6	3.143	1.943	3.707	2.447
7	2.998	1.895	3.499	2.365
8	2.896	1.860	3.355	2.306
9	2.821	1.833	3.250	2.262
10	2.764	1.812	3.169	2.228
11	2.718	1.796	3.106	2.201
12	2.681	1.782	3.055	2.179
13	2.650	1.771	3.012	2.160
14	2.624	1.761	2.977	2.145
15	2.602	1.753	2.947	2.131
16	2.583	1.746	2.921	2.120
17	2.567	1.740	2.898	2.110
18	2.552	1.734	2.878	2.101
19	2.539	1.729	2.861	2.093
20	2.528	1.725	2.845	2.086
21	2.518	1.721	2.831	2.080
22	2.508	1.717	2.819	2.074
23	2.500	1.714	2.807	2.069
24	2.492	1.711	2.797	2.064
25	2.485	1.708	2.787	2.060
30	2.457	1.697	2.750	2.042

40	2.423	1.684	2.704	2.021

Adopted from Table III of "Statistical Tables for Biological Agricultural and Medical Research" (1947, R.A. Fisher and F. Yates).
* For pH only when required.

4.17

4.17	11/18/2011 – CWLP submits groundwater monitoring program to Illinois EPA	11.18.2011 CWLP GWMP	CWLP	01180	01208

Electronic Filing: Received, Clerk's Office 02/13/2020

ANDREWS ENGINEERING, INC.

November 18, 2011

Alan Keller, P.E., Manager, Permit Section
Illinois Environmental Protection Agency
Division of Water Pollution Control
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Re: City Water, Light and Power – Power Plant Ash Impoundment
NPDES Permit No. IL0024767

Dear Mr. Keller:

On behalf of City Water, Light and Power, City of Springfield, Illinois, Andrews Engineering, Inc. has prepared the enclosed Groundwater Monitoring Program (GMP). This GMP was prepared to address the Illinois EPA, Division of Water Pollution Control's October 19, 2011 correspondence regarding the preparation of a GMP for an ash impoundment at the City Water, Light and Power facility.

If you have any questions or require further information, please contact me.

Sincerely,

Mahlon T. Hewitt, L.P.G.
Senior Hydrogeologist

MTH:mth:sjb

Enclosure

cc: Sue Corcoran – Environmental Health and Safety, City Water Light and Power, City of Springfield

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Reporting

3300 Ginger Creek Drive, Springfield, Illinois 62711 ◆ 217.787.2334 fax 217.787.9495 www.andrews-eng.com

Electronic Filing: Received, Clerk's Office 02/13/2020

City Water, Light & Power
Power Plant Ash Impoundment
NPDES Permit No. IL0024767

Groundwater Monitoring Program

November 2011

Prepared for:
City Water, Light & Power
201 E. Lake Shore Drive
Springfield, Illinois

Prepared by:

ANDREWS
ENGINEERING, INC.
3300 Ginger Creek Drive
Springfield, Illinois 62711
Tel: (217) 787-2334; Fax: (217) 787-9495

Response to 1st RIP
CWLP - 01181

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Figure 1: Proposed Groundwater Monitoring Network
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APPENDICES

Appendix A – Statistical Method for Determination of Backgrounds

1. INTRODUCTION

This Groundwater Monitoring Program (GMP) has been prepared in response to the October 19, 2011 correspondence from the Illinois EPA's Division of Water Pollution Control regarding the power plant ash impoundment impacts to groundwater. Onsite groundwater sampling near the ash impoundments, completed in June of 2010, indicated elevated concentrations of boron, arsenic, iron, and manganese.

As a result of the detection in the groundwater, the Illinois EPA requested that City Water, Light and Power (CWLP) prepare a GMP that will allow the collection of additional groundwater samples to confirm the initial sampling results and provide background groundwater quality. The items included in the Illinois EPA's October 19, 2011 correspondence are identified in italicized text, CWLP comments are in bold:

1. *Statistical background groundwater sampling was discussed during the meeting. At least six groundwater samples should be collected from each monitoring well within one year to establish a statistically valid representation of water quality can be determine using the method in Attachment 1 or other approved method. The method should be used to determine the upper 95 percent confidence limit for each of the Class I groundwater monitoring parameters listed in 35 IAC 620.410(a) and (d). Groundwater quality information should be provided in both a paper and electronic format.*

   In response to Item No. 1, there are 4 comments to be made:

   - **Four samples collected over four consecutive quarters are sufficient to provide a statistically valid database for calculation of an upper 95-/99-percent confidence limit. As such, the collection of groundwater samples over four consecutive quarters is being proposed.**

   - **As requested, the method used to determine the upper 95-percent confidence limit will be per Attachment 1 of the October 19, 2011 Illinois EPA correspondence. The method is provided as Appendix A of this GMP.**

   - **The groundwater monitoring parameters will be limited to those parameters that have been detected in groundwater. Performing analyses of the entire 35 Illinois Administrative Code (IAC) 620.410(a) and (d) suite of parameters is not necessary given the existing analytical results provided in the August 2010 Ash Pond Assessment Report. The list of parameters is to include the total and dissolved portions of the arsenic, barium, boron, chloride, chromium (VI), fluoride, iron, manganese, nitrogen nitrate as (N), sulfate, and zinc.**

   - **Lastly, all groundwater sampling analytical results will be provided for Illinois EPA review per Item Nos. 2 and 5 of the October 19, 2011 Illinois EPA correspondence.**

2. *Additionally, CWLP should establish a quarterly monitoring program for the designated monitoring wells. The monitoring wells should be sampled for Class I groundwater chemical parameters listed in 35 IAC 620.410(a) and (d). Both background and replacement monitoring wells should be screened in the upper most water bearing materials. Provide the monitoring well drillers logs and completion reports to the Illinois*

EPA once well completion work is finished. Two rounds of groundwater sampling should be completed at each designated monitoring well by April 30, 2012, with results provided to the Illinois EPA by May 30, 2012.

In response to Item No. 2, there are 4 comments to be made:

- **This submittal provides the requested quarterly groundwater monitoring program for the designated wells.**
- **As indicated above, groundwater monitoring parameters will be limited to those parameters that have been detected in groundwater.**
- **The drilling, logging, and monitoring well installation of the borings completed for the background and replacement wells will be overseen and logged by an Illinois licensed professional geologist. The geological boring logs and monitoring well construction reports will be provided to the Illinois EPA per Item Nos. 2 and 5. The screens of these wells will be placed such that they intersect the uppermost water bearing materials. Based on historical characterization data, the uppermost saturated zone is comprised of the coarse grained silt, sand, and gravel deposits that rest directly on top of the weathered bedrock surface.**
- **As requested, two rounds of sampling will be completed at each designated monitoring well by April 30, 2012 with results provided to the Illinois EPA by May 30, 2012.**

3. *Once adequate data has been collected to provide a statistically valid representation of groundwater quality, CWLP may request that analytes, which have been consistently below detectable levels, be dropped from the monitoring program.*

   In response to Item No. 3, it is understood that a request to remove analytes from the groundwater monitoring program may be made for those parameters that are consistently below detectable levels. It is proposed that the term "consistently" be understood to mean four consecutive quarters.

4. *The Illinois EPA may require the completion of additional activities to fully assess the extent and nature of impacts to groundwater, based on available and on-going groundwater monitoring results.*

   In response to Item No. 4, it is understood that additional activities may be necessary to fully address the extent and nature of impacts to groundwater. Additional activities will be proposed as necessary based on the results of the 2012 groundwater sampling activities.

5. *All completed drillers logs, well completion reports and the annual groundwater monitoring results should be submitted to the appropriate compliance and permitting sections within the Illinois EPA's Division of Water Pollution Control.*

   In response to Item No. 5, all necessary reporting will be completed as requested.

The above reference items are addressed within the GMP. The GMP is designed to detect any changes in the groundwater chemistry in the areas directly downgradient to the impoundments near the creek and defines the initial procedures for determining the source of any changes that are detected. Included in the GMP are:

- A brief description of the hydrogeology
- Identification of the most likely potential contaminant migration pathways
- Technical specifications for well construction, groundwater sampling, sample analyses and well abandonment
- Sampling methods and procedures

2. HYDROGEOLOGIC SETTING

The hydrogeologic setting of the area in and surrounding the ash impoundment has been characterized through multiple subsurface investigations. The earliest investigation was completed in June 1989, and the most recent investigation was completed in April 2010. The details of these investigation are summarized in the August 2010 Ash Pond Assessment Report previously submitted to the Illinois EPA Bureau of Water.

The site geology is comprised of approximately 40 to 50 feet of unconsolidated clastic materials overlying the surface of the weathered shale. The overburden materials range in grain size, from clays, silts and silty clays to sands and gravels. The overall tendency is for the finer-grained materials (clays, silty clays and silts) to overlie the coarser-grained materials (sands and gravels). This coarsening downward is present throughout much of the site. At the majority of the borehole locations, the coarser materials rest directly on top of the weathered bedrock surface. In addition, in some locations creek fill materials, ranging from silty clays and organic silty clays to silty sands and clayey sands appear to be in direct hydraulic communication with the coarse grained materials that directly overlie the bedrock surface. Due to the highly variable hydraulic characteristics and random placement of the creek fill materials further characterization is difficult.

Groundwater monitoring wells have been installed in the coarser grained deposits and weathered shale encountered at the bedrock surface. Wells associated with the ash impoundment are identified as AP-1, AP-2, AP-3, AP-4, and AW-3. The most recent groundwater elevation data collected at wells AP-1 through AP-4 and AW-3 are dated May 23, 2011. This dataset includes groundwater elevations for wells R101, G106, G110, R111, G112, G113, G120, G121, G122, P-5D, P-7S, P-7D, P-7R, P-7M, P-9S, P-9D, AW-1, AW-2, AW-3, AP-1, AP-2, AP-3, and AP-4 and surface water elevations for locations designated as DAP, CLAR.PD, CELL1LEAC, L303, and EVAP CELL. Based on this potentiometric surface data, groundwater moves from east-southeast to the west-northwest with a horizontal gradient of approximately 0.00555 (between wells AW-1 and AP-1). There is also an eastward component of flow along the eastern portion of the ash impoundment. In this area groundwater flow may likely move towards the landfill and then northward to the creek. Detailed potentiometric surface data were provided in the August 2010 Ash Pond Assessment Report.

3. CONTAMINANT MIGRATION PATHWAYS

The contaminant migration pathway is characterized as the first water-bearing zone that contains sufficient hydrogeologic characteristics to provide solute movement from the ash impoundments. Wells screened across this zone should provide the earliest and most-reliable indications of a release. Over the site, the uppermost, laterally continuous, source of water to wells is the weathered upper surface of the bedrock along with any overlying silt, sand, and gravel to which it is hydraulically connected. In some locations, this includes creek fill material as described above.

4. MONITORING WELL NETWORK

4.1 Proposed Groundwater Monitoring Well Network

The purpose of the GMP is to characterize the uppermost saturated zone and to outline the proposed groundwater monitoring system that will detect any changes in the groundwater chemistry in the area adjacent to the ash impoundment and to define the initial procedures for determining the source of any changes in the groundwater chemistry that occur within those areas.

The network will consist of six monitor wells screening the silt, sand, and gravel at the bedrock interface. The direction of groundwater flow, as described above is to the west-northwest; therefore, the northern and western boundaries of the landfill will be downgradient to the subject unit and the southern and eastern boundaries will be upgradient. The monitoring network includes two upgradient wells (existing well AP-4 and proposed well AP-5) and four downgradient wells (AP-1, AP-2, AP-3, and AW-3).

The well locations, both proposed and existing, are depicted in Figure 1. Table 1 provides a list of the wells and approximate screen intervals.

4.1.1 Well Installation Schedule

Five groundwater monitoring wells (AP-1, AP-2, AP-3, AP-4, and AW-3) have been installed to monitor groundwater quality with respect to the ash impoundment. It may be necessary to replace existing wells AP-1 and AP-2 due to damage caused by flooding. These wells will be repaired or replaced and contain a sealed cap to ensure potential floodwaters do not inundate the well casing. One additional background monitoring well (AP-5) is proposed in an area southeast of the ponds, which should allow for evaluation of the groundwater upgradient to and unaffected by the subject ponds. The proposed installation/construction schedule is listed in Table 1.

5. MONITORING WELL CONSTRUCTION

Monitoring wells to be installed or replaced shall be constructed in accordance with the Illinois Water Well Construction Code (Title 77, Chapter I, Subchapter R, Part 920), Illinois EPA Administrative Procedure #11 (Monitor Well Design Criteria). Specifically, the screen and casing of each monitoring well will be constructed of two-inch diameter, polyvinyl chloride (PVC) or other appropriate material. The screens shall be continuous slot or machine cut with a #10 slot

(or as otherwise necessitated by the grain size of the screened deposits). The filter pack surrounding the screen shall consist of a clean, well-sorted material that meets the grain size specifications set forth in the previously cited references.

The annular space between the casing and the borehole wall shall be sealed with a relatively impermeable, inert, expandable material such as a bentonite or cement/bentonite grout. The seal shall extend above the highest known seasonal groundwater level.

At the surface, a concrete pad shall be installed around the well. The pad shall extend at least two feet below the surface (i.e., below the frost line) and slope away from the well casing so rainwater will be diverted away from the well. The portion of the well casing above the ground surface must be protected and locked to minimize damage or tampering. A monitor well detail is provided in Figure 2.

As appropriate, boring logs and well completion reports shall be submitted to the Illinois EPA within 60 days of installation. These will be sent to the address provided on the Illinois EPA correspondence for the Bureau of Water, Division of Water Pollution Control. Well completion reports shall be submitted to the Illinois Department of Public Health or approved local health department within 30 days of installation (77 IAC 920.170 (i)).

6. WELL DEVELOPMENT

Each new or replacement well shall be developed to minimize turbidity and increase flow into the well. Surge blocks, bailers or other appropriate devices shall be used to produce surges of groundwater in the screened interval to develop the wells. A minimum of 24 hours after completion of well installation shall pass prior to any well development to allow full hydration of the bentonite annular seal and to allow the cement grout or bentonite grout to set properly. This waiting time will minimize the possibility of grout contamination to the well. Over time, if the yield of groundwater decreases at any well due to siltation, redevelopment of that well shall be conducted.

7. ESTABLISHMENT OF BACKGROUND CONCENTRATIONS

Pursuant to Item No. 1 of the October 19, 2011 Illinois EPA correspondence background concentrations will be developed. Background concentrations are chemical concentrations or parameter values that represent naturally-occurring groundwater that has not been impacted by the ash impoundment or other facility activities. These concentrations are typically established by analysis of water samples from wells located upgradient to the subject unit or otherwise documented as not being affected by the facility. Background concentrations are developed from samples collected for four consecutive quarters. The chemical constituents include only those parameters detected at the ash impoundment wells.

The background concentrations are statistically analyzed to establish site-specific upper confidence limits for each chemical or parameter. Based on existing groundwater quality data, the parameters of concern are limited to the total and dissolved portions of the arsenic, barium, boron, chloride, chromium (VI), fluoride, iron, manganese, nitrogen nitrate as (N), potassium, sodium, sulfate, and zinc.

If, during the period of collecting four consecutive quarterly samples a disparity in natural groundwater chemistry is identified within the boundaries of the ash impoundment, the spatially variable groundwater chemistry will be addressed through the derivation of well-specific background concentrations. These concentrations are referred to as intrawell concentrations. Concentrations that apply to all wells based on groundwater geochemistry at the upgradient monitoring locations are referred to as interwell concentrations.

8. INTERWELL CONCENTRATIONS

Interwell concentrations are statistically derived upper prediction limits based on data from upgradient monitoring wells. The resulting prediction limits are assigned to each well within the monitor well network. The use of interwell concentrations indicates the upgradient groundwater quality is representative of the groundwater quality within the extents of the monitored zone within the existing facility boundary. A statistical method used to derive interwell concentrations is included in Appendix A.

9. INTRAWELL CONCENTRATIONS

Intrawell concentrations are derived by obtaining four consecutive quarters of data from a specific well or groups of wells and statistically calculating an upper prediction limit. The prediction limit is typically the intrawell concentrations. Intrawell concentrations account for the spatial variability of groundwater concentrations and minimize the potential for false positives when evaluating the quarterly or annual analytical data. False positives or false exceedences would unnecessarily require a groundwater assessment.

10. GROUNDWATER SAMPLING

10.1 Quarterly Monitoring

All groundwater monitoring wells in the proposed network shall be routinely sampled and analyzed for the parameters listed in Table 2 or as otherwise approved by the Illinois EPA. These have been selected based upon their concentrations found in previous ash impoundment leachate as compared to the background groundwater concentrations, their mobility and their resistance to attenuation.

10.2 Sampling Schedule

Sampling for routine analysis shall be conducted in accordance with the following schedule:

Sampling Quarter	Report Due Date
Jan. – Feb. (1)	April 15
April – May (2)	July 15
July – Aug. (3)	October 15
Oct. – Nov. (4)	January 15

Annual monitoring shall take place during the second quarter sampling event (April or May). Reporting of the groundwater sampling and analysis shall be completed pursuant to Item No. 2 and No. 5 of the October 19, 2010 correspondence.

10.3 Sampling Procedure

The procedures described below should be applied to the retrieval of groundwater samples at the facility. Alternative procedures may be implemented if appropriate. If alternative methods are utilized, documentation shall be kept in the facility record.

Upon arrival at the sampling point, the sampler will inspect the condition of the monitoring well. This shall include, but not be limited to, the condition of the casing and lock, evidence of tampering, condition of the pad and any standing water in the immediate vicinity of the well. Any defects observed will be reported to the owner/operator of the facility. Defects that do not hinder sampling, but may alter the results of the sampling (e.g., missing cap, cracked riser, or tampering) will be noted and remedied prior to the next sampling event. If the monitoring well has any defects that hinder the sampling process, the sampler will notify the owner/operator and the well or condition will be fixed prior to the next sampling event.

10.3.1 Water Level Measurements

Water levels shall be measured in each well prior to any purging or sampling. These should be taken within the shortest possible time of each other, as to prevent temporal distortion of the water surface data.

The following steps should be followed to obtain accurate water level readings:

1. Following the exterior inspection, remove the lock and open the well. Inspect the condition of the interior 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. *Note: If the cap is not vented and a pressure differential exists, the water level must be allowed to stabilize before a final measurement is made. ASTM Standard D4750 describes how to determine a stabilized water level.*
2. Rinse the probe and cable of the water level meter with de-ionized water prior to reading the water level.
3. Slowly lower the probe into the well until the meter indicates the water surface has been reached.
4. Record the depth to water (to the nearest 0.01 foot) and the time on the worksheet.
5. Extend probe to the bottom of the well.
6. Record the total depth of the well (to the nearest 0.01 foot) on the worksheet.
7. Remove the probe from the well. Rinse the probe and line with de-ionized water.
8. Replace the cap. Close and lock the well. Properly dispose of any waste materials.

If dedicated pumps are utilized for sampling purposes, devices such as bubble gauges attached to the pumps may be used to measure the water level instead of portable measuring tools. This applies to low-flow sampling equipment or Micro-Purge systems.

10.3.2 Well Purging

10.3.2.1 Normal-Flow Wells

After all water level measurements have been taken, the monitoring wells shall be purged to remove "stagnant" water. Effort will be taken to minimize turbulence in the well. Purging shall continue until:

- pH, specific conductance, and temperature have stabilized. Stabilization shall be considered as three successive measurements within
  - pH unit,
  - C°, and
  - micromho/cm., or
- A minimum of one to three well volumes of water have been removed from the well.

Well purging should cease if the groundwater level drops to the top of the screen as determined with a depth-to-water meter. If necessary, slow-recovering wells shall be allowed to recharge for 24 hours. If there is still insufficient water to fill the minimum number of sample containers, the well will be considered dry. Notes shall be kept on the worksheet with regard to water levels, times, volume of water removed and any other relevant parameters. If there is adequate water volume in the well, the well shall be sampled.

Typically, purging shall be done at a rate not to exceed the rate of withdrawal during the original well development. In the event of minimal recharge, it may be necessary for the water level to fall below the top of the screen in order to collect the samples.

10.3.2.2 Purging Procedures

Each groundwater monitoring well is purged by using either a bailer or a pump. The bailer, if used, shall be made of a similar material as the well. If a pump is selected, the pump shall be constructed of stainless steel, with either stainless steel impellers with Teflon gaskets or Teflon bladders. Other materials deemed appropriate for environmental sampling by the manufacturer or applicable governmental entity may be utilized. After noting the well volume on the worksheet, the following protocols shall be used.

- *Bailers*
  1. Calculate the number of bailers necessary to remove one to three well volumes of water.
  2. Remove the minimum well volume and collect the samples, or follow steps 3 through 5.
  3. Remove one well volume of water from the well. Test pH, Specific Conductance (SC), and Temperature (T). Note volume and parameter values on worksheet. *Note: The sampler will ensure that agitation of the water column in the well is kept at a minimum. This will include, but not be limited to lowering the bailer slowly into the water, purging from the top (not bottom) of the water column and removing the bailer slowly from the water. These measures apply to all purging and sampling steps that deal with removing water from the well.*
  4. Remove 1.0 to 1.5 gallons of water. Test pH, SC, and T. Note volume and parameter values on worksheet.

5. Repeat Step 4 until pH, SC, and T stabilize or three well volumes of water have been removed.
6. If the water level drops to the top of the screen or there is insufficient water to obtain all necessary samples, the slow recovery procedures shall apply.
7. If there is sufficient water volume in the well to obtain all samples, sample collection shall begin at this time.

- *Pumps – Submersible or Positive Displacement*

1. Connect the pump control to the pump.
2. Place a calibrated volume (e.g., a beaker) under the pump outlet.
3. Engage the pump and remove one well volume of water. Test pH, SC, and T. Record parameter values on worksheet. *Note: To ensure the well is not pumped dry, the pump intake will be no deeper than the midpoint of the screen.*
4. Remove 1.0 to 1.5 gallons of water. Test pH, SC, and T. Record values on worksheet.
5. Repeat Step 4 until pH, SC and T stabilize or three well volumes of water have been removed.
6. If the water level drops to the top of the screen or there is insufficient water to obtain all necessary samples, the slow recovery procedures shall apply.

Groundwater removal should not exceed the rate utilized for the original well development.

10.3.3 Sample Collection

10.3.3.1 Field Measurements

Upon arrival at each groundwater monitoring well, the sampler shall log on the worksheet the date, time, ambient air temperature, general weather conditions, and individuals present, including sample team members and any observers. The values for pH, SC, and T shall be recorded prior to obtaining the groundwater samples. This may be accomplished in conjunction with the purging of the well.

In addition to the general information, field measurements shall be performed as described below:

- Temperature – Obtain a water sample from the well. Place the sample in a disposable container, insert the thermometer, wait until the thermometer has stabilized and record the temperature.
- 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 de-ionized water. Obtain a sample from the well, place probe in sample and record pH.
- Specific Conductance – Confirm calibration of instrument by comparing with an appropriate buffer solution. Adjust for temperature compensation (if meter is not self-compensating). Rinse probe with de-ionized water. Obtain a sample from the well, place probe in sample and record the Specific Conductance.

10.3.3.2 Field Quality Assurance/Quality Control (QA/QC)

Data quality is dependent on rigorous adherence to systematic QA/QC procedures. Mistakes can result in false indications of contamination that lead to unnecessary, time-consuming studies and activities. It is essential that field personnel are properly trained and the equipment is properly maintained, calibrated and used.

Cross contamination of samples shall be avoided. Protective material, which is discarded after each well, includes the chemical resistive gloves and the disposable plastic sheeting that provides a clean working area for equipment and instruments. Equipment that might contaminate the samples (e.g., disposable bailers) should not be removed from its packaging before it is needed. Multiuse equipment (e.g., water table probes) should be cleaned with de-ionized water before and after each use.

10.3.3.3 Preservation and Special Handling

Sample preservation techniques will typically adhere to Handbook for Sampling and Sample Preservation of Water and Wastewater, (US EPA, EPA-600/4-82-029, 1982), Test Methods for Evaluating Solid Wastes, (SW-846 3rd Edition, 1992) and A Field Guide for Environmental Sampling (Illinois EPA, Division of Laboratories Handbook, 1993).

10.3.4 Transportation of Samples

Groundwater samples shall be transported to the laboratory in sealed, insulated shipping containers, ice chests or coolers. The shipping containers shall be sturdy, and if samples are contained in glass bottles, bottle dividers shall be used to prevent breakage. All samples for organic analysis and numerous other parameters will be packed in ice or a packaged refrigerant as necessary for proper preservation. The samples shall be shipped/delivered to the laboratory as soon as practical, preferably within 24 hours of sample collection.

All samples (shipped or delivered) shall be accompanied by a chain-of-custody record. The sampler shall retain a copy of the record and forward the original with the samples to the laboratory performing the analyses. Once the laboratory has received the samples, a representative from the laboratory is to complete the record, retain a copy for their file and return the original with the chemical analysis reports to the sampler.

10.3.5 Laboratory Analysis

Laboratory analysis and testing methods will typically be in accordance with the most recent edition of *Test Methods for Evaluating Solid Waste*, (US EPA, 1992). The specific testing methods used shall be identified in the analysis report. Other references (unless superseded) for testing methods are:

- Methods for Chemical Analysis of Water and Wastes (EPA 600/4-79-020, revised March 1983);
- Test Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater (EPA 600/4-82-057, July 1982);
- Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water, (US EPA, September 1986); and

- Standard Methods for the Examination of Water and Wastewater, (APHA-AWWA-WPCF, 16th edition, 1985 and 1988 Supplement).

These materials are included as part of this application by reference.

QA/QC programs will likely vary from laboratory to laboratory but will contain the same general methodologies. The QA/QC programs are implemented to ensure the stated accuracy and precision of analytical data. At no time will a method be utilized that has a Practical Quantitation Limit (PQL) above the regulatory standards found in 35 IAC 620.410 unless otherwise approved by the Illinois EPA.

Several methodologies will be used by the laboratory to ensure representative analytical results. Some methodologies that may be used are:

- Calibration tests shall be used to verify instrument performance. Instrumental calibration curves will be maintained in a manner consistent with the instrument and method utilized.
- Spiked laboratory control samples and/or quality control test standards may be used to monitor the performance of the analytical method.
- Matrix spike and matrix spike duplicate analytes are samples in which solutions of specific analytes are added to a sample matrix prior to sample extraction/digestion and analysis. Samples are split into duplicates, spiked and analyzed. Percentage recoveries and relative percentage differences are calculated for each analyte detected.
- Replicate samples shall be routinely analyzed to check the precision of the instrumentation and/or methodology employed for all analytical methods.
- Where applicable, method blanks are prepared and analyzed each day or sample batch to ensure that the system is free of contamination.

Typically, the laboratory's QA/QC program will follow requirements in the most recent edition of *Test Methods for Evaluation Solid Waste*, (US EPA, SW-846, 1986). Other QA/QC methods may be utilized as part of laboratory policy.

Variations of the methods described in this section may be utilized if approved by the Illinois EPA.

11. CHEMICAL ANALYSIS EVALUATION

Once background concentrations have been derived, the results of the chemical analyses of the groundwater samples collected from the designated wells shall be individually examined to determine if an observed increase has occurred. This evaluation shall be done each quarter until groundwater monitoring is discontinued. This evaluation will entail a review of the analytical results to determine if the following increases are observed:

- The concentration of any constituent shows a progressive increase over eight consecutive quarters
- The concentration of any constituent exceeds its established intrawell/interwell value

- The concentration of any parameter exceeds a groundwater quality standard listed under 35 Ill. Adm. Code 620.410(a) and (d)

Should it be deemed necessary, the subject well(s) will be re-sampled within 90 days of the initial sampling event, to confirm the observed increase. The operator shall ensure that the samples and sampling protocol used will detect any statistically significant increase in the concentration of the suspect constituent.

If a confirmed increase has occurred, an assessment groundwater monitoring plan will be prepared to determine the rate and extent of the contamination. The Illinois EPA Bureau of Water, Division of Water Pollution shall be notified of the sampling results and shall be included in further details of the site assessment.

12. PLUGGING AND ABANDONMENT REQUIREMENTS

12.1 Plugging and Sealing of Drill Holes

All drill holes including exploratory borings that are not converted into monitoring wells/piezometers, gas monitoring probes, gas collection wells, etc. were sealed after all necessary information had been obtained to prohibit surface contamination from entering the water-bearing units or cross contamination from other water-bearing zones.

Soil borings that penetrate water-bearing zones are sealed by pumping neat cement grout, cement-bentonite grout or a high solids bentonite through a tremi pipe from the bottom of the borehole, displacing the formation water from the top of the borehole. This can be accomplished in an open borehole or by pumping the grout through the column of augers still in place. Any boreholes that exhibited partial collapse above the water-bearing zone may have to be redrilled to ensure proper sealing. Boreholes that did not penetrate a water-bearing deposit(s) can be filled from the surface as long as methods are used to ensure that the sealant reaches the bottom of the borehole.

12.2 Monitoring Well Abandonment

All monitoring wells or piezometers not used in the GMP shall be sealed within 30 days of abandonment in accordance with 77 IAC 920.120. Sealing requirements vary with the type of material in which the well is screened. In general, if the well is of known and competent construction, the screened interval can be backfilled with clean (free of mud, dirt or contaminants) pea gravel or limestone chips. The rest of the well casing is then filled through a tremi pipe with neat cement grout, cement-bentonite grout or high solids bentonite grout. All excess drilling mud, cuttings, oil and other contaminated materials produced from drilling operations shall be disposed of properly. The area around the borehole shall be restored to original conditions as appropriate.

13. CONCLUSIONS

The proposed GMP has been designed to detect changes in groundwater quality within the monitored zone, and detect potential discharges downgradient from the ash pond. The GMP will enhance timely evaluation and investigation of any changes in groundwater, whether related to the ash pond or offsite sources.

TABLE 2
PROPOSED ROUTINE MONITORING PARAMETERS
Power Plant Ash Impoundment
CWLP

Parameter	Units	Parameter Type
Bottom of Well Elevation	ft MSL	Field
Depth to Water (BLS)	feet	Field
Depth to Water (from MP)	feet	Field
Elevation of GW Surface	ft MSL	Field
pH (field)	units	Field
Specific Conductance (field)	umhos/cm	Field
Temperature	deg. F	Field
arsenic, dissolved	mg/l	Inorganic
arsenic, total	mg/l	Inorganic
barium, dissolved	mg/l	Inorganic
barium, total	mg/l	Inorganic
boron, dissolved	mg/l	Inorganic
boron, total	mg/l	Inorganic
chloride, dissolved	mg/l	Inorganic
chloride, total	mg/l	Inorganic
fluoride, dissolved	mg/l	Inorganic
fluoride, total	mg/l	Inorganic
iron, dissolved	mg/l	Inorganic
iron, total	mg/l	Inorganic
manganese, dissolved	mg/l	Inorganic
manganese, total	mg/l	Inorganic
nitrogen, nitrate as (N), dissolved	mg/l	Inorganic
nitrogen, nitrate as (N), total	mg/l	Inorganic
sulfate, dissolved	mg/l	Inorganic
sulfate, total	mg/l	Inorganic
zinc, dissolved	mg/l	Inorganic
zinc, total	mg/l	Inorganic

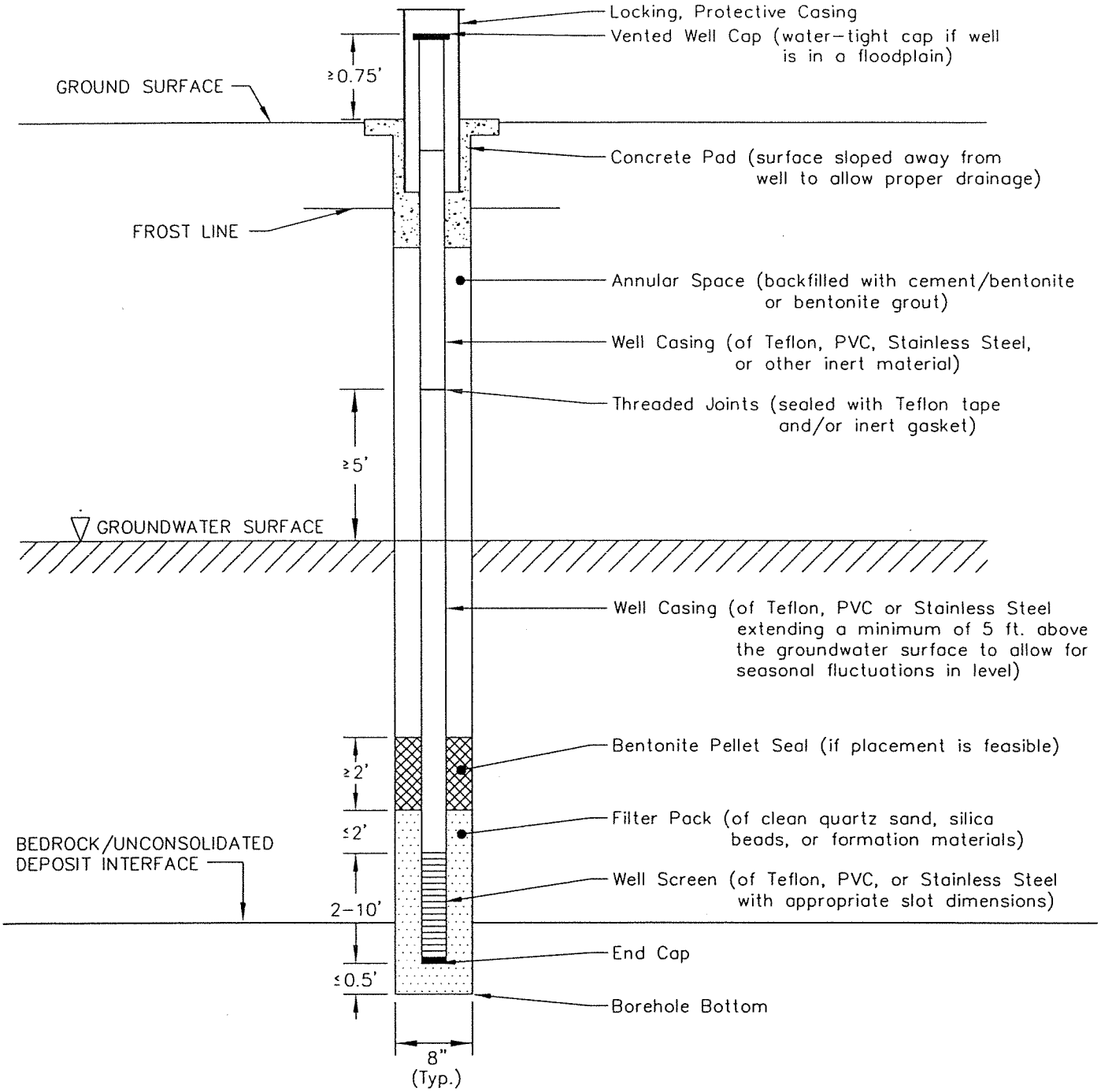
FIGURES

TABLES

TABLE 1
PROPOSED MONITORING NETWORK
Power Plant Ash Impoundment
CWLP

Well ID	Monitoring Position	Material Screened	Ground Surface Elevation (ft MSL)	Top of Casing Elevation (ft MSL)	Approximate Screen Interval (ft MSL)		
AP-1	Downgradient	Bedrock/unconsolidated interface	532.9	537.8	507.9	-	497.9
AP-2	Downgradient	Bedrock/unconsolidated interface	533.2	540.3	523.2	-	513.2
AP-3	Downgradient	Bedrock/unconsolidated interface	533.7	535.6	523.7	-	513.7
AP-4	Upgradient	Bedrock/unconsolidated interface	553.9	554.6	503.9	-	493.9
AP-5	Upgradient	Bedrock/unconsolidated interface	~570		~500	-	~510
AW-3	Downgradient	Bedrock/unconsolidated interface	537.8	541.5	506.3	-	496.3

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NOTE: Detail after 77 IAC 920.170 and I.E.P.A. Administrative Procedure #11

ANDREWS ENGINEERING, INC.
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APPROVED BY: MTH	DESIGNED BY: MTH	DRAWN BY: MPN

GROUNDWATER MONITORING WELL DETAIL

PLANS PREPARED FOR
CWLP
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: NOVEMBER 2011
PROJECT ID: 2011-127
FILE: GMW DETAIL.DWG

SHEET NUMBER: FIG. 2

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APPENDIX A

STATISTICAL METHOD FOR DETERMINATION OF BACKGROUNDS

Statistical Analyses Method

1.0 References

1. 35 Illinois Administrative Code 811.320
2. "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Final Guidance." Office of Solid Waste, USEPA, April 1989.
3. "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Addendum to Interim Final Guidance." Office of Solid Waste, USEPA, July 1992.

2.0 Statistical Method

The statistical method for determination of an interwell background concentration includes the calculation of the 95% upper confidence limit (95% CL) for each parameter utilizing at least four consecutive quarters of data. Calculation of an intrawell background concentration requires calculation of the 99% upper confidence limit (99% CL). Prior to the calculation of the upper confidence limit, the data set is evaluated for normality, outliers and the percentage of non-detect values. Each of the steps for determining the upper confidence limit is outlined below in Sections 2.1 through 2.4.

2.1 Normality Testing

The distribution of the data is tested for normality using the Shapiro-Wilk normality test. If the data is not found to follow a normal distribution, a nonparametric statistical method shall be utilized. Generally, the highest detected concentration is utilized as the upper confidence limit if the data set is found to be nonparametric. If the data is found to follow a normal distribution, the procedures outlined below are used to determine the upper confidence limit.

2.2 Handling of Outliers

Prior to statistical analyses, the data set is evaluated for outliers. Outliers are defined as data points that vary significantly from the mean value of the data set. Outliers may represent sampling error, contamination from surface run-off, analytical laboratory error, or anomalous site conditions. Outliers, if not removed from the data set, can erroneously increase the background concentration which makes the background concentration less likely to detect an exceedences related to a release from a waste unit. Once a statistical outlier has been identified, the concentrations shall be evaluated to

determine the cause. If the outlier is determined to be a result of sampling, laboratory or some other error, the outlier will be removed from the data set. If no specific reason can be documented the point will be considered representative of site conditions and will be included in the statistical analysis. Statistical analysis will then be conducted as described below.

2.3 Handling of Non-Detects (NDs)

Non-detect values (NDs) are handled according to the percentage of Non-Detects (%ND) present in the data set. The data treatment is completed according to the following criteria:

a) For under 0% NDs, no adjustment is made to the values in the data set.
b) For under 15% NDs, the value of one-half (½) the reported Detection Limit (DL) is substituted for the ND value, and the mean and standard deviation are calculated using detected values with the substituted ND values.
c) For 15-50% NDs, Cohen's Adjustment is used to adjust the mean and standard deviation. The adjusted mean and standard deviation are then used to calculate the Confidence Limit.
d) For over 50% but not 100% NDs, the highest recorded concentration is substituted for the prediction limit.
e) For 100% NDs, the Practical Quantitation Limit (PQL) will be substituted for the ND value. The mean and standard deviation will be calculated using the substituted ND values.

2.4 Calculation of the Confidence Limit

After any outliers are removed and the data has been treated for non-detect values, the statistical procedure for calculation of the Confidence Limit will be conducted according to the following steps:

a) <u>Calculate arithmetic mean</u>

The arithmetic mean is calculated using the pooled data for each parameter. The arithmetic mean (X_b) is calculated using the following equation:

$$X_b = \frac{X_1 + X_2 + \ldots + X_n}{n}$$

where: X_b = Average background value

Response to 1st RTP
CWLP - 01205

X_n = Individual background value for *n* sample

n = Number of background values

b) Calculate standard deviation

The standard deviation is calculated using the pooled data for each parameter. The standard deviation is calculated using the following equation:

$$S_b = \sqrt{\frac{(X_1 - X_b) + (X_2 - X_b) + \ldots + (X_n - X_b)}{n - 1}}$$

where: S_b = Population standard deviation
X_n = Individual background value for *n* sample
X_b = Mean (1)
n = Number of background samples

c) Calculate the 95% Upper Confidence Limit

The 95% Upper Confidence Limit is calculated for each parameter using the mean (1), the standard deviation (2), the number of background samples, and the Student's t value given for $\sigma = 0.05$ (95% Confidence). The Student's t value varies upon the number of background samples. The 95% Upper Confidence Limit is calculated using the following equation:

$$CL = X_b \pm S_b \bullet t \bullet \sqrt{1 + \frac{1}{n}}$$

where: CL = Upper Confidence Limit (Upper and Lower for pH)
X_b = Mean (1)
S_b = Standard Deviation (2)
t = Student's t value at 0.05 significance (95% Confidence)
n = Number of background samples

4.28

4.28	8/3/2011 – Illinois EPA reviews June 2010 groundwater data and requests a meeting	2011 IEPA CWLP letters	CWLP	01328	01336

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PAT QUINN, GOVERNOR

August 3, 2011

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AUG - 4 2011
ENVIRONMENTAL
HEALTH & SAFETY

Sue Corcoran
City Water, Light, and Power
Environmental Affairs
7th and Monroe Street
Springfield, Illinois 62757

Re: Ash Impoundment Groundwater Monitoring Report
City Water, Light, and Power – NPDES Permit No. IL0024767

Dear Ms. Corcoran:

The Illinois Environmental Protection Agency (Illinois EPA) has reviewed the groundwater quality data from June 2010. Initial groundwater monitoring data at the City Water, Light, and Power Plant shows elevated levels of boron, manganese, arsenic, and iron at monitoring wells located downgradient from the ash storage impoundments. The Illinois EPA requests a meeting to further discuss groundwater quality conditions at the site. Please contact us within 15 days of the date of this letter, to schedule a meeting.

Thank you for your attention to these matters. If you have any questions concerning this letter, please contact Bill Buscher or Carl Kamp of the Hydrogeology and Compliance Unit at 217-785-4787.

Sincerely,

Alan Keller, P.E.
Manager, Permit Section
Division of Water Pollution Control

CC: Bill Buscher
Darin LeCrone
Carl Kamp
Springfield Regional IEPA
Records

Rockford • 4302 N. Main St., Rockford, IL 61103 • (815) 987-7760
Elgin • 595 S. State, Elgin, IL 60123 • (847) 608-3131
Bureau of Land – Peoria • 7620 N. University St., Peoria, IL 61614 • (309) 693-5462
Collinsville • 2009 Mall Street, Collinsville, IL 62234 • (618) 346-5120
Des Plaines • 9511 W. Harrison St., Des Plaines, IL 60016 • (847) 294-4000
Peoria • 5415 N. University St., Peoria, IL 61614 • (309) 693-5463
Champaign • 2125 S. First St., Champaign, IL 61820 • (217) 278-5800
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Response to 1st RTP
CWLP - 01328

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cy: PJ Sue Christine

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PAT QUINN, GOVERNOR

October 19, 2011

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ENVIRONMENTAL HEALTH & SAFETY

Ms. Sue Corcoran
Environmental Health & Safety
City Water, Light, and Power
East Lake Shore Drive
Springfield, Illinois 62712

Re: City, Water, Light, and Power - Power Plant Ash Impoundment Meeting Response - NPDES Permit No. IL0024767

Dear Ms. Corcoran:

This letter is in response to the September 7, 2011 meeting with City, Water, Light, and Power (CWLP) and the Illinois Environmental Protection Agency (Illinois EPA) concerning power plant ash impoundment impacts to groundwater. On-site groundwater sampling near the ash impoundments completed in June of 2010, indicated elevated concentrations of boron, arsenic, iron and manganese. The Illinois EPA determined that additional groundwater sampling is necessary to confirm the initial sampling results, and provide background groundwater quality at the site. Also, a groundwater monitoring program plan should be established, with a quarterly monitoring plan and a background determination plan for monitoring wells AP-1, AP-2, AP-3, AP-4, AW-3, and background well. The following items are provided for your review and appropriate action:

1. Statistical background groundwater sampling was discussed during the meeting. At least six groundwater samples should be collected from each monitoring well within one year to establish a statistically valid representation of existing groundwater quality. A statistically valid representation of water quality can be determined using the method in Attachment 1 or other approved method. The method should be used to determine the upper 95 percent confidence limit for each of the Class I groundwater monitoring parameters listed in 35 IAC 620.410(a) and (d). Groundwater quality information should be provided in both a paper and electronic format.

2. Additionally, CWLP should establish a quarterly monitoring program for the designated, monitoring wells. The monitoring wells should be sampled for Class I groundwater chemical parameters listed in 35 IAC 620.410(a) and (d). Both background and replacement monitoring wells should be screened in the upper most water bearing materials. Provide the monitoring well drillers logs and completion reports, to the Illinois EPA once well completion work is finished. Two rounds of groundwater sampling should be completed at each designated monitoring well by April 30, 2012, with results provided to the Illinois EPA by May 30, 2012.

Response to 1st RTP
CWLP - 01329

3. Once adequate data has been collected to provide a statistically valid representation of groundwater quality, CWLP may request that analytes, which have been consistently below detectable levels, be dropped from the monitoring program.

4. The Illinois EPA may require the completion of additional activities to fully assess the extent and nature of impacts to groundwater, based on available and on-going groundwater monitoring results.

5. Please send the drillers logs, well completion reports, and the annual groundwater monitoring reports to the following addresses:

Illinois Environmental Protection Agency
Division of Water Pollution Control
Compliance Assurance Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

Illinois Environmental Protection Agency
DWPC - Springfield Region
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

Illinois Environmental Protection Agency
Hydrogeology and Compliance Unit
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

A groundwater monitoring program plan with a schedule for completing the above work and a map locating the monitoring wells, must be submitted to the Illinois EPA for review and approval within 30 days of the date this letter. Thank you for your attention to these matters. If you have any questions concerning this letter, please contact Carl Kamp of the Hydrogeology and Compliance Unit at 217-785-4787.

Sincerely,

Alan Keller

Alan Keller P.E.
Manager, Permit Section
Division of Water Pollution Control

cc:
Rick Cobb
Bill Buscher
Carl Kamp
Shu-Mei Tsai
BOW Records

Sangamon County GW General File

ATTACHMENT 1

A. This method should be used to predict the confidence limit when single groundwater samples are taken from each monitoring (test) well.

1. Determine the arithmetic mean $(\overline{X}_b)$ of each indicator parameter for the background sampling period. If more than one background (upgradient) well is used, an equal number of samples must be taken from each well.

$$\overline{X}_b = \frac{X_1 + X_2 + \ldots X_n}{n}$$

Where:

$\overline{X}_b$ = Average background value for a given chemical parameter

X_n = Background values for each upgradient sample

n = the number of background samples taken

2. Calculate the background variance (S_b^2) and standard deviation (S_b) for each parameter using the values (X_n) from each background sample of the upgradient well(s) as follows:

$$S_b^2 = \frac{(X_1 - \overline{X}_b)^2 + (X_2 - \overline{X}_b)^2 + \ldots + (X_n - \overline{X}_b)^2}{n-1}$$

$$S_b = \sqrt{S_b^2}$$

3. Calculate the upper confidence limit using the following formula:

$$CL = \overline{X}_b \pm t\sqrt{1+1/n}\ (S_b)$$

Where:

CL = upper confidence limit prediction
(upper and lower limits should be calculated for pH)

t = one-tailed t value at the required significance level and at n-1 degrees of freedom from Table 1
(a two-tailed t value should be used for pH)

4. If the values of any routine parameter for any monitoring well exceed the upper confidence limit for that parameter, the permittee shall conclude that a statistically significant change has occurred at that well.

5. When some of the background (upgradient) values are less than the Method Detection Limit (MDL), a value of one-half (1/2) the MDL shall be substituted for each background value that is reported as less than the MDL. All other computations shall be calculated as given above.

B. If all the background (upgradient) values are less than the MDL for a given parameter, the Practical Quantitation Limit (PQL), for the analytical method utilized, shall be used to evaluate data from monitoring wells. If the analytical results from any monitoring well exceed two (2) times the PQL for any single parameter, or if they exceed the PQLs for two or more parameters, the permittee shall conclude that a statistically significant change has occurred.

Table 1

Standard t-Tables Level of Significance

Degrees of freedom	t-values (one-tail)		t-values (two-tail)*	
	99%	95%	99%	95%
4	3.747	2.132	4.604	2.776
5	3.365	2.015	4.032	2.571
6	3.143	1.943	3.707	2.447
7	2.998	1.895	3.499	2.365
8	2.896	1.860	3.355	2.306
9	2.821	1.833	3.250	2.262
10	2.764	1.812	3.169	2.228
11	2.718	1.796	3.106	2.201
12	2.681	1.782	3.055	2.179
13	2.650	1.771	3.012	2.160
14	2.624	1.761	2.977	2.145
15	2.602	1.753	2.947	2.131
16	2.583	1.746	2.921	2.120
17	2.567	1.740	2.898	2.110
18	2.552	1.734	2.878	2.101
19	2.539	1.729	2.861	2.093
20	2.528	1.725	2.845	2.086
21	2.518	1.721	2.831	2.080
22	2.508	1.717	2.819	2.074
23	2.500	1.714	2.807	2.069
24	2.492	1.711	2.797	2.064
25	2.485	1.708	2.787	2.060
30	2.457	1.697	2.750	2.042

40	2.423	1.684	2.704	2.021

Adopted from Table III of "Statistical Tables for Biological Agricultural and Medical Research" (1947, R.A. Fisher and F. Yates).

* For pH only when required.

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cy: PJ
Sue
Christine

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

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PAT QUINN, GOVERNOR JOHN J. KIM, INTERIM DIRECTOR

December 29, 2011

Ms. Sue Corcoran
Environmental Health & Safety
City Water, Light, and Power
East Lake Shore Drive
Springfield, Illinois 62712

Re: City, Water, Light, and Power - Power Plant Ash Impoundment - Groundwater Monitoring Program Response - NPDES Permit No. IL0024767

Dear Ms. Corcoran:

This letter is a follow-up to the November 18, 2011 letter from City, Water, Light, and Power (CWLP) concerning the Groundwater Monitoring Program (Program) for the power plant ash impoundment site.

The Illinois EPA has reviewed the information provided and determined that the Program is approvable with the following revision. The monitoring wells must be sampled for Class I groundwater chemical parameters listed in 35 IAC 620.410(a) and (d). Once adequate data has been collected to provide a statistically valid representation of groundwater quality, CWLP may request that analytes, which have been consistently below detectable levels, be dropped from the monitoring program.

Thank you for your attention to these matters. If you have any questions concerning this letter, please contact Carl Kamp of the Hydrogeology and Compliance Unit at 217-785-4787.

Sincerely,

Alan Keller

Alan Keller P.E.
Manager, Permit Section
Division of Water Pollution Control

cc:

Rick Cobb
Bill Buscher
Carl Kamp
Shu-Mei Tsai
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Sangamon County GW General File

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2125 S. First St., Champaign, IL 61820 (217)278-5800
2009 Mall St., Collinsville, IL 62234 (618)346-5120

9511 Harrison St., Des Plaines, IL 60016 (847)294-4000
5407 N. University St., Arbor 113, Peoria, IL 61614 (309)693-5462
2309 W. Main St., Suite 116, Marion, IL 62959 (618)993-7200
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OFFICE OF PUBLIC UTILITIES
CITY OF SPRINGFIELD, ILLINOIS

J. MICHAEL HOUSTON, MAYOR

ENVIRONMENTAL HEALTH & SAFETY

APPA certified RP3 Reliable Public Power Provider

September 25, 2013

Illinois Environmental Protection Agency
Division of Water – Groundwater Section
Attn: Carl Kamp, P.G.
1021 N. Grand Ave., East
PO Box 19276
Springfield, IL 62794-9276

Dear Mr. Kamp:

Please find enclosed City Water, Light & Power's (CWLP) groundwater monitoring results for the first and second quarters of 2013. Please note that this data has not been evaluated by our consultant.

On June 21, 2013, CWLP submitted the 2012 data with a request to continue collecting groundwater data through 2013 to allow for groundwater quality to stabilize in AP-5, our upgradiant well. These background concentrations continue to appear to show decreasing trends during these sampling events.

CWLP still requests to continue sampling through 2013 to obtain data representation of background conditions. Once statistically valid data has been collected, revised background concentrations will be submitted to the Illinois Environmental Protection Agency.

If you should have any questions or require any further information, please feel free to contact Sue Corcoran, of my staff, or myself at (217) 757-8610.

Sincerely,

P.J. Becker
Environmental Health & Safety Manager

PJB/SC/gj

Cy: Christine Zeman (CWLP)

Response to 1st RTP
CWLP - 01335

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OFFICE OF PUBLIC UTILITIES
CITY OF SPRINGFIELD, ILLINOIS

J. MICHAEL HOUSTON, MAYOR

ENVIRONMENTAL HEALTH & SAFETY

APPA certified
RP3
Reliable Public Power Provider

October 31, 2013

Illinois Environmental Protection Agency
Division of Water – Groundwater Section
Attn: Carl Kamp, P.G.
1021 N. Grand Ave. East
PO Box 19276
Springfield, IL 62794-9276

Dear Mr. Kamp:

Please find enclosed City Water, Light & Power's (CWLP) groundwater monitoring results for the third quarter of 2013. Please note that this data has not been evaluated by our consultant.

On June 21, 2013, CWLP submitted the 2012 data with a request to continue collecting groundwater data through 2013 to allow for groundwater quality to stabilize in AP-5, our upgradiant well. These background concentrations continue to appear to show decreasing trends during these sampling events.

CWLP still requests to continue sampling through 2013 to obtain data representation of background conditions. Once statistically valid data has been collected, revised background concentrations will be submitted to the Illinois Environmental Protection Agency.

If you should have any questions or require any further information, please feel free to contact Sue Corcoran, of my staff, or myself at (217) 757-8610.

Sincerely,

P.J. Becker
Environmental Health & Safety Manager

PJB/SC/gj

Cy: Christine Zeman (CWLP)

Response to 1st RTP
CWLP - 01336

5.3

5.3	7/28/2010 - USEPA request to access property for inspection	7.20.2010 USEPA letter	CWLP	01508	01510

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

7/28/10

Mr. S. David Farris
Environmental Health & Safety Manager
Office of Public Utilities
City of Springfield
201 E. Lake Shore Drive
Springfield, Illinois 62712

Re: Access to real property at Dallman

Dear Mr. Farris:

The United States Environmental Protection Agency ("EPA") requests access to the real property at the Dallman facility ("Property"). EPA plans to conduct this site assessment on August 13, 2010.

EPA's engineering contractor, Kleinfelder will be conducting these site assessments. The point of contact for Kleinfelder is Brian Havens who can be reached at (402-3312260 or BHavens@kleinfelder.com

According to publicly-available records or information provided by the Facility, EPA believes that these Properties are owned by the City of Springfield.

EPA requests such access as part of its assessment of the structural integrity of:

+ coal combustion residue surface impoundments or similar diked or bermed management units at the Facility;

+ management units at the Facility that are designated as landfills which receives liquid-borne material from a coal combustion residue surface impoundment or similar diked or bermed management unit; and

+ management units at the Facility which may not currently receive coal combustion residue but which has not been closed in accordance with applicable state or federal regulations.

EPA will undertake such investigation pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §§ 9601-9675.

EPA needs access to the Property initially from the dates noted above, but may require additional access thereafter.

Enclosed please find a consent form that, once executed, will provide EPA with access to each of the Properties for the above purposes. Please review, sign, and return the form to EPA as soon as possible but not later than August 7, 2010. The signed form can be faxed to me at 703-308-0514, emailed to hoffman.stephen@epa.gov or mailed to me at:

Stephen Hoffman
Office of Resource Conservation and Recovery
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW (5304P)
Washington, D.C. 20460

In either case, each form should be sent to my attention.

You may assert a business confidentiality claim covering all or part of the information requested during the site visit, in the manner described by 40 C. F. R. Part 2, Subpart B. Information covered by such a claim will be disclosed by EPA only to the extent and only by means of the procedures set forth in 40 C.F.R. Part 2, Subpart B. If no such claim accompanies the information when EPA receives it, the information may be made available to the public by EPA without further notice to you. If you wish EPA to treat any information provided to EPA during the site visits as "confidential" you must so advise EPA or its contractor at the time of the visit.

If you have questions and comments regarding the consent form or the scope of the activities that will be undertaken by EPA at the Property, please contact me at 703-308-8413. Thank you for your immediate cooperation in this matter.

Sincerely yours,

/Stephen Hoffman/
Stephen Hoffman
Senior Environmental Scientist
Office of Resource conservation and Recovery
U. S. Environmental Protection Agency
Hoffman.stephen@epa.gov

Enclosure 1

Facility Name: Dallman Ash Pond
Address of Facility: 3100 Stevenson Dr., Springfield, IL 62703

I, S. David Farris, as the manager or other duly authorized representative of City of Springfield, hereby consent to officers, employees, and authorized representatives of the United States Environmental Protection Agency (collectively "EPA") entering and having continued access to the Dallman facility which is collectively defined herein as:

each coal combustion residue surface impoundment or similar diked or bermed management unit at the Facility;

each management unit at the Facility that is designated as a landfill which receives liquid-borne material from a coal combustion residue surface impoundment or similar diked or bermed management unit; and

each management unit at the Facility which may not currently receive coal combustion residue which has not been closed in accordance with applicable state or federal regulations,

For the purposes of assessing the:

- structural integrity of each Impoundment;
- adequacy of each spillway related to each Impoundment;
- potential effects of overtopping of non-overflow structures related to each Impoundment;
- nature of the soils, ground water, surface water, geology, and hydrogeology at and around each Impoundment;
- history of each Impoundment's performance via data from monitoring instruments; and
- quality and adequacy of public safety protections for each Impoundment.

I understand that these actions by EPA are to be undertaken pursuant to its investigative authority under the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §§ 9601-9675.

This written permission is given by me voluntarily with knowledge of my right to refuse and without threats or promises of any kind.

August 2, 2010
Date

S. David Farris, CIH, CSP
Printed name and Signature of Facility Manager or Authorized Representative

5.5

5.5	8/8/2011 – CWLP responds to USEPA inspection report and provides an action plan	CWLP Response Letter 8.8.2011	CWLP	01512	01516

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OFFICE OF PUBLIC UTILITIES
CITY OF SPRINGFIELD, ILLINOIS

APPA certified RP3 Reliable Public Power Provider

CERTIFIED MAIL # 7008-1830-0002-7625-2456

August 8, 2011

Mr. Stephen Hoffman
U.S. Environmental Protection Agency
Two Potomac Yard
2733 South Crystal Drive
5th Floor, N-5237
Arlington, VA 22202-2733

RE: Coal Ash Impoundment Site Assessment Final Report
Dallman Power Station, City of Springfield, Illinois

Dear Mr. Hoffman:

This is a response on behalf of City of Springfield, Illinois, City Water, Light and Power (CWLP) to United States Environmental Protection Agency's ("EPA") July 7, 2011 email requesting CWLP to inform you of our plans to address the recommendations in EPA's Coal Ash Impoundment Site Assessment for the Dallman Power Station. The Ash Pond Assessment of the City of Springfield's Dallman Power Station was conducted on August 13, 2010, by EPA contractor, Kleinfelder.

The Final Report noted, among other things, that one of CWLP's ash ponds has a permit issued by the Illinois Department of Natural Resources (IDNR), with a Hazard Classification of III, while the National Inventory of Dams includes the Lakeside Ash Pond with a Hazard Classification of "low".
The assessment report contained eight recommendations. CWLP responds to each of these recommendations as follows;

Section 6.2, Priority 1 Recommendations

1. *Prepare an emergency action plan for the facility by 10/1/2011.*

   CWLP plans to incorporate the ash impoundments into the existing emergency action plan (EAP) for Spaulding Dam, which is on the same property, just south of the ash ponds. The existing EAP for Spaulding Dam is administered through the Illinois Department of Natural Resources (IDNR). CWLP will proceed in having this completed by an established timeframe determined by IDNR.

2. *Perform a hydrologic and hydraulic study by 10/1/2011.*

   CWLP is currently undergoing an Ash Pond Assessment with the Illinois Environmental Protection Agency (IEPA) and this recommendation could be addressed in conformance with the IEPA's review. Additionally, CWLP has received an estimate from an engineering company for the cost of this study, and intends to budget this work in the next fiscal year (March 2012 through February 2013).

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3. *Establish seepage and groundwater monitoring program by 10/1/2011.*

   CWLP is currently undergoing an Ash Pond Assessment with IEPA and this recommendation could be addressed in conformance with the IEPA's review. Additionally, CWLP has received an estimate from an engineering company for the cost of the development and implementation of this program, and intends to budget this work in the next fiscal year (March 2012 through February 2013).

4. *Perform embankment and structure stability analysis by 10/1/2011.*

   The ash impoundments are currently under the regulatory authority of IDNR pursuant to IDNR's regulations for the construction and maintenance of dams, covering, among other issues, the structural stability of berms and embankments. One of our ponds is permitted by IDNR under these regulations. CWLP plans to request that IDNR perform a hazard classification assessment on our ash pond structures. Based on the IDNR assessment, if a stability analysis and/or additional investigation of the structures are warranted, CWLP will proceed in having this completed by an established timeframe determined by IDNR. Additionally, CWLP has received an estimate from an engineering company for the cost of this analysis and intends to budget this work in the next fiscal year (March 2012 through February 2013).

5. *Control vegetation in the upstream and downstream slopes. Remove the trees from the embankment including the large tree at the overflow outlet discharge point by 10/1/2011.*

   CWLP has begun to remove and control the vegetation, however, due to heavy precipitation in the spring and early summer, some of these areas have been difficult to gain access to with heavy machinery. Once these areas are accessible, CWLP will remove the trees and additional brush on the embankments. CWLP expects to complete this work by January 1, 2012. CWLP will continue to perform regular mowing or chemical spray to control brush and weeds.

Section 6.3, Priority 2 Recommendations

1. *Repair erosion of embankment on an as needed basis.*

   During regular embankment inspections, if inadequacies are noted, CWLP will repair areas that show signs of erosion.

2. *Maintain a log of maintenance and other activities at the fly ash impoundments and supportive facilities on an ongoing basis.*

   A preventative maintenance schedule has been established through our work order system, which documents all major activities that occur at the ash ponds.

3. *Develop an Operation and Maintenance manual for the impoundments and the facility by 10/1/2011.*

   CWLP has a current Operations and Maintenance manual for the ash impoundments that was provided to the Agency during their inspection. CWLP will review and update this manual by January 1, 2012.

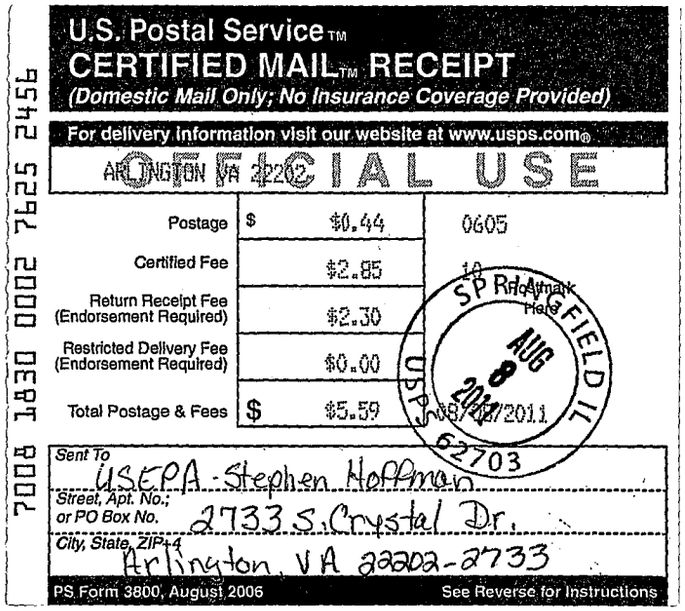
CWLP notes that Kleinfelder's inspection of ash pond stability was conducted under the authority claimed by EPA under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) which EPA apparently is not now relying upon for its recommendations. As noted above, Illinois has established regulations covering ash pond stability, as well as the environmental impacts of ash ponds through the regulations of IDNR and those of the Illinois Pollution Control Board implemented by the IEPA. In addition, as you know, the EPA has proposed a Coal Combustion Residual rule that will likely impact the engineered aspects of ash ponds, taking into consideration the hydrological and structural aspects of ash ponds, and which may also force ash pond closure. Under these regulatory uncertainties and overlap, CWLP has and will continue to take every reasonable effort to make CWLP's ash impoundments structurally sound and environmentally secure. Accordingly, CWLP appreciates the information in the Final Report. If you should have any questions or require additional information, please do not hesitate to contact Sue Corcoran, of my staff, or myself at (217) 757-8610.

Sincerely,

P.J. Becker
Environmental Health & Safety Manager

PJB/gj

Cy: Christine Zeman (CWLP)
John Davis (CWLP)



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Street, Apt. No.; or PO Box No.: 2733 S. Crystal Dr.
City, State, ZIP+4: Arlington, VA 22202-2733

PS Form 3800, August 2006 — See Reverse for Instructions

5.12

5.12	5/10/2011 – USEPA ash pond inspection final report with recommendations	USEPA Site Assessment Final Report 5.10.2011	CWLP	01616	01693

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COAL ASH IMPOUNDMENT
SITE ASSESSMENT FINAL REPORT



Dallman Power Station
City of Springfield
Springfield, Illinois

Prepared by:

KLEINFELDER
Bright People. Right Solutions.

611 Corporate Circle, Suite C
Golden, CO 80401

KLEINFELDER PROJECT NUMBER 112618-6

May 10, 2011

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Response to 1st RTP
CWLP - 01617

I acknowledge that the management units referenced herein:

- Dallman Ash Pond
- Lakeside Ash Pond

Were assessed on August 13, 2010

Signature: Brian T. Havens Date: 5/10/11

Brian T. Havens, P.E.
Lead Geotechnical Engineer



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EXECUTIVE SUMMARY

Background information taken from the U. S. Environmental Protection Agency's (EPA's) website:

> "Following the December 22, 2008 dike failure at the TVA/Kingston, Tennessee coal combustion waste (CCW) ash pond dredging cell that resulted in a spill of over 1 billion gallons of coal ash slurry, covered more than 300 acres and impacted residences and infrastructure, the EPA is embarking on an initiative to prevent the catastrophic failure from occurring at other such facilities located at electric utilities in an effort to protect lives and property from the consequences of a impoundment or impoundment failure of the improper release of impounded slurry."

As part of the EPA's effort to protect lives and the environment from a disaster similar to that experienced in 2008, Kleinfelder was contracted to perform a site assessment at the Dallman Power Generating Station that is owned and operated by the City of Springfield, Illinois. This report summarizes the observations and findings of the site assessment that occurred on August 13, 2010.

The coal combustion waste impoundments observed during the site assessment included:

- Lakeside Ash Pond – Commissioned prior to 1958
- Dallman Ash Pond – Commissioned in 1977

Preliminary observations made during the site assessment are documented on the Site Assessment Checklist presented in Appendix A. A copy of this checklist was transmitted to the EPA following the field walk-through. A more detailed discussion of the observations is presented in Section 4, "Site Observations."

The Dallman Ash Pond impoundment and the original (lower) portion of the Lakeside Ash Pond impoundment are not regulated by any state agency and therefore do not currently have a designated hazard rating. The raised portion of the Lakeside Ash Pond impoundment is regulated by the Illinois Department of Natural Resources and has a Hazard Classification of "III." In addition, the National Inventory of Dams includes the Lakeside Ash Pond with a Hazard Classification of "Low." Due to the potential environmental and economic impacts that a failure at either of these impoundments would present, it is recommended a Hazard Classification of "Significant" be assigned to both impoundments.

Overall, the site appears to be reasonably well maintained and operated with a few areas of concern as discussed in Section 6, "Recommendations."

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On the date of this site assessment, there appeared to be no immediate threat to the safety of the impoundment embankments. No assurance can be made regarding the impoundments condition after this date. Subsequent adverse weather and other factors may affect the condition.

A brief summary of the Priority 1 and 2 Recommendations is given below. A more detailed discussion is provided in Section 6, “Recommendations”.

Priority 1 Recommendations

1. Prepare an Emergency Action Plan (EAP) for the facility.
2. Perform a hydrologic and hydraulic study.
3. Establish a seepage and groundwater monitoring program.
4. Perform embankment and structural stability analyses.
5. Control vegetation on the upstream and downstream slopes. Remove the trees from the embankment, including the large tree at the overflow outlet discharge point.
6. Establish sufficient freeboard for west embankment of Dallman Ash Pond at sluice pipe notches.

Priority 2 Recommendations

1. Repair erosion of embankment.
2. Maintain a log of maintenance and other activities at the fly ash impoundments and supporting facilities.
3. Develop an Operation and Maintenance (O&M) manual for the impoundments and the facility.

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Appendix B	Site Assessment Photographs
Appendix C	Response Letter to the EPA's Section 104(e) Request for Information

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SECTION 1 – INTRODUCTION

1.1 General

This report has been prepared for the United States Environmental Protection Agency (EPA) to document findings and observations from a site assessment at the Dallman Power Station on August 13, 2010.

The following sections present a summary of data collection activities, site information, performance history of the facility's impoundments, a summary of site observations, and recommendations resulting from the site investigation.

1.2 Project Location

The Dallman Power Generating Station and Lakeside Power Generating Station are located on the western bank of Lake Springfield in Springfield, Illinois as shown in Figure 1. The Lakeside Ash Pond is located immediately downstream of Spaulding Dam at the north end of Lake Springfield. The Dallman Ash Pond is located directly north of the Lakeside Ash Pond. The City of Springfield is located in Sangamon County at approximately 39°46'54" N and 89°39'01" W. The City of Springfield has a population of over 117,000 with the metro area having a population over 208,000. Springfield is the capitol of Illinois.

1.3 Site Documentation

The City of Springfield provided the following documents during the time of this assessment to aid in the review of the impoundments:

- Burns & McDonnell, Project Plans, August 13, 1976, Sheets C-1, C-1c, Y-28, Y-29, Y-30, Y-31, Y-32, Y-33, Y-34 and Y-35.
- Hanson Engineers, Inc., Project Plans and Technical Specifications, Lakeside Ash Pond Embankment Modification, August 3, 1987, Sheets 1, 2, 3 and 4.
- Aero-Metric, Inc., Sheboygan, Wisconsin, Topographic Mapping of Dallman Power Plant West Ash Pond, March 19, 2004.
- Hanson Engineers, Maintenance Plan for Lakeside Ash Pond Dam, June 1987.
- Hanson Engineers, Repair of Sinkhole, CWLP Lakeside Ash Disposal Area, September 27, 2004.
- Hanson Engineers, Project Drawings and Specifications, Embankment Toe Drain Additions and Drainage Blanket, CWLP Lakeside Ash Disposal Area, June 18, 1992.
- Illinois Department of Transportation, "Permit No. 19172 for Modification, Operation and Maintenance of the Lakeside Ash Disposal Area Embankment," November 2, 1987.
- PSI, Piezometer Installation for CWLP Ash Ponds, July 12, 2010.

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- Rapps Engineering & Applied Science, Potentiometric Surface for 2nd Quarter 2010 at FGDS Development Landfill, August 2010.
- City of Springfield, "Ash Pond Modification Project (Internal Memo)," July 27, 1987.
- City of Springfield, Construction of the Ash Pond Berm Daily Notes, November 11, 1987 through May 16, 1988.
- Hanson Engineers, Ash Disposal Area Embankment Evaluation, December 31, 1990.
- Hanson Engineers, "Inspection and Recommendations for North Embankment Seepage," September 30, 1993.
- City of Springfield, "Lakeside Ash Pond Berm (Internal Memo)," October 5, 1993.
- Hanson Professional Services, Inc., "Dam Inspection Report," July 30, 1988.
- Hanson Professional Services, Inc., "Dam Inspection Report," June 30, 2004.
- Hanson Professional Services, Inc., "Dam Inspection Report, August 5, 2003.
- Hanson Engineers, "Dam Inspection Report," July 18, 2001.
- Hanson Engineers, "Dam Inspection Report," June 23, 2000.
- Hanson Engineers, "Dam Inspection Report," June 21, 1999.
- Hanson Engineers, "Dam Inspection Report," June 29, 1994.
- Hanson Engineers, "Dam Inspection Report," June 22, 1992.
- City of Springfield, Owner's Maintenance Statement and Dam Inspection Report, November 30, 1990.
- City of Springfield, Owner's Maintenance Statement and Dam Inspection Report, October 31, 1989.

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SECTION 2 – SITE ASSESSMENT

2.1 Attendees

The site assessment was performed on August 13, 2010 by Brian Havens, P.E. and Matt Gardella, E.I.T. of Kleinfelder. Other persons present during the site assessment included:

- Sue Corcoran – City of Springfield
- David Farris – City of Springfield
- Jeff Hillebrenner – City of Springfield
- Christine Zeman – City of Springfield

2.2 Impoundments Inspected

Impoundments and associated structures that were observed during the site assessment included:

- Dallman Ash Pond – Commissioned in 1977
- Lakeside Ash Pond – Commissioned prior to 1958

Observations from the site assessment are documented on the Site Assessment Evaluation Checklists presented in Appendix A. A summary of observations from the site assessment is presented in Section 4.

2.3 Weather During Assessment

During the assessment of the Dallman Power Station impoundments, the weather was sunny and clear with high humidity. Temperatures ranged from 90° to 95° F, and wind ranged from 0 to 5 miles per hour (mph).

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SECTION 3 – SITE INFORMATION AND HISTORY

3.1 Site Information and History

The City of Springfield operates two coal-fired power generation facilities, the V.Y. Dallman Power Station and the Lakeside Power Station, as well as a potable water treatment plant. All three of these facilities are located at the same site, which is on the west side of Lake Springfield near Spaulding Dam. The Lakeside Power Station was constructed in the 1930's, and the Dallman Power Station was constructed in the 1970's. The Dallman Power Station contains three coal-fired boilers, and the Lakeside Power Station contains two coal-fired boilers. The Lakeside Power Station was retired in January 2009.

The ash handling practices at the City of Springfield are typical for a coal-fired power plant. Bottom ash and fly ash from all units are sluiced to ash ponds. The raw lake water used for sluicing is obtained from the once-through cooling water systems for the generator condensers. Three separate ash transport systems serve Dallman Units 31 and 32, Dallman Unit 33, and Lakeside. The City of Springfield operates two ash ponds, the Lakeside Ash Pond and the Dallman Ash Pond, and has the flexibility to determine which pond will receive ash. Both ash ponds are located immediately north (downstream) from Spaulding Dam as shown in Figure 2. East Lakeshore Drive is situated on the crest of Spaulding Dam.

The Lakeside Ash Pond is primarily a diked embankment with some incising along the east perimeter. Cell 3 is no longer receiving ash and is in the process of being closed. Cells 1, 2, and 4 no longer receive ash, but do receive scrubber blowdown and filter cake sludge from the drinking water facility. Sluice pipes transporting scrubber blowdown and filter cake sludge discharge into the southwest corner of the pond. Water from the Lakeside Ash Pond discharges into the clarification pond shown in Figure 2. The clarification pond is part of the original Lakeside Ash Pond that was not raised when the remainder of the Lakeside Ash Pond was raised. The clarification pond is used as a final settling pond before discharging water from the pond to Sugar Creek.

The Dallman Ash Pond is a diked embankment. Sluice pipes transporting ash from power generating operations discharge into the primary ash pond at three locations along the west side of the pond as needed (see Figure 2). Water from the Dallman Ash Pond also discharges into the clarification pond.

Prior to the current operational layout at the site of the current power plants, there may have been a fly ash pond located adjacent to the Lakeside Power Station when the power station was constructed in the 1930's. This pond has apparently since been filled and limited information is available regarding this pond.

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3.2 Pertinent Data

A. GENERAL

1. Name ..... V.Y. Dallman Power Generating Station and Lakeside Power Generating Station
2. State ..... Illinois
3. County ..... Sangamon
4. Latitude ..... 39° 45' 31'' North
5. Longitude ..... 89° 36' 12'' West
6. River used for operations ..... Lake Springfield and Sugar Creek
7. Year Constructed ..... 1930's
8. Modifications ..... Embankment raise to Lakeside Ash Pond in 1987-1988
9. Current Hazard Classification ..... Lakeside Ash Pond-Low; Dallman Ash Pond-Not classified
10. Proposed Hazard Classification ..... Significant
11. Size ..... Lakeside Ash Pond – Small; Dallman Ash Pond-Small[2]

B. IMPOUNDMENTS

LAKESIDE POND

1. Type ..... Earthen Dike/Incised Combination
2. Crest Elevation ..... 565± feet[1]
3. Crest Length ..... Approximately 3,900 feet
4. Crest Width ..... 10 feet
5. Impoundment Height ..... Approximately 30 feet
6. Upstream Slope 1H:1V
7. Downstream Slope 2H:1V
8. Volume of Stored Ash ..... 670 acre-feet
9. Ash Storage Capacity ..... 744 acre-feet

DALLMAN POND

1. Type ..... Earthen Dike
2. Crest Elevation ..... 554± feet[1]
3. Crest Length ..... Approx. 4,300 feet
4. Crest Width ..... 15 feet
5. Impoundment Height ..... App. 20 feet
6. Upstream Slope 2.5H:1V
7. Downstream Slope 2.5H:1V
8. Volume of Stored Ash ..... 452 acre-feet
9. Ash Storage Capacity ..... 682 acre-feet

C. DRAINAGE BASIN

1. Area of Drainage Basin ..... Unknown
2. Downstream Description: ..... Discharges directly into Sugar Creek

D. POND INLET

LAKESIDE POND

1. Pond Inlet ..... Multiple inlet sluice pipes from the generating stations

DALLMAN POND

1. Pond Inlet ..... Multiple inlet sluice pipes from the generating stations

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E. POND CAPACITY

LAKESIDE POND

1. Pond Capacity ..... Normal Storage is approximately 744 acre-feet

DALLMAN POND

2. Pond Capacity ..... Normal Storage is approximately 682 acre-feet

F. PRIMARY SPILLWAY

LAKESIDE POND

1. Description ..... N/A – No Spillway Present

DALLMAN POND

1. Description ..... N/A – No Spillway Present

G. OUTLET WORKS

LAKESIDE POND

1. Description ..... Reinforced concrete structure with steel walkway
2. Location ..... Approximately 16 feet into the pond from north embankment centerline
3. Intake Structure ..... Weir box with broad-crested weir (stop logs)
   a. Intake Invert Elevation ..... Adjustable
4. Discharge Conduit ..... Reinforced concrete pipe
   a. Length ..... Approximately 60 feet
   b. Diameter ..... 24 inches
5. Outlet Structure ..... Concrete pipe support
   a. Outlet Invert Elevation ..... 549 feet[1]
   b. Energy Dissipation ..... None[3]
6. Discharge Channel ..... Directly into clarification pond
7. Discharge Capacity with Water Surface at Top of Impoundment ..... Unknown

DALLMAN POND

1. Description ..... Reinforced concrete structure with steel walkway
2. Location ..... Approximately 59 feet into the pond from south embankment centerline
3. Intake Structure ..... Weir box with broad-crested weir (stop logs)
   a. Intake Invert Elevation ..... Adjustable
4. Discharge Conduit ..... High Density Polyethylene (HDPE) pipe
   a. Length ..... Approximatley120 feet
   b. Diameter ..... 24 inches
5. Outlet Structure ..... Reinforced concrete headwall
   a. Outlet Invert Elevation ..... 533.5 feet[1]
   b. Energy Dissipation ..... None[3]
6. Discharge Channel ..... Directly into clarification pond
7. Discharge Capacity with Water Surface at Top of Impoundment ..... Unknown

CLARIFICATION POND

1. Description ..... Concrete intake structure with steel walkway and pump structure in embankment
2. Location ..... Approximately 65 feet into the pond from west embankment centerline
3. Intake Structure ..... Weir box with broad-crested weir (stop logs)
   a. Intake Invert Elevation ..... Adjustable
4. Discharge Conduit ..... High Density Polyethylene (HDPE) pipe
   b. Length ..... Approximately120 feet
   c. Diameter ..... 30 inch

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5. Outlet Structure ..... Reinforced concrete headwall
   d. Outlet Invert Elevation ..... 532.5 feet[1]
   e. Energy Dissipation ..... Riprap
6. Discharge Channel ..... Directly into Sugar Creek
7. Discharge Capacity with Water Surface at Top of Impoundment ..... Unknown

H. MANAGEMENT

1. Owner ..... City of Springfield, Illinois
2. Purpose ..... Coal Fired Energy Generation

Notes:
1. All elevations based on construction drawings by Burns & McDonnell (Dallman Ash Pond) and Hanson Engineers (Lakeside Ash Pond).
2. Impoundment is unregulated; size is based on Illinois Department of Natural Resources Administrative Code for Impoundment Safety.
3. Structure was inundated during the time of inspection and was not able to be inspected.

3.3 Regional Geology and Seismicity

The plant site is situated in the Sugar Creek Valley. As such, the subsurface conditions are expected to include Quaternary alluvial deposits overlying sedimentary bedrock. Based on our review of historical soil borings completed by PSI at the west perimeter of the ash ponds in 2010, it appears that the alluvial deposits at the site include combinations of clay, silt, and sand. The alluvial soil profile appears to be underlain by shale bedrock at the boring locations.

The plant site is situated in a Seismic Zone 1 area. We have noted that the New Madrid Fault has a documented history of seismic activity but is located more than 200 miles south of the plant site.

3.4 Hydrology and Hydraulics

The ponds appear to be situated in such a manner that the watershed drainage contributing to the stored volume of the ponds is most likely limited to stormwater runoff from an area directly east of the Lakeside Ash Pond and precipitation that falls within the impoundments themselves. However, the exact extents of the watershed cannot be determined without a current topographic survey of the surrounding area and of the impoundments themselves.

During the assessment, documents, such as hydrologic studies, hydraulic design calculations and assumptions, and impoundment break analyses, were not available for our review. As a result, the design inflow, design freeboard, and other important components of the impoundment designs are unknown at this time.

We did note that the freeboard along the west side of the Dallman Ash Pond was negligible at the locations where the sluice pipes penetrate through the embankment crest, resulting in an apparent higher risk of embankment overtopping at these locations.

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3.5 Geotechnical Considerations

Regarding stability of the embankment slopes, we understand that the City of Springfield does not have documentation of specific stability analyses for the impoundments. One aspect of the embankment stability that merits consideration is the raised portion of the Lakeside Ash Pond embankment. The vertical embankment extension is a combination of scrubber sludge and silty clay that were placed on top of existing bottom ash and other sluiced materials. Pore pressures in the ash beneath the vertical embankment extension may reduce the stability of the embankment extension if the pore pressures are not sufficiently dissipated with some type of internal drainage system. The plans show a collector drain near the toe of the raised portion of the embankment, which may reduce these pore pressures, but further evaluation is merited.

Regarding seepage, we understand that uncontrolled seepage has been observed at various locations on the downstream slope along the north and west sides of the Lakeside Ash Pond's vertical embankment extension by the City of Springfield and Hanson Professional Services at various times between 1992 and 2008. As a result, we understand that various modifications were made to limit uncontrolled seepage at the raised portion of the embankment, including installation of additional toe drains, inverted filters, and filter cake sludge seals. We noted visible uncontrolled seepage along the west side of the Lakeside Ash Pond during our recent visit as well. Based on the continued presence of uncontrolled seepage water, some type of monitoring system would be valuable to document changes in seepage rate or composition.

3.6 Structural Considerations

The primary structures within this facility include the outlet works for the Lakeside Ash Pond, Dallman Ash Pond, and the clarification pond (part of the original Lakeside Ash Pond). These structures are described in Section 3.2.G of this report. According to eight separate inspection reports performed in the last 18 years, the bridge and piers for the Lakeside Ash Pond outlet structure were in "good condition". During our assessment, the visible portions of the outlet works for each of the three structures appeared to be in good condition.

Documentation of the structural portions of the impoundments under seismic loading was not available for our review. Although the plant site is located in a zone of relatively low risk for damaging seismic activity, evaluation of the structural components of the impoundments under applicable seismic loading conditions merits consideration.

3.7 Performance Evaluations

There have been no known previous federal or state assessments of the ash ponds at this site. Based on observations by the City of Springfield and Hansen Professional Services, there have been no major incidents involving the ash ponds. City of Springfield personnel perform daily visits to the impoundments and their associated structures to evaluate the operating conditions of the ponds. In addition,

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the City of Springfield retains Hanson Professional Services, Inc. to make an annual site assessment with recommendations.

3.8 Hazard Classification

The Dallman Ash Pond is not regulated by any state agency and therefore does not currently have a designated hazard rating. The Lakeside Ash Pond is regulated by the Illinois Department of Natural Resources and is classified as a "Low Hazard" potential. However, due to the potential environmental and economic impacts that a failure at either of these impoundments would present, it is recommended that a hazard classification of "Significant" be assigned to both impoundments. A "High Hazard" rating was not assigned to the impoundments, because it is not expected that a loss of life situation would be likely in the event of a failure. A loss of life situation is not expected because the ash ponds are immediately adjacent to the Sugar Creek without any homes, recreational facilities, businesses, roads, or other structures immediately downstream of the impoundments. However, a hazard classification analysis is needed to determine the hazard classification of the impoundments.

3.9 Site Access

We were required to seek permission from the City of Springfield, Illinois to gain access to the plant site. After arriving at the site and meeting with representatives of the City of Springfield, we were escorted by facility personnel to assess the impoundments. The impoundments can be accessed by standard car during normal weather conditions via gravel-surfaced roadways on the City of Springfield property.

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SECTION 4 – SITE OBSERVATIONS

The impoundment embankments, toes, and outlet works (portions not inundated at the time of assessment) of both the Lakeside Ash Pond and Dallman Ash Pond were observed during the August 13, 2010 site assessment. General observations of these features are presented below; more specific observations of the site and facilities are documented in the Site Assessment Evaluation Checklist provided in Appendix A.

4.1 Lakeside Pond

4.1.1 Upstream Slope

Overall, the upstream slope of the impoundment was in satisfactory condition. Specific observations include:

- Grasses and woody bushes were observed on the upstream slope for Cell Number 3.

4.1.2 Crest

Overall, the crest of the impoundment was in satisfactory condition. Photograph 28 shows the condition of the crest where it abuts the crest of Spaulding Dam. Specific observations include:

- The impoundment crest is a roadway.
- No major depressions or rutting were noted on the impoundment crest.
- Minor erosion was noted on the crest in multiple locations. This erosion was typically less than six inches in depth and typically appeared on the edges of the crest, where grade breaks occurred when transitioning to embankment slopes.

4.1.3 Downstream Slope

Overall, the downstream slope was in satisfactory condition. Photographs 25, 26, and 27 show the conditions of the downstream slope. Specific observations include:

- Uncontrolled seepage was noted on the west downstream slope near the juncture between the original top of embankment and the toe of the raised portion of the embankment. This area also serves as a vehicle access road.
- Portions of the downstream slopes were covered with thick vegetation.
- Sluice lines are located on the west downstream slope.

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4.1.4 Downstream Toe Areas

The toe areas of the embankment were in satisfactory condition. See Photograph 33 for the condition of these areas.

4.1.5 Outlet Works

The outlet works of the Lakeside Ash pond are described in Section 3.2.G.

4.1.6 Impoundment Inlet

Inflow into the Lakeside Ash Pond is via metal piping at the southwest corner of the impoundment, storm water runoff that flows naturally into the pond, and precipitation.

4.2 Dallman Pond and Clarification Pond

4.2.1 Upstream Slope

Overall, the upstream slope of the impoundment was in satisfactory condition.

4.2.2 Crest

Overall, the crest of the impoundment was in satisfactory condition. Photograph 3 shows the condition of the crest. Specific observations include:

- The impoundment crest is a roadway.
- No major depressions or rutting were noted on the impoundment crest.
- Minor erosion was noted on crest in multiple locations. This erosion was typically less than six inches in depth and typically appeared on the edges of the crest, where grade breaks occurred when transitioning to embankment slopes.

4.2.3 Downstream Slope

Overall, the downstream slope was in satisfactory condition. Photograph 9 shows the conditions of the downstream slope. Specific observations include:

- Grasses and woody bushes were observed on the downstream slope and at the toe of the embankment for a large portion of the impoundment.
- Minor erosion was noted near the crest in multiple locations. This erosion was typically less than six inches in depth and typically appeared on the edges of the crest where grade breaks occurred when transitioning to embankment slopes. However, we noted some locations where the erosion was greater than 12 inches in depth as shown in Photograph 7.

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4.2.4 Toe Areas

The toe areas of the embankment were in satisfactory condition. See Photographs 16 and 18 for the condition of these areas. Specific observations include:

- A mature tree was noted at the toe of the embankment near the clarification pond outlet.

4.2.5 Outlet Works

The outlet works of the Dallman Ash Pond and the clarification pond are described in Section 3.2.G.

4.2.6 Impoundment Inlet

Inflow into the Dallman Ash Pond is via multiple inlet pipes on the west side of the ash pond, storm water runoff that flows naturally into the pond, and precipitation.

4.3 Other

Kleinfelder inquired if the City of Springfield had developed an Emergency Action Plan (EAP) related to a potential failure of the impoundments. Kleinfelder understands that an EAP has not been developed for this site.

Kleinfelder also inquired if the City of Springfield had developed an Operation and Maintenance (O&M) manual for the ponds. A maintenance plan was developed for the Lakeside Ash Pond in June 1987, but an operations manual has not been developed for this pond. In addition, an O&M manual has not been developed for the Dallman Ash Pond.

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SECTION 5 – OVERALL CONDITION OF THE FACILITY IMPOUNDMENTS

5.1 Analysis and Conclusions

Our analysis is summarized in three general considerations that are presented as follows:

Safety of the Impoundments including Maintenance and Methods of Operation

We understand that the impoundments have a history of safe performance. However, the future performance of these impoundments will depend on a variety of factors that may change over time, including surface water hydrology, changes in groundwater levels, changes in embankment integrity, etc. In light of this situation, we have noted several items, as follows, that present some concern in this regard:

- One or more mature trees exist on the toe and slopes of the clarification pond near the outlet to Sugar Creek. The root systems from these trees may impact the embankment integrity and eventually create preferential paths for uncontrolled seepage.
- An Emergency Action Plan (EAP) is not currently in place at the site to mitigate damage in the event of an emergency related to failure of the impoundment(s).
- Analyses of the slope stability for the embankments are not currently available for our review.
- Visible uncontrolled seepage continues at the raised portion of the embankment of the Lakeside Ash Pond.
- Documentation of the impoundment capacity under potential hydrologic and hydraulic loading is not currently available for review. Overtopping of the Dallman Ash Pond at the sluice pipe penetrations is a concern.
- We understand that an Operation and Maintenance (O&M) manual is not currently in place for the site, except for the maintenance plan developed in 1987 for the Lakeside Ash Pond. Developing an O&M manual, which includes a section that discusses the safety assessment and monitoring program, would be recommended to standardize safety assessment and monitoring practices.

Changes in Design or Operation of the Impoundments following Initial Construction

The Lakeside Ash Pond embankment was raised approximately 10 feet in 1987-1988. This modification was designed by Hanson Professional Services and has been monitored by Hanson periodically and, at a minimum, every 5 years.

Adequacy of Program for Monitoring Performance of the Impoundments

The present monitoring program primarily involves visual assessments by city personnel and by Hanson Professional Services. These visual assessments seem to be adequate to address issues such as surface erosion and general condition of

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the impoundments. However, a more detailed monitoring program is recommended to be established to quantify various important factors associated with embankment stability. Those factors include, but are not limited to, seepage quantities through the embankment, the amount of sediments carried by the seepage water, and the fluctuation of ground water levels.

5.2 Summary Statement

I acknowledge that the management unit(s) referenced herein were personally inspected by me and found to be in the following condition:

FAIR

Signature: Brian T. Havens Date: 5/10/11

Brian T. Havens, P.E.
Lead Geotechnical Engineer

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SECTION 6 – RECOMMENDATIONS

6.1 Definitions

Priority 1 Recommendation: Priority 1 Recommendations involve the correction of severe deficiencies where action is required to ensure the structural safety and operational integrity of a facility, or that may threaten the safety of the impoundment.

Priority 2 Recommendation: Priority 2 Recommendations are where action is needed or required to prevent or reduce further damage or impaired operation of the facility and/or improve or enhance the O&M of the facility, which do not appear to threaten the safety of the impoundment.

Based on observations during the site assessment, it is recommended that the following actions be taken at the Dallman Power Generating Station.

6.2 Priority 1 Recommendations

1. **Prepare an emergency action plan (EAP) for the facility by 10/1/2011.** An EAP should be prepared for the ponds as well as any other pertinent features related to the impoundments. The EAP should be reviewed by the EPA.
2. **Perform a hydrologic and hydraulic study by 10/1/2011.** This study should be performed to determine if the existing ponds are capable of impounding the appropriate inflow from a design flood without overtopping of the impoundments. At a minimum, documentation required for this evaluation will include a current topographic survey of the site and surrounding drainage basin, basin characteristics (surface runoff/infiltration conditions), and sufficient hydrologic data to determine the design storm event. The results of this evaluation should be reviewed by the EPA.
3. **Establish seepage and ground water monitoring program by 10/1/2011.** As discussed in Section 3.5, uncontrolled seepage water was observed on the west downstream slope of the Lakeside Ash pond. The presence of uncontrolled seepage water at the downstream embankment raises questions regarding the integrity and the stability of the embankment. Therefore, a detailed monitoring program should be established to quantify various important factors, including seepage quantities through the embankment, the amount of sediments carried by the seepage water, and the fluctuation of ground water levels.
4. **Perform embankment stability analyses by 10/1/2011.** Due to the lack of documented engineering design analysis, new stability analyses of the impoundments should be performed. The analyses should incorporate seepage monitoring data and include evaluation of the embankments and the structures under seismic loading scenarios. Stability analyses for the Lakeside Ash Pond should include specific consideration of pore water pressures in the ash beneath the raised portion of the embankment because these pore pressures may have a significant impact on stability if internal drainage features are not sufficiently

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relieving the pore pressures. The results of this evaluation should be reviewed by the EPA.

5. **Control vegetation on the upstream and downstream slopes. Remove the trees from the embankment including the large tree at the overflow outlet discharge point by 10/1/2011.** Refer to Federal Emergency Management Agency's (FEMA) Manual 534, "Impact of plants on Earthen Impoundments" for guidance on vegetation removal. This manual is available on the FEMA website**.**

6.3 Priority 2 Recommendations

1. **Repair erosion of embankment on an as-needed basis.** Minor surface erosion was noted at various locations across the site. Areas where erosion has occurred should be filled in and re-dressed with appropriate fill in order to prevent erosion from cutting further into the embankments.
2. **Maintain a log of maintenance and other activities at the fly ash impoundments and supporting facilities on an on-going basis.** We believe that this log will provide continuity during periods of staff change.
3. **Develop an Operation and Maintenance (O&M) manual for the impoundments and the facility by 10/1/2011.** The O&M manual should include at least the following three key elements:
   - Procedures needed for operation and maintenance of the impoundments during typical operating conditions
   - Procedures for monitoring performance of the impoundments, including visible changes (i.e. surface erosion, settlement and sloughing), internal embankment changes (i.e. erosion due to uncontrolled seepage), and fluctuations in groundwater level
   - The EAP

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SECTION 7 – GLOSSARY OF TERMS

For the EPA Ash Pond Assessment program, the following glossary of terms shall be used for classification unless otherwise noted.

Hazard Potential Rating

"Hazard Potential" means the possible adverse incremental consequences that result from the release of water or stored contents due to the failure of the impoundment or pond or the misoperation of the impoundment, pond, or appurtenances. The Hazard Potential Classification of an impoundment or pond shall not reflect in any way on the current condition of the impoundment or pond and its appurtenant works, including the impoundment's or pond's safety, structural integrity, or flood routing capacity. These classifications are as described below:

1. **Low Hazard Potential**

   "Low Hazard Potential" means a impoundment's or pond's failure will result in no probable loss of human life and low economic loss or environmental loss, or both. Economic losses are principally limited to the owner's property.

2. **Significant Hazard Potential**

   "Significant Hazard Potential" means a impoundment's or pond's failure will result in no probable loss of human life but can cause major economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. Significant Hazard Potential classification impoundments or ponds are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

3. **High Hazard Potential**

   "High Hazard Potential" means an impoundment's or pond's failure will result in probable loss of human life.

Size Classification

In accordance with the Illinois Department of Natural Resources (IDNR) Administrative Code for Impoundment Safety, "Part 3702 - Construction and Maintenance of Impoundments" dated January 13, 1987, an impoundment system is classified by size, based on its height and potential storage capacity. Size classification is determined by which category (storage or height) is greatest (produces the larger size classification).

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Category	Storage (acre-feet)	Height (feet)
Small	<1,000	<40
Intermediate	≥ 1,000 to <50,000	≥ 40 to <100
Large	≥ 50,000	≥ 100

Overall Classification of Impoundment

In a system similar to the New Jersey Department of Environmental Protection Impoundment Safety Guidelines for the Inspection of Existing Impoundments (January 2008), when the following terms are capitalized, they denote and shall be used to describe the overall classification of the impoundment as follows:

SATISFACTORY - No existing or potential impoundment safety deficiencies are recognized. Acceptable performance is expected (the term expected is to be defined as likely) under all applicable loading conditions (static, hydrologic, and seismic) in accordance with the applicable criteria. Minor maintenance items may be required.

FAIR – Acceptable performance is expected (the term expected is to be defined as likely) under all required loading conditions (static, hydrologic, and seismic) in accordance with the applicable safety regulatory criteria. Minor deficiencies may exist that require remedial action and/or secondary studies or investigations.

POOR - A management unit safety deficiency is recognized for any required loading condition (static, hydrologic, and seismic) in accordance with the applicable impoundment safety regulatory criteria. Remedial action is necessary. POOR also applies when further critical studies or investigations are needed to identify any potential impoundment safety deficiencies.

UNSATISFACTORY – The facility is considered unsafe. An impoundment safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution. Pond restrictions may be necessary.

Condition Rating Criteria

In a system similar to the U.S. Department of Interior, Safety Evaluation of Existing Impoundments (SEED 1995), the terms ”Satisfactory,” “Fair,” ”Poor,” and “Unsatisfactory,” are used in a general sense when describing the structural condition and the operational adequacy of the equipment for a impoundment or pond and its appurtenant works during the visual assessment. In addition, the term “Unknown” may be utilized, as applicable.

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Satisfactory – Expected to fulfill intended function.

Fair – Expected to fulfill intended function, but maintenance or other actions are recommended.

Poor – May not fulfill intended function; maintenance, repairs, or other actions are necessary.

Unsatisfactory – Is not expected to fulfill intended function; repair, replacement, or modification is necessary.

Unknown – Not visible, not accessible, not inspected, or unable to determine the condition rating based on the observation taken.

Recommendation Listing

Recommendations shall be written concisely and identify the specific actions to be taken. The first word in the recommendation should be an action word (i.e. “Prepare”, “Perform”, or ”Submit”). The recommendations shall be prioritized and numbered to provide easy reference. Impoundment Safety Recommendations shall be grouped, listed or categorized similar to the U.S. Department of Interior, Reclamation Manual - Directives and Standards - Review/Examination Program for High- and Significant-Hazard Impoundments (July, 1998 FAC 01-07) as follows:

Priority 1 Recommendations: Priority 1 Recommendations involve the correction of severe deficiencies where action is required to ensure the structural safety and operational integrity of a facility or that may threaten the safety of the impoundment.

Priority 2 Recommendations: Priority 2 Recommendations are where action is needed or required to prevent or reduce further damage or impaired operation of the facility and/or improve or enhance the O&M of the facility, which do not appear to threaten the safety of the impoundment.

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SECTION 8 – LIMITATIONS

The scope of this work is for a preliminary screening for the EPA and plant owner/operator of the visible performance and apparent stability of the impoundment embankments based only on the observable surface features and information provided by the owner/operator. Other features below the ground surface may exist or may be obscured by vegetation, water, debris, or other features that could not be identified and reported. This site assessment and report were performed without the benefit of any soil drilling, sampling, or testing of the subsurface materials, calculations of capacities, quantities, or stability, or any other engineering analyses. The purpose of this assessment is to provide information to the EPA and the plant owner/operator about recommended actions and/or studies that need to be performed to document the stability and safety of the impoundments.

This work was performed by qualified personnel in a manner consistent with that level of care and skill ordinarily exercised by other members of Kleinfelder's profession, practicing in the same locality, under similar conditions, and at the date the services are provided. Kleinfelder's conclusions, opinions, and recommendations are based on a limited number of observations. It is possible that conditions could vary between or beyond the observations made. Kleinfelder makes no other representation, guarantee, or warranty, express or implied, regarding the services, communication (oral or written), report, opinion, or instrument of service provided. Kleinfelder makes no warranty or guaranty of future embankment stability or safety.

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Recommendations contained in this report are based on preliminary field observations without the benefit of subsurface explorations, laboratory tests, or detailed knowledge of the existing construction. If the scope of the proposed recommendations changes from that described in this report, the conclusions and recommendations contained in this report are not considered valid unless the changes are reviewed and the conclusions of this report are modified or approved in writing by Kleinfelder. Kleinfelder cannot be responsible for interpretation by others of this report or the conditions encountered in the field.

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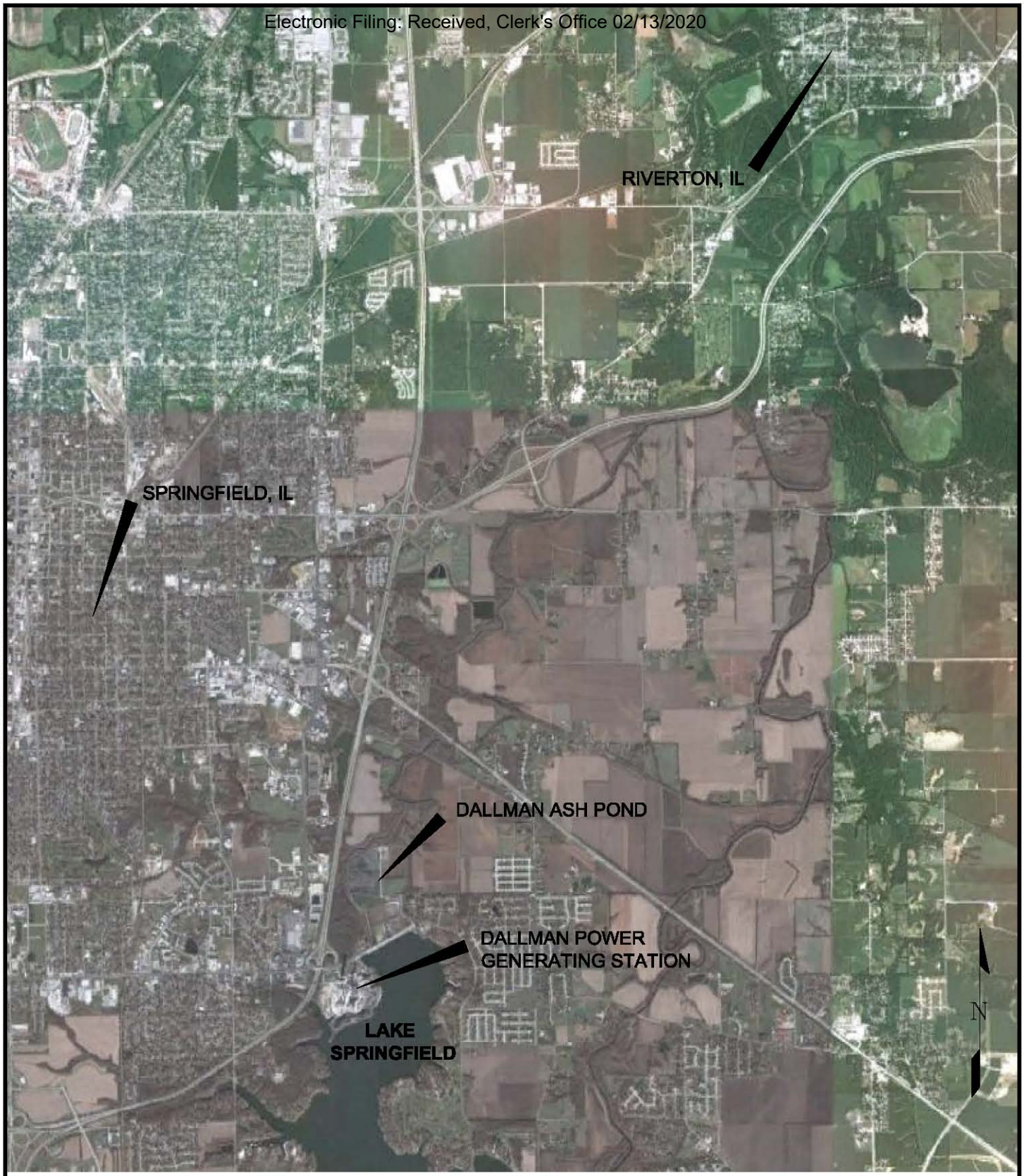
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DATE:	08/27/10
DRAWN BY:	MAG
CHECKED BY:	BDH
FILE NAME:	

DALLMAN POWER STATION
VICINITY MAP

DALLMAN POWER GENERATING STATION
3100 STEVENSON DRIVE
SPRINGFIELD, IL 62707

FIGURE
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Response to 1st RTP
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PROJECT NO.	112618
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DRAWN BY:	MAG
CHECKED BY:	BDH
FILE NAME:	

DALLMAN POWER STATION
AERIAL LOCATION MAP

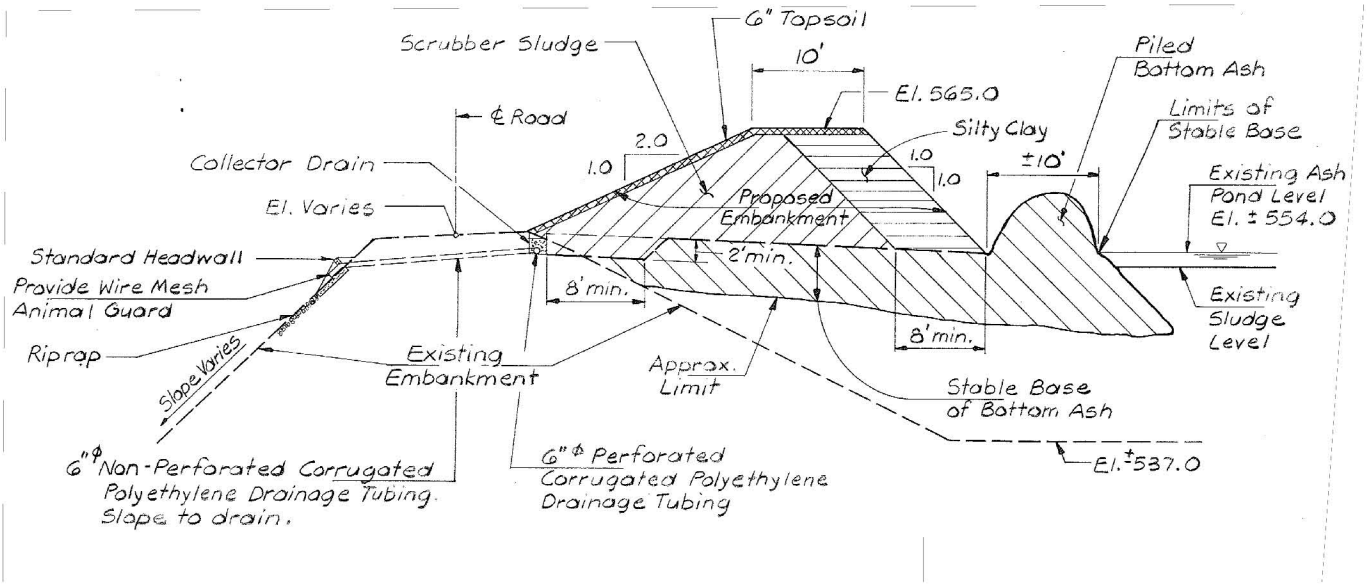
DALLMAN POWER GENERATING STATION
3100 STEVENSON DRIVE
SPRINGFIELD, IL 62707

FIGURE
2

01 Sep 2010, 11:30am, MGardella

U:\MGardella\ASH PONDS\Reports\Dallman Report\

Response to 1st RTP
CWLP - 01646



TYPICAL EMBANKMENT SECTION - LAKESIDE POND (WITH IMPROVEMENTS)

NTS

IMAGE SOURCE: HANSON ENGINEERS - ASH POND EMBANKMENT MODIFICATION DRAWINGS SHEET 1 - 08/03/87

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

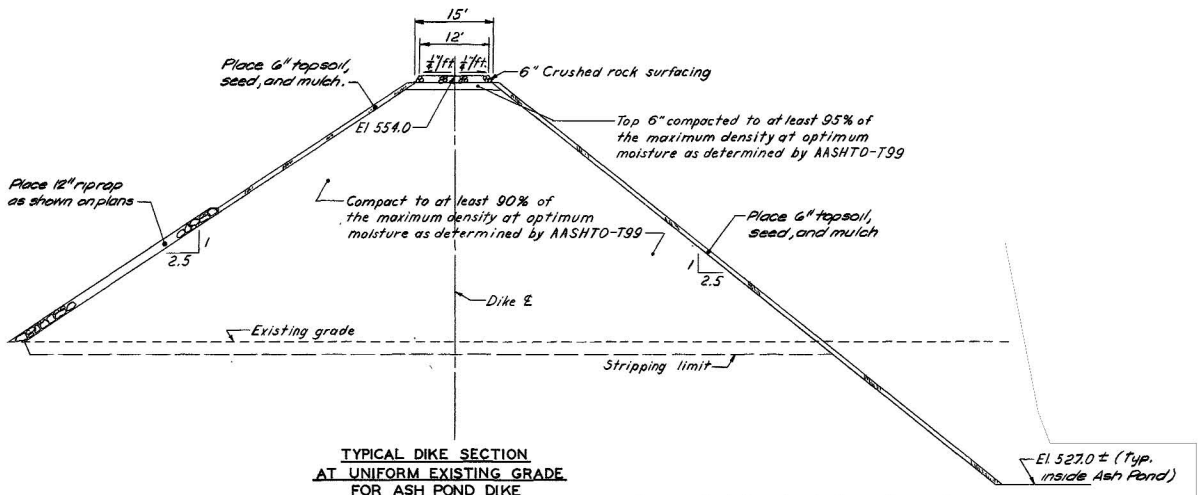
PROJECT NO.	112618
DATE:	08/27/10
DRAWN BY:	MAG
CHECKED BY:	BDH
FILE NAME:	

TYPICAL CROSS SECTION LAKESIDE POND

DALLMAN POWER GENERATING STATION
3100 STEVENSON DRIVE
SPRINGFIELD, IL 62707

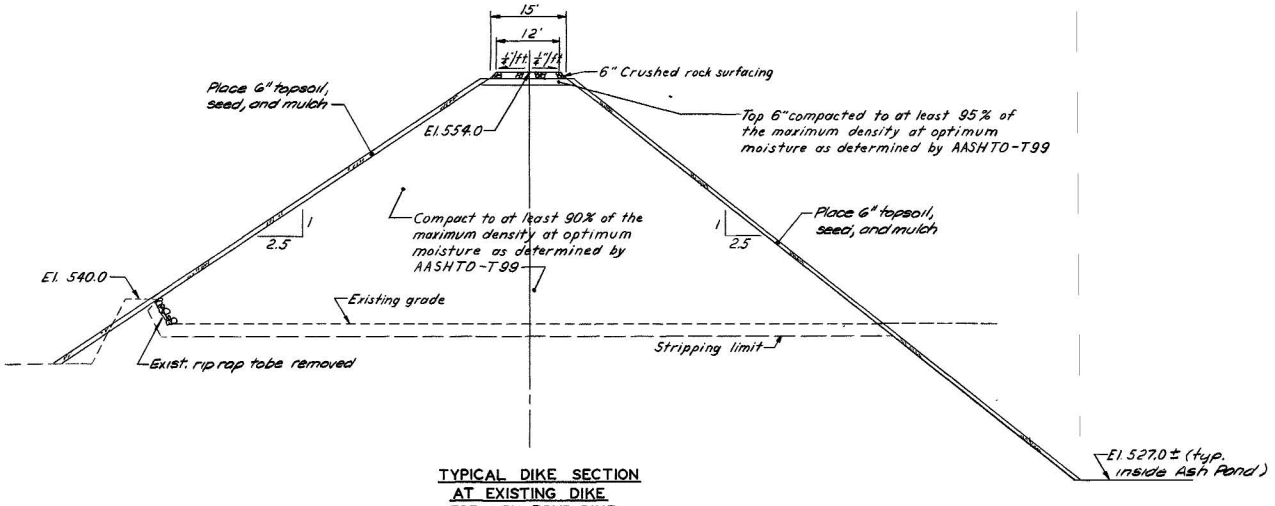
FIGURE
3

01 Sep 2010, 11:50am, MGardella
U:\MGardella\ASH PONDS\Reports\Dallman Report\



TYPICAL DIKE SECTION
AT UNIFORM EXISTING GRADE
FOR ASH POND DIKE
DIKE A AND DIKE ACCESS ROAD
Not to Scale

Desired el. for the bottom of pond is El. 527.0. However it may fluctuate to avoid unsuitable material. Proposal shall include all costs for obtaining the required amount of fill material from inside of pond or from borrow area.



TYPICAL DIKE SECTION
AT EXISTING DIKE
FOR ASH POND DIKE
DIKE A AND DIKE ACCESS ROAD
Not to Scale

TYPICAL CROSS SECTION DALLMAN POND

NTS

IMAGE SOURCE: BURNS & MCDONNELL - TYPICAL CROSS SECTION DETAILS - IMAGE DATE 08/13/76

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PROJECT NO.	112618
DATE:	08/27/10
DRAWN BY:	MAG
CHECKED BY:	BDH
FILE NAME:	

TYPICAL CROSS SECTION DALLMAN POND

DALLMAN POWER GENERATING STATION
3100 STEVENSON DRIVE
SPRINGFIELD, IL 62707

FIGURE
4

Response to 1st RTP
CWLP - 01648

18 Apr 2011, 2:09pm, MGardella
W:\112618 EPA Ash Pond Inspections\Task 6 - Dallman\Dallman Report\

ATTACHED IMAGES:
ATTACHED XREFS:
Dwn-L:\2008\93399

CAD FILE: W:\112618 EPA Ash Pond Inspections\Task 6 - Dallman\Dallman Report\ LAYOUT: General (2)



FIGURE 5 1 of 1 sheets

SCALE: NTS
DATE: 08/27/10
CHECKED BY: B. HAVENS
DRAWN BY: M. GARDELLA
DESIGNED BY: N/A

PHOTO PLAN OF INSPECTION POINTS - DALLMAN ASH POND AND CLARIFICATION POND

DALLMAN POWER GENERATING STATION
3100 STEVENSON DRIVE
SPRINGFIELD, IL 62707

KLEINFELDER
Bright People. Right Solutions.
611 Corporate Circle, Suite C
Golden, Colorado 80401
PH. 303-237-5601 FAX. 303-237-5602
www.kleinfelder.com

PROJ. NO. 112618
ACAD FILE: Dallman Figure 5.dwg

NO.	REVISION	BY	DATE
0	-	—	—
0	-	—	—
0	-	—	—
0	-	—	—
0	-	—	—

PLOTTED: 18 Apr 2011, 1:57pm, MGardella

ATTACHED IMAGES:
ATTACHED XREFS:
Dwn-L:\2008\90399

CAD FILE: W:\112618 EPA Ash Pond Inspections\Task 6 - Dallman\Dallman Report\ LAYOUT: General (2)



IMAGE SOURCE: GOOGLE EARTH PRO - IMAGE DATE 08/27/10

FIGURE 6
1 of 1 sheets

SCALE: NTS
DATE: 08/27/10
CHECKED BY: B. HAVENS
DRAWN BY: M. GARDELLA
DESIGNED BY: N/A

PHOTO PLAN OF INSPECTION POINTS - LAKESIDE POND

DALLMAN POWER GENERATING STATION
3100 STEVENSON DRIVE
SPRINGFIELD, IL 62707

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Golden, Colorado 80401
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www.kleinfelder.com

PROJ. NO. 112618
ACAD FILE: Dallman Figure 6.dwg

NO.	REVISION	BY	DATE
0	-	—	—
0	-	—	—
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0	-	—	—
0	-	—	—

PLOTTED: 18 Apr 2011, 2:04pm, MGardella

Appendix A

Site Assessment Evaluation Checklists

US EPA ARCHIVE DOCUMENT

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: CWLP Ash Ponds | Date: 8-13-10

Unit Name: Lakeside Ash Pond | Operator's Name: City of Springfield, IL

Unit I.D.: | Hazard Potential Classification: High (Significant) Low

Inspector's Name: Brian Havens, Matt Gardella

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	X		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	see below		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	see below		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?		X	Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	565		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?		X	Is water exiting outlet flowing clear?	X	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?		X	From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?	X	
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?		N/A	From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		X	23. Water against downstream toe?		X
17. Cracks or scarps on slopes?		X	24. Were Photos taken during the dam inspection?	X	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
1	Operator makes informal observations on a daily basis. Hanson Professional Services inspects every 5 years.
2 and 3	Water levels are variable due to operations, but are within the range of 554 to 565 where 554 is the invert at the outlet pipe and 565 is the top of berm
21	Minor seepage noted on west side of pond at base of vertical extension (roadway)

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # IL0024767 INSPECTOR Brian Havens, Matt Gardella

Date 8/13/10

Impoundment Name Lakeside Ash Pond

Impoundment Company City of Springfield, IL

EPA Region V

State Agency (Field Office) Addresss 1021 North Grand Avenue East Springfield, IL 62794-9276

Name of Impoundment Lakeside Ash Pond

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update _____

	Yes	No
Is impoundment currently under construction?	_____	X
Is water or ccw currently being pumped into the impoundment?	X	_____

IMPOUNDMENT FUNCTION: Storage of flyash, bottom ash, boiler slag, flue gas emission control residuals and drinking water filter plant sludge

Nearest Downstream Town : Name Riverton, IL

Distance from the impoundment 6 miles

Impoundment Location: Latitude ~~Longitude~~ 39 Degrees 45 Minutes 47 Seconds

Longitude ~~Latitude~~ 89 Degrees 35 Minutes 50 Seconds

State IL County Sangamon

Does a state agency regulate this impoundment? YES X NO _____

If So Which State Agency? Illinois DNR - Vertical extension of impoundment only

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

_____ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

_____ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

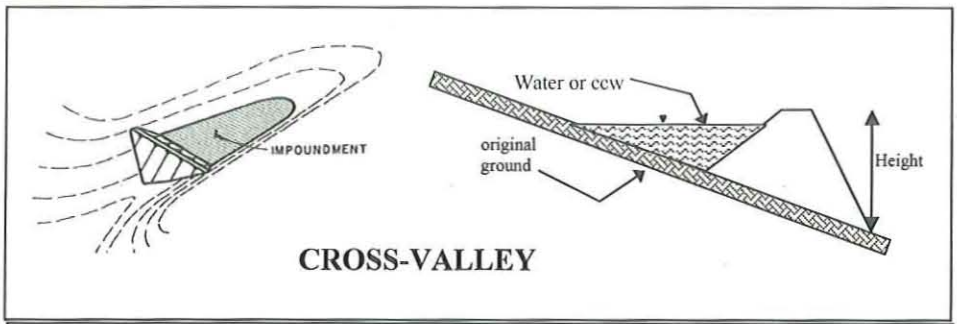
__X__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

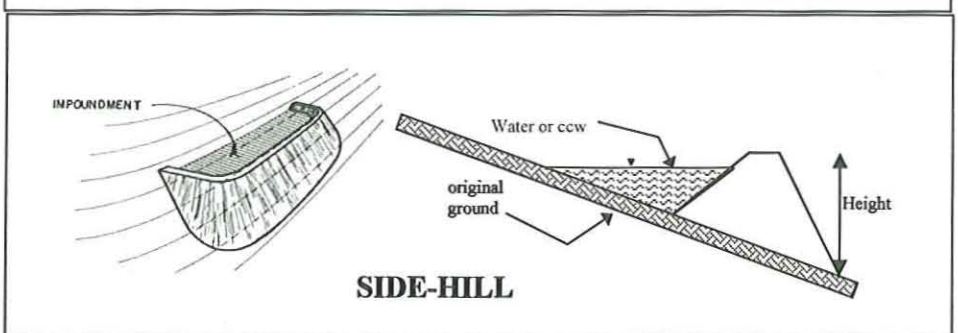
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

Failure could result in movement of flyash into Sugar Creek, resulting in environmental damage and flow disruptions downstream from Spaulding Dam with some ecomomic losses. Loss of life appears to be unlikely as there are no structures between the ash pond and Sugar Creek. Also, no significant structures seem to appear until the Village of Riverton, Illinois approximately 6 miles downstream.

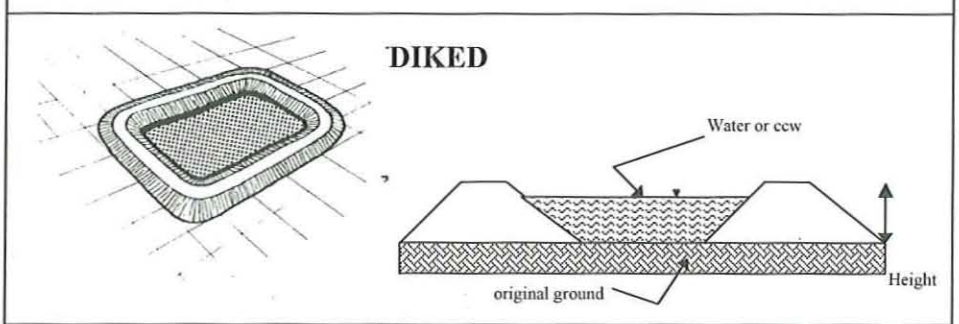
CONFIGURATION:



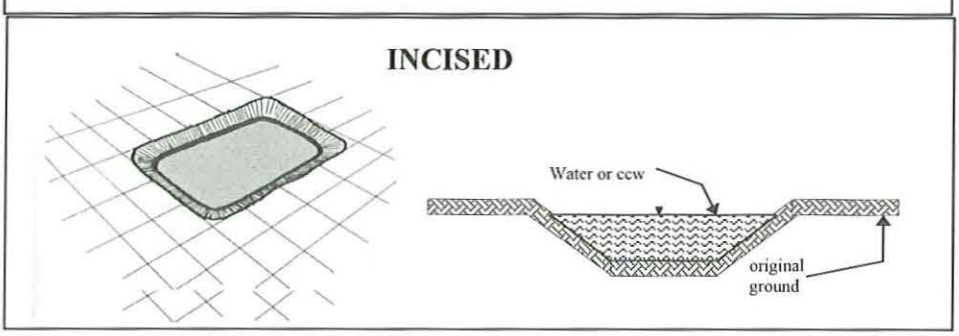
CROSS-VALLEY



SIDE-HILL



DIKED



INCISED

_____ Cross-Valley
_____ Side-Hill
__X__ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height 30 feet
Pool Area ~2 ~~BTH~~ acres
Current Freeboard ~5 feet

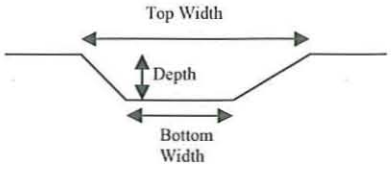
Embankment Material Clay
Liner N/A
Liner Permeability N/A

TYPE OF OUTLET (Mark all that apply)

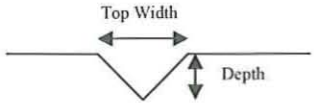
_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width
_____

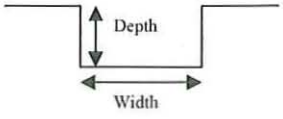
TRAPEZOIDAL



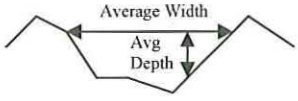
TRIANGULAR



RECTANGULAR

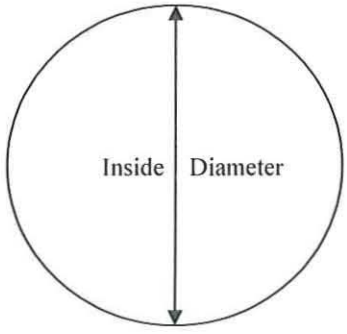


IRREGULAR



_____ **Outlet**

_____ inside diameter



Material
_____ corrugated metal
_____ welded steel
__X__ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) _____

_____

Is water flowing through the outlet? YES _____ NO _____

_____ **No Outlet**

_____

_____ **Other Type of Outlet** (specify) _____

The Impoundment was Designed By Unknown; Vertical expansion by Hanson Professional Services

Has there ever been a failure at this site? YES _____ NO X

If So When? _____

If So Please Describe : _____

Has there ever been significant seepages at this site? YES X NO _____

If So When? See below

IF So Please Describe: _____

1999 Seepage at North and West sides of pond
→ Recommendation to repair visible seepage holes at North
→ Recommendation to add more toe drainage and seal pond with filter cake sludge at west side

2001 Seepage at North side of pond
→ Recommendation to add inverted filter inside pond

2003 Seepage at West side of pond
→ Recommendation to add inverted filter inside pond

2008 Seepage at West side of pond
→ Recommendation to monitor

1992 Seepage at West side of pond
→ Recommendation to add additional toe drain

1993 Seepage at North & Northeast sides of pond
→ Recommendations to add additional toe drain

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES _____ NO X

If so, which method (e.g., piezometers, gw pumping,...)? _____

If so Please Describe : _____

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: CWLP Ash Ponds | Date: 8-13-10

Unit Name: Dallman Ash Pond | Operator's Name: City of Springfield, IL

Unit I.D.: | Hazard Potential Classification: High (Significant) Low

Inspector's Name: Brian Havens, Matt Gardella

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?		X	18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	X		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	Approx. 548		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?		X	Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	553.6		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?		X	Is water exiting outlet flowing clear?		X
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?		N/A	From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)	X		At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?		N/A	From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		X	23. Water against downstream toe?	X	
17. Cracks or scarps on slopes?		X	24. Were Photos taken during the dam inspection?	X	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
1	No formal inspection program. Operator makes informal observations on a daily basis while observing other aspects of operations
2	Primary ash pond level approx. 548.1 to 552.9 Clarifying ash pond level approx. 548.1 or lower
9	6" to 8" trees growing on embankment near outlet to Sugar Creek

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # IL0024767 INSPECTOR Brian Havens, Matt Gardella
Date 8/13/10

Impoundment Name Dallman Ash Pond
Impoundment Company City of Springfield, IL (CWLP)
EPA Region V
State Agency (Field Office) Addresss 1021 North Grand Avenue East
Springfield, IL 62794-9276
Name of Impoundment Dallman Ash Pond
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update _____

	Yes	No
Is impoundment currently under construction?	_____	X
Is water or ccw currently being pumped into the impoundment?	X	_____

IMPOUNDMENT FUNCTION: Storage of flyash, bottom ash, boiler slag, FGD landfill leachate and onsite industrial waste water treatment plant sludge

Nearest Downstream Town : Name Riverton, IL
Distance from the impoundment 6 miles
Impoundment Location:
Longitude W 89 Degrees 36 Minutes 00 Seconds
Latitude N 39 Degrees 46 Minutes 07 Seconds
State IL County Sangamon

Does a state agency regulate this impoundment? YES _____ NO X

If So Which State Agency? _____

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

_____ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

_____ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

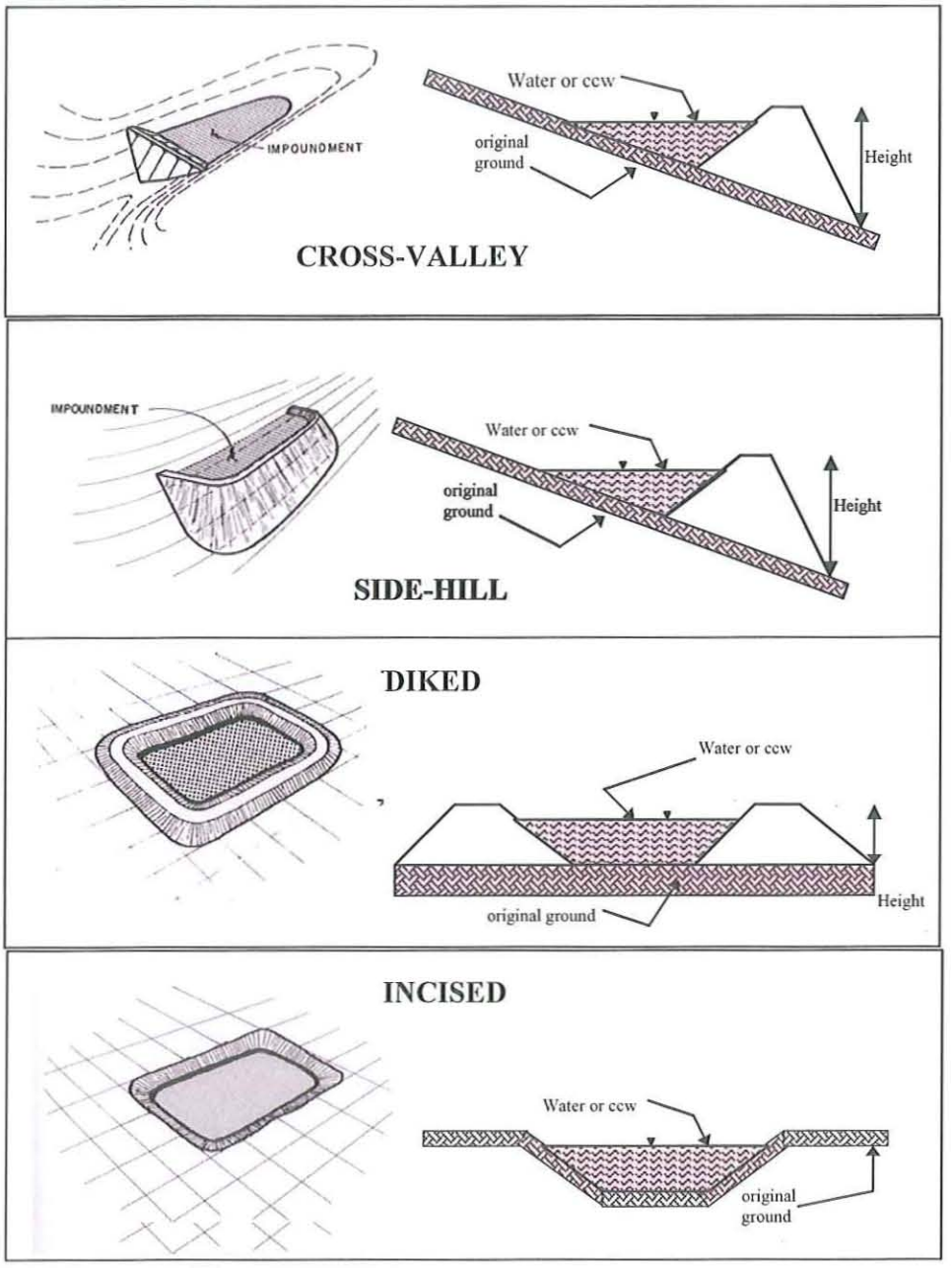
__X__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

Failure could result in movement of flyash into Sugar Creek, resulting in environmental damage and flow disruptions downstream from Spaulding Dam with some economic losses. Loss of life appears to be unlikely as there are no structures between the ash pond and Sugar Creek. Also, no significant structures seem to appear until the Village of Riverton, Illinois approximately 6 miles downstream.

CONFIGURATION:



_____ Cross-Valley
_____ Side-Hill
__X__ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

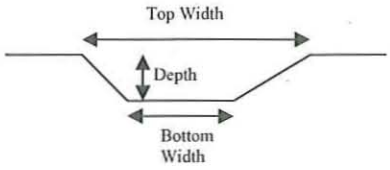
Embankment Height 20 feet
Pool Area ~34 acres
Current Freeboard 2.4'-6.3', but less at sluice pipe cut in embankment feet
Embankment Material Clay
Liner N/A
Liner Permeability N/A

TYPE OF OUTLET (Mark all that apply)

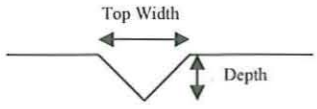
_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width
_____

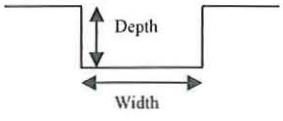
TRAPEZOIDAL



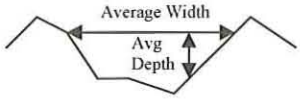
TRIANGULAR



RECTANGULAR

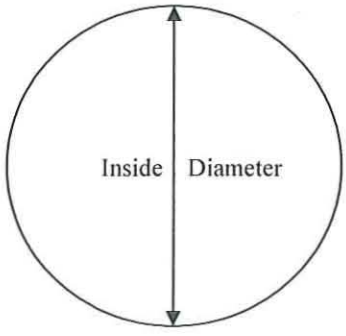


IRREGULAR



_____ **Outlet**

~36" inside diameter



Material
_____ corrugated metal
_____ welded steel
__X__ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) _____

_____

Is water flowing through the outlet? YES __X__ NO _____

_____ **No Outlet**

_____

_____ **Other Type of Outlet** (specify) _____

The Impoundment was Designed By Burns & McDonnell Engineering

Has there ever been a failure at this site? YES _____ NO X

If So When? _____

If So Please Describe : _____

Has there ever been significant seepages at this site? YES BTH NO X

If So When? _____

IF So Please Describe: _____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES _____ NO X

If so, which method (e.g., piezometers, gw pumping,...)? _____

If so Please Describe : _____

Appendix B

Site Assessment Photographs



Photo 1 – Dallman Ash Pond Typical Northern Embankment Looking West (Note Uneven Slope Surface)



Photo 2 – Dallman Ash Pond Typical Northern Embankment Looking East (Note Vegetation on Slope)



Photo 3 – Dallman Ash Pond Typical Crest Condition Looking East



Photo 4 – Dallman Ash Pond Typical Crest Condition Looking South



Photo 5 – Dallman Ash Pond Typical Crest Condition Looking South West



Photo 6 – Dallman Ash Pond Typical Crest Condition Looking West



Photo 7 – Surface Erosion Greater than 12” on Downstream Slope and Edge of Crest



Photo 8 – Sluice Pipe Inlet into Dallman Ash Pond (Note Cut in Embankment)



Photo 9 – Grate on Crest Providing Roadway Access Over Sluice Pipe Inlet into Dallman Ash Pond



Photo 10 – Alternate Sluice Pipes (Not Active during Inspection, Note Cut in Embankment)



Photo 11 – Inactive Sluice Pipe Outlet Connection



Photo 12 – Boiler Slag Sluice Pipe into Dallman Ash Pond (Note Backfilled Embankment)



Photo 13 – Boiler Slag Outlet Connection



Photo 14 – Sluice Pipes Running to Dallman Ash Pond on Western Embankment Crest



Photo 15 – Typical Newly Installed Monitoring Well



Photo 16 – Dallman Ash Pond Typical Western Embankment Looking South



Photo 17 – Gas Pipeline Penetrating Embankment between Dallman Ash Pond & Clarification Pond



Photo 18 – Termination of Outlet Pipe for Clarification Pond (Note Mature Tree on Slope)



Photo 19 – Channel from Clarification Pond Outlet Piping (Note Riprapped Channel)



Photo 20 – Erosion of Creek Slopes Adjacent to Outlet Works Piping from Clarification Pond



Photo 21 – Clarification Pond Outlet Structure Intake



Photo 22 – Clarification Pond Outlet Structure and Pump House (Intake for Outlet is in the Background)



Photo 23 – Looking South Along the Old Lakeside Ash Pond Channel (Channel on Left Side of Photo)



Photo 24 – Seepage Area Looking West from Crest



Photo 25 – Seepage Area Looking South



Photo 26 – Seepage Area at Base of Vertical Extension of Old Lakeside Ponds



Photo 27 – Seepage Area Looking East (Note Vertical Extension of Old Lakeside Ponds)



Photo 28 – Southern Edge of the Old Lakeside Ponds Embankment Looking East



Photo 29 – Old Lakeside Pond Cell Number 1



Photo 30 – Old Lakeside Pond Cell Number 2



Photo 31 – Old Lakeside Pond Cell Number 3 Overgrown and Currently Inactive



Photo 32 – General Photograph of V.Y. Dallman Power Station



Photo 33 – Embankment Separating the Old Lakeside Ponds from the Clarification Pond



Photo 34 – Embankment Separating the Clarification Pond from the Dallman Ash Pond



Photo 35 – Permitted Landfill Area on the Northeast Side of the Dallman Ash Pond



Photo 36 – Permitted Landfill Area Looking East



Photo 37 – Lime Stockpile Looking North from Dallman Ash Pond Eastern Embankment



Photo 38 – Dallman Ash Pond Looking South Along Eastern Embankment

Appendix C

Response Letter to the EPA's Request for Information

Electronic Filing: Received, Clerk's Office 02/13/2020

OFFICE OF PUBLIC UTILITIES
CITY OF SPRINGFIELD, ILLINOIS
TIMOTHY J. DAVLIN, MAYOR
R. TODD RENFROW, GENERAL MANAGER

Via Federal Express

March 26, 2009

Mr. Richard Kinch
U.S. Environmental Protection Agency
Two Potomac Yard
2733 S. Crystal Drive
5th Floor N-5783
Arlington, VA 22203-2733

RE: Request for Information Under Section 104(e) of the Comprehensive Environmental Response, Compensation and Liability Act, 42 USC 9604(e)

Dear Mr. Kinch:

In response to the letter dated March 9, 2009, from Barry Breen to the Plant Manager of the Dallman Power Station, please be advised that the City of Springfield, Illinois, owns and operates the V.Y. Dallman Power Station and the Lakeside Power Station at 3100 Stevenson Drive, Springfield, Sangamon County, Illinois. The City also operates a potable water treatment plant (filter plant) at this site. The station consists of three coal-fired boilers at Dallman and two coal-fired boilers at Lakeside. These plants generate electricity for the residents and businesses in Springfield and provide potable water to Springfield and surrounding communities. Approximately 200 people are employed at the power generating stations and an additional 20 people are employed at the water treatment plant.

The ash handling practices at the City are typical for a coal-fired power plant. Bottom ash and fly ash from all units are sluiced to ash ponds. The raw lake water used for sluicing is obtained from the once-through cooling water systems for the generator condensers. Three separate ash transport systems serve Dallman Units 31 and 32, Dallman Unit 33, and Lakeside.

The City operates two ash ponds, the Lakeside ash pond and the Dallman ash pond at this site, and has operating flexibility to determine which pond will receive ash.

Response to 1st RTP
CWLP - 01689

Surface Impoundment Survey

1. *Relative to the National Inventory of Dams criteria for High, Significant, Low, or Less-than-Low, please provide the potential hazard rating for each management unit and indicate who established the rating, what the basis of the rating is, and what federal or state agency regulates the unit(s). If the unit(s) does not have a rating, please note that fact.*

Under the National Inventory of Dams, the Lakeside Ash Pond is listed as NPDP ID #IL50232. It's hazard class is low. Dallman Ash Pond is not listed on the Inventory.

In the State of Illinois, dam safety is regulated by the Illinois Department of Natural Resources (IDNR). The regulations are located at Illinois Administrative Code, Title 17: Conservation, Chapter I: Department of Natural Resources, Subchapter h: Water Resources, Part 3702 Construction and Maintenance of Dams.

In Illinois, there are three classifications of dams: Class I, Class II and Class III, based on degree of threat to life and property in the event of a dam failure. Class I has the highest hazard.

The City's two ash ponds were constructed prior to 1980, when Illinois adopted the dam safety regulations. They were inspected by IDNR soon after the regulations were adopted. At that time, the City was not required to obtain a dam permit. However, the Lakeside Ash Pond was modified in 1988, and was then required to obtain a Class III dam safety permit. Currently, Dallman Ash Pond does not have a dam safety permit.

2. *What year was each management unit commissioned and expanded?*

The year the Lakeside Ash Pond was commissioned could not be determined. Based on an aerial photo, it was prior to 1958. The pond was expanded in 1988.

Construction began on Dallman Ash Pond in 1976. It has not been expanded.

3. *What materials are temporarily or permanently contained in the unit? Use the following categories to respond to this question: (1) fly ash; (2) bottom ash; (3) boiler slag; (4) flue gas emission control residuals; (5) other. If the management unit contains more than one type of material, please identify all that apply. Also, if you identify "other," please specify the other types of materials that are temporarily or permanently contained in the unit(s).*

Lakeside Ash Pond contains fly ash, bottom ash, boiler slag, flue gas emission control residuals (not including bulk amounts of scrubber sludge) and drinking water filter plant sludge.

Dallman Ash Pond contains fly ash, bottom ash, boiler slag, FGD landfill leachate and onsite industrial waste water treatment plant sludge.

4. *Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management unit(s) under the supervision of a Professional Engineer? Is inspection and monitoring of the safety of the waste management unit(s) under the supervision of a Professional Engineer?*

The Lakeside Ash Pond original designs could not be found. The expansion of Lakeside Ash Pond was designed by Hanson Engineers, Inc. The ash pond is inspected periodically by Hanson Engineers as required by the dam safety permit.

The Dallman Ash Pond was designed by Burns and McDonnell. The unit is not required to have periodic inspections by a Professional Engineer since it does not have a dam safety permit.

5. *When did the company last assess or evaluate the safety (i.e., structural integrity) of the management unit(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the company plans on assessment or evaluation in the future, when is it expected to occur?*

The Lakeside Ash Pond was last inspected by a Professional Engineer in July 2008 from Hanson Professional Services. The engineer, Danny Kerns, P.E., has evaluated this site during and after construction since 1987. There were two noted items that required minor repairs within the year. These were repairing erosion areas and regrading of the north embankment and scheduling the removal of small trees and brush. Safety integrity is listed as not yet imperiled for these measures. Corrective actions are in progress. The next inspection is due in 2013.

Dallman Ash Pond is not required to be inspected by a Professional Engineer since it does not have a dam safety permit.

6. *When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state or federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.*

The City is not aware of any federal inspections. It is our understanding the ponds were inspected by the State when the regulations were adopted, but the City does not have any records of those inspections. We are not aware of any planned future inspections.

7. *Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issue(s) with the management unit(s), and, if so, describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.*

There have been no inspections by State or Federal officials within the past year of Lakeside or Dallman Ash Ponds.

8. What is the surface area (acres) and total storage capacity of each of the management units? What is the volume of materials currently stored in each of the management unit(s)? Please provide the date that the volume measurement(s) was taken. Please provide the maximum height of the management unit(s). The basis for determining maximum height is explained later in this enclosure.

Dallman Ash Pond
Surface Area: 34.5 acres
Storage Capacity: 1,100,000 cu yd
Current Vol. Stored: 730,000 cu yd
Maximum Height: 20 ft
Date: Jan. 1, 2009

Lakeside Ash Pond
Surface Area: 35 acres
Storage Capacity: 1,200,000 cu yd
Current Vol. Stored: 1,080,000 cu yd
Maximum Height: 30 ft
Date: Jan. 1, 2009

9. Please provide a brief history of known spills or unpermitted releases from the unit within the last ten years, whether or not these were reported to State or Federal regulatory agencies. For purposes of this question, please include only releases to surface water or to the land (do not include releases to groundwater).

The Lakeside Ash Pond was inspected by Hanson Professional Services in June 1999. There was seepage in the North embankment. It was recommended to repair the holes to stop seepage. This report was filed with IDNR. The Lakeside Ash Pond was inspected by Hanson Professional Services in June 2000. No deficiencies were noted. This report was also filed with IDNR.

Lakeside Ash Pond was also inspected in July 2001, July 2003, and June 2004. In September 2004, a sink hole developed in the Northwest corner of the pond. The City hired Hanson to recommend a method to repair the sink hole and investigate a second sink hole that was developing. The areas were repaired.

10. Please identify all current legal owner(s) and operator(s) at the facility.

Owner: City of Springfield
Operator: City of Springfield

I certify that the information contained in this response to EPA's request for information and the accompanying documents is true, accurate, and complete. As to the identified portions of this response for which I cannot personally verify their accuracy, I certify under penalty of law that this response and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Signature: _____

Name: John R. Jaun

Title: Power Generation Director

If you should have any questions or require additional information regarding these responses, please contact me at (217) 757-8610, ext. 1105.

Sincerely,

S. David Farris, CIH, CSP
Environmental Health & Safety Manager

SDF/SC/gj

6.1

6.1	9/22/2010 – CWLP submits hydrological assessment and well sampling data to Illinois EPA	2010 Ash Pond Impoundment Hydrogeological Assessment	CWLP	01694	01833

Stabilize, Inc.
507 N. Walnut Street
Springfield, IL 62702
217.525.6653
Fax 888.440.6658
Email: Rmmcde@aol.com

Dedicated to the spreading of the Gospel of Jesus Christ to the world!

September 22, 2010

Mr. Allan Keller, PE
Manager Permit Section
Bureau of Water Pollution Control
Illinois Environmental Protection Agency
1021 N. Grand Avenue East
Springfield, IL 62794

Re. City Water, Light, and Power - 35 IAC 620 Ash Pond Assessment

Dear Mr. Keller:

In accordance with your letter dated June 24, 2010 we are pleased to submit the results of the hydrogeologic assessment of the ash pond impoundment area at the City of Springfield Municipal Utility - City Water, Light and Power.

If you have any questions about the submittal, please do not hesitate to contact me at (217) 525-6653. Thank you for your cooperation in advance.

Sincerely,

R. Michael McDermont, PE, CMRS
President

RMM/hrm

enclosure

Ash Pond Assessment

INTRODUCTION

In accordance with the Illinois Environmental Protection Agency's (IEPA) request for additional information demonstrating compliance with 35 Illinois Administrative Code (IAC) 620, City Water, Light and Power (CWLP) is providing this hydrogeological assessment of the ash ponds. CWLP operates a series of ash and lime sludge clarification or settling ponds east of the power plant complex in Springfield, Illinois. The utility is owned and operated by the City of Springfield. The ponds are operated under a National Pollutant Discharge Elimination System (NPDES) Permit Number IL0024767. The ash ponds are located north of East Lake Shore Drive, just east of Interstate 55. The site is bordered on the south by Lake Springfield, on the west and north by Sugar Creek and on the east by CWLP's permitted FGDS landfill. The facility is located in the eastern half of Range 5 west, Township 15 north, Section 12 in Sangamon County, Illinois (Springfield East Quadrangle, Illinois, USGS). The setting is depicted on Figure 1.

Beyond the areas depicted on Figure 1, to the west is Interstate 55 and at a greater distance is Dirksen Parkway that parallels the interstate. Commercial property is abundant on both sides of this street and these businesses rely on potable water delivered by CWLP. There are no known water supply wells in this area. The lake is south of the ponds along with the impoundment dam. A flood plain and clay soil borrow area for the landfill is located in the area north of the ash ponds. There is City property located directly east of the ponds that includes a flood plain along with the landfill area. Residences are located further east in several subdivisions. There residences are typically served by potable water from CWLP, as the subdivisions were built in the 1970's, 1980's and 1990's.

The FGDS Disposal facility was constructed within an old river valley which is characterized by flat topography and a meandering stream. Sugar Creek flows adjacent the site. Sugar creek receives water from both surface runoff from adjacent properties, effluent from the ash pond impoundments and discharges from the Lake Springfield Spaulding Dam. Topographically, the waste disposal area is surrounded on the southeast and southwest by higher ground which appears to be bedrock outcrops. Low lying areas are located to the north and east and are within the old river valley.

The impoundment ponds include the Dallman Ash Pond that was placed in service in approximately 1976. This pond is approximately 36 acres. The pond has an average invert elevation of 527 feet MSL from the plan sheet design. Therefore the pond is approximately 27 feet deep from the top of the perimeter roadway. Both flyash and bottom ash is sluiced to the Dallman Ash Pond with raw lake water.

The Lakeside Ash Pond was placed into service prior to 1958. The Lakeside Ash Pond has been divided into three separate ponds with the East Lime Pond being 7.3 acres in size, the west lime Pond 4.2 acres and the remaining Lakeside Ash Pond consisting of 32.3 acres.

The lime ponds receive the sludge, typically composed of lime, flocculants and lake water solids from the water treatment plant clarifiers. These ponds are typically operated one at a time. The clarified supernatant from these ponds flows into the Lakeside Ash Pond.

The Lakeside power plant has been shut down and therefore bottom and fly coal combustion ash is no longer being sluiced to the Lakeside Ash Pond with raw lake water. Efforts continue to reclaim both ash as well as lime sludge from the pond areas. The lime sludge is used to correct pH on agricultural farmland in lieu of typical lime stone application.

The settled water from both the Dallman Ash Pond and Lakeside Ash Pond flow into opposite sides of the center Clarification Pond before being discharged through permitted NPDES Outfalls 004 or 006. Outfall 004 discharges the water into Sugar Creek and alternately Outfall 006 discharges the water back to Lake Springfield. The clarification pond consists of 10 acres. The maximum permitted water flow through the pond system is approximately 7.5 MGD. The clarification pond is also thought to be approximately 27 feet deep with an average invert elevation of 527 ft MSL.

The southern area of the ash ponds and dam is bounded by Lake Springfield. The lake was made by constructing an earthen Spaulding Dam across Sugar Creek. Therefore the lake and the dam are upgradient in terms of groundwater flow direction and groundwater quality.

The adjacent landfill on the east disposes of Flue Gas Desulphurization Sludge from the electric generating facility's sulfur dioxide scrubbers. The landfill is segregated into two regulated units. Unit 1 is a closed landfill regulated by the 35 Illinois Administrative Code (IAC) 807 regulations and comprises approximately 10.5 acres. Unit 2 is north of Unit 1 and consists of 22.3 acres with only 3.5 acres currently being developed to date. This landfill is regulated by the 35 IAC 811 regulations.

Much of the ash ponds and landfill were constructed in the Sugar Creek flood plain. In fact the dam was constructed of glacial till largely consisting of silty clay to clayey silt ensuring that the reconstructed earthen dam, and pond embankments, exhibit low permeability characteristics. Recompacted silty clay samples from the native soils have exhibited permeability's in the 1×10^{-7} to 1×10^{-9} cm/sec range with relative ease and reproducibility based upon construction of the landfill's liner and final cover systems. The in-place creek sediment's soil permeability's predominantly range from 1×10^{-6} to 1×10^{-8} cm/sec.

The property on which these landfill cells and ash ponds have been constructed was originally agricultural land. Based on a 1976 USGS quadrangle map and old design drawings, Sugar Creek originally meandered through the property. The creek was abandoned when the Dallman Ash Pond was constructed and was rerouted to its present position.

The landfill cells were reportedly created by constructing berms above original grade and excavating soils within the cells. The soils excavated from the cell inverts were used to construct the perimeter berms. The total area of the landfill is approximately 25 acres.

Accordingly much is known about the east side of the ash ponds based upon the regulatory required hydrogeologic studies that have been done for the landfill. The landfill has approximately 25 monitoring wells and piezometers spread over the approximate 40 acre total area. Details regarding the specific hydrogeologic investigation in this area are available from the IEPA Bureau of Land CWLP – FGDS Landfill Facility Number 1678250020. These investigations have been summarized and augmented with the 2010 field investigation on the west side of the CWLP ash ponds.

Should the Agency require these numerous hydrogeological studies these reports they can be easily supplied by us or may be reviewed from the Bureau of Land file.

POTABLE WATER WELLS

The Illinois State Water Survey was contacted in the past and the potable water wells in a 0.5 mile radius are provided on Figure 2. This figure was prepared by Patrick Engineering, Inc. Most of these wells are likely no longer used based upon the availability of potable water from CWLP in this increasing urbanized area. The water well records are provided in Attachment A.

HYDROGEOLOGICAL INVESTIGATIONS

Six subsurface investigations have been conducted in and adjacent to the three landfill cells and ash ponds. These investigations were as follows:

1. Professional Service Industries (PSI), June, 1989. This investigation consisted of five soil borings within the east section of the south cell (Cell) 1).

2. Andrews Environmental Engineering (AEE), February, 1990. This investigation was performed for the center cell (Cell 2) and consisted of 13 soils borings. The drilling and soil testing was performed by PSI.

3. Andrews Environmental Engineering (AEE), March, 1990. This investigation was performed to install six monitoring wells at the facility. The drilling, soil testing and well construction was performed by PSI.

4. Patrick Engineering (PEI), July, 1992. This investigation was performed to further characterize the hydrogeology of the landfill setting. Approximately 44 soil boring and piezometers were installed by PEI.

5. Stabilize, Inc. (SI), December, 2008. This investigation installed three new monitoring wells as part of an assessment program for the landfill. The drilling, soil testing and well construction was performed by Reynolds Well Drilling.

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6. City Water Light and Power (CWLP), April, 2010. This investigation was performed to install four piezometers on the west side of the ash ponds along Sugar Creek. The drilling, soil testing and well construction was performed by PSI.

The data from Investigations 1 through 4 was summarized, tabulated and consolidated for the landfill permitting process. This information is provided below. The findings from the assessment well and ash pond investigation are then provided to correlate the larger expanded project area with the landfill's hydrogeology findings.

GENERALIZED STRATIGRAPHY

The available landfill report data was carefully reviewed to determine the general site stratigraphy to define the complex site hydrogeologic conditions. Based on this review, there appears to be six major geologic units present at the site. The six units are as follows:

(1) Fill Materials - These materials consist of soils used for constructing the berms and the soils used for filling Sugar Creek when it was rerouted to the west. The fill materials for berms generally consisted of clayey soils. However, the materials used for filling the creek appeared to be variable ranging from silty clays to organic silty clays.

(2) Upper Cohesive Deposit - This unit consists of loess and alluvial silty clays to clayey silts.

(3) Shallow Sand - This unit, consisting of silty to clayey sand, underlies the Upper Cohesive Deposit.

(4) Lower Cohesive Deposit - This unit underlies Shallow Sand and consists of silty to sandy clays.

(5) Basal Sand - Underlying the Lower Cohesive Deposit is the Basal Sand which consists of silty to clayey sands, and sands with minor amounts of gravel.

(6) Bedrock - Bedrock is encountered below the Basal Sand and consists of Pennsylvanian shale.

REGIONAL GEOLOGY

A review of published regional geologic studies was conducted for the area immediately surrounding the project site. A thorough discussion of the regional geology has been presented by the Illinois State Geologic Survey (ISGS) in a report entitled "Geology for Planning in the Springfield-Decatur Region, Illinois". Based on the publications, the regional unconsolidated overburden is comprised of lacustrine and alluvial sands, silts and clays overlying Pennsylvanian shale. This stratigraphy is expected at the project site as the sited is located within an old river valley between bedrock outcrops. A brief summary of the regional overburden stratigraphy, bedrock stratigraphy, groundwater resources, and groundwater use in the vicinity of the project site is provided in the following sections.

Regional Overburden Stratigraphy

Available regional surface geology maps indicate that unconsolidated deposits in the area of the project site consist primarily of Cahokia Alluvium overlying the Equality Formation. Other soils such as loess, modern soils and glacial tills may deposits. The Cahokia Alluvium and Equality Formation are reported to be alluvial silt deposits. The total thickness of the unconsolidated deposits ranges from approximately 10 to 50 feet with an average thickness of about 25 feet based on water supply well within the area. The Cahokia Alluvium generally consists of fine-grained silty to clayey soils. Small discontinuous lenses of sand and gravel are commonly encountered. It has been described as ranging from yellowish brown to gray to dark in color.

The Equality Formation consists primarily of silty clays which have been deposited in quiet glacial melt water lakes. It is normally massive in appearance and commonly contains localized lenses of clay and sand.

Regional Bedrock Stratigraphy

The unconsolidated overburden deposits are underlain by Pennsylvanian shales, limestones, sandstones, and coals. Outcrops of Pennsylvanian shale are present to the west and southeast of the project site. The uppermost Pennsylvanian rocks in the region have been correlated to the Modesto Formation of the Mcleansboro Group.

The most predominant materials in the Modesto Formation are thick gray shales. The sandstone members are usually not as thick as the shales; however, there are local channel deposits which can be up to 80 feet thick. Most of the limestone and coal seams are relatively thin when compared to the shales and sandstones.

The Pennsylvanian rocks are underlain by rocks of the Mississippian, Devonian, Silurian, Ordovician and Cambrian systems. The Mississippian, Devonian, and Silurian rocks consist of limestone, dolomite, and to a lesser extent shale formations. The Ordovician Cambrian rocks are primarily dolomites and sandstones with some relatively extensive shale formations.

Springfield No. 5 Coal Mine

Illinois basin coal deposits typically occur in stratigraphic sequences called cyclothems, this is especially true for Pennsylvanian coal, such as those found in the Springfield No. 5. This coal may have been mined near the western half of the project site. Published data for the region indicates that the Springfield No. 5 coal is probably 5 to 7 feet thick, and is present at a depth of approximately 200 feet below the ground surface.

Regional Groundwater Resources

The largest groundwater yields in the Sangamon County area are obtained from large diameter wells finished in sand and gravel deposits and the upper portions of the Pennsylvanian rocks. Throughout Sangamon County, the Pennsylvanian bedrock will yield minor amount of groundwater in areas where it is fractured. Locally, sandstone lenses may also yield small amounts of water. Water supply wells are usually not extended more than 150 feet into the bedrock because the groundwater in the lower part of the Pennsylvanian rocks is highly mineralized.

Groundwater Use in the Vicinity of Project Site

The available water well logs from Illinois State Water Survey (ISWS) that are located within an approximate one mile radius of the project site were obtained. The locations of the wells in reference to the project area are shown in Figure 2. Copies of the logs are included in Appendix A. A review of these logs indicated the following:

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(1) The water supply wells range in depth from 11.5 to 52 feet below the ground surface with an average depth of about 33 feet.

(2) The wells are drilled to the top of bedrock and obtain water from the overburden deposits and the upper few feet of the bedrock surface.

(3) The wells are typically about three feet in diameter due to the low yield of the formations in which they are completed.

SITE GEOLOGY

The results from each of the six different investigations were consistent with the results from previous investigation regarding the different hydrogeologic units present at the site. As discussed before, six distinct geologic units, namely: Fill Materials, Upper Cohesive Deposit, Shallow Sand, Lower Cohesive Deposit, Basal Sand, and Bedrock are present at the site. A more detailed description of all six units based on the available landfill data is presented in the following sections based upon the individual landfill investigations. Narrative regarding the latest ash pond investigation will be provided following the background information available for the adjacent landill.

Fill Materials

Two types of fill materials were encountered at the site. One being the soils used to construct the containment berms and the other being soils used to abandon the creek. Based on the borings drilled through the berms, the berms were generally constructed with silty clays which were likely obtained from within the landfill cells. The borings made along the abandoned creek locations indicate that the creek fill materials consist of variable soils ranging from silty clays to silty sands. It is noted that in some locations the containment berms were constructed directly over the creek fill.

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Based on the materials encountered within the creek channel, it is apparent that the creek abandonment was not performed according to current engineering practices. The Fill Materials consist of both cohesive and granular soils. The cohesive soils are characterized as silty clays to organic silty clays organics were typically encountered. In some areas, the cohesive fill materials extended down to the top of bedrock. The granular fill materials are typically poorly graded silty to clayey sands and contain organics or wood fragments. In some areas, the granular fill materials also extended down to the top of bedrock.

The landfill laboratory testing program was concentrated on the creek fill materials. The cohesive fill materials exhibit the following range of index and engineering properties: liquid limit = 34 to 46, plasticity index = 9 to 26, gravel content = 0 %, sand content = 2% to 48%, silt/clay content = 52% to 98%, dry density = 80 pcf to 104 pcf, and laboratory hydraulic conductivity ranging from 7.6 x 10-8 cm/sec to 2.1 x 10-5 cm/sec.

Cation exchange capacity (CEC) tests indicate CEC values range from 14 to 18 meq/100 gm. The granular fill materials contain 0% to 2% gravel, 55% to 65% sand and 33% to 45% silt/clay, based on sieve analyses. One laboratory hydraulic conductivity test was performed using a Shelby tube sample obtained from berm fill at location P-9D and indicate hydraulic conductivity value of 3.3 x 10-8 cm/sec.

Upper Cohesive Deposit

The Upper Cohesive Deposit (USD) consists mainly of brown, light brown, and brownish-gray silty clays and clayey silts having soft to stiff consistency. This deposit includes all eolian soils (loess) deposited near the surface, isolated pockets and lenses of fine grained silty to clayey sand at some locations and alluvial silts and silty clays. The UCD is present in all areas of the landfill footprint except in areas where Sugar Creek cut through. The UCD was encountered either at the ground surface or below the fill materials and ranged in thickness from 2.5 to 19 feet. The thickness of the UCD was impacted significantly when the landfill bottom was excavated. In addition, recent earthwork landfill cell development activities may have caused changes in the thickness of the deposit.

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Laboratory tests were performed on representative soil samples obtained from this deposit to aid in classification and correlation of the UCD between boring locations. The deposit exhibits the following range of index and engineering properties: liquid limit = 23 to 33, plasticity index = 2 to 14, gravel content = 0%, sand content = 18% to 40%, silt/clay content = 60% to 85%, dry density = 99 to 103 pcf, CEC = 10 to 16.5 meq/100 gm. It is noted that one silt sample obtained from this unit was non-plastic and it is not included in the range of values. Triaxial hydraulic conductivity tests performed on undisturbed 3-inch diameter thin-walled Shelby tube samples indicates that the vertical hydraulic conductivity of this unit ranges from 1.6 x 10-8 cm/sec to 5.2 x 10-7 cm/sec.

Shallow Sand

The Shallow Sand underlies the UCD and consists of a brown to gray silty to clayey fine sand. It contains small lenses of silty clay and clayey silt. This unit is not continuous over the entire site. Its thickness ranges from one to three feet over most of the investigated area.

Laboratory tests performed on representative samples collected from the Shallow Sand unit during this and previous investigations indicate the Shallow Sand contains 0% gravel, 50% to 52% sand, and 48% to 50% silt/clay.

Lower Cohesive Deposit

The Lower Cohesive Deposit (LCD) consists of brown, gray, and brownish gray silt clays, clayey silts and clays having very soft to stiff consistency. The LCD ranges in thickness from 0 to 22 feet with an average thickness of about 15 feet. The deposit was not encountered in isolated areas along the abandoned creek, possibly due to excessive of creek bottom in these areas.

The LCD is generally overlain by the Shallow Sand and underlain by the Basal Sand. However, within the abandoned creek area, the LCDE was encountered directly below the creek fill. In some areas the Basal Sand is not present and the LCD directly overlies the bedrock.

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In some areas the soils in the LCD are very similar in color and texture to the soils in the UCD. The distinction between the two deposits was based on the presence or changes in soil consistency (as measured with a calibrated hand held penetrometer) and a marked difference in moisture content. The LCD is not exposed at the ground surface in the investigated area.

The LCD exhibits the following range of index and engineering properties: liquid limit = 23 to 71, plasticity index = 3 to 39, gravel content = 0%, sand content = 8% to 48%, silt/clay content = 52% to 95%, dry density = 78 pcf to 105 pcf, and cation exchange capacity = 6 to 11 meq/100 gm. The high plasticity clays were encountered in northeast areas of Cell 3 (CB-2, P-3D, and P-4). Hydraulic conductivity of undisturbed samples ranged from 1.3 x 10-8 cm/sec to 1.8 x 10-6 cm/sec. It is noted that three samples tested from this unit showed non-plastic characteristics and these are not included in the range of values.

Basal Sand

In general, the lower most hydrogeologic unit in the overburden stratigraphy at the project site is the Basal Sand (BS). It consists of brown to gray colored, poorly graded, silty to clayey fine sands to well graded sands with minor amounts of fine gravel. This unit was encountered in a medium dense to dense condition. The top elevation of the Basal Sand varies from elevation 491 to 513 feet, and the thickness ranges from about 0 to 12.3 feet. The unit was not encountered in a few scattered areas possibly due to excessive erosion of creek bottom.

The Basal Sand generally overlies the bedrock surface and underlies the LCD. Pockets of very hard fine-grained silty clay to clay are present overlying the bedrock in scattered areas, and the Basal Sand is present above these pockets of clayey deposits. The origin of these pockets of clayey deposits is probably weathered bedrock. The Basal Sand generally consists of 0% to 34% gravel, 50% to 91% sand, and 6% to 44% silt/clay from the numerous landfill borings.

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The Bedrock at the project site consists of Pennsylvanian shales. The bedrock sediments are gray in color. The bedrock surface elevation varies from elevation 492 feet (in G-106) near the center of the project site to 558 in B-14, which is located on a bedrock outcrop near the southeast corner of Cell 1. In general, the bedrock surface slopes from both the east and west towards the center of the landfill Cells 2 and 3 in the landfill area.

Rock Quality Designation (RQD) measurements were performed on all core samples taken from the landfill area. RQD's measured from core samples collected during this investigation ranges from 80% to 100%. The RQD values indicate that the bedrock is not highly fractured. Two in situ hydraulic conductivity tests were performed to determine the hydraulic conductivity tests were performed to determine the hydraulic conductivity of the upper portions of the bedrock. Test results indicate the hydraulic conductivity values of the bedrock ranged from 1.8 x 10-7 cm/sec to 1.3 x 10-6 cm/sec. This shows that the bedrock encountered at the project site is relatively impermeable. There is good correlation between the lithology of the rocks tested and the hydraulic conductivity values obtained.

SITE HYDROGEOLOGY

A thorough analysis of the available data collected during the previous investigations indicates that there are three water deposits present at the landfill. These deposits are:

1) Creek Fill
2) Shallow Sand
3) Basal Sand

The creek fill materials identified during the previous landfill investigations have a significant affect on the site hydrogeologic conditions. In some areas, the fill materials, consisting of either granular soils or organic silty clays, extend from existing grade to the bedrock surface and locally interconnect all three water bearing units. The Upper and Lower Cohesive Deposits are considered to act as aquitards (where present) which restrict vertical flow into the water bearing units. Bedrock is considered to act as an aquiclude.

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Creek Fill

Fill materials encountered in the landfill borings range from silty clays and organic silty clays to silty sands and clayey sands. These water level measurements indicate that groundwater flow within the creek fill materials is complicated because of the highly variable hydraulic characteristics of the fill materials and their random placement. In some areas, there appears to be direct hydraulic communication between fill materials, Shallow Sand and Basal Sand.

A total of four landfill piezometers were screened into the fill materials. Of these, one piezometer was installed into cohesive fill material and the other piezometers were installed in granular fill materials. Hydraulic conductivity of the granular fill materials based of field hydraulic conductivity tests ranged from 6.1 x 10-2 cm/sec. The hydraulic conductivity of the cohesive fill material, based on one slug test, ranged from 7.1 x 10-5 cm/sec to 1.1 x 10-4 cm/sec. These values represent the hydraulic conductivity in the horizontal direction.

Laboratory hydraulic conductivity test performed on landfill cohesive fill materials ranged from 2.1 x 10-3 cm/sec to 3.3 x 10-8 cm/sec. The higher hydraulic conductivity values are believed to be typical of soils which contain organic matter (e.g. wood fragments). The hydraulic conductivity values based on laboratory tests are generally considered to be representative of the coefficient of hydraulic conductivity in the vertical direction because of the sample configuration during testing. However, because of the randomness of the fill, it is more likely that the hydraulic conductivity is within the range of 10-5 to 10-4 cm/sec.

Upper Cohesive Deposit

The upper Cohesive Deposit has a relatively low hydraulic conductivity in the vertical direction as determined by laboratory triaxial hydraulic conductivity tests from borings taken from the landfill investigation. The hydraulic conductivity values determined from the laboratory tests ranged from 1.6 x 10-8 cm/sec to 5.2 x 10-7 cm/sec. However, the UCD is an alluvial Deposit and it is expected that the horizontal coefficient of hydraulic conductivity will be significantly greater than the vertical coefficient. Based on test results for the Lower Cohesive Deposit (see below), it is anticipated that the horizontal hydraulic conductivity for the UCD is in the range of 10-6 to 10-5 cm/sec.

Shallow Sand

Two landfill piezometers were screened in the Shallow Sand unit to provide information on piezometric levels and to perform slug tests. The hydraulic conductivity of this unit based on the slug test results is estimated to generally be within a range o 3.6 x 10-3 cm/sec to 2.9 x 10-2 cm/sec.

Lower Cohesive Deposit

The Lower Cohesive Deposit has a relatively low hydraulic conductivity. Hydraulic conductivity in the vertical direction based on triaxial hydraulic conductivity tests range from 1.3 x 10-8 to 1.8 x 10-6 cm/sec. Hydraulic conductivity in the horizontal direction based on two slug tests performed in piezometers screened in this deposit ranges from 4.6 x 10-5 cm/sec to 7.6 x 10-5 cm/sec. This variation in the vertical and horizontal conductivity is expected due to the nature in which this soil was developed.

Basal Sand

The Basal Sand was saturated in all locations where it was encountered. The measured hydraulic conductivity of this unit ranged from 5.6 x 10-4 cm/sec to 3.6 x 10-2 cm/sec in the landfill piezometers with the lower values associated with fine sands having larger silt/clay content. The groundwater is present under confined conditions based on the water level measurements obtained during this investigation.

Figure 3 shows the interpreted potentiometric surface within this unit on May 25, 2010. The potentiometric surface of the Basal Sand varies from elevation 541 – feet to elevation 527 – feet. The groundwater flow in the Basal Sand is towards the center of Cells 1 and 2 from the east, the west and the south directions, and discharge is towards Sugar Creek to the north.

Bedrock

The bedrock at the project site consists of mainly shale with isolated thin coal layers. In situ hydraulic conductivity test (slug tests) indicated that the hydraulic conductivity for the upper portions of the bedrock range from 1.8 x 10-7 cm/sec to 1.3 x 10-6 cm/sec. There appears to be good correlation between the rock lithology and the measured values of hydraulic conductivity. The bedrock over most of the site will act as an aquiclude and prevent the downward flow of groundwater flow.

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City Water, Light & Power
FGDS Landfill

Potentiometric Surface Map
Basal Sand Unit
2nd Quarter 2010



Scale: 1 inch = 200 feet

Contour Interval = 1 foot

Min/Max Gradient
7.54E-005 0.0671

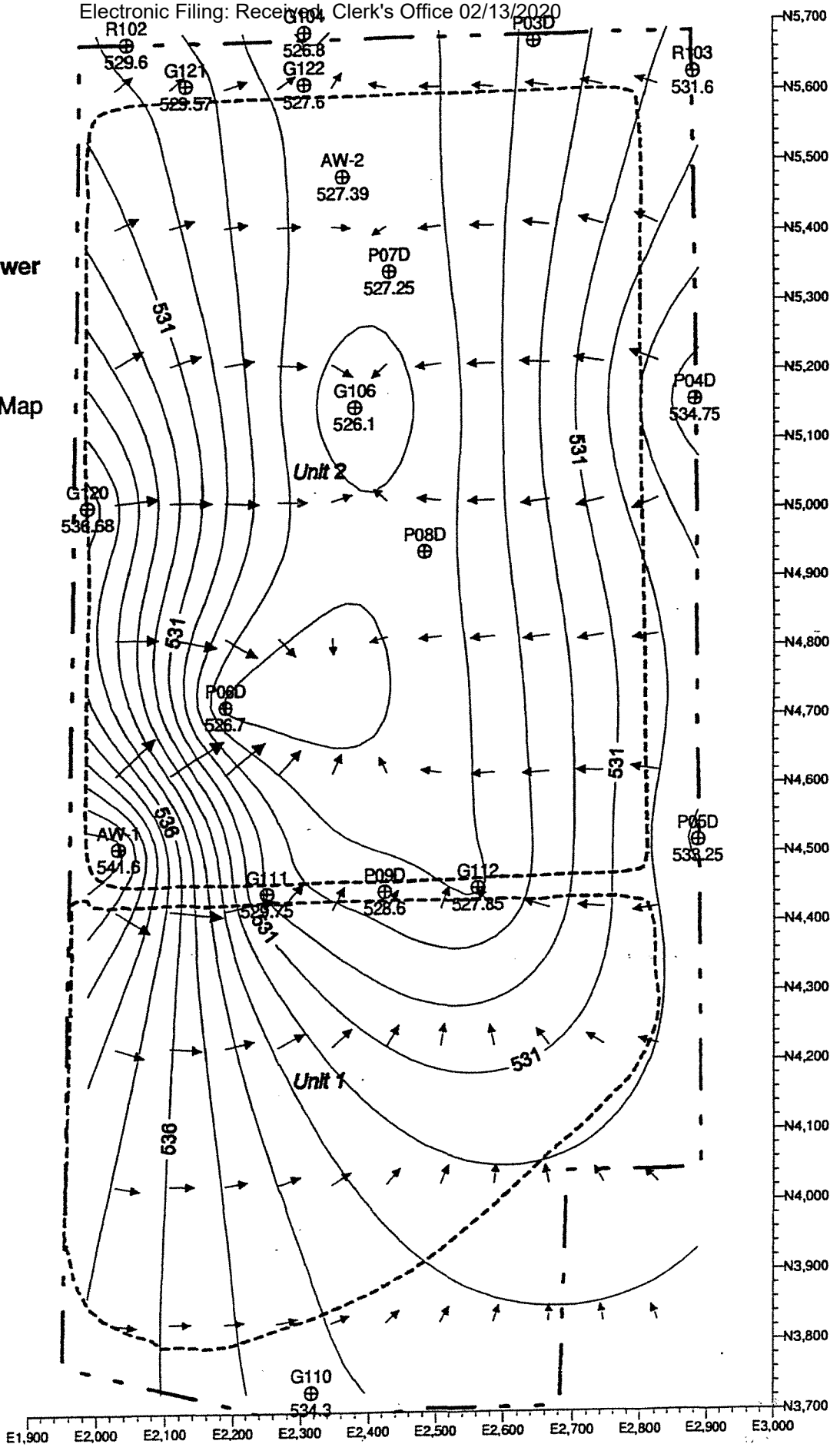


Figure 3
Response to 1st RTP
CWLP - 01709

Electronic Filing: Received, Clerk's Office 02/13/2020

The exploration program consisted of drilling 4 borings depths ranging from 19.5 to 60 feet, installing 4 piezometers and performing 4 slug tests. The piezometers were installed to obtain groundwater level measurements and to perform slug test. The locations of all borings and piezometers are shown in the PSI report provided in Attachment B.

The goals of the exploration program were to:

1. Further delineate the six geologic units identified after reviewing the results of previous investigations on the west side of the ash pond.

2. Determine the hydraulic characteristics of the six geologic nits (Fill Materials, Upper Cohesive Deposit, Shallow sand, Lower Cohesive Deposit, Basal Sand, and Bedrock).

3. Obtain representative and undisturbed soil samples for laboratory testing.

4. Obtain one round of groundwater sampling for characterization according to the 35 IAC groundwater standards.

5. Determine index and engineering properties of the different hydrogeologic strata.

All field explorations were performed under the direction of CWLP staff without benefit of an independent consultant. The contract driller maintained the daily drilling records, logged the soil samples and rock cores, selected representative samples for laboratory testing, and supervised the installation of piezometers. The field logs together with the laboratory tests were used to develop the boring logs presented in Attachment B. The borings were logged according to the Soil Description Terminology and the locally adapted version of the Unified Soil Classification System, ASTM D 2487.

Drilling and Sampling Procedures

The borings were drilled with a Central Mine Equipment (CME) rotary drill rig mounted on an all-terrain vehicle. Boreholes were advanced utilizing either 4-1/4 inch hollow system augers to stabilize the sides of the boreholes.

The soils were sampled by driving a 2-inch O.D. standard penetration test split spoon sampler in accordance with a modified version of ASTM D 1586. Borings were sampled continuously from one foot below the ground surface to total depth. The sample method, soil type, location, and recovery for each sample interval are shown on the Boring Logs.

Representative soil samples obtained by the standard penetration method were preserved for laboratory analyses. When a break in the soil stratigraphy was logged in a split spoon sample interval, the sample was split and representative soil samples above and below the stratigraphic break were preserved. Hand held calibrated penetrometer tests were performed in the field on cohesive samples to serve as a general measure of soil consistency and to estimate unconfined compressive strengths. After sealing the jars, individual samples were labeled, boxed and transported to the PSI Laboratory for testing.

Based upon the soil borings the shallow sand is not present except in AP -4 and may have been removed as part of the realignment of sugar creek. The ash pond invert is situated in clayey silts or silty clay that act as a natural retardation to the migration of contaminants from the ash ponds. Beneath this low permeability layer is the basal sand that continues across the site and beneath the basal sand is the confining layer of shale. Boring AP-4 encountered flyash in its boring and therefore the groundwater quality from this piezometer may be suspect based upon contamination, annular space seal, etc. Figure 4 is a north south cross section showing the geology of the Borings AP-1 through AP-4 along with the ash pond data for illustrative purposes. Figure 5 contains a copy of the construction information for the Dallman Ash Pond and a portion of the clarification pond.

Piezometer Construction

Each piezometer consisted of a 2-inch I.D. PVC riser pipe connected to a ten feet long, slotted PVC screen. Silica sand filter pack was installed around the slotted well screen. Bentonite pellets or Volclay grout were installed above the filter pack to form a seal.

Piezometer Development

The piezometers were developed using a one-inch I.D. and five foot long PVC bailer. Numerous piezometer casing volumes of water removed from each well to ensure that the screens were unobstructed.

Sampling

Samples of the four piezometers on the west side of the ash ponds was done with the landfill permitted groundwater wells during the end of May and beginning of June. Samples were collected by CWLP personnel for non organic parameters of the new Ash Pond Piezometers. Sample results for AP-1, AP-2, AP-3 and AP-4, AW-3, G120 and G110 are provided in Attachment D. The Ash Pond wells were sampled for total metal concentrations in comparison to dissolved as is customary for groundwater wells. A review of site specific available data for both dissolved versus total parameters for boron and iron revealed an approximate ratio of dissolved to total concentration of 33% as indicated below and in Attachment D. Therefore the following results are note worthy in terms of the 620 standards, but are not indicative of exceedences when this correlation is used in the evaluation process.

Well ID	Potential Exceedence	Standard	Total	Dissolved
AP-1	Iron	5.0 mg/l	5.68 mg/l	
AP-2	Boron	2.0 mg/l	2.63 mg/l	
AP-3	Boron	2.0 mg/l	11.9 mg/l	
AP-3	Iron	5.0 mg/l	10.1 mg/l	
AP-4	Iron	5.0 mg/l	11.2 mg/l	
AW-3	Iron	5.0 mg/l	12 mg/l	4.23 mg/l
G-110	Iron	5.0 mg/l	6.71 mg/l	2.73 mg/l
G-120	Iron	5.0 mg/l	28.6 mg/l	19.9 mg/l

Monitoring Well G120 is down gradient from Cell 1 of the FGDS landfill and the results of the sampling there are more likely indicative of the impact of the landfill than the ash pond to the west.

Surveying

The locations and elevations of all borings and piezometers were surveyed by CWLP personnel. The locations are expressed relative to a project grid system. The elevations of all boring and piezometers are based on U.S.G.S. mean sea level datum. A summary of the survey data is presented in Table 1.

Water Level Measurements

Water levels were measured in all piezometers, monitoring wells, and surface water bodies present in the vicinity of the landfill and ash ponds by CWLP personnel on may 25, 2010. The depth to water in the measurements were then converted to elevations. The water elevations were plotted by Surfer and the potentiometric surface map is presented as Figure 5 for the combined landfill and ash pond piezometers.

Slug Tests

Slug tests were performed in all piezometers installed during this investigation to provide an estimate of the hydraulic conductivity of the soils within the screened interval. Four piezometers were tested in the Basal Sand revealing a mean hydraulic conductivity of 1.73 x 10-2 cm/sec.

SUMMARY

The site geology at the project area has been determined based on comprehensive subsurface investigations performed by numerous consultants. Based on these investigations, six major geologic units have been identified at the site. These units are: fill materials within the old abandoned creek channel, upper cohesive deposit, shallow sand, lower cohesive deposit, basal sand, and bedrock (shale).

Based on hydraulic conductivity testing, particle size distribution test, and water level measurements, the fill materials within the old creek channel, the shallow sand, and the basal sand are the water bearing units present at the site. Laboratory and field tests provide the range of hydraulic conductivity values for each of these units.

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MONITORING WELL OR PIEZOMETER	POWER PLANT COORDINATES	GROUND ELEVATION	TOP OF CONCRETE BASE ELEV.	TOP OF PVC PIPE ELEV.	TOP OF WELL CASING
3D	N. 5672.4 E. 2644.9	530.5			
3F	N. 5672.2 E. 2651.4	530.5			
AP-1	N. 5133.5 E. 835.4	532.9		537.8	
AP-2	N. 4188.8 E. 723.8	533.2		540.3	
AP-3	N. 3808.0 E. 823.5	533.7		535.6	
AP-4	N. 2467.6 E. 1511.8	553.9		554.6	
AW-1	N. 4511.9 E. 2030.4		552.8		556.0
AW-2	N. 5480.6 E. 2361.3		526.7		529.6
AW-3	N. 5608.1 E. 1744.2		537.8		541.5
G-104	N. 5687.2 E. 2305.9	530.6		533.0	533.6
G-106	N. 5149.7 E. 2378.9		524.6	526.1	
G-121	N. 5612.8 E. 2130.0		553.7	555.6	556.0
G-110	N. 3728.6 E. 2315.7		555.2	557.2	557.5
G-112	N. 4450.9 E. 2560.6		552.6	554.8	554.9
G-113	N. 4510.0 E. 2886.0		534.9	537.7	537.8
G-120	N. 5009.4 E. 1986.9	553.1	FLUSH WITH GROUND		
G-122	N. 5613.2 E. 2305.1		552.6	554.4	554.9
P-4	N. 5156.3 E. 2880.7	536.0		539.0	
P-5D	N. 4516.7 E. 2885.0	534.9		537.7	
P-6S	N. 4725.7 E. 2191.4	524.7		527.5	
P-6D	N. 4717.0 E. 2186.8	524.7		534.2	
P-6R	N. 4708.0 E. 2181.0	524.7		531.2	
P-7S	N. 5340.0 E. 2420.0	526.2		528.5	
P-7D	N. 5345.0 E. 2430.0	526.5		528.5	
P-7R	N. 5327.0 E. 2422.0	525.6		528.7	
P-7M	N. 5337.0 E. 2432.8	526.0		528.1	
P-8S	not found				
P-8D	N. 4939.7 E. 2482.7	522.7		530.1	
P-9S	N. 4447.3 E. 2415.6	552.5		555.7	
P-9D	N. 4446.3 E. 2422.4	553.6		556.1	
R-101	N. 4049.5 E. 2863.2		544.0	546.8	547.0
R-102	N. 5673.8 E. 2043.9		535.9	539.2	539.4
R-103	N. 5625.3 E. 2878.4		536.3	538.6	538.8
R-111	N. 4437.4 E. 2249.7	554.0	FLUSH WITH GROUND		

Table 1

Response to 1st RTP
CWLP - 01714

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The fill materials and the shallow sand are not considered to be aquifers. The fill materials are variable consisting of organic, clayey and sandy soils with different hydraulic characteristics. The shallow sand consists of clayey sand and is thin and discontinuous across the site. Neither deposit could produce a sustained pumping rate such that they would be considered sources of groundwater for potable us.

The basal sand is considered the uppermost aquifer at the site. The basal sand consists of silty to clean sands to fine gravel and has a relatively high permeability. The predominant groundwater flow at the site occurs within this deposit.

The bedrock at the site generally consists of shale. In situ hydraulic conductivity tests (slug tests) had little response indicating that the shale is competent and has a low hydraulic conductivity. The bedrock will act as an aquiclude.

The sampling of the piezometers: AP - 1, AP - 2, AP - 3 AP - 4, AW - 3, G-120 and G-110 which surround the ash pond impoundment system indicate minimal exceedence of the 35 IAC 620 Class II groundwater standards. The ash ponds are located in a non-residential area with few residences. If there is any impact from inadvertent leakage of the ponds to the groundwater, it will be relatively minimal as any ash impoundment subsurface leakage will likely flow into Sugar Creek combining with that much greater water flow. Sugar Creek is the same water source that receives the effluent from the ponds after treatment of the solids and pH adjustment as well as sanitary treatment plant discharges further down stream. The clayey soils that the ash ponds are located in and constructed with should retard any migrating pollutants that might otherwise be present.

We hereby certify that the information contained herein is true to the best of our understanding based upon our experience with the City Water, Light and Power ash ponds and landfill.

R. Michael McDermont, PE, CMRS
President
Stabilize, Inc.



(Seal)

Expires: 11/30/2011

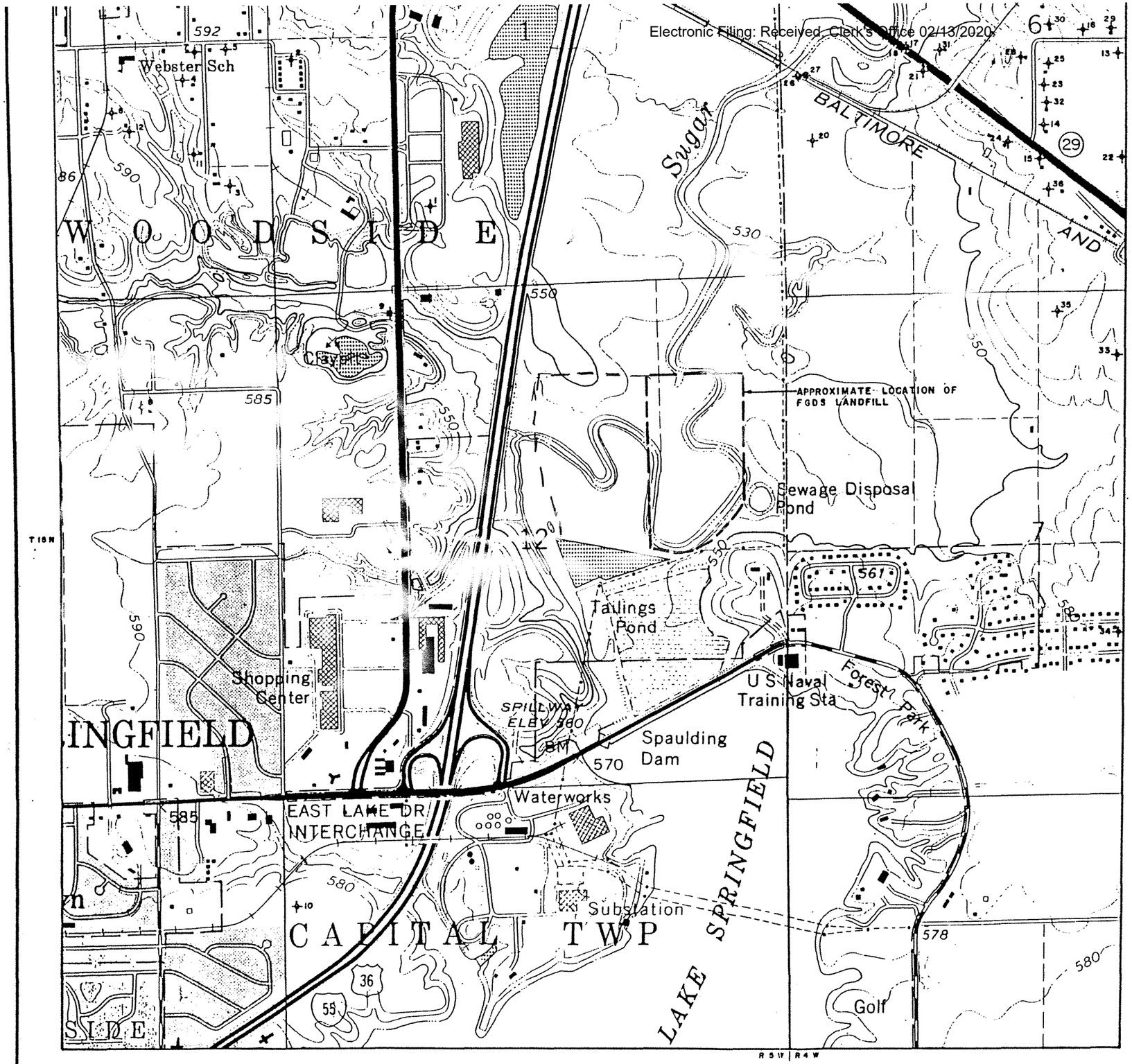
Electronic Filing: Received, Clerk's Office 02/1



FIGURE 1

Response to 1st RTP
CWLP - 01717

Electronic Filing: Received, Clerk's Office 02/13/2020



LEGEND

- 1 (WELL NO.) WATER WELL
- 26 (BORING NO.) SOIL BORING

NOTES:

1. BASE MAP WAS COMPILED FROM THE SPRINGFIELD EAST, ILL. (1976) U.S.G.S. 7.5 MINUTE QUADRANGLE MAP.
2. ALL WELLS (AND BORINGS) IN THE VICINITY OF THE FGDS LANDFILL SITE FOR WHICH RECORDS ARE ON FILE WITH THE ILLINOIS STATE WATER SURVEY AS OF MARCH, 1993 HAVE BEEN PLOTTED.
3. THE TOPOGRAPHY WITHIN LANDFILL AREA HAS CHANGED DUE TO DISPOSAL FACILITY DEVELOPMENT BY CWLP.

SCALE 0 500 1000 FEET

0 1/4 1/2 MILE

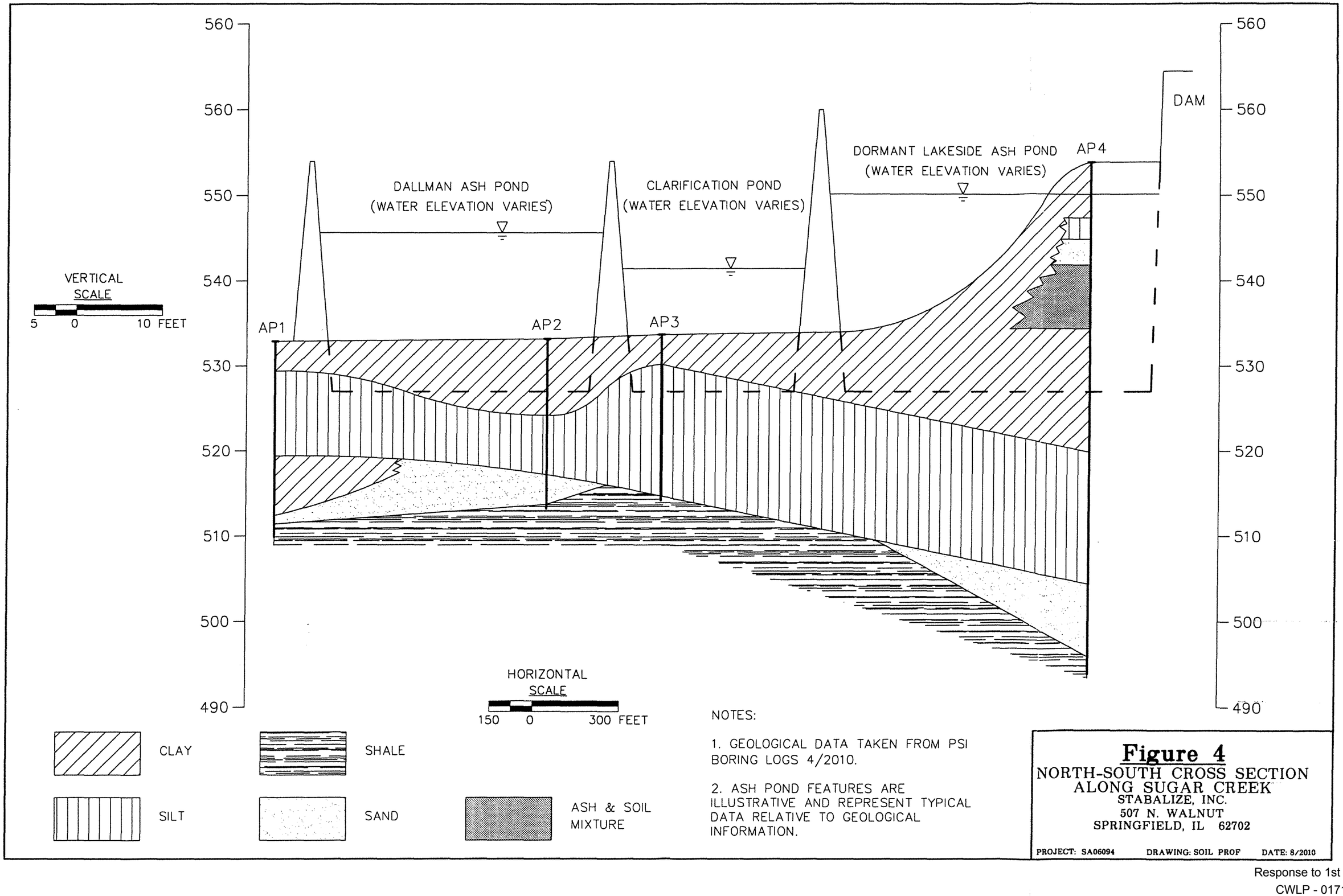
REV.	DATE	DESCRIPTION	DR BY	APP BY

SCALE:	AS SHOWN	PROJECT: HYDROGEOLOGIC INVESTIGATION FGDS LANDFILL, SPRINGFIELD, IL CITY WATER, LIGHT & POWER
DATE:	MARCH, 1993	
DES BY	KRR 3/26/93	SHEET TITLE: WATER WELL LOCATION MAP
DR BY	WRM 3/29/93	
CHK BY	KRR 3/30/93	
APP BY	JCS 4/05/93	

PATRICK ENGINEERING INC.
Engineers • Architects • Hydrologists
Geologists • Surveyors
Springfield, Illinois

SHEET 2 OF 12 4340
DRAWING NO.

Figure 2
Response to 1st RTP
CWLP - 01718



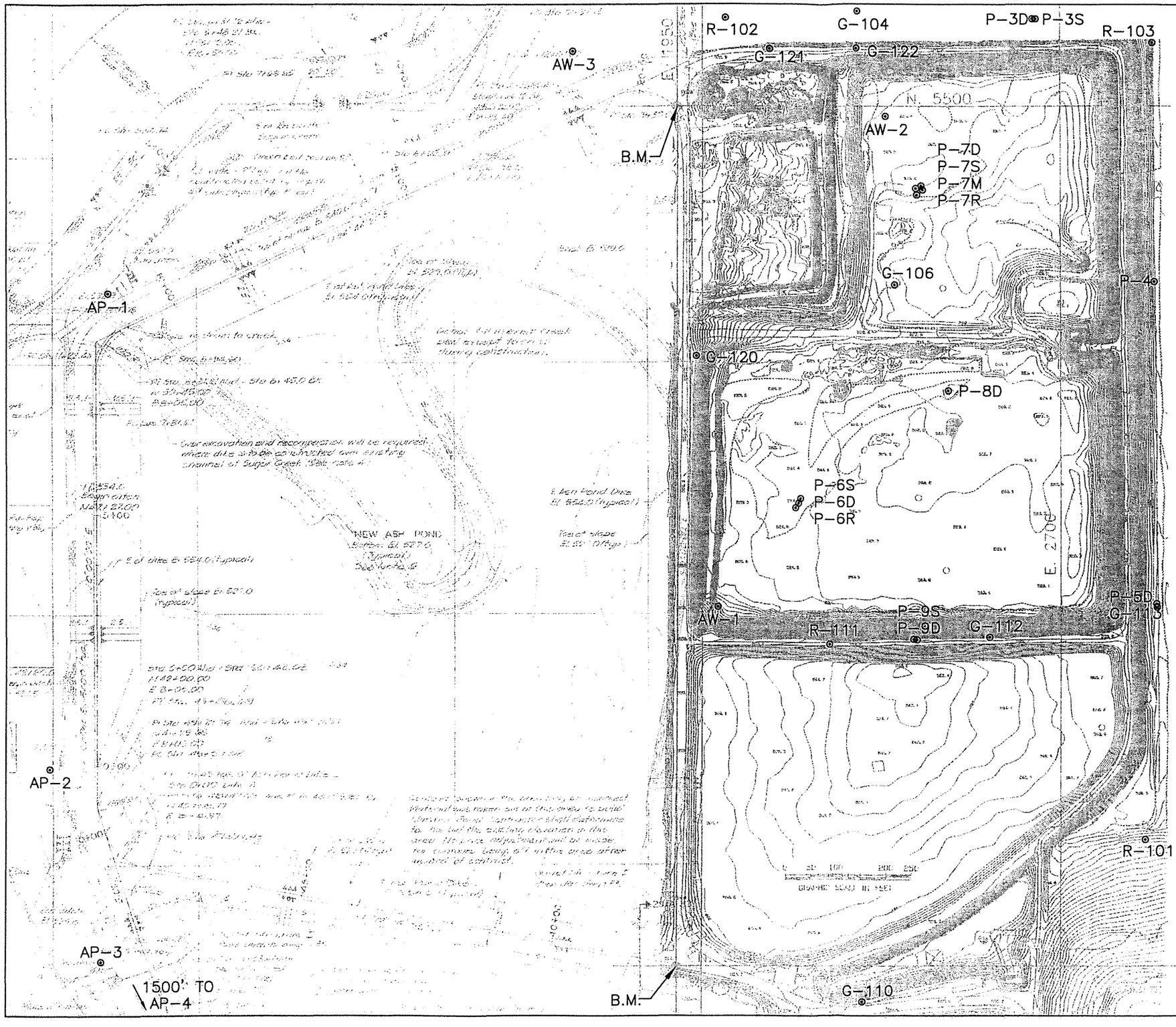
NOTES:

1. GEOLOGICAL DATA TAKEN FROM PSI BORING LOGS 4/2010.

2. ASH POND FEATURES ARE ILLUSTRATIVE AND REPRESENT TYPICAL DATA RELATIVE TO GEOLOGICAL INFORMATION.

Figure 4
NORTH-SOUTH CROSS SECTION
ALONG SUGAR CREEK
STABALIZE, INC.
507 N. WALNUT
SPRINGFIELD, IL 62702

PROJECT: SA06094 DRAWING: SOIL PROF DATE: 8/2010



BENCH MARK – CONCRETE MONUMENT:
POWER PLANT COORDINATES
N. 5500 E. 1950 – ELEVATION 553.16 MSL

BENCH MARK – CONCRETE MONUMENT:
POWER PLANT COORDINATES
N. 3800 E. 1950 – ELEVATION 553.78 MSL

ELEVATION REFERENCES:

N.E. CORNER OF TOP OF CONCRETE STRUCTURE AT S.E. CORNER OF ASH POND: ELEVATION 553.70 FEET MSL.

TOP OF CONCRETE STRUCTURE AT NORTHEASTERLY SIDE OF LAKESIDE ASH POND OPPOSITE METAL STAIRS: ELEVATION 565.03 FEET MSL.

NOTES:

1) WELL AP-4 NOT SHOWN ON MAP.

2) BENCH MARKS COULD NOT BE LOCATED. SURVEY DONE WITH GPS.

3) WELL P-8D AREA INUNDATED BY WATER, NOT SURVEYED. LOCATION UNCHANGED FROM PREVIOUS SURVEY DONE IN APRIL 2008.

4) WELL R-111 IS APPROXIMATELY 8' SOUTH OF PREVIOUS WELL G-111.

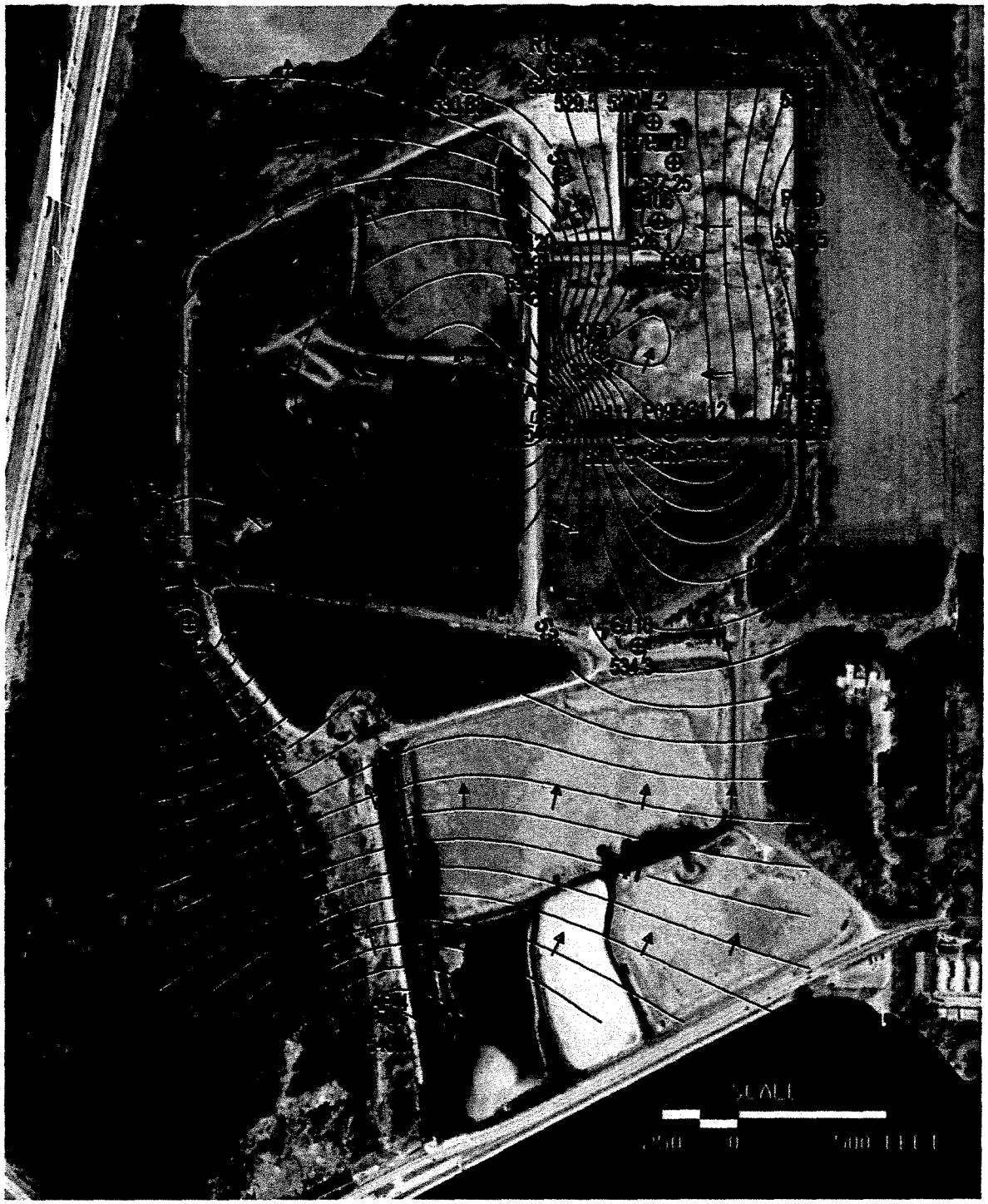
PROFESSIONAL LAND SURVEYOR
DAVID S. MIHELSIC
035-003762
SPRINGFIELD, ILLINOIS
STATE OF ILLINOIS
6/02/10

N

SCALE: 1"=200'

S:\row\Mihelsic\...\wells 2010

CITY WATER LIGHT & POWER SPRINGFIELD, ILLINOIS
MONITORING WELL AND PIEZOMETER
Figure 5
DATE OF SURVEY: MAY, 2010



RAPPS
Engineering & Applied Science, Inc.

821 S. DURKIN DR. • SPRINGFIELD, IL 62704 • (217) 787-2118
P.O. BOX 925 • CARBONDALE, IL 62903 • (618) 521-0574

ILLINOIS PROFESSIONAL DESIGN FIRM No. 184-001130
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Figure 6

POTENTIOMETRIC SURFACE
2ND QUARTER 2010

CITY WATER, LIGHT & POWER
FGDS DEVELOPMENT LANDFILL
SANGAMON COUNTY, ILLINOIS

PROJECT: SA06094 DRAWING: 2Q10 DATE: 8/10

ATTACHMENT A

Electronic Filing: Received, Clerk's Office 02/13/2020

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Pratt, R. Mr. Well No. _____
Address R. R. #7 Springfield IL
Driller Reynolds, Joseph R. License No. 092-6014
11. Permit No. 133085 Date 06/30/87
12. Water from shale 13. County Sangamon
at depth _____ to _____ ft. Sec. 1
14. Screen: Diam. _____ in. Twp. 15 N
Length: _____ ft. Slot _____ Rge. 5 W
Elev. _____

NW NE NE

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PLASTIC	-1	11
36	CONCRETE	11	41

16. Size hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. Formations passed through	Thickness	Bottom
top soil	2	2
yellow clay	10	12
sandy clay	2	14
hardpan	5	19
blue clay	2	21
shale	20	41

Sangamon 12-167-24552-00 01-15N-05W

OUTSIDE

	Thickness	Top	Bottom
Top soil	3	0	3
Yellow clay	15	3	18
Brown clay	1	18	19
Hard pan	5	19	24

Finished in hard pan at 19 to 24'.

Cased with 36" Concrete from 0 to 20'.

Static level from surface 10'.

Tested capacity 20 gallons per minute.
Screen none.
Bottom set at 24'.

S.S. #52306

NO ENVELOPE

COMPANY Miles and Son
FARM Fiskas, Raymond L. NO. 1
DATE DRILLED 1965 COUNTY NO. 1481
AUTHORITY Miles and Son
ELEVATION
LOCATION 430' N line, 320' E line of NW SE SW
COUNTY SANGAMON

1-15N-5W

PEI Assigned Log No. 1

Electronic Filing: Received, Clerk's Office 02/13/2020

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Tomlin, Clarence Well No. #2
Address Shale Bluffs Rd. Springfield IL
Driller Erwin, James License No. 102-2037
11. Permit No. 95882 Date 09/03/80
12. Water from clay 13. County Sangamon
at depth 24 to 25 ft. Sec. 1
14. Screen: Diam. ____ in. Twp. 15 N
Length: ____ ft. Slot ____ Rge. 5 W
Elev. ____

NW NW SW

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PVC	-1	10
36	CONCRETE	10	40

16. Size hole below casing: ____ in.
17. Static level ____ ft. below casing top which is ____ ft. above ground level. Pumping level ____ ft. when pumping at ____ gpm for ____ hours.

18. Formations passed through	Thickness	Bottom
driveway, gravel	1	1
brown clay	20	21
sandy clay	3	24
gray shale	16	40

Sangamon 12-167-24103-00 01-15N-05W

PEI Assigned Log No. 2

LOG OF WATER WELL

Property owner Springfield Dairy Co. Well No. 1
Drilled by Millard Sears Year 1967

Formations passed through	Thickness	Depth of Bottom
top soil	2	2
clay	18	20
Hard pan	3	23
Shale	3	26
Permit NF 3170		
S.S. #54857 COUNTY No. 1482		
Received from Strat. 11-1-67		

(Continue on back if necessary)

Finished in Shale at 23 to 26 ft.
Cased with 36 inch Concrete from 0 to 26 ft.
and ____ inch ____ from ____ to ____ ft.
Size hole below casing Hand dug inch. Static level from surf. 16 ft.
Tested capacity ____ gal. per min. Temperature ____ °F.
Water lowered to ____ ft. ____ in. in ____ hrs. ____ min.
Length of test ____ hrs. ____ min. Screen ____
Slot ____ Diam. ____ Length ____ Bottom set at ____ ft.

[Show location in Section Plat]

Township name Woodside Elev. ____ Sec. 1
Description of location Lot 16 in Twnship plat. Also NW¼ of sec. 1 T15N R5E. Twp 15N
Rge 5E
Signed Marvel Mills County Sangamon
SANGAMON
Copy for Illinois State Geological Survey Index: 1-15N-5W

outside

Response to 1st RTP
CWLP - 01724

Electronic Filing: Received, Clerk's Office 02/13/2020

LOG OF WATER WELL

Property owner H. Brazer Well No. 1

Drilled by E . C . Baker & Sons Year 1957

Formations passed through	Thick-ness	Depth of Bottom
Yellow Clay	22	22
Blue Sandy Shale	2	24

COUNTY No. 22649

[Continue on back if necessary]

Finished in ____ at ____ to ____ ft.

Cased with ____ inch ____ from 0 to ____ ft.

and ____ inch ____ from ____ to ____ ft.

Size hole below casing ____ inch. Static level from surf. ____ ft.

Tested capacity ____ gal. per min. Temperature ____ °F.

Water lowered to ____ ft. ____ in. in ____ hrs. ____ min.

Length of test ____ hrs. ____ min. Screen ____

Slot ____ Diam. ____ Length ____ Bottom set at ____ ft.

[Show location in Section Plat]

Township name Woodside Elev. ____

Description of location 1 Mile South East of Springfield , Ill

Sec. 2 Twp. 15N Rge. 5W

Signed F.F. & J.C. Baker County Sangamon

SANGAMON 2-15N-5W

Copy for Illinois State Geological Survey Index:

PEI Assigned Log No. 3

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Ushman, John Well No. ____
Address R. R. #7 Springfield Il
Driller Reynolds, Joseph R. License No. 092-6014
11. Permit No. 127235 Date 10/02/86
12. Water from sdy clay & sdy gvl 13. County Sangamon
at depth 17 to 27 ft. Sec. 1
14. Screen: Diam. ____ in. Twp. 15 N
Length: ____ ft. Slot ____ Rge. 5 W
Elev. ____

SW NE NE

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PLASTIC	-1	10
36	CONCRETE	10	36

16. Size hole below casing: ____ in.
17. Static level ____ ft. below casing top which is ____ ft. above ground level. Pumping level ____ ft. when pumping at ____ gpm for ____ hours.

18. Formations passed through	Thickness	Bottom
top soil	2	2
yellow clay	10	12
sandy clay	7	19
hardpan	4	23
blue clay	3	26
sand & gravel	1	27
blue clay	9	36

Sangamon 12-167-23817-00 01-15N-05W

OUTSIDE

Response to 1st RTP
CWLP - 01725

Electronic Filing: Received, Clerk's Office 02/13/2020

Property owner Frank Siciliano Well No. 1

Drilled by Miles & Sons Year 66

Formations passed through	Thickness	Depth of Bottom
Yellow Clay Permit NF 691	15	15
Hard pan	10	25
Shale	5	30

COUNTY No. 1484

S.S. #53090

Received with samples. From R. Frame 6-7-66

[Continue on back if necessary]

Finished in Shale at 25 to 30 ft.

Cased with 36 inch Concrete from 0 to 30 ft.

and ____ inch ____ from ____ to ____ ft.

Size hole below casing none inch. Static level from surf 12 ft.

Tested capacity ____ gal. per min. Temperature ____ °F.

Water lowered to ____ ft. ____ in. in ____ hrs. ____ min.

Length of test ____ hrs. ____ min. Screen ____

Slot ____ Diam ____ Length ____ Bottom set at ____ ft.

[Show location in Section Plat]

Township name ____ Elev. ____

Description of location 420 S 60 E NW¼ NW NE SE

Sec. 2 Twp. 15N Rge. 5W

Signed Gerald Miles County Sangamon

Copy for Illinois State Geological Survey Index: SANGAMON 2-15N-5W

PEI Assigned Log No. 4

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Scotty's Self-Service Strge Well No. #1
Address 1035 Outer Park-Suote 310 Springfield IL
Driller Erwin, James License No. 102-2037
11. Permit No. 52539 Date 09/22/76
12. Water from coarse sand 13. County Sangamon
at depth 27 to 30 ft.
14. Screen: Diam. ____ in.
Length: ____ ft. Slot ____
Sec. 2
Twp. 15 N
Rge. 5 W
Elev. ____

NE NE SE

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PVC SCH 40	-1	10
36	CONCRETE	10	40

16. Size hole below casing: ____ in.
17. Static level 10 ft. below casing top which is 1 ft. above ground level. Pumping level ____ ft. when pumping at ____ gpm for ____ hours.

18. Formations passed through	Thickness	Bottom
no record	40	40

PEI Assigned Log No. 5

Sangamon 12-167-24104-00 02-15N-05W

Electronic Filing: Received, Clerk's Office 02/13/2020

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Snyder, Henry Well No. #1
Address 2640 E. Ash Springfield IL
Driller Erwin, James License No. 102-2037
11. Permit No. 118383 Date 06/14/85
12. Water from brown sandy clay 13. County Sangamon
at depth 20 to 22 ft. Sec. 2
14. Screen: Diam. ____ in. Twp. 15 N
Length: ____ ft. Slot ____ Rge. 5 W
Elev. ____

NE NE SE

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PVC SCH 40	-1	10
36	CONCRETE	10	40

16. Size hole below casing: ____ in.
17. Static level ____ ft. below casing top which is ____ ft. above ground level. Pumping level ____ ft. when pumping at ____ gpm for ____ hours.

18. Formations passed through	Thickness	Bottom
top soil	2	2
brown clay	12	14
yl sdy strks brn c	17	31
yellow clay	3	34
ylsh, gray clay	6	40
gray till	0	40

Sangamon 12-167-23620-00 02-15N-05W

PEI Assigned Log No. 7

Property owner Howard J. Schuler Well No. 1
Drilled by Wells & Sons Year 66

Formations passed through Permit NE 708	Thickness	Depth of Bottom
Yellow Clay	15	15
Hard pan	10	25
Shale	5	30
COUNTY No 1485.		
Received 7-12-66		

[Continue on back if necessary]

Finished in Shale at 25 to 30 ft.
Cased with 36 inch Concrete from 0 to 30 ft.
and ____ inch ____ from ____ to ____ ft.
Size hole below casing 40 inch. Static level from surf. 12 ft.
Tested capacity ____ gal. per min. Temperature ____ °F.
Water lowered to ____ ft. ____ in. in ____ hrs. ____ min.
Length of test ____ hrs. ____ min. Screen ____
Slot ____ Diam. ____ Length ____ Bottom set at ____ ft.
[Show location in Section Plat]
Township name ____ Elev. ____
Description of location 1205 150 W
NE SE NW SE
Signed Murrel Wells
Copy for Illinois State Geological Survey

Sec. 2
Twp 15N
Rge. 5W
County Sangamon
SANGAMON
Index: 2-15N-5W

PEI Assigned Log No. 6

Electronic Filing: Received, Clerk's Office 02/13/2020

LOG OF WATER WELL

(3)

Property owner Charles A. Hinsey Well No. 1

Drilled by Spaulding & Clark Drilling Co. Year 1957

Formations passed through	Thickness	Depth of Bottom
Soil	3	3
Yellow clay	16	19
Yellow clay (sandy)	6	25
Blue clay	21	46
Sandstone	1	47
Shale	11	58
Coal	2	60
Underclay	3	63
Shale	2	65
Limestone	22	87
Shale	18	105

COUNTY No. 575

[Continue on back if necessary]

Finished in Limestone at 65 to 87 ft.

Cased with 3 inch Buttweld from 0 to 105 ft.

and ____ inch ____ from ____ to ____ ft.

Size hole below casing 6 inch. Static level from surf. 12 ft.

Tested capacity 4 plus gal. per min. Temperature ____ °F.

Water lowered to ____ ft. ____ in. in ____ hrs. ____ min.

Length of test ____ hrs. ____ min. Screen None

Slot ____ Diam. ____ Length ____ Bottom set at ____ ft.

[Show location in Section Plat]

Township name Woodside Elev. 599

Description of location SW¼ of SW¼ Sec 11

Sec. 11 Twp. 15N Rge. 5W

Signed [signature] County Sangamon

SANGAMON

Copy for Illinois State Geological Survey Index: 11-15N-5W

outside

10. Property owner GEORGE HAMMONS Well No. ____
Address 800 S. 16TH Spfld, Ill
Driller ERWIN License No. 102-203
11. Permit No. 74921 Date MAY 31, 78
12. Water from CLAY Formation 13. County SANGAMON
at depth 16 to 19 ft. Sec. 11
14. Screen: Diam. ____ in. Twp. 15N
Length: ____ ft. Slot ____ Rge. 5W
Elev. ____

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
6"	SCH 40 PLASTIC		10
36" ID	CONCRETE	10	40

SHOW LOCATION IN SECTION PLAT

SE ¼. NW ¼. NE ¼.

16. Size Hole below casing: ____ in.
17. Static level 10 ft. below casing top which is 1 (permit) ft. above ground level. Pumping level ____ ft. when pumping at ____ gpm for ____ hours. Sub. pump set at 34'

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
TOP SOIL	2	2
BROWN CLAY	5	7
BROWN & WHITE CLAY	9	16
BROWN SANDY CLAY	3	19
SAND ROCK	1	20
BROWN SHALE	2	22
GRAY SHALE	18	40

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED James Erwin DATE 5/31/78

SANGAMON COUNTY No. 22812 11-15N-5W

PEI Assigned Log No. 8

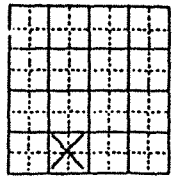
Electronic Filing: Received, Clerk's Office 02/13/2020

Page 1 **ILLINOIS GEOLOGICAL SURVEY, URBANA**

	Thickness	Top	Bottom
Bridge boring #1 Section 1SB Sta. 479+54 111' Rt. Cl. Med.			
Clay, silty, black	1.5		1.5
Clay, silty, yellow-brown - stiff	4		5.5
Clay loam, silty, yellow & gray mottled - stiff	4		9.5
Clay, silty, gray-brown - medium	5		14.5
Clay, sandy, gray-brown - stiff	4.5		19
Clay till, sandy, brown - very stiff	3		22
Clay till, brown - hard	6		28
			T.D.
Copy of Highway Division log filed in Groundwater Section			
Typed by Engineering Geology Section			
NO ENVELOPE			

COMPANY Illinois Division of Highways
FARM FA 196 under GM&O RR. NO. 1
DATE DRILLED 11-9-64 COUNTY NO. 1487
AUTHORITY Log by Division of Highways
ELEVATION 607.0'
LOCATION SE¼ SW¼
COUNTY SANGAMON

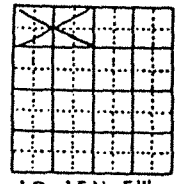
outside


13-15N-5W

Page 1 **ILLINOIS GEOLOGICAL SURVEY, URBANA**

	Thickness	Top	Bottom
Brown silty clay, loam - frozen	1.5		1.5
Gray and brown mottled silty clay loam with some vegetation	3		4.5
Dark gray loam, organic	3		7.5
Weathered brown shale - loose fragments	3		10.5
Black shale - fissile	1		11.5
			TD
Bridge boring #1 Section 17X Station 53+80 73' Left Center Line Med.			
Copy of Highway Division Log filed in Groundwater Section			
NO ENVELOPE			

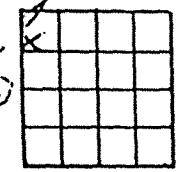
COMPANY Illinois Division of Highways
FARM FA 169 Culvert NO. B-1
DATE DRILLED February 4, 1966 COUNTY NO. 1486
AUTHORITY Log by Division of Highways
ELEVATION 536' G.L.
LOCATION N/2 NW
COUNTY SANGAMON


12-15N-5W

PEI Assigned Log No. 9

Electronic Filing: Received, Clerk's Office 02/13/2020

10. Property owner Richard Fortune Well No. ____
Address 172 E Hazel Dell - Sprfld, Ill
Driller Milo L Sam License No. 92-503
11. Permit No. NE-4955 Date Sept 24 68
12. Water from Clay Formation 13. County Sangamon
at depth 14 to 16 ft. Sec. 13
14. Screen: Diam. None in. Twp. 15N
Length: ____ ft. Slot ____ Rge. 5W
Elev. ____



15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
36	Concrete	+1	2.0

SHOW LOCATION IN SECTION PLAT
SW NW NW
(permit)

16. Size Hole below casing: None in.
17. Static level 14 ft. below casing top which is ____ ft. above ground level. Pumping level ____ ft. when pumping at ____ gpm for ____ hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
Top Soil	2	2
Yellow Clay	12	14
Brown Clay	6	20

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED Marvel Miller DATE 10-13-68

COUNTY No. 1375

SANGAMON 13-15N-5W

PEI Assigned Log No. 10

Page 1 **ILLINOIS GEOLOGICAL SURVEY, URBANA**

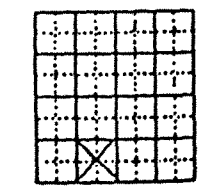
Strata	Thickness	Top	Bottom
Bridge boring #4 Section 1SB Sta. 482+26, 111' Lt. CL. Med.			
Clay, silty, black	1.5		1.5
Clay loam, silty, yellow-brown - medium	5		6.5
Clay loam, silty, yellow & gray mottled - stiff	2.5		9
Clay, silty, gray-brown - medium	7.5		16.5
Clay, sandy, gray & brown mottled - medium	3		19.5
Clay, gray-brown - very stiff	4.5		24
Clay till, sandy, brown - hard	4.5		28.5
Gray limestone boulder -cored	.5		29
Clay till, gray-brown	1.5		30.5
Diorite boulder -cored			
Limestone boulder - cored; 95% recovery	2.5		33
Clay till, gray	4.5		37.5
			T.D.

Typed by Engineering Geology Section

Copy of Highway Division log filed in Groundwater Section NO ENVELOPE

COMPANY Illinois Division of Highways
FARM FA 196 under GM&O RR. NO. 4
DATE DRILLED 11-10-64 COUNTY NO. 1488
AUTHORITY Log by Division of Highways
ELEVATION 605.5'
LOCATION SE¼ SW¼
COUNTY SANGAMON

outside



13-15N-5W

Response to 1st RTP
CWLP - 01730

Electronic Filing: Received, Clerk's Office 02/13/2020

Completed 9-6-78

10. Property owner ROBERT CLARK Well No. 1
Address 1933 So. 18th.
Driller ERWIN License No. 102-205
11. Permit No. 78727 Date 8-30-78
12. Water from CLAY Formation 13. County SANGAMON
at depth 25 to 26' ft. Sec. 2
14. Screen: Diam. ____ in. Twp. 15N
Length: ____ ft. Slot ____ Rge. 5W
Elev. ____

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
6"	PVC SCH 40		16
36"	CONCRETE	10	45

SHOW LOCATION IN SECTION PLAT
SW NE SE
(permit)

16. Size Hole below casing: ____ in.
17. Static level 20 ft. below casing top which is / ft. above ground level. Pumping level ____ ft. when pumping at ____ gpm for ____ hours. Sub. pump set at 40'

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
BROWN CLAY	20	20
BROWN HARDPAN	4	24
SANDY CLAY	2	26
BROWN HARD PAN	4	30
SHALE - GRAY	15	45

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED Jim Erwin DATE Sept 18, 78

SANGAMON COUNTY No. 22807 2-15N-5W

PEI Assigned Log No. 11

10. Property owner ROBERT CLARK Well No. 2
Address SPRINGFIELD
Driller GEORGE COOK License No. 46452 102-61
11. Permit No. 46452 Date 4-76
12. Water from SANDY CLAY Formation 13. County SANGAMON
at depth 14' to ____ ft. Sec. 2
14. Screen: Diam. ____ in. Twp. 15N
Length: ____ ft. Slot ____ Rge. 5W
Elev. ____

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
6"	PLASTIC	+1	-2
36"	CONCRETE	-2	-30

SHOW LOCATION IN SECTION PLAT
NE NE NE
(permit)

16. Size Hole below casing: ____ in.
17. Static level ____ ft. below casing top which is ____ ft. above ground level. Pumping level ____ ft. when pumping at ____ gpm for ____ hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
TOP SOIL		2
YELLOW CLAY		12
SANDY CLAY		17
HARD PAN		24
BLUE CLAY		28
SHALE		30

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED George Cook DATE 4-76

SANGAMON COUNTY No. 22453 2-15N-5W

outside

Electronic Filing: Received, Clerk's Office 02/13/2020

10. Prope.. , owner Henry J. Keller Well No. 1
Address 215 E. Clayton Sprfld, Ill.
Driller Miles & Sons License No. 92-503
11. Permit No NE 0765 Date Sept 26, 1966
12. Water from Clay Formation 13. County Sangamon
at depth 29 to 30 ft. Sec. 2
14. Screen: Diam. 2 in. Twp. 15N
Length: ____ ft. Slot ____ Rge. 5W
Elev. ____

SHOW LOCATION IN SECTION PLAT
SE/4 NW SE (permit)

15. Casing and Liner Pipe

Diam. (In.)	Kind and Weight	From (Ft.)	To (Ft.)
36	Concrete	+1	39

16. Size Hole below casing: Hand dug in.
17. Static level 2.7 ft. below casing top which is 1 ft. above ground level. Pumping level ____ ft. when pumping at ____ gpm for ____ hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
yellow Clay	25	25
Sandy Clay	5	30
Blue Clay	9	39

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED Murrel Miles DATE 12/6/66

COUNTY No. 1429

SANGAMON 2-15N-5W

PEI Assigned Log No. 12

LOG OF WATER WELL

Page 1

Property owner M. H. Clayton Well No. 1
Drilled by Miles & Sons Year 66
Permit NE 709

Formations passed through	Thickness	Depth of Bottom
Yellow Clay	15	15
Hard pan	10	25
Shale	5	30

COUNTY No 1483.

Received 7-12-66

[Continue on back if necessary]

Finished in Shale at 25 to 30 ft.
Cased with 36 inch Concrete from 0 to 30 ft.
and ____ inch ____ from ____ to ____ ft.
Size hole below casing Hand inch. Static level from surf. 1F ft.
Tested capacity ____ gal. per min. Temperature ____ °F.
Water lowered to ____ ft. ____ in. in ____ hrs. ____ min.
Length of test ____ hrs. ____ min. Screen ____
Slot ____ Diam. ____ Length ____ Bottom set at ____ ft.

[Show location in Section Plat]

Township name ____ Elev. ____ Sec. 2
Description of location 460 S 60 E. Twp 15N
Mi. SE NW SW Rge. 5W
Signed Murrel Miles County Sangamon
SANGAMON
Copy for Illinois State Geological Survey Index: 2-15N-5W

outside

Response to 1st RTP
CWLP - 01732

Electronic Filing: Received, Clerk's Office 02/13/2020

10. Property owner Jack Burnstine Well No. _____
Address 16 Wood Mill Road Sherman, Il. 62684
Driller Joseph R. Reynolds License No. 92-601
11. Permit No. 86116 Date May 29, 1979
12. Water from Clay (Formation) 13. County Sangamon
at depth 16 to 27 ft. Sec. 6
14. Screen: Diam. _____ in. Twp. 15N
Length: _____ ft. Slot _____ Rge. 4W
Elev. _____

SHOW LOCATION IN SECTION PLAT
NE NW SE
(permit)

15. Casing and Liner Pipe

Diam. (In.)	Kind and Weight	From (Ft.)	To (Ft.)
10	Plastic	+1	-9
36	Concrete	-9	-27

16. Size Hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours. Sub. pump set at 20'

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
Top Soil	0-3'	
Clay	20'	
Glacial Drift	27'	

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED Joyce K Reynolds DATE May 30, 1979
Cook & Reynolds Well Drilling, Inc.
R.R. 5 - 3300 Terminal Avenue
Springfield, Il. 62707
No. 23084 6-15N-4W
SANGAMON

PEI Assigned Log No. 13

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Bortmess, Ron Well No. _____
Address 605 South Walnut St. Rochester IL
Driller Reynolds, Joseph R. License No. 092-6014
11. Permit No. 117031 Date 03/29/85
12. Water from sandy clay 13. County Sangamon
at depth 17 to _____ ft. Sec. 6
14. Screen: Diam. _____ in. Twp. 15 N
Length: _____ ft. Slot _____ Rge. 4 W
Elev. _____

NW NW SE

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PLASTIC	-1	10
36	CONCRETE	10	32

16. Size hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. Formations passed through	Thickness	Bottom
top soil	2	2
yellow clay	10	12
sandy clay	7	19
hardpan	4	23
blue clay	5	28
shale	4	32
limestone	0	32

Sangamon 12-167-23577-0.0 06-15N-04W

PEI Assigned Log No. 14

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Cheffy, Edward Well No. _____
Address 1 Linden Lane Springfield IL
Driller Reynolds, Joseph R. License No. 092-6014
11. Permit No. 117670 Date 05/07/85
12. Water from sandy clay 13. County Sangamon
at depth 18 to _____ ft.
14. Screen: Diam. _____ in.
Length: _____ ft. Slot _____
Sec. 6
Twp. 15 N
Rge. 4 W
Elev. _____

NW NW SE

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PLASTIC	-1	11
36	CONCRETE	11	32

16. Size hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. Formations passed through	Thickness	Bottom
top soil	2	2
yellow clay	12	14
sandy clay	5	19
hardpan	2	21
sandstone	2	23
shale	9	32
limestone	0	32

Sangamon 12-167-23602-00 06-15N-04W

PEI Assigned Log No. 15

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Chastain, George Well No. #1
Address 18 Apache Drive Springfield IL
Driller Erwin, James License No. 102-2037
11. Permit No. 52461 Date 09/21/76
12. Water from clay 13. County Sangamon
at depth 18 to 19 ft.
14. Screen: Diam. _____ in.
Length: _____ ft. Slot _____
Sec. 6
Twp. 15 N
Rge. 4 W
Elev. _____

SE SW NE

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PVC SCH 40	-1	10
36	CONCRETE	10	30

16. Size hole below casing: _____ in.
17. Static level 10 ft. below casing top which is 1 ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. Formations passed through	Thickness	Bottom
no record	30	30

Sangamon 12-167-24055-00 06-15N-04W

PEI Assigned Log No. 16

(2540) Electronic Filing: Received, Clerk's Office 02/13/2020

ILLINOIS GEOLOGICAL SURVEY, URBANA

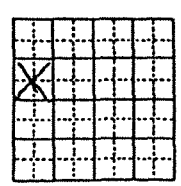
	Thickness	Top	Bottom
Bridge boring #1 Section 8-BR-1 Sta. 61+40 12' Rt. CL NB Ln			
Clay, yellow and gray mottled - stiff	9		9
Clay, silty, yellow and gray mottled medium	6.5		15.5
Clay, yellow and gray mottled - very stiff	4.5		20
Sandstone, shaly, light gray - 5' core-run, 80% retained	5		25 T.D.

Copy of Highway Division log filed in Groundwater Section

Typed By Engineering Geology Section

NO ENVELOPE

COMPANY Illinois Division of Highways
FARM FA 25 over Sugar Creek NO. 1
DATE DRILLED 9-4-63 COUNTY NO. 1472
AUTHORITY ~~Log~~ by Division of Highways
ELEVATION 545.0'
LOCATION NW SW
COUNTY SANGAMON

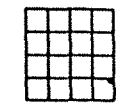


6-15N-4W

PEI Assigned Log No. 17

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Edwards, Ken Well No. _____
Address R. R. #7 Springfield IL
Driller Reynolds, Joseph R. License No. 092-6014
11. Permit No. 136875 Date 11/03/87
12. Water from sandy clay 13. County Sangamon
at depth _____ to _____ ft.
14. Screen: Diam. _____ in.
Length: _____ ft. Slot _____
Sec. 6
Twp. 15 N
Rge. 4 W
Elev. _____



15. Casing and Liner Pipe SE SE NE

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PLASTIC	-1	15
36	CONCRETE	15	33
24	CONCRET	31	55

16. Size hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. Formations passed through	Thickness	Bottom
top soil	2	2
yellow clay	12	14
sandy clay	5	19
hardpan	4	23
blue clay	4	27
shale	28	55

Sangamon 12-167-24618-00 06-15N-04W

outside

Response to 1st RTP
CWLP - 01735

Electronic Filing: Received, Clerk's Office 02/13/2020

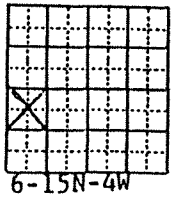
Page 1 **ILLINOIS GEOLOGICAL SURVEY, URBANA**

	Thickness	Top	Bottom
Bridge boring #3 Section 8-BR-1 Sta. 59+07 Rt. 22' CL NB Ln			
Clay, silty, light brown - soft	14		14
Clay loam, sandy, brown and gray mottled - medium	5.5		19.5
Clay loam, gray - organic, soft, with pieces of decayed wood	4		23.5
Sand, gray - medium, loose	6		29.5
Clay loam, light gray - soft	7.5		37
Clay till, light gray, angular and sharp; fragments of rock mix ½" - very stiff	3		40
Clay, shaly, light gray - very stiff to hard	5		45
			T.D.

Typed by Engineering Geology Section
Copy of Highway Division Log
filed in Groundwater Section

NO ENVELOPE

COMPANY Illinois Division of Highways
FARM FA 25 over Sugar Creek NO. 3
DATE DRILLED 9-6-63 COUNTY NO. 1474
AUTHORITY Log by Division of Highways
ELEVATION 541.0'
LOCATION NW SW
COUNTY SANGAMON



PEI Assigned Log No. 18

Page 1 **ILLINOIS GEOLOGICAL SURVEY, URBANA**

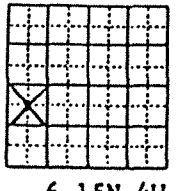
	Thickness	Top	Bottom
Bridge boring #2 Section 8-BR-1 Sta. 60+35 CL NB Ln			
Sandy loam, light brown	3		3
Clay, silty, gray and green mottled, with pieces of decayed wood - medium	7		10
Shale, gray-green - weak; stiff	6		16
Shale, light gray - very stiff;	3		19
core-run, 50% retained	2.5		21.5
			T.D.

Copy of Highway Division log
filed in Groundwater Section

Typed by Engineering Geology Section

NO ENVELOPE

COMPANY Illinois Division of Highways
FARM FA 25 over Sugar Creek NO. 2
DATE DRILLED 9-6-63 COUNTY NO. 1473
AUTHORITY Log by Division of Highways
ELEVATION 519.5'
LOCATION NW SW
COUNTY SANGAMON



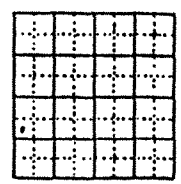
PEI Assigned Log No. 19

Response to 1st RTP
CWLP - 01736

Electronic Filing: Received, Clerk's Office 02/13/2020

Strata	Thickness	Top	Bottom
GEOLOGICAL RECORD: (Sample Data)			
Pennsylvanian System		50	555
Mississippian System		555	1538
Aux Vases sandstones, no show oil		610	652
Ste. Genevieve limestone		652	662
Rosiclare formation, no show of oil		662	670
Fredonia, St. Louis & Salem formations, undifferentiated.		670	902
Osage shales		902	
Keokuk-Burlington limestones, dolomites and shales of the Osage series, no shows of oil.		1066	1418
Choteau (Louisiana) limestone		1418	1422
Kinderhook shales		1422	1474
New Albany shale		1474	1538
Silurian System (Devonian Absent)		1538	1600
Dolomite, white to light gray, very fine sucrosic, tight, slightly porous, no shows of oil.			
Core #1: Recovered 25' Dolomite, white and light gray grading in part to gray-greenish, fine sucrose to dense argillaceous, slight traces or porosity, no shows of oil.		1547	1572
Drilled:		1572	1600
Dolomite, light gray-greenish, tight, non-porous, no shows of oil.		1572	1590
Limestone, dolomitic, white, to light gray, slightly fossiliferous with traces of chert, no show of oil.		1590	1600
Total Depth			1600
Casing: 8 5/8" cemented at 65'. 7 7/8" hole, 65' to T.D.			

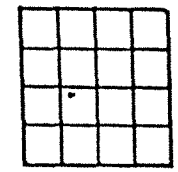
COMPANY Otto Krachik
FARM Graham, Geo. NO. 1
DATE DRILLED October 1958 COUNTY NO. 607
AUTHORITY R. F. Anderson
ELEVATION 535' DF, Company
LOCATION 330' S line, 330' W line of NW SW
COUNTY SANGAMON



6-15N-4W

PEI Assigned Log No. 20

10. Property owner Joseph Parris III Well No. _____
Address 2072 N 7th SPRINGFIELD
Driller George Cook License No. 102-61
11. Permit No. 31985 SHALE Date 8-8-74
12. Water from ~~Formation~~ 13. County SANGAMON
at depth 19 to _____ ft.
14. Screen: Diam. _____ in.
Length: _____ ft. Slot _____
Sec. 6
Twp. 15N
Rge. 4W
Elev. _____



15. Casing and Liner Pipe

Diam. (In.)	Kind and Weight	From (Ft.)	To (Ft.)
6"	PLASTIC	+1	-10
36"	CONCRETE	-10	-41

SHOW LOCATION IN SECTION PLAT
300'NL, 120'WL
NE SW
(Permit)

16. Size Hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
TOP SOIL	3	3
YELLOW CLAY	12	15
HARD PAN	2	17
SHALE	23	40

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED George Cook DATE 9-74

COUNTY No. 22078

SANGAMON 6-15N-4W

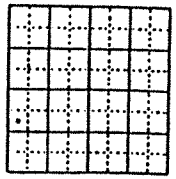
PEI Assigned Log No. 21

Response to 1st RTP
CWLP - 01737

Electronic Filing: Received, Clerk's Office 02/13/2020

Strata	Thickness	Top	Bottom
CORE #1 1547-1572'			
SILURIAN			
Dolomite, faint light greenish-gray, white specks, slightly chalky, mostly finely crystalline in streakd, pin head vugs in streaks	2.0		1949.0
Dolomite, light greenish-gray, white specks in streaks, a few pin head vugs scattered top 10' and calcareous bottom 4'	23.0		1572.0

COMPANY Otto Krachik
FARM Graham, George NO. 1
DATE DRILLED October, 1958 COUNTY NO. 607
AUTHORITY W. F. Meents
ELEVATION 535'DF - Company
LOCATION 330'S line, 330'W line, of NW SW
COUNTY SANGAMON CORE#3777



6-15N-4W

PEI Assigned Log No. 20

Strata	Thickness	Top	Bottom
Dry and abandoned. Plugged October 15, 1958. Coal, 365-371'. Information from Plugging Affidavit.			
Electric log not run - Company			
Radio Active Survey not run - Company			
Time log filed.			
S.S.# 32858			

COUNTY Otto Krachik
SANGAMON

Graham, Geo. #1
6-15N-4W

Response to 1st RTP
CWLP - 01738

Electronic Filing: Received, Clerk's Office 02/13/2020

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Hewitt, Ross Well No. _____
Address 2421 E. Griffiths Ave Springfield IL
Driller Reynolds, Joseph R. License No. 092-6014
11. Permit No. 124380 Date 06/06/86
12. Water from sandy clay 13. County Sangamon
at depth 19 to _____ ft. Sec. 6
14. Screen: Diam. _____ in. Twp. 15 N
Length: _____ ft. Slot _____ Rge. 4 W
Elev. _____

SE NW SE

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PLASTIC	-1	13
36	CONCRETE	13	32

16. Size hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. Formations passed through	Thickness	Bottom
top soil	2	2
yellow clay	10	12
sandy clay	7	19
hardpan	7	26
shale	6	32
limestone	0	32

Sangamon 12-167-23743-00 06-15N-04W

PEI Assigned Log No. 22

GEOLOGICAL WATER SURVEYS WATER WELL RECORD
Completed 7-21-68

10. Dept. Mines and Minerals permit No. NP 4429 Year 68
11. Property owner ALVAN HEISSINGER Well No. 1
Address RR #7 SPRINGFIELD ILL.
Driller MILLER & SON License No. 92-263
12. Water from SAND Formation 13. County SANGAMON
at depth 18 to 20 ft. Sec. 6
14. Screen: Diam. _____ in. Twp. 15N
Length: _____ ft. Slot _____ Rng. 4W
Elev. _____

SHOW LOCATION IN SECTION PLAT
NW SE SE
(permit)

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
36	CONCRETE	-1	30

16. Size Hole below casing: NONE in.
17. Static level 15 ft. below casing top which is 1 ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
CLAY	18	18
SAND - COARSE	2	20
SANDY LOAM	10	30
(CONTINUE ON SEPARATE SHEET IF NECESSARY)		

SIGNED Marvin L. Miller DATE July 21, 68

1318

SANGAMON 6-15N-4W

OUTSIDE

Response to 1st RTP
CWLP - 01739

Electronic Filing: Received, Clerk's Office 02/13/2020

Completed 3-76

10. Property owner [illegible] Well No. _____
Address [illegible] SPRINGFIELD
Driller [illegible] License No. [illegible]
11. Permit No. [illegible] Date 3-10-76
12. Water from [illegible] Formation 13. County [illegible]
at depth 22' to _____ ft. Sec. 6
14. Screen: Diam. _____ in. Twp. 15N
Length: _____ ft. Slot _____ Rge. 4W
Elev. _____

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
6"	PLASTIC	+1	10
36"	CONCRETE	10	22

SHOW LOCATION IN SECTION PLAT
NW NW SE (permit)

16. Size Hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
Top Soil		3
yellow clay		11
Sandy clay		19
Hard pan Rock		2Y
yellow clay		27
Rock		27

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED [illegible] DATE 3-76

SANGAMON COUNTY No. 2244

6-15N-4W

PEI Assigned Log No. 234

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Kutscher, Larry Well No. _____
Address 616 Woodland Ave. Springfield IL
Driller Reynolds, Joseph R. License No. 092-6014
11. Permit No. 120043 Date 08/30/85
12. Water from sand 13. County Sangamon
at depth _____ to 17 ft. Sec. 6
14. Screen: Diam. _____ in. Twp. 15 N
Length: _____ ft. Slot _____ Rge. 4 W
Elev. _____

15. Casing and Liner Pipe SE NW SE

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PLASTIC	-1	10
36	CONCRETE	10	22

16. Size hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. Formations passed through	Thickness	Bottom
top soil	2	2
yellow clay	10	12
sandy clay	4	16
sand	1	17
hardpan	5	22
limestone	0	22

Sangamon 12-167-23666-00 06-15N-04W

OUTSIDE

Response to 1st RTP
CWLP - 01740

Electronic Filing: Received, Clerk's Office 02/13/2020

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Sabo, Chuck Well No. _____
Address R. R. #7 Springfield IL
Driller Reynolds, Joseph R. License No. 092-6014
11. Permit No. 133081 Date 06/30/87
12. Water from sandstone 13. County Sangamon
at depth _____ to _____ ft.
14. Screen: Diam. _____ in.
Length: _____ ft. Slot _____
Sec. 6
Twp. 15 N
Rge. 4 W
Elev. _____

SE NE SW

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PLASTIC	-1	13
36	CONCRETE	13	22
24	CONCRETE	21	36

16. Size hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. Formations passed through	Thickness	Bottom
top soil	2	2
yellow clay	12	14
hardpan	8	22
sandstone	14	36

Sangamon 12-167-24549-00 06-15N-04W

PEI Assigned Log No. 24

10. Property owner STEVEN LEACH Well No. _____
Address R R #1 ROCHESTER
Driller GEORGE COOK License No. 102.21
11. Permit No. 31572 Date 7-26
12. Water from SANDY CLAY 13. County SANGAMON
Formation
at depth 17 to _____ ft.
14. Screen: Diam. _____ in.
Length: _____ ft. Slot _____
Sec. 6
Twp. 15N
Rge. 4W
Elev. _____

SHOW LOCATION IN SECTION PLAT

NW NW SE (Permit)

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
6"	PLASTIC	+-	-10
36"	CONCRETE	-10	-22

16. Size Hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
TOP SOIL	4	4
YELLOW CLAY	12	16
SANDY CLAY	3	19
HARD PAN	6	25
SAND STONE	3	28

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED George Cook DATE 8-7-26

COUNTY No. 22079

SANGAMON 6-15N-4W

PEI Assigned Log No. 25

Electronic Filing: Received, Clerk's Office 02/13/2020

ILLINOIS GEOLOGICAL SURVEY, URBANA

Bridge boring #3
Section 8-B-1
Sta. 59+52 8' Rt. CL.

	Thickness	Top	Bottom
Clay loam, brown - fill	9		9
Loam, sandy, brown - medium	4		13
Loam, sandy, brown - very soft	5		18
Loam, sandy, dark gray-green, organic - very soft	5		23
Clay loam, sandy, dark gray-green, organic - soft	2.5		25.5
Clay, varved, light gray - very soft	3		28.5
Loam, silty, gray-brown, organic - medium	7		35.5
Silt, gray, organic - medium	5.5		41
Clay, silty, gray - medium	2.5		43.5
Shale, light gray - stiff	9		52.5
			T.D.

Copy of Highway Division log
filed in Groundwater Section
Typed by Engineering Geology Section

NO ENVELOPE

COMPANY Illinois Division of Highways
FARM SBI-24 over Sugar Creek NO. 3
DATE DRILLED 4-18-61 COUNTY NO. 1477
AUTHORITY Log by Highway Division
ELEVATION 536.2'
LOCATION NW SW
COUNTY SANGAMON

6-15N-4W

PEI Assigned Log No. 26

ILLINOIS GEOLOGICAL SURVEY, URBANA

Bridge boring #1
Section 8-B-1
Sta. 61+00 5' Lt. CL

	Thickness	Top	Bottom
Clay loam, dark brown; fill material	6		6
Clay, yellow and gray mottled, silty; very stiff	2.5		8.5
Silt, yellow and gray mottled - medium	4.5		13
Clay, shaly, blue-green and brown layered - very stiff	2.5		15.5
Shale, sandy, red-brown - very stiff	2.5		18
Shale, sandy, blue-gray; hard; core	3		21
Shale, gray - very stiff; core	18		39
			T.D.

Copy of Highway Division log
filed in Groundwater Section

Typed by Engineering Geology Section

NO ENVELOPE

COMPANY Illinois Division of Highways
FARM SBI-24 over Sugar Creek NO. 1
DATE DRILLED 4-11-61 COUNTY NO. 1476
AUTHORITY Log by Highway Division
ELEVATION 542.7'
LOCATION NW SW
COUNTY SANGAMON

6-15N-4W

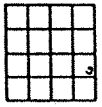
PEI Assigned Log No. 27

Response to 1st RTP
CWLP - 01742

Electronic Filing: Received, Clerk's Office 02/13/2020

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Miller, Don T. Well No. _____
Address R.R. Box #296 New Berlin IL
Driller Reynolds, Joseph R. License No. 092-6014
11. Permit No. 96725 Date 10/21/80
12. Water from sandy clay 13. County Sangamon
at depth 17 to _____ ft. Sec. 6
14. Screen: Diam. _____ in. Twp. 15 N
Length: _____ ft. Slot _____ Rge. 4 W
Elev. _____



15. Casing and Liner Pipe SE NE SE

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PLASTIC	-1	10
36	CONCRETE	10	29

16. Size hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

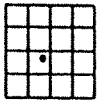
18. Formations passed through	Thickness	Bottom
top soil	2	2
yellow clay	10	12
sandy clay	7	19
hardpan	5	24
sandstone	5	29
rock	0	29

Sangamon 12-167-24058-00 06-15N-04W

outside

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Luster, Orla J. Well No. #1
Address Apt. #400 Lincoln Towers Springfield IL
Driller Erwin, James License No. 102-2037
11. Permit No. 67185 Date 09/23/77
12. Water from _____ 13. County Sangamon
at depth _____ to _____ ft. Sec. 6
14. Screen: Diam. _____ in. Twp. 15 N
Length: _____ ft. Slot _____ Rge. 4 W
Elev. _____



15. Casing and Liner Pipe NE NE SW

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PVC SCH 40	-1	10
36	CONCRETE	10	40

16. Size hole below casing: _____ in.
17. Static level _____ ft. below casing top which is 1 ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. Formations passed through	Thickness	Bottom
no records	40	40

Sangamon 12-167-24056-00 06-15N-04W

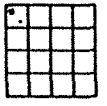
PEI Assigned Log No. 28

Response to 1st RTP

CWLP - 01743

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Sanderfield, Dennis Well No. #2
Address Springfield IL
Driller Erwin, James License No. 102-2037
11. Permit No. 89674 Date 09/18/79
12. Water from _____ 13. County Sangamon
at depth _____ to _____ ft.
14. Screen: Diam. _____ in.
Length: _____ ft. Slot _____
Sec. 6
Twp. 15 N
Rge. 4 W
Elev. _____



15. Casing and Liner Pipe NW NW NW

Diam. (in.)	Kind and Weight	From (ft)	To (ft)

16. Size hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

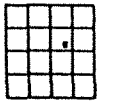
18. Formations passed through	Thickness	Bottom
brown clay	18	18
brown shale	6	24
gray shale	24	48
blk slate (hd coal)	3	51
fire clay	1	52
gray shale	8	60

Sangamon 12-167-24063-00 06-15N-04W

outside

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Requarth, Joseph Well No. #1
Address 1050 W. Calhoun Springfield IL
Driller Erwin, James License No. 102-2037
11. Permit No. 93529 Date 04/25/80
12. Water from sandy clay 13. County Sangamon
at depth 14 to 16 ft.
14. Screen: Diam. _____ in.
Length: _____ ft. Slot _____
Sec. 6
Twp. 15 N
Rge. 4 W
Elev. _____



15. Casing and Liner Pipe SE SW NE

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PVC SCH 40	-1	10
36	CONCRETE	10	31

16. Size hole below casing: _____ in.
17. Static level 10 ft. below casing top which is 1 ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. Formations passed through	Thickness	Bottom
top soil	1	1
brown clay	6	7
brown & white clay	4	11
white & yellow clay	4	15
sandy brown clay	5	20
brown clay	11	31

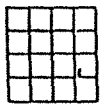
Sangamon 12-167-24062-00 06-15N-04W

PEI Assigned Log No. 29

Response to 1st RTP
CWLP - 01744

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Springler, Tim Well No. _____
Address Springfield Il
Driller Reynolds, Joseph R. License No. 092-6014
11. Permit No. 96892 Date 10/24/80
12. Water from sandy clay 13. County Sangamon
at depth 17 to _____ ft.
14. Screen: Diam. _____ in.
Length: _____ ft. Slot _____
Sec. 6
Twp. 15 N
Rge. 4 W
Elev. _____



15. Casing and Liner Pipe SW NE SE

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PLASTIC	-1	10
36	CONCRETE	10	20

16. Size hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

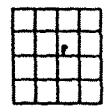
18. Formations passed through	Thickness	Bottom
top soil	2	2
yellow clay	10	12
sandy clay	7	19
sandstone	1	20

Sangamon 12-167-24065-00 06-15N-04W

OUTSIDE

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Siciliano, Frank Well No. #1
Address 608 W. Highland Springfield IL
Driller Erwin, James License No. 102-2037
11. Permit No. 86808 Date 06/18/79
12. Water from sandy clay 13. County Sangamon
at depth 16 to 17 ft.
14. Screen: Diam. _____ in.
Length: _____ ft. Slot _____
Sec. 6
Twp. 15 N
Rge. 4 W
Elev. _____



15. Casing and Liner Pipe SW SW NE

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PVC SCH 40	-1	10
36	CONCRETE	10	40

16. Size hole below casing: _____ in.
17. Static level 15 ft. below casing top which is 1 ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. Formations passed through	Thickness	Bottom
black top soil	1	1
brown clay	4	5
wh-gry c/brn yl strk	12	17
gray hardpan	4	21
gray shale	19	40

Sangamon 12-167-24064-00 06-15N-04W

PEI Assigned Log No. 30

Electronic Filing: Received, Clerk's Office 02/13/2020

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Vicari, Jerry Well No. _____
Address R.R. #10 Springfield IL
Driller Reynolds, Joseph R. License No. 092-6014
11. Permit No. 115763 Date 11/14/84
12. Water from sandy clay 13. County Sangamon
at depth 19 to _____ ft.
14. Screen: Diam. _____ in.
Length: _____ ft. Slot _____
Sec. 6
Twp. 15 N
Rge. 4 W
Elev. _____

NW NE SW

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PLASTIC	-1	12
36	CONCRETE	12	27

16. Size hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. Formations passed through	Thickness	Bottom
top soil	2	2
yellow clay	12	14
sandy clay	5	19
hardpan	2	21
shale	6	27

Sangamon 12-167-24070-00 06-15N-04W

PEI Assigned Log No. 31

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Turner, Robert E. Well No. _____
Address R.R. #2 Rochester IL
Driller Reynolds, Joseph R. License No. 092-6014
11. Permit No. 96350 Date 09/29/80
12. Water from sandy clay 13. County Sangamon
at depth 17 to _____ ft.
14. Screen: Diam. _____ in.
Length: _____ ft. Slot _____
Sec. 6
Twp. 15 N
Rge. 4 W
Elev. _____

SE NE SE

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PLASTIC	-1	10
36	CONCRETE	10	31

16. Size hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. Formations passed through	Thickness	Bottom
top soil	2	2
yellow clay	10	12
sandy clay	7	19
sandstone	8	27
shale	4	31
limestone	0	31

Sangamon 12-167-24069-00 06-15N-04W

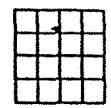
outside

Response to 1st RTP
CWLP - 01746

Electronic Filing: Received, Clerk's Office 02/13/2020

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Bradburg, Bruce Well No. _____
Address R. R. #7 Springfield IL
Driller Reynolds, Joseph R. License No. 092-6014
11. Permit No. 127370 Date 10/08/86
12. Water from sandy clay 13. County Sangamon
at depth _____to_____ft. Sec. 7
14. Screen: Diam._____in. Twp. 15 N
Length:_____ft. Slot _____ Rge. 4 W
Elev. _____



15. Casing and Liner Pipe NW NE SE

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PLASTIC	-1	13
36	CONCRETE	13	49

16. Size hole below casing: _____in.
17. Static level _____ft. below casing top which is _____ft. above ground level. Pumping level_____ft. when pumping at _____ gpm for_____hours.

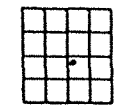
18. Formations passed through	Thickness	Bottom
top soil	2	2
yellow clay	12	14
sandy clay	5	19
hardpan	4	23
blue clay	8	31
shale	18	49

Sangamon 12-167-23828-00 07-15N-04W

OUTSIDE

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Wojciciki, Ronald Well No. _____
Address 1743 Wildrose Dr. Springfield IL
Driller Reynolds, Joseph R. License No. 092-6014
11. Permit No. 115764 Date 11/14/84
12. Water from sand & gravel 13. County Sangamon
at depth 21 to_____ft. Sec. 6
14. Screen: Diam._____in. Twp. 15 N
Length:_____ft. Slot _____ Rge. 4 W
Elev. _____



15. Casing and Liner Pipe NW NW SE

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PLASTIC	-1	10
36	CONCRETE	10	31

16. Size hole below casing: _____in.
17. Static level _____ft. below casing top which is _____ft. above ground level. Pumping level_____ft. when pumping at _____ gpm for_____hours.

18. Formations passed through	Thickness	Bottom
top soil	2	2
yellow clay	10	12
sandy clay	4	16
hardpan	5	21
sand & gravel	1	22
blue clay	9	31
rock	0	31

Sangamon 12-167-24071-00 06-15N-04W

PEI Assigned Log No. 32

Completed 6-19-68 Electronic Filing: Received, Clerk's Office 02/13/2020

10. Dept. Mines and Minerals permit No. W-4238 Year 68
11. Property owner EDWARD V. ECK Well No. 67
Address R.F.D. SPRINGFIELD, ILL. Rt. 4
Driller MILES & SON License No. 92-503
12. Water from HARD PAN 13. County SANGAMON
Formation
at depth 18 to 24 ft. Sec. 7
14. Screen: Diam. ____ in. Twp. 15N
Length: ____ ft. Slot ____ Rng. 4W
Elev. ____

SHOW LOCATION IN SECTION PLAT
NW NE NE
(permit)

15. Casing and Liner Pipe

Diam. (In.)	Kind and Weight	From (Ft.)	To (Ft.)
36	CONCRETE	-0	30

16. Size Hole below casing: UNK in.
17. Static level 18 ft. below casing top which is 1 ft. above ground level. Pumping level ____ ft. when pumping at ____ gpm for ____ hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
Top Soil	2	2
CLAY	16	18
HARD PAN	6	24
BLUE CLAY	6	30
(CONTINUE ON SEPARATE SHEET IF NECESSARY)		

SIGNED Maynard Mick DATE June 19 1968

1317

SANGAMON 7-15N-4W

outside

10. Property owner Richard Claus Well No. ____
Address 57 Columbine
Driller Joe Reynolds License No. 92-601
11. Permit No. 63246 Date 7-6-77
12. Water from Sandy Clay 13. County Sang
Formation
at depth 15 to ____ ft. Sec. 7
14. Screen: Diam. ____ in. Twp. 15N
Length: ____ ft. Slot ____ Rge. 4W
Elev. ____

SHOW LOCATION IN SECTION PLAT
SE NW NE
(permit)

15. Casing and Liner Pipe

Diam. (In.)	Kind and Weight	From (Ft.)	To (Ft.)
6"	Plastic	+1	-10
36"	Concrete	-10	-52

16. Size Hole below casing: ____ in.
17. Static level ____ ft. below casing top which is ____ ft. above ground level. Pumping level ____ ft. when pumping at ____ gpm for ____ hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
Top Soil	2	2'
Yellow Clay	8	10'
Sandy Clay	5	15'
Hard Pan	8	23'
Shale &	29	52'

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED Joseph Reynolds DATE ____

COUNTY No. 22765

SANGAMON 7-15N-4W

PEI Assigned Log No. 33

Response to 1st RTP
CWLP - 01748

Electronic Filing: Received, Clerk's Office 02/13/2020

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Metzger, Ron Well No. _____
Address 4025 Pichsair Springfield IL
Driller Reynolds, Joseph R. License No. 092-6014
11. Permit No. 125894 Date 08/12/86
12. Water from sandy clay 13. County Sangamon
at depth _____ to _____ ft. Sec. 7
14. Screen: Diam. _____ in. Twp. 15 N
Length: _____ ft. Slot _____ Rge. 4 W
Elev. _____

SE NW SE

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PLASTIC	-1	14
36	CONCRETE	14	50

16. Size hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. Formations passed through	Thickness	Bottom
top soil	2	2
yellow clay	15	17
sandy clay	4	21
hardpan	6	27
blue clay	2	29

Sangamon 12-167-23782-00 07-15N-04W

PEI Assigned Log No. 34

Completed 11-76

10. Property owner JOHN H JARVIS Well No. _____
Address 2704 E Jackson SELD
Driller JOSEPH REYNOLDS License No. 92-601
11. Permit No. 54482 Date 11-8-76
12. Water from SANDY CLAY 13. County _____
Formation
at depth 19' to _____ ft. Sec. 7
14. Screen: Diam. _____ in. Twp. 15N
Length: _____ ft. Slot _____ Rge. 4W
Elev. _____

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
6"	PLASTIC	+1	-10
36"	CONCRETE	-10	-43

SHOW LOCATION IN SECTION PLAT
NW NW NE
(permit)

16. Size Hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
TOP SOIL		2
YELLOW CLAY		12
SANDY CLAY		19
HARD PAN		23
BLUE CLAY		33
SHALE		43
LIMESTONE		43

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED Joseph Reynolds DATE _____

COUNTY NO. 22574

SANGAMON 7-15N-4W

PEI Assigned Log No. 35

Electronic Filing: Received, Clerk's Office 02/13/2020

10. Property owner Robert L. Bly Well No. _____
Address 1916 N. 22nd Springfield, Ill.
Driller Miles & Sons License No. 92-503
11. Permit No. NCH263 Date June 21, 68
12. Water from Clay Formation 13. County Sangamon
at depth 24 to 28 ft. Sec. 6
14. Screen: Diam. Same in. Twp. 15N
Length: _____ ft. Slot _____ Rge. 4W
Elev. _____

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
36	CONCRETE	+1	41

SHOW LOCATION IN SECTION PLAT
NW NW NW
(permit)

16. Size Hole below casing Same in.
17. Static level 24 ft. below casing top which is 1 ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
Yellow Clay	8	8
Brown Clay	16	24
Sandy Clay	9	33
Bolder Clay	8	41

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED Marvel Miles DATE June 24 68

COUNTY No. 1354

SANGAMON 6-15N-4W

outside

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Bartel, William Well No. _____
Address R. R. #7 Box 171 Springfield IL
Driller Reynolds, Joseph R. License No. 092-6014
11. Permit No. 138930 Date 12/31/87
12. Water from sandstone 13. County Sangamon
at depth _____ to _____ ft. Sec. 6
14. Screen: Diam. _____ in. Twp. 15 N
Length: _____ ft. Slot _____ Rge. 4 W
Elev. _____

15. Casing and Liner Pipe NW SW SE

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PLASTIC	-1	11
36	CONCRETE	10	29
24	CONCRETE	28	40

16. Size hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. Formations passed through	Thickness	Bottom
top soil	2	2
yellow clay	12	14
sandy clay	5	19
hardpan	4	23
blue clay	4	27
shale	2	29
sandstone	11	40

Sangamon 12-167-24652-00 06-15N-04W

PEI Assigned Log No. 36

Response to 1st RTP
CWLP - 01750

APPENDIX B
BORING LOGS

SUMMARY OF (INTERPRETED) GEOLOGIC DATA

SUMMARY OF GEOLOGIC DATA (INTERPRETED)
FGDS LANDFILL
SPRINGFIELD, ILLINOIS

Boring/ Piezometer/ Monitoring Well	Coordinates		Ground Elevation	El. Top of Bedrock	El. Top of Basal Sand	Thickness of Basal Sand (ft.)	El. Top of Lower Clay (ft.)	Thickness of Lower Clay (ft.)	Top of Shallow Sand (ft.)	Thickness of Shallow Sand (ft.)	Thickness of Upper Clay (ft.)	Thickness of Fill (ft.)	Remarks
	East	North											
B-1*	2685.6	5260.5	523.2	490.2	499.2	5.0	509.2	10.0	512.8	3.6	10.4	NE	Clay overlies bedrock
B-2*	2241.0	5482.9	526.7	496.7	NE	NE	510.7	14.0	512.7	2.0	14.0	NE	
B-3*			553.0±	498.5	505.0	6.5	519.0	14.0	520.0	0.9	13.1	20.0	Located on berm Not surveyed
B-4*	2060.4	5488.2	530.1	496.6	505.6	9.0	516.1	10.5	NE	NE	14.0	NE	
B-5*	2049.3	5204.3	529.5	496.0	504.3	8.3	512.5	8.2	514.5	2.0	15.0	NE	
B-6*	2588.6	5072.9	530.8	493.3	500.8	4.5	514.8	14.0	NE	NE	11.5	NE	Clay overlies bedrock
B-7*	2684.2	4743.9	523.3	494.8	499.8	5.0	508.3	8.5	NE	1.5	2.5	12.5	
B-8*	2706.2	4565.9	523.8	494.8	501.2	6.4	513.3	12.1	NE	NE	10.5	NE	
B-9*	2506.0	4690.7	522.7	495.7	502.2	6.5	510.3	8.1	513.9	3.6	8.8	NE	
B-10*	2463.3	4589.2	523.6	498.1	499.4	1.3	516.1	16.7	NE	NE	7.5	NE	
B-11*	2391.2	4775.2	523.6	495.4	501.8	6.4	515.2	13.4	NE	NE	8.4	NE	
B-12*	2210.8	4924.2	524.9	494.9	500.4	5.5	517.4	17.0	518.9	1.5	6.0	NE	
B-13*	2275.9	4524.7	523.8	494.5	499.3	4.8	516.8	17.5	518.0	1.2	5.8	NE	

SUMMARY OF GEOLOGIC DATA (INTERPRETED)
FGDS LANDFILL
SPRINGFIELD, ILLINOIS

Boring/ Piezometer/ Monitoring Well	Coordinates		Ground Elevation	El. Top of Bedrock	El. Top of Basal Sand	Thickness of Basal Sand (ft.)	El. Top of Lower Clay (ft.)	Thickness of Lower Clay (ft.)	Top of Shallow Sand (ft.)	Thickness of Shallow Sand (ft.)	Thickness of Upper Clay (ft.)	Thickness of Fill (ft.)	Remarks
	East	North											
B-14*	2791.1	3763.9	572.7	553.7	NE	NE	NE	NE	NE	NE	12.5	NE	Bedrock outcrop
B-15*	1752.7	5579.6	536.7	516.7	NE	NE	523.7	7.0	527.7	4.0	9.0	NE	
CB-1*	2663.1	5559.1	527.3	495.0	507.3	12.3	NE	NE	NE	NE	NE	20.0	Creek
CB-2*	2700.9	5427.5	526.2	<496.7	503.7	4.5	506.2	2.5	NE	NE	NE	19.5	Creek
CB-3*	2542.3	5359.4	525.8	<495.8	498.8	2.0	513.8	15.0	NE	NE	NE	12.0	Creek
CB-4*	2490.4	5240.9	525.1	<503.1	ND	ND	513.3	>10.2	NE	NE	NE	11.8	Creek
CB-5*	2390.9	5197.4	523.4	<507.4	ND	ND	515.2	>7.8	515.6	0.4	7.8	NE	
CB-6*	2367.5	5079.8	527.0	494.5	501.0	6.5	518.0	17.0	518.8	0.8	8.2	NE	
CB-7*	2377.9	4938.0	523.8	<507.8	ND	ND	515.0	>7.2	NE	NE	8.8	NE	
CB-8*	2564.6	4862.3	522.7	<502.7	ND	ND	508.9	>6.2	NE	NE	NE	13.8	
CB-9*	2736.2	4799.8	525.5	<499.5	503.5	>4.0	509.3	5.8	NE	NE	NE	16.2	
P-1D*	1973.1	4806.1	553.4	501.4	504.4	3.0	513.9	9.5	NE	NE	NE	39.5	Located on berm
P-1S*	1973.9	4821.3	553.4	<511.4	ND	ND	514.7	>3.3	NE	NE	NE	ND	Located on berm
P-2D*	1975.9	5226.0	553.9	498.1	500.9	2.8	516.4	15.5	NE	NE	13.8	37.5	Located on berm

SUMMARY OF GEOLOGIC DATA (INTERPRETED)
FGDS LANDFILL
SPRINGFIELD, ILLINOIS

Boring/ Piezometer/ Monitoring Well	Coordinates		Ground Elevation	El. Top of Bedrock	El. Top of Basal Sand	Thickness of Basal Sand (ft.)	El. Top of Lower Clay (ft.)	Thickness of Lower Clay (ft.)	Top of Shallow Sand (ft.)	Thickness of Shallow Sand (ft.)	Thickness of Upper Clay (ft.)	Thickness of Fill (ft.)	Remarks
	East	North											
P-2S*	1976.3	5237.1	533.9	ND	ND	ND	ND	ND	NE	NE	ND	ND	Located on berm
P-3D*	2645.4	5672.5	530.5	497.0	502.5	5.5	517.0	14.5	NE	NE	NE	13.5	Creek
P-3S*	2651.4	5672.5	530.5	ND	ND	ND	518.5	>2.0	NE	NE	NE	ND	Not sampled continuously
P-4*	2880.7	5156.3	535.9	493.6	501.9	8.3	519.9	18.0	NE	NE	16.0	NE	
P-5D*	2885.0	4516.7	534.9	507.6	512.9	5.3	NE	NE	NE	NE	NE	22.0	Creek
P-5S*	2887.0	4510.7	534.9	ND	ND	ND	ND	ND	NE	NE	ND	ND	Not sampled continuously
P-6D*	2186.8	4717.0	524.8	493.3	497.3	4.0	517.3	20.0	518.3	1.0	6.5	NE	
P-6R*	2175.7	4719.5	524.8	492.3	ND	ND	ND	ND	ND	ND	ND	ND	Not sampled continuously
P-6S*	2191.4	4725.7	524.9	ND	ND	ND	517.4	>2.5	518.4	1.0	6.5	ND	Not sampled continuously
P-7D*	2432.5	5342.8	526.5	494.0	500.5	5.0	514.5	14.0	515.0	0.5	11.5	NE	Clay overlies bedrock
P-7M*	2432.8	5337.0	525.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	Not sampled continuously

SUMMARY OF GEOLOGIC DATA (INTERPRETED)
FGDS LANDFILL
SPRINGFIELD, ILLINOIS

Boring/ Piezometer/ Monitoring Well	Coordinates		Ground Elevation	El. Top of Bedrock	El. Top of Basal Sand	Thickness of Basal Sand (ft.)	El. Top of Lower Clay (ft.)	Thickness of Lower Clay (ft.)	Top of Shallow Sand (ft.)	Thickness of Shallow Sand (ft.)	Thickness of Upper Clay (ft.)	Thickness of Fill (ft.)	Remarks
	East	North											
P-7R*	2424.5	5326.9	525.4	491.4	ND	ND	ND	ND	ND	ND	ND	ND	Not sampled continuously
P-7S*	2426.3	5337.1	526.3	ND	ND	ND	515.3	>3.0	515.8	0.5	10.5	ND	Not sampled continuously
P-8D*	2482.7	4939.7	522.7	496.2	500.7	3.5	508.7	8.0	NE	NE	NE	14.0	Clay overlies bedrock
P-8S*	2486.0	4933.1	522.8	ND	ND	ND	ND	ND	NE	NE	NE	ND	Not sampled continuously
P-9D*	2422.4	4446.3	553.2	495.7	501.2	5.5	521.2	20.0	NE	NE	5.7	NE	Located on berm
P-9S*	2415.6	4447.3	553.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	Located on berm
B-1 thru B-6**	NA	NA	NA	These borings were made in the north-east corner of Cell No. 1. These locations were not surveyed; therefore, the data from these borings was not used to interpret site conditions.									PSI (1989)
B-1**	NA	NA	525.4	502.4	NE	NE	NE	NE	NE	NE	NE	23.0	Creek
B-2**	NA	NA	525.3	496.8	NE	NE	518.0	21.2	521.5	3.5	3.8	NE	
B-3**	NA	NA	523.8	ND	500.8	>7.0	508.8	8.0	514.8	6.0	9.0	NE	
B-4**	NA	NA	522.6	495.1	502.6	3.0	514.0	11.4	NE	NE	2.5	6.0	Clay
B-5**	NA	NA	523.5	494.5	499.0	4.5	514.5	15.5	NE	NE	9.0	NE	

SUMMARY OF GEOLOGIC DATA (INTERPRETED)
FGDS LANDFILL
SPRINGFIELD, ILLINOIS

Boring/ Piezometer/ Monitoring Well	Coordinates		Ground Elevation	El. Top of Bedrock	El. Top of Basal Sand	Thickness of Basal Sand (ft.)	El. Top of Lower Clay (ft.)	Thickness of Lower Clay (ft.)	Top of Shallow Sand (ft.)	Thickness of Shallow Sand (ft.)	Thickness of Upper Clay (ft.)	Thickness of Fill (ft.)	Remarks
	East	North											
B-6**	NA	NA	522.7	495.7	500.7	5.0	NE	NE	NE	NE	NE	22.0	Creek
B-11**	NA	NA	522.5	496.5	501.5	5.0	NE	NE	NE	NE	NE	21.0	Creek
B-12**	NA	NA	522.2	494.7	NE	NE	509.2	14.5	NE	NE	NE	13.0	Creek
B-13**	NA	NA	522.2	495.2	NE	NE	512.2	17.0	NE	NE	4.0	6.0	
B-14**	NA	NA	522.3	493.8	498.3	4.5	516.3	18.0	NE	NE	6.0	NE	
B-15**	NA	NA	524.4	ND	496.4	>2.0	514.4	18.0	NE	NE	10.0	NE	
B-16**	NA	NA	523.2	495.7	497.7	2.0	508.2	10.5	NE	NE	6.0	6.0	
B-17**	NA	NA	522.5	495.5	497.5	2.0	504.5	7.0	NE	NE	NE	18.0	Creek
R-101**	2863.2	4049.5	543.8	511.8	NE	NE	530.6	18.8	530.8	0.2	13.0	NE	
R-102**	2043.9	5673.8	535.8	499.8	500.8	1.0	522.8	22.0	NE	NE	13.0	NE	
R-103**	2878.4	5625.3	536.1	506.6	NE	NE	516.6	10.0	517.1	0.5	19.0	NE	
G-104**	2305.9	5688.6	530.7	495.7	502.7	7.0	507.6	4.9	NE	NE	NE	23.0	Creek
G-105**	1994.6	5016.9	553.5	502.0	505.5	0.7	514.5	9.0	NE	NE	15.0	24.0	
G-106**	2378.9	5149.7	524.2	492.2	499.2	7.0	515.2	16.0	516.2	1.0	8.0	NE	

ND = No Data
NE = Not Encountered
NA = Not Available

* Patrick Engineering Inc.
** Professional Service Industries, Inc.

ATTACHMENT B

PSI Information To Build On
Engineering • Consulting • Testing

August 30, 2010

City Water, Light & Power
Environmental Health & Safety
201 East Lake Shore Drive
Springfield, Illinois 62712

Attn: Ms. Sue Corcoran
Tel: 217-757-8610
Fax: 217-757-8615

Re: Piezometer Installation
CWLP Ash Ponds
East Lake Shore Drive
Springfield, Illinois
PSI Report No. 0020522-1 Rev. 1 Page 1 of 22 (including attachments)

Dear Ms. Corcoran:

In general accordance with your instructions, Professional Service Industries, Inc. (PSI) has completed the installation of four (4) temporary piezometers at the periphery of CWLP's ash pond area in Springfield, Illinois. Additionally, certain laboratory analysis was performed, as was in situ hydraulic conductivity (slug) testing. The piezometer locations are identified on the attached location plan. Boring depths and static water levels are shown in the table below.

	AP-1	AP-2	AP-3	AP-4
Date drilled	4/21/2010	4/21/2010	4/21/2010	4/20/2010
Total boring depth (ft)	31.5	20	19.5	60
Piezometer depth from top of first casing above ground surface (ft)	33.15	19.47	19.63	58.93
Piezometer depth from ground surface (ft)	28.34	17.18	17.91	58.31
Well screen length (ft)	10	10	10	10
Static water level from ground surface (5/5/2010)	4.81	3.89	5.16	5.95

The borings were drilled to depths ranging from approximately 17.2 to 58.3 feet below the existing ground surface, respectively. It is PSI's understanding that the purpose for these soil borings is to aid CWLP in assessing the groundwater quality outside the existing CWLP ash ponds. The general boring locations were determined and located in the field by CWLP personnel. With the approval of Ms. Corcoran, AP-2 was offset to the north of the clarifier pond drainage pipe. Depths on the attached boring logs are relative to the ground surface at each boring location.

Water level observations were made during and upon completion of the boring operations and are noted on the boring logs presented herewith. In addition, static water levels were observed

at the time of the slug testing. In relatively impervious soils, the accurate determination of the groundwater elevation may not be possible even after several days of observation. Seasonal variations, temperature and recent rainfall conditions may influence the levels of the groundwater table and volumes of water will depend on the permeability of the soils.

Soil samples were visually classification in the field for logging purposes. The limited laboratory testing program included grain size analysis. Where soil tests are reported, they have been performed in accordance with generally acceptable or applicable standards. Sieve analysis worksheets are appended. Soil samples were conveyed to CWLP upon completion of the well installation activities.

A copy of the boring logs are appended. The stratification of the soils on the log represents the soil conditions in the actual boring location. Lines of demarcation represent the approximate boundaries between the soil types, but the transition may be gradual.

On May 5, 2010, in situ rising head hydraulic conductivity (slug) testing was performed on each of the four piezometers. Testing was conducted by rapidly removing one bailer (1 liter) of groundwater from the well while recording the rate of recovery using a Solinst 3001 level logger. Hydraulic conductivity was estimated using the Hvorslev method. Based on this method, the average hydraulic conductivity was estimated at 2.50E-02. Slug test results and hydraulic conductivity calculations are appended.

PSI appreciates the opportunity to perform these services and if we can be of further service, please contact our office at (217) 544-6663.

Respectfully submitted,
PROFESSIONAL SERVICE INDUSTRIES, INC.

James Gerloff, E.I.
Branch Manager

William P. Pongracz, P.E.
Vice President

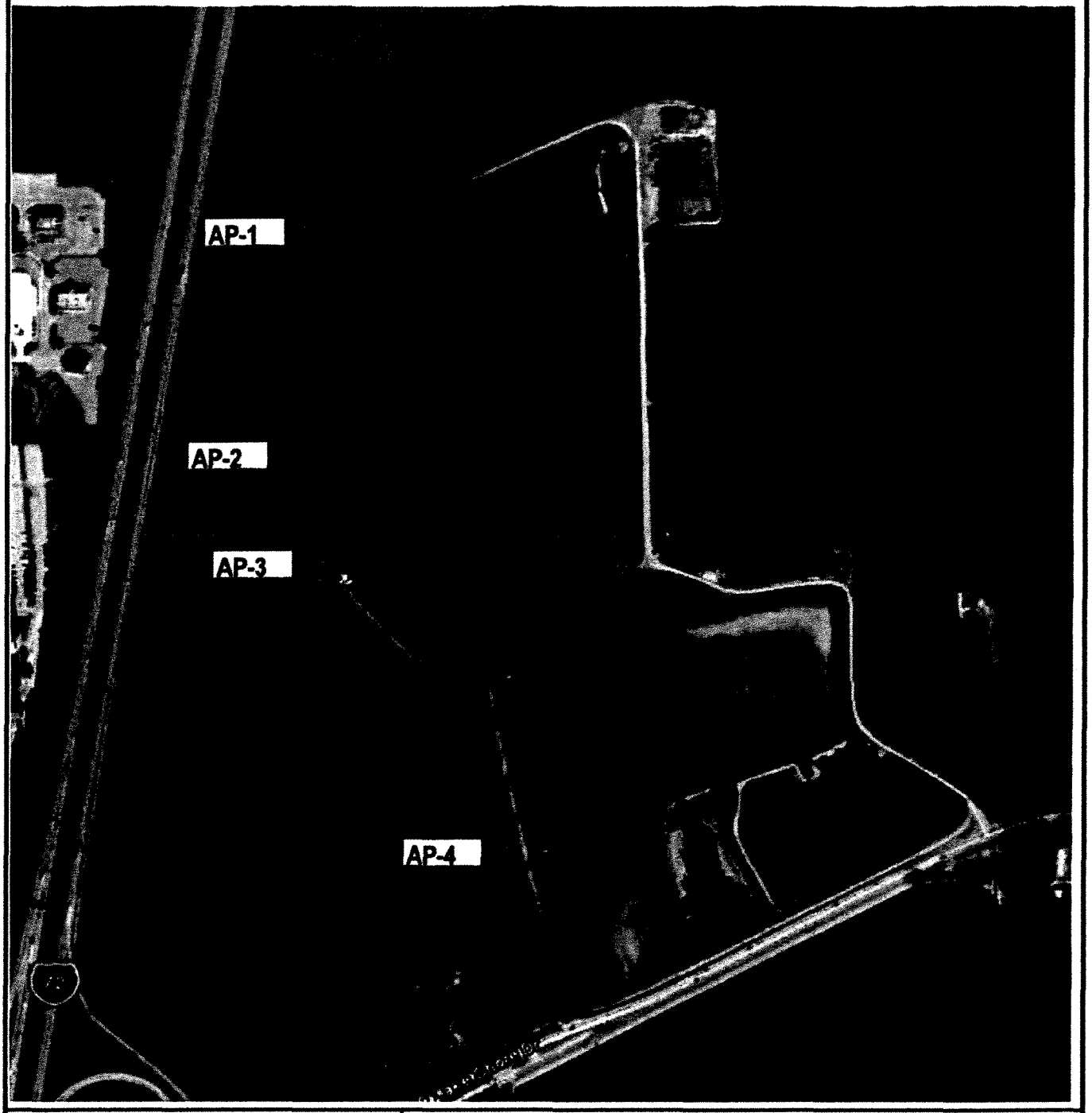
Attachments: Key to Symbols
Boring Logs (4 pages)
Piezometer Location Plan
In-Situ Hydraulic Conductivity Results (6 pages)
Sieve Analysis Worksheets (8 pages)

Distribution: (1) above

PIEZOMETER LOCATION PLAN

Electronic Filing: Received, Clerk's Office 12/13/2020

SOURCE:	DATE:	SCALE:	
Google © 2010 / DigitalGlobe © 2010	Nov-05	No Scale	



psi Information To Build On
Engineering • Consulting • Testing
480 North Street, Springfield, Illinois 62704
phone 217/544-6663 fax 217/544-6148

PIEZOMETER LOCATION PLAN

PSI PROJECT No.:	0020522
Project:	Piezometer Installation
Location:	CWLP Ash Pond
	East Lake Shore Drive
	Springfield, Illinois

KEY TO SYMBOLS


Fill (made ground)


USCS Low Plasticity Clay


USCS Silt


USCS Low Plasticity Sandy Clay


USCS Clayey Sand


USCS Well-graded Sand with Silt


USCS Poorly-graded Sand


USCS Well-graded Sand

HSA = Hollow Stem Auger

CFA = Continuous Flight Auger

SPT = Standard Penetration Test

DCP = Dynamic Cone Penetrometer

SS = Split-spoon Sampler

ST = Shelby Tube Sampler

RC = Rock Core

DD = Dry Density

LL = Liquid Limit

PL = Plastic Limit

Qu = Unconfined Compressive Strength

Qp = Pocket Penetrometer

RQD = Rock Quality Designation

REC'D = Rock Core Recovery Percentage

PID = Photo Ionic Detector (ppm)

MR* = Unable to determine depth of water due to mud rotary drilling methods

The borings were advanced into the ground using hollow stem augers. At regular intervals throughout the boring depths, soil samples were obtained with either a 1.4-inch I.D., 2.0-inch O.D., split-spoon sampler or a 3-inch diameter Shelby tube. The split-spoon sampler was first seated 6-inches to penetrate any loose cuttings and then driven an additional foot where possible with blows of a 140 pound hammer falling 30-inches. The number of hammer blows required to drive the sampler each 6-inch increment is recorded in the field. The penetration resistance "N-value" is redesignated as the number of hammer blows required to drive the sampler the final foot and, when properly evaluated, is an index to cohesion for clays and relative density for sands. The split-spoon sampling procedures used during this exploration are in general accordance with ASTM Designation D 1586.

Relatively undisturbed Shelby tube samples were obtained by forcing a section of 3-inch diameter steel tubing into the soil at the desired sampling levels. This sampling procedure was in general accordance with ASTM Designation D 1587. Each tube, together with the encased soil, was carefully removed from the ground, sealed and transported to the laboratory for testing.

Professional Service Industries, Inc.
480 North Street
Springfield, Illinois 62704
Telephone: 217/544-6663
Fax: 217/544-6143

PSI Job No.: 0020522
Project: Piezometer Installation
Location: CWLP Ash Pond
East Lake Shore Drive
Springfield, Illinois

Professional Service Industries, Inc.
480 North Street
Springfield, Illinois 62704
Telephone: 217/544-6663
Fax: 217/544-6143

Electronic Filing: Received, Clerk's Office 02/13/2020

LOG OF BORING AP-1

PSI Job No.: 0020522
Project: Piezometer Installation
Location: CWLP Ash Pond
East Lake Shore Drive
Springfield, Illinois

Drilling Method: Hollow Stem Auger
Sampling Method: Split Spoon
Hammer Type: CME Automatic; ETR = 86%
Boring Location: See attached boring location plan.

WATER LEVELS
While Drilling 9 feet
Upon Completion N/A
Delay N/A

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %
	0	1	18	Dark brown silty CLAY, very stiff, slightly moist	CL	7-8-9 N_{60}=24	
	5	2	18	Dark brown clayey SILT, stiff, slightly moist	ML	5-5-5 N_{60}=14	
		3	18	Gray clayey SILT, trace brown, firm, moist		2-2-3 N_{60}=7	
	10	4	18		ML	2-2-3 N_{60}=7	
		5	18			1-2-2 N_{60}=6	
	15	6	18	Gray silty CLAY, few brown sand, firm, saturated	CL	1-2-2 N_{60}=6	
		7	18	Gray sandy CLAY, stiff, saturated	CLS	4-3-4 N_{60}=10	
	20	8	18	Blue-gray clayey SILT, soft to very stiff, moist to saturated		3-3-4 N_{60}=10	
		9	18		ML	1-2-1 N_{60}=4	
	25	10	18	Gray SAND with SILT, medium dense/very stiff, saturated	SW-SM	6-7-6 N_{60}=19	
	30	11	6	Gray SHALE, hard, slightly moist	CL	50/6"	
				Boring terminated ay -31.5'			
	35						

STANDARD PENETRATION TEST DATA
N in blows/ft
Moisture PL LL
0 25 50
STRENGTH, tsf
Qu Qp
0 2.0 4.0

Additional Remarks

Well Diagram: J-Plug; Concrete Cap; 2" PVC Solid Riser; Bentonite Seal; Sand Filter Pack; 0.01" PVC Slotted Well Screen

Completion Depth: 35.0 ft
Date Boring Started: 4/21/10
Date Boring Completed: 4/21/10
Logged By: Rob Preuss
Drilling Contractor: PSI, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude:
Longitude:
Drill Rig: ATV D50
Remarks: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Moistures determined by visual methods.

The stratification lines represent approximate boundaries. The transition may be gradual.

Professional Service Industries, Inc.
480 North Street
Springfield, Illinois 62704
Telephone: 217/544-6663
Fax: 217/544-6143
Electronic Filing: Received, Clerk's Office 02/13/2020

LOG OF BORING AP-2

PSI Job No.: 0020522
Project: Piezometer Installation
Location: CWLP Ash Pond
East Lake Shore Drive
Springfield, Illinois

Drilling Method: Hollow Stem Auger
Sampling Method: Split Spoon
Hammer Type: CME Automatic; ETR = 86%
Boring Location: See attached boring location plan.

WATER LEVELS

While Drilling	9 feet
Upon Completion	N/A
Delay	N/A

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ● × Moisture ◪ PL ● LL (0, 25, 50) STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks	Well Diagram
	0			1	10	Dark brown silty CLAY, some sand, stiff, slightly moist (FILL)	CL	4-4-6 N_{60}=14				J-Plug, Concrete Cap
	5			2	8	Dark brown silty CLAY, soft to firm, moist	CL	2-2-2 N_{60}=6				2" PVC Solid Riser
				3	6	Gray silty CLAY, soft to firm, moist	CL	1-1-2 N_{60}=4				Bentonite Seal
	10			4	18	Gray clayey SILT, soft to firm, saturated		2-2-2 N_{60}=6				
				5	18		ML	2-1-1 N_{60}=3				Sand Filter Pack
	15			6	18			2-1-2 N_{60}=4				
				7	18	Light gray SAND, dense, saturated	SP	4-9-16 N_{60}=36				0.01" PVC Slotted Well Screen
	20			8	14	Gray SHALE, hard, slightly moist	CL	19-24-50/2"				
						Boring terminate at -20'						

Completion Depth: 20.0 ft
Date Boring Started: 4/21/10
Date Boring Completed: 4/21/10
Logged By: Rob Preuss
Drilling Contractor: PSI, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude:
Longitude:
Drill Rig: ATV D50
Remarks: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Moistures determined by visual methods.

The stratification lines represent approximate boundaries. The transition may be gradual.

Professional Service Industries, Inc.
480 North Street
Springfield, Illinois 62704
Telephone: 217/544-6663
Fax: 217/544-6143

Electronic Filing: Received, Clerk's Office 02/13/2020

LOG OF BORING AP-3

PSI Job No.: 0020522
Project: Piezometer Installation
Location: CWLP Ash Pond
East Lake Shore Drive
Springfield, Illinois

Drilling Method: Hollow Stem Auger
Sampling Method: Split Spoon
Hammer Type: CME Automatic; ETR = 86%
Boring Location: See attached boring location plan.

WATER LEVELS
While Drilling: None feet
Upon Completion: N/A
Delay: N/A

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ● × Moisture ◪ PL ✱ LL 0 25 50 STRENGTH, tsf ▲ Qu ✱ Qp 0 2.0 4.0	Additional Remarks	Well Diagram
	0			1	18	Dark brown silty CLAY, very stiff, slightly moist	CL	6-7-8 N_{60}=21				J-Plug
	5			2	18	Gray/brown clayey SILT, soft to stiff, moist to saturated	ML	3-3-4 N_{60}=10				Concrete Cap
				3	18			1-1-1 N_{60}=3				2" PVC Solid Riser
	10			4	18	Gray clayey SILT, soft to very stiff, saturated		2-1-2 N_{60}=4				Bentonite Seal
				5	18			2-2-4 N_{60}=9				Sand Filter Pack
	15			6	16		ML	2-2-4 N_{60}=9				0.01" PVC Slotted Well Screen
				7	18			4-4-6 N_{60}=14				
	20			8	10	Gray SHALE, hard, slightly moist Boring terminated at -19.5	CL	32-50/3"		>>		

Completion Depth: 20.0 ft
Date Boring Started: 4/21/10
Date Boring Completed: 4/21/10
Logged By: Rob Preuss
Drilling Contractor: PSI, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude:
Longitude:
Drill Rig: ATV D50
Remarks: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Moistures determined by visual methods.

The stratification lines represent approximate boundaries. The transition may be gradual.

Professional Service Industries, Inc.
480 North Street
Springfield, Illinois 62704
Telephone: 217/544-6663
Fax: 217/544-6143

Electronic Filing: Received, Clerk's Office 02/13/2020

LOG OF BORING AP-4

PSI Job No.: 0020522
Project: Piezometer Installation
Location: CWLP Ash Pond
East Lake Shore Drive
Springfield, Illinois

Drilling Method: Hollow Stem Auger
Sampling Method: Split Spoon
Hammer Type: CME Automatic; ETR = 86%
Boring Location: See attached boring location plan.

WATER LEVELS

While Drilling	11 feet
Upon Completion	N/A
Delay	N/A

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %
	0	1	17	Brown silty CLAY, some brown sand, firm to stiff, slightly moist (FILL)	CL	4-4-3 N_{60}=10	
	5	2	18	Brown silty CLAY, trace roots, firm to stiff, moist (FILL)	CL	4-3-2 N_{60}=7	
		3	10	Brown SILT, trace gray, firm to stiff, moist (FILL)	ML	6-3-2 N_{60}=7	
	10	4	12	5" Brown SAND transitioning to Black FLY ASH at 9.4', stiff to very stiff, slightly moist (FILL)		2-2-4 N_{60}=9	
		5	18		SAND/FLY ASH	2-2-2 N_{60}=6	
	15	6	16			2-1-1 N_{60}=3	
		7	16	Black FLY ASH, some fine sub-round gravel, stiff to very stiff, moist to saturated (FILL)	FLY ASH	6-6-5 N_{60}=16	
	20	8	18	Gray/green (organic?) CLAY, stiff, trace fine sand, moist to saturated		3-3-3 N_{60}=9	
		9	1		CL	3-3-4 N_{60}=10	
	25	10	18	Brown/gray silty CLAY, fiorm to stiff, saturated		2-2-3 N_{60}=7	
	30				CL		
		11	18	Gray SILT, stiff to very stiff, saturated		3-3-4 N_{60}=10	
	35						
		12	18			4-4-4 N_{60}=11	
	40				ML		
		13	18			4-4-6 N_{60}=14	
	45						
		14	18	Gray fine to coarse SAND, medium dense, saturated		4-5-7 N_{60}=17	
	50						
		15	18		SW	5-5-7 N_{60}=17	
	55						
		16	1	Gray SHALE, hard, moist	CL	50/1"	
	60			Boring terminated at -60'			

STANDARD PENETRATION TEST DATA
N in blows/ft
Moisture
PL
LL
0 25 50

STRENGTH, tsf
Qu
Qp
0 2.0 4.0

Additional Remarks

Well Diagram
J-Plug
Concrete Cap
2" PVC Solid Riser
Bentonite Seal
Sand Filter Pack
0.01" PVC Slotted Screen

Completion Depth: 60.0 ft
Date Boring Started: 4/20/10
Date Boring Completed: 4/20/10
Logged By: Rob Preuss
Drilling Contractor: PSI, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude:
Longitude:
Drill Rig: ATV D50
Remarks: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Moistures determined by visual methods.

The stratification lines represent approximate boundaries. The transition may be gradual.

In-Situ Hydraulic Conductivity Test Analysis
Utlizing the Hvorslev Slug Test Method[1]

GOVERNING EQUATION:

$$K = (r^2 * \ln(L_e/R))/(2L_eT_o)$$

K is the hydraulic conductivity (cm/sec)
r is the radius of the well casing (cm)
R is the radius of the borehole (cm)
L_e is the length of the well screen (cm)
T_o is the time it takes for the water level to rise or fall 37% of the initial change (sec)

CWLP Ash Ponds, East Lake Shore Drive, Springfield, Illinois **In-Situ Hydraulic Conductivity Analysis[2]**

Test Number	Test Type	L_e (ft)	L_e (cm)	T_o (min)	T_o (sec)	K (cm/sec)
AP-4	Rising Head	10.0	304.8	0.025	1.500	7.64E-02
AP-3	Rising Head	10.0	304.8	0.083	4.980	2.30E-02
AP-2.1	Rising Head	10.0	304.8	0.150	9.000	1.27E-02
AP-2.2	Rising Head	10.0	304.8	0.167	10.020	1.14E-02
AP-1	Rising Head	10.0	304.8	1.667	100.020	1.15E-03

AVERAGE: 2.50E-02

CONSTANTS			
r (inch)	r (cm)	R (inch)	R (cm)
2.0	5.08	8.0	20.3

HVORSLEV CALCULATIONS					
Test	L_e/R (-)	$\ln(L_e/R)$ (-)	L_eT_o (cm*sec)	K (cm/sec)	
AP-4	15.00	2.71	4.57E+02	**7.64E-02**	
AP-3	15.00	2.71	1.52E+03	**2.30E-02**	
AP-2.1	15.00	2.71	2.74E+03	1.27E-02	
AP-2.2	15.00	2.71	3.05E+03	1.14E-02	AP-2 AVG: **1.21E-02**
AP-1	15.00	2.71	3.05E+04	**1.15E-03**	

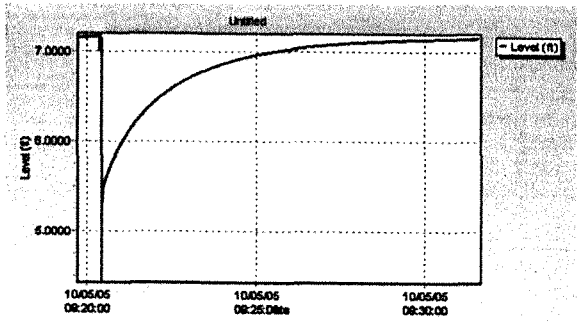
Notes:

[1] Hvorslev slug test method applied as described by C.W. Fetter in Applied Hydrology (Third Edition) published by Prentice-Hall in New Jersey in 1994 on pages 247-251.

[2] In-situ hydraulic conductivity tests conducted on monitoring wells, MW-1 thru MW-4 on May 5, 2010.

Solinst	3001
Report generated:	5/11/2010
Report from file:	...\mw-4.csv
Serial number:	1032308
Unit name:	Solinst 3001
Test name:	AP-1 Test 1
Test defined on:	5/5/2010
Test started on:	5/5/2010 9:20:28
Test stopped on:	5/5/2010 9:21:41
Data gathered using Linear testing	
Time between data points:	1 Seconds.
Number of data samples:	75
TOTAL DATA SAMPLES	75
Channel number [1]	
Measurement type:	Level
Unit	feet
Channel number [2]	
Measurement type:	Temperature
Unit	Deg C
Sensor Range:	
Specific gravity:	
Mode:	TOC
User-defined reference*:	33.15 Feet H2O
Referenced on:	test start
Pressure head at reference:	Feet H2O

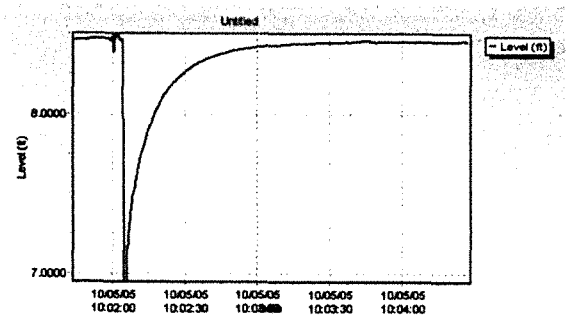
*Well depth to top of first casing terminating above ground. Does not include above ground extensions.



	Date	Time	ET (sec)	Time (min)	Test Time (min)	Temperature	Level	Water Level Bottom of well to TOC* (ft)	Change of Static Water Level (ft)	h/ho	
1	5/5/2010	9:20:27	0	0.000		11.254	7.1703	25.980	0		TEST START
2	5/5/2010	9:20:28	1	0.017	0.000	11.252	5.298	27.852	1.8723	1	SLUG REMOVED
3	5/5/2010	9:20:29	2	0.033	0.017	11.254	5.3992	27.751	1.7711	0.945646833	
4	5/5/2010	9:20:30	3	0.050	0.033	11.254	5.4584	27.692	1.7119	0.914029948	
5	5/5/2010	9:20:31	4	0.067	0.050	11.257	5.4885	27.662	1.6818	0.898253485	
6	5/5/2010	9:20:32	5	0.083	0.067	11.255	5.519	27.631	1.6513	0.881983361	
7	5/5/2010	9:20:33	6	0.100	0.083	11.258	5.5421	27.608	1.6282	0.869625564	
8	5/5/2010	9:20:34	7	0.117	0.100	11.257	5.5658	27.584	1.6045	0.856967366	
9	5/5/2010	9:20:35	8	0.133	0.117	11.258	5.5919	27.558	1.5784	0.843027293	
10	5/5/2010	9:20:36	9	0.150	0.133	11.257	5.6074	27.543	1.5629	0.834748705	
11	5/5/2010	9:20:37	10	0.167	0.150	11.257	5.6237	27.526	1.5466	0.826042835	
12	5/5/2010	9:20:38	11	0.183	0.167	11.258	5.6423	27.508	1.528	0.81610553	
13	5/5/2010	9:20:39	12	0.200	0.183	11.259	5.6595	27.491	1.5108	0.806921968	
14	5/5/2010	9:20:40	13	0.217	0.200	11.258	5.676	27.474	1.4943	0.798106277	
15	5/5/2010	9:20:41	14	0.233	0.217	11.259	5.6922	27.458	1.4781	0.789456518	
16	5/5/2010	9:20:42	15	0.250	0.233	11.261	5.7084	27.442	1.4619	0.780804358	
17	5/5/2010	9:20:43	16	0.267	0.250	11.259	5.7226	27.427	1.4477	0.773220104	
18	5/5/2010	9:20:44	17	0.283	0.267	11.259	5.7383	27.412	1.432	0.764834695	
19	5/5/2010	9:20:45	18	0.300	0.283	11.26	5.7519	27.398	1.4184	0.757570902	
20	5/5/2010	9:20:46	19	0.317	0.300	11.259	5.766	27.384	1.4043	0.750040058	
21	5/5/2010	9:20:47	20	0.333	0.317	11.261	5.7815	27.369	1.3888	0.74178147	
22	5/5/2010	9:20:48	21	0.350	0.333	11.259	5.7955	27.355	1.3748	0.734284036	
23	5/5/2010	9:20:49	22	0.367	0.350	11.259	5.8088	27.341	1.3615	0.727180473	
24	5/5/2010	9:20:50	23	0.383	0.367	11.26	5.8224	27.328	1.3479	0.71901666	
25	5/5/2010	9:20:51	24	0.400	0.383	11.259	5.8355	27.315	1.3348	0.712019938	
26	5/5/2010	9:20:52	25	0.417	0.400	11.26	5.8489	27.301	1.3214	0.705182965	
27	5/5/2010	9:20:53	26	0.433	0.417	11.261	5.8621	27.288	1.3082	0.698712513	
28	5/5/2010	9:20:54	27	0.450	0.433	11.26	5.875	27.275	1.2953	0.691822892	
29	5/5/2010	9:20:55	28	0.467	0.450	11.261	5.8867	27.263	1.2836	0.685573893	
30	5/5/2010	9:20:56	29	0.483	0.467	11.26	5.8996	27.250	1.2707	0.678683972	
31	5/5/2010	9:20:57	30	0.500	0.150	11.259	5.9124	27.238	1.2579	0.67184746	
32	5/5/2010	9:20:58	31	0.517	0.500	11.259	5.9236	27.226	1.2467	0.665865513	
33	5/5/2010	9:20:59	32	0.533	0.517	11.259	5.9351	27.215	1.2352	0.659723336	
34	5/5/2010	9:21:00	33	0.550	0.533	11.26	5.9479	27.202	1.2224	0.652886824	
35	5/5/2010	9:21:01	34	0.567	0.550	11.259	5.9589	27.191	1.2114	0.647011697	
36	5/5/2010	9:21:02	35	0.583	0.567	11.258	5.9699	27.180	1.2004	0.64113667	
37	5/5/2010	9:21:03	36	0.600	0.583	11.259	5.9803	27.170	1.19	0.635581905	
38	5/5/2010	9:21:04	37	0.617	0.600	11.258	5.9928	27.157	1.1775	0.628905824	
39	5/5/2010	9:21:05	38	0.633	0.617	11.26	6.0028	27.147	1.1675	0.6235846	
40	5/5/2010	9:21:06	39	0.650	0.633	11.258	6.0142	27.136	1.1561	0.617476832	
41	5/5/2010	9:21:07	40	0.667	0.650	11.257	6.025	27.125	1.1453	0.611707626	
42	5/5/2010	9:21:08	41	0.683	0.667	11.259	6.0346	27.115	1.1357	0.606580142	
43	5/5/2010	9:21:09	42	0.700	0.683	11.258	6.0448	27.105	1.1255	0.601132297	
44	5/5/2010	9:21:10	43	0.717	0.700	11.259	6.0554	27.095	1.1149	0.595470811	
45	5/5/2010	9:21:11	44	0.733	0.717	11.258	6.0658	27.084	1.1045	0.589916146	
46	5/5/2010	9:21:12	45	0.750	0.733	11.259	6.0765	27.074	1.0938	0.58420125	
47	5/5/2010	9:21:13	46	0.767	0.750	11.257	6.0864	27.064	1.0839	0.578913636	
48	5/5/2010	9:21:14	47	0.783	0.767	11.257	6.096	27.054	1.0743	0.573786252	
49	5/5/2010	9:21:15	48	0.800	0.783	11.257	6.1055	27.045	1.0648	0.568712279	
50	5/5/2010	9:21:16	49	0.817	0.800	11.259	6.1144	27.036	1.0559	0.563958787	
51	5/5/2010	9:21:17	50	0.833	0.817	11.257	6.1235	27.027	1.0468	0.559068435	
52	5/5/2010	9:21:18	51	0.850	0.833	11.259	6.1332	27.017	1.0371	0.553917641	
53	5/5/2010	9:21:19	52	0.867	0.850	11.257	6.1423	27.008	1.028	0.549067309	
54	5/5/2010	9:21:20	53	0.883	0.867	11.256	6.1513	26.999	1.019	0.544260387	
55	5/5/2010	9:21:21	54	0.900	0.883	11.257	6.1613	26.989	1.009	0.538909363	
56	5/5/2010	9:21:22	55	0.917	0.900	11.258	6.1693	26.981	1.001	0.534636543	
57	5/5/2010	9:21:23	56	0.933	0.917	11.257	6.1786	26.971	0.9917	0.529669391	
58	5/5/2010	9:21:24	57	0.950	0.933	11.257	6.1869	26.963	0.9834	0.52523634	
59	5/5/2010	9:21:25	58	0.967	0.950	11.257	6.196	26.954	0.9743	0.520376008	
60	5/5/2010	9:21:26	59	0.983	0.967	11.258	6.2045	26.946	0.9658	0.515836137	
61	5/5/2010	9:21:27	60	1.000	0.983	11.257	6.213	26.937	0.9573	0.511296287	
62	5/5/2010	9:21:28	61	1.017	1.000	11.256	6.2215	26.929	0.9488	0.506756399	
63	5/5/2010	9:21:29	62	1.033	1.017	11.256	6.2287	26.921	0.9416	0.502910658	
64	5/5/2010	9:21:30	63	1.050	1.033	11.255	6.2371	26.913	0.9332	0.498424398	
65	5/5/2010	9:21:31	64	1.067	1.050	11.257	6.2466	26.903	0.9237	0.493360426	
66	5/5/2010	9:21:32	65	1.083	1.067	11.257	6.2524	26.898	0.9179	0.49025263	
67	5/5/2010	9:21:33	66	1.100	1.083	11.255	6.2615	26.889	0.9088	0.485392298	
68	5/5/2010	9:21:34	67	1.117	1.100	11.256	6.268	26.882	0.9023	0.481920832	
69	5/5/2010	9:21:35	68	1.133	1.117	11.255	6.2762	26.874	0.8941	0.477540992	
70	5/5/2010	9:21:36	69	1.150	1.133	11.255	6.2835	26.867	0.8868	0.473642048	
71	5/5/2010	9:21:37	70	1.167	1.150	11.255	6.2923	26.858	0.878	0.468941943	
72	5/5/2010	9:21:38	71	1.183	1.167	11.256	6.2979	26.852	0.8724	0.465950969	
73	5/5/2010	9:21:39	72	1.200	1.183	11.256	6.3053	26.845	0.865	0.461996511	
74	5/5/2010	9:21:40	73	1.217	1.200	11.255	6.3126	26.837	0.8577	0.458099664	
75	5/5/2010	9:21:41	74	1.233	1.217	11.254	6.3208	26.829	0.8495	0.453720024	

Solinst	3001		
Report generated:	5/11/2010		
Report from file:	...\mw-3_1.csv		
Serial number:	1032308		
Unit name:	Solinst 3001		
Test name:	AP-2	Test 1	
Test defined on:	5/5/2010		
Test started on:	5/5/2010	10:02:05	
Test stopped on:	5/5/2010	10:02:58	
Data gathered using Linear testing			
Time between data points:	1	Seconds.	
Number of data samples:	55		
TOTAL DATA SAMPLES	55		
Channel number [1]			
Measurement type:	Level		
Unit	feet		
Channel number [2]			
Measurement type:	Temperature		
Unit	Deg C		
Sensor Range:			
Specific gravity:			
Mode:	TOC		
User-defined reference*:	19.47	Feet H2O	
Referenced on:	test start		
Pressure head at reference:		Feet H2O	

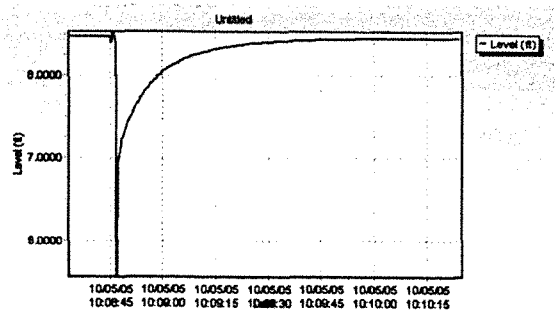
*Well depth to top of first casing terminating above ground. Does not include above ground extensions.



	Date	Time	ET (sec)	Time (min)	Test Time (min)	Temperature	Level	Water Level Bottom of well to TOC* (ft)	Change of Static Water Level (ft)	hbq	
1	5/5/2010	10:02:04	0	0.000		11.23	6.4182	11.052	0		TEST START
2	5/5/2010	10:02:05	1	0.017	0.000	11.231	6.9143	12.556	1.5039	1	SLUG REMOVED
3	5/5/2010	10:02:06	2	0.033	0.017	11.231	7.2562	12.214	1.162	0.772557756	
4	5/5/2010	10:02:07	3	0.050	0.033	11.231	7.3727	12.097	1.0455	0.6951925	
5	5/5/2010	10:02:08	4	0.067	0.050	11.231	7.4828	11.987	0.9354	0.621982845	
6	5/5/2010	10:02:09	5	0.083	0.067	11.231	7.5707	11.899	0.8475	0.563534809	
7	5/5/2010	10:02:10	6	0.100	0.083	11.231	7.6472	11.823	0.771	0.512567066	
8	5/5/2010	10:02:11	7	0.117	0.100	11.231	7.715	11.755	0.7032	0.467584261	
9	5/5/2010	10:02:12	8	0.133	0.117	11.232	7.7747	11.695	0.6435	0.427887493	
10	5/5/2010	10:02:13	9	0.150	0.133	11.232	7.8285	11.642	0.5897	0.392113837	
11	5/5/2010	10:02:14	10	0.167	0.150	11.232	7.878	11.592	0.5402	0.359199418	
12	5/5/2010	10:02:15	11	0.183	0.167	11.231	7.9204	11.550	0.4978	0.331005051	
13	5/5/2010	10:02:16	12	0.200	0.183	11.232	7.9625	11.508	0.4557	0.303012186	
14	5/5/2010	10:02:17	13	0.217	0.200	11.232	8.0004	11.470	0.4178	0.277811028	
15	5/5/2010	10:02:18	14	0.233	0.217	11.232	8.0325	11.438	0.3857	0.25646652	
16	5/5/2010	10:02:19	15	0.250	0.233	11.232	8.0633	11.407	0.3549	0.235956435	
17	5/5/2010	10:02:20	16	0.267	0.250	11.231	8.0906	11.379	0.3276	0.217833633	
18	5/5/2010	10:02:21	17	0.283	0.267	11.23	8.1151	11.355	0.3031	0.201542656	
19	5/5/2010	10:02:22	18	0.300	0.283	11.23	8.1395	11.331	0.2787	0.185318173	
20	5/5/2010	10:02:23	19	0.317	0.300	11.23	8.1616	11.308	0.2566	0.170623047	
21	5/5/2010	10:02:24	20	0.333	0.317	11.23	8.1805	11.290	0.2377	0.158056722	
22	5/5/2010	10:02:25	21	0.350	0.333	11.229	8.2001	11.270	0.2181	0.14502294	
23	5/5/2010	10:02:26	22	0.367	0.350	11.229	8.2158	11.254	0.2024	0.134583416	
24	5/5/2010	10:02:27	23	0.383	0.367	11.229	8.2315	11.239	0.1867	0.124143893	
25	5/5/2010	10:02:28	24	0.400	0.383	11.229	8.2454	11.225	0.1728	0.114901257	
26	5/5/2010	10:02:29	25	0.417	0.400	11.228	8.2589	11.211	0.1593	0.105924596	
27	5/5/2010	10:02:30	26	0.433	0.417	11.228	8.2709	11.199	0.1473	0.097946342	
28	5/5/2010	10:02:31	27	0.450	0.433	11.227	8.2821	11.188	0.1361	0.090486038	
29	5/5/2010	10:02:32	28	0.467	0.450	11.228	8.2931	11.177	0.1251	0.083183722	
30	5/5/2010	10:02:33	29	0.483	0.467	11.227	8.3029	11.167	0.1153	0.076667332	
31	5/5/2010	10:02:34	30	0.500	0.150	11.226	8.3123	11.158	0.1059	0.070416816	
32	5/5/2010	10:02:35	31	0.517	0.500	11.226	8.3207	11.149	0.0975	0.064831436	
33	5/5/2010	10:02:36	32	0.533	0.517	11.225	8.3292	11.141	0.089	0.059179467	
34	5/5/2010	10:02:37	33	0.550	0.533	11.225	8.3355	11.135	0.0827	0.054990358	
35	5/5/2010	10:02:38	34	0.567	0.550	11.224	8.3418	11.128	0.0764	0.05080125	
36	5/5/2010	10:02:39	35	0.583	0.567	11.224	8.3491	11.121	0.0691	0.045947204	
37	5/5/2010	10:02:40	36	0.600	0.583	11.223	8.3548	11.115	0.0634	0.042157058	
38	5/5/2010	10:02:41	37	0.617	0.600	11.223	8.3615	11.109	0.0567	0.037701978	
39	5/5/2010	10:02:42	38	0.633	0.617	11.223	8.3654	11.105	0.0528	0.035108717	
40	5/5/2010	10:02:43	39	0.650	0.633	11.222	8.3729	11.097	0.0453	0.030121684	
41	5/5/2010	10:02:44	40	0.667	0.650	11.222	8.3781	11.094	0.0421	0.027993883	
42	5/5/2010	10:02:45	41	0.683	0.667	11.221	8.3803	11.090	0.0379	0.025201144	
43	5/5/2010	10:02:46	42	0.700	0.683	11.221	8.385	11.085	0.0332	0.022076936	
44	5/5/2010	10:02:47	43	0.717	0.700	11.22	8.3888	11.081	0.0294	0.019549172	
45	5/5/2010	10:02:48	44	0.733	0.717	11.22	8.3922	11.078	0.026	0.017288384	
46	5/5/2010	10:02:49	45	0.750	0.733	11.22	8.3959	11.074	0.0223	0.014828114	
47	5/5/2010	10:02:50	46	0.767	0.750	11.219	8.3983	11.072	0.0199	0.013232283	
48	5/5/2010	10:02:51	47	0.783	0.767	11.219	8.4029	11.067	0.0153	0.010173649	
49	5/5/2010	10:02:52	48	0.800	0.783	11.218	8.4042	11.066	0.014	0.00930913	
50	5/5/2010	10:02:53	49	0.817	0.800	11.218	8.4084	11.062	0.0098	0.006516391	
51	5/5/2010	10:02:54	50	0.833	0.817	11.218	8.4099	11.060	0.0083	0.005518984	
52	5/5/2010	10:02:55	51	0.850	0.833	11.218	8.4117	11.058	0.0065	0.004322098	
53	5/5/2010	10:02:56	52	0.867	0.850	11.218	8.4145	11.056	0.0037	0.00246027	
54	5/5/2010	10:02:57	53	0.883	0.867	11.217	8.416	11.054	0.0022	0.001462863	
55	5/5/2010	10:02:58	54	0.900	0.883	11.216	8.4182	11.052	0	0	

Solinst	3001		
Report generated:	5/11/2010		
Report from file:	...\mw-3_2.csv		
Serial number:	1032308		
Unit name:	Solinst 3001		
Test name:	AP-2	Test 2	
Test defined on:	5/5/2010		
Test started on:	5/5/2010	10:08:48	
Test stopped on:	5/5/2010	10:09:43	
Data gathered using Linear testing			
Time between data points:	1	Seconds.	
Number of data samples:	57		
TOTAL DATA SAMPLES	57		
Channel number [1]			
Measurement type:	Level		
Unit	feet		
Channel number [2]			
Measurement type:	Temperature		
Unit	Deg C		
Sensor Range:			
Specific gravity:			
Mode:	TOC		
User-defined reference*:	19.47	Feet H2O	
Referenced on:	test start		
Pressure head at reference:		Feet H2O	

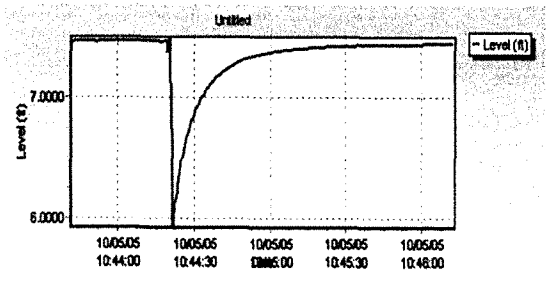
*Well depth to top of first casing terminating above ground. Does not include above ground extensions.



	Date	Time	ET (sec)	Time (min)	Test Time (min)	Temperature	Level	Water Level Bottom of well to TOC* (ft)	Change of Static Water Level (ft)	h/ho	
1	5/5/2010	10:08:47	0	0.000		11.111	8.4246	11.045	0	1	TEST START
2	5/5/2010	10:08:48	1	0.017	0.000	11.114	6.9757	12.494	1.4489	0.840568707	SLUG REMOVED
3	5/5/2010	10:08:49	2	0.033	0.017	11.114	7.2067	12.263	1.2179	0.743843681	
4	5/5/2010	10:08:50	3	0.050	0.033	11.116	7.3467	12.123	1.0779	0.684435089	
5	5/5/2010	10:08:51	4	0.067	0.050	11.117	7.4619	12.008	0.9627	0.597211678	
6	5/5/2010	10:08:52	5	0.083	0.067	11.117	7.5593	11.911	0.8653	0.539374696	
7	5/5/2010	10:08:53	6	0.100	0.083	11.117	7.6431	11.827	0.7815	0.486507006	
8	5/5/2010	10:08:54	7	0.117	0.100	11.118	7.7197	11.750	0.7049	0.442268547	
9	5/5/2010	10:08:55	8	0.133	0.117	11.121	7.7838	11.686	0.6406	0.401783064	
10	5/5/2010	10:08:56	9	0.150	0.133	11.12	7.8425	11.628	0.5821	0.366070812	
11	5/5/2010	10:08:57	10	0.167	0.150	11.12	7.8942	11.576	0.5304	0.333149286	
12	5/5/2010	10:08:58	11	0.183	0.167	11.123	7.9419	11.528	0.4827	0.304299814	
13	5/5/2010	10:08:59	12	0.200	0.183	11.123	7.9837	11.486	0.4409	0.278280078	
14	5/5/2010	10:09:00	13	0.217	0.200	11.123	8.0214	11.449	0.4032	0.256283372	
15	5/5/2010	10:09:01	14	0.233	0.217	11.124	8.0533	11.417	0.3713	0.234106634	
16	5/5/2010	10:09:02	15	0.250	0.233	11.124	8.0854	11.385	0.3392	0.214575575	
17	5/5/2010	10:09:03	16	0.267	0.250	11.125	8.1137	11.356	0.3109	0.196833446	
18	5/5/2010	10:09:04	17	0.283	0.267	11.125	8.1388	11.333	0.2878	0.180136655	
19	5/5/2010	10:09:05	18	0.300	0.283	11.127	8.1636	11.306	0.261	0.166816206	
20	5/5/2010	10:09:06	19	0.317	0.300	11.126	8.1829	11.287	0.2417	0.154600041	
21	5/5/2010	10:09:07	20	0.333	0.317	11.127	8.2006	11.269	0.224	0.142176824	
22	5/5/2010	10:09:08	21	0.350	0.333	11.127	8.2186	11.251	0.206	0.131064946	
23	5/5/2010	10:09:09	22	0.367	0.350	11.126	8.2347	11.235	0.1899	0.120988336	
24	5/5/2010	10:09:10	23	0.383	0.367	11.127	8.2493	11.221	0.1753	0.11208503	
25	5/5/2010	10:09:11	24	0.400	0.383	11.128	8.2622	11.208	0.1624	0.103250742	
26	5/5/2010	10:09:12	25	0.417	0.400	11.128	8.275	11.195	0.1496	0.095451722	
27	5/5/2010	10:09:13	26	0.433	0.417	11.129	8.2863	11.184	0.1383	0.087859756	
28	5/5/2010	10:09:14	27	0.450	0.433	11.129	8.2973	11.173	0.1273	0.080198771	
29	5/5/2010	10:09:15	28	0.467	0.450	11.13	8.3084	11.162	0.1162	0.072505556	
30	5/5/2010	10:09:16	29	0.483	0.467	11.13	8.3152	11.155	0.1094	0.068834751	
31	5/5/2010	10:09:17	30	0.500	0.150	11.129	8.3253	11.145	0.0993	0.063979571	
32	5/5/2010	10:09:18	31	0.517	0.500	11.13	8.3319	11.138	0.0927	0.059355373	
33	5/5/2010	10:09:19	32	0.533	0.517	11.132	8.3386	11.131	0.086	0.052384568	
34	5/5/2010	10:09:20	33	0.550	0.533	11.132	8.3487	11.121	0.0759	0.049278763	
35	5/5/2010	10:09:21	34	0.567	0.550	11.131	8.3532	11.117	0.0714	0.044930637	
36	5/5/2010	10:09:22	35	0.583	0.567	11.132	8.3595	11.111	0.0651	0.041593451	
37	5/5/2010	10:09:23	36	0.600	0.583	11.132	8.3639	11.106	0.0607	0.039290614	
38	5/5/2010	10:09:24	37	0.617	0.600	11.133	8.3697	11.100	0.0549	0.03443992	
39	5/5/2010	10:09:25	38	0.633	0.617	11.133	8.3747	11.095	0.0499	0.030367665	
40	5/5/2010	10:09:26	39	0.650	0.633	11.133	8.3806	11.089	0.044	0.027883222	
41	5/5/2010	10:09:27	40	0.667	0.650	11.134	8.3842	11.086	0.0404	0.02532956	
42	5/5/2010	10:09:28	41	0.683	0.667	11.134	8.3879	11.082	0.0367	0.023673131	
43	5/5/2010	10:09:29	42	0.700	0.683	11.134	8.3903	11.080	0.0343	0.020912416	
44	5/5/2010	10:09:30	43	0.717	0.700	11.135	8.3943	11.076	0.0303	0.018703844	
45	5/5/2010	10:09:31	44	0.733	0.717	11.134	8.3975	11.073	0.0271	0.018013666	
46	5/5/2010	10:09:32	45	0.750	0.733	11.135	8.3985	11.072	0.0261	0.015114916	
47	5/5/2010	10:09:33	46	0.767	0.750	11.135	8.4027	11.067	0.0219	0.012978361	
48	5/5/2010	10:09:34	47	0.783	0.767	11.136	8.4058	11.064	0.0188	0.011111878	
49	5/5/2010	10:09:35	48	0.800	0.783	11.135	8.4085	11.062	0.0161	0.009041342	
50	5/5/2010	10:09:36	49	0.817	0.800	11.136	8.4115	11.059	0.0131	0.008420181	
51	5/5/2010	10:09:37	50	0.833	0.817	11.136	8.4124	11.058	0.0122	0.006783752	
52	5/5/2010	10:09:38	51	0.850	0.833	11.137	8.4148	11.055	0.0096	0.006004555	
53	5/5/2010	10:09:39	52	0.867	0.850	11.138	8.4159	11.054	0.0087	0.004693216	
54	5/5/2010	10:09:40	53	0.883	0.867	11.138	8.4178	11.052	0.0068	0.004003037	
55	5/5/2010	10:09:41	54	0.900	0.883	11.137	8.4188	11.051	0.0058	0.001725447	
56	5/5/2010	10:09:42	55	0.917	0.900	11.137	8.4221	11.048	0.0025	0.000483125	
57	5/5/2010	10:09:43	56	0.933	0.917	11.138	8.4239	11.046	0.0007		

Solinst	3001		
Report generated:	5/11/2010		
Report from file:	...\mw-2_1.csv		
Serial number:	1032308		
Unit name:	Solinst 3001		
Test name:	AP-3	Test 1	
Test defined on:	5/5/2010		
Test started on:	5/5/2010		10:44:21
Test stopped on:	5/5/2010		11:45:28
Data gathered using Linear testing			
Time between data points:	1		Seconds.
Number of data samples:	69		
TOTAL DATA SAMPLES	69		
Channel number [1]			
Measurement type:	Level		
Unit	feet		
Channel number [2]			
Measurement type:	Temperature		
Unit	Deg C		
Sensor Range:			
Specific gravity:			
Mode:	TOC		
User-defined reference*:	19.83		Feet H2O
Referenced on:	test start		
Pressure head at reference:			Feet H2O

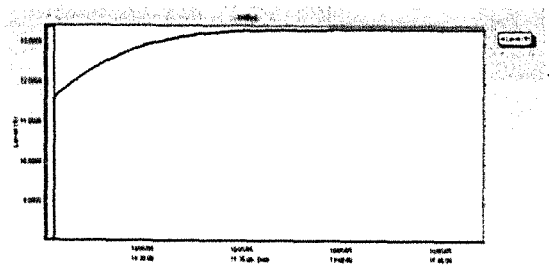
*Well depth to top of first casing terminating above ground. Does not include above ground extensions.



	Date	Time	ET (sec)	Time (min)	Test Time (min)	Temperature	Level	Water Level Bottom of well to TOC* (ft)	Change of Static Water Level (ft)	h/h0	
1	5/5/2010	10:44:20	0	0.000		11.841	7.4264	12.204	0	1	TEST START
2	5/5/2010	10:44:21	1	0.017	0.000	11.841	4.946	14.684	2.4804	0.562570653	SLUG REMOVED
3	5/5/2010	10:44:22	2	0.033	0.017	11.841	6.031	13.599	1.3954	0.481777133	
4	5/5/2010	10:44:23	3	0.050	0.033	11.841	6.2314	13.399	1.195	0.424286405	
5	5/5/2010	10:44:24	4	0.067	0.050	11.839	6.374	13.256	1.0524	0.378947428	
6	5/5/2010	10:44:25	5	0.083	0.067	11.841	6.4939	13.136	0.9325	0.334945978	
7	5/5/2010	10:44:26	6	0.100	0.083	11.841	6.5956	13.034	0.8308	0.30047573	
8	5/5/2010	10:44:27	7	0.117	0.100	11.84	6.6811	12.949	0.7453	0.2705612	
9	5/5/2010	10:44:28	8	0.133	0.117	11.841	6.7553	12.875	0.6711	0.244315433	
10	5/5/2010	10:44:29	9	0.150	0.133	11.84	6.8204	12.810	0.606	0.221577166	
11	5/5/2010	10:44:30	10	0.167	0.150	11.837	6.8768	12.753	0.5496	0.201459442	
12	5/5/2010	10:44:31	11	0.183	0.167	11.839	6.9267	12.703	0.4997	0.182782782	
13	5/5/2010	10:44:32	12	0.200	0.183	11.837	6.9731	12.657	0.4533	0.167432872	
14	5/5/2010	10:44:33	13	0.217	0.200	11.837	7.0111	12.619	0.4153	0.152515723	
15	5/5/2010	10:44:34	14	0.233	0.217	11.839	7.0481	12.582	0.3783	0.139977423	
16	5/5/2010	10:44:35	15	0.250	0.233	11.836	7.0792	12.551	0.3472	0.127601987	
17	5/5/2010	10:44:36	16	0.267	0.250	11.837	7.1094	12.521	0.317	0.117279471	
18	5/5/2010	10:44:37	17	0.283	0.267	11.837	7.1355	12.495	0.2909	0.10824867	
19	5/5/2010	10:44:38	18	0.300	0.283	11.837	7.1579	12.472	0.2685	0.099217868	
20	5/5/2010	10:44:39	19	0.317	0.300	11.834	7.1803	12.450	0.2461	0.092041606	
21	5/5/2010	10:44:40	20	0.333	0.317	11.834	7.1981	12.432	0.2283	0.084220267	
22	5/5/2010	10:44:41	21	0.350	0.333	11.836	7.2175	12.413	0.2089	0.077487502	
23	5/5/2010	10:44:42	22	0.367	0.350	11.834	7.2342	12.396	0.1922	0.072044831	
24	5/5/2010	10:44:43	23	0.383	0.367	11.831	7.2477	12.382	0.1787	0.066561846	
25	5/5/2010	10:44:44	24	0.400	0.383	11.833	7.2613	12.369	0.1651	0.061723915	
26	5/5/2010	10:44:45	25	0.417	0.400	11.831	7.2733	12.357	0.1531	0.057329463	
27	5/5/2010	10:44:46	26	0.433	0.417	11.83	7.2842	12.346	0.1422	0.053098275	
28	5/5/2010	10:44:47	27	0.450	0.433	11.829	7.2947	12.335	0.1317	0.049427612	
29	5/5/2010	10:44:48	28	0.467	0.450	11.829	7.3038	12.326	0.1226	0.045718433	
30	5/5/2010	10:44:49	29	0.483	0.467	11.828	7.313	12.317	0.1134	0.042736043	
31	5/5/2010	10:44:50	30	0.500	0.150	11.83	7.3204	12.310	0.106	0.039781969	
32	5/5/2010	10:44:51	31	0.517	0.500	11.83	7.3277	12.302	0.0987	0.036828387	
33	5/5/2010	10:44:52	32	0.533	0.517	11.827	7.3358	12.294	0.0906	0.034510563	
34	5/5/2010	10:44:53	33	0.550	0.533	11.828	7.3408	12.289	0.0856	0.032212546	
35	5/5/2010	10:44:54	34	0.567	0.550	11.827	7.3465	12.284	0.0799	0.029932317	
36	5/5/2010	10:44:55	35	0.583	0.567	11.827	7.3529	12.277	0.0735	0.028100306	
37	5/5/2010	10:44:56	36	0.600	0.583	11.825	7.3567	12.273	0.0697	0.026044186	
38	5/5/2010	10:44:57	37	0.617	0.600	11.826	7.3618	12.268	0.0646	0.024109015	
39	5/5/2010	10:44:58	38	0.633	0.617	11.825	7.3666	12.263	0.0598	0.022536688	
40	5/5/2010	10:44:59	39	0.650	0.633	11.823	7.3705	12.260	0.0559	0.020803096	
41	5/5/2010	10:45:00	40	0.667	0.650	11.824	7.3748	12.255	0.0516	0.019392034	
42	5/5/2010	10:45:01	41	0.683	0.667	11.823	7.3783	12.252	0.0481	0.018142236	
43	5/5/2010	10:45:02	42	0.700	0.683	11.823	7.3814	12.249	0.045	0.016771488	
44	5/5/2010	10:45:03	43	0.717	0.700	11.821	7.3848	12.245	0.0416	0.015582008	
45	5/5/2010	10:45:04	44	0.733	0.717	11.82	7.3878	12.242	0.0386	0.014352824	
46	5/5/2010	10:45:05	45	0.750	0.733	11.82	7.3908	12.239	0.0356	0.01326399	
47	5/5/2010	10:45:06	46	0.767	0.750	11.819	7.3935	12.237	0.0329	0.012261461	
48	5/5/2010	10:45:07	47	0.783	0.767	11.818	7.3943	12.236	0.0321	0.011812611	
49	5/5/2010	10:45:08	48	0.800	0.783	11.817	7.3971	12.233	0.0293	0.010764393	
50	5/5/2010	10:45:09	49	0.817	0.800	11.816	7.3997	12.230	0.0267	0.00936333	
51	5/5/2010	10:45:10	50	0.833	0.817	11.819	7.4032	12.227	0.0232	0.008111434	
52	5/5/2010	10:45:11	51	0.850	0.833	11.815	7.4038	12.226	0.0226	0.008587325	
53	5/5/2010	10:45:12	52	0.867	0.850	11.817	7.4051	12.225	0.0213	0.00729721	
54	5/5/2010	10:45:13	53	0.883	0.867	11.816	7.4083	12.222	0.0181	0.007176282	
55	5/5/2010	10:45:14	54	0.900	0.883	11.815	7.4086	12.221	0.0178	0.006208678	
56	5/5/2010	10:45:15	55	0.917	0.900	11.813	7.411	12.219	0.0154	0.00566478	
57	5/5/2010	10:45:16	56	0.933	0.917	11.815	7.4116	12.218	0.0148	0.004836349	
58	5/5/2010	10:45:17	57	0.950	0.933	11.814	7.4149	12.215	0.0115	0.004394453	
59	5/5/2010	10:45:18	58	0.967	0.950	11.813	7.4155	12.215	0.0109	0.00411224	
60	5/5/2010	10:45:19	59	0.983	0.967	11.811	7.4162	12.214	0.0102	0.003647815	
61	5/5/2010	10:45:20	60	1.000	0.983	11.811	7.4176	12.212	0.0088	0.003104336	
62	5/5/2010	10:45:21	61	1.017	1.000	11.81	7.4187	12.211	0.0077	0.002902758	
63	5/5/2010	10:45:22	62	1.033	1.017	11.81	7.4192	12.211	0.0072	0.001975488	
64	5/5/2010	10:45:23	63	1.050	1.033	11.808	7.4215	12.209	0.0049	0.00185454	
65	5/5/2010	10:45:24	64	1.067	1.050	11.809	7.4218	12.208	0.0046	0.001330431	
66	5/5/2010	10:45:25	65	1.083	1.067	11.811	7.4231	12.207	0.0033	0.000808322	
67	5/5/2010	10:45:26	66	1.100	1.083	11.81	7.4244	12.206	0.002	0.000967686	
68	5/5/2010	10:45:27	67	1.117	1.100	11.809	7.424	12.206	0.0024	0.000282213	
69	5/5/2010	10:45:28	68	1.133	1.117	11.807	7.4257	12.204	0.0007		
70											
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72											
73											
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Solinst	3001	
Report generated:	5/11/2010	
Report from file:	...\MW-1.lev	
Serial number:	1032308	
Unit name:	Solinst 3001	
Test name:	AP-4	
Test defined on:	5/5/2010	
Test started on:	5/5/2010	11:25:32
Test stopped on:	5/5/2010	11:25:51
Data gathered using Linear testing		
Time between data points:	0.5	Seconds.
Number of data samples:	41	
TOTAL DATA SAMPLES	41	
Channel number [1]		
Measurement type:	Level	
Unit	feet	
Channel number [2]		
Measurement type:	Temperature	
Unit	Deg C	
Sensor Range:		
Specific gravity:		
Mode:	TOC	
User-defined reference*:	58.93	Feet H2O
Referenced on:	test start	
Pressure head at reference:		Feet H2O

*Well depth to top of first casing terminating above ground. Does not include above ground extensions.



	Date	Time	ET (sec)	Time (min)	Test Time (min)	Temperature	Level	Water Level Bottom of well to TOC* (ft)	Change of Static Water Level (ft)	h/ho	
1	5/5/2010	11:25:31	0	0.000		12.799	13.4081	45.522	0		TEST START
2	5/5/2010	11:25:31	0	0.000	0.000	12.789	11.9721	46.958	1.436		
3	5/5/2010	11:25:32	0.5	0.008	0.008	12.794	8.02638	50.904	5.38172	1	SLUG REMOVED
4	5/5/2010	11:25:32	1	0.017	0.017	12.785	11.2523	47.678	2.1558	0.400678254	
5	5/5/2010	11:25:33	1.5	0.025	0.025	12.79	11.5307	47.399	1.8774	0.34884758	
6	5/5/2010	11:25:33	2	0.033	0.033	12.781	11.5481	47.382	1.86	0.345614413	
7	5/5/2010	11:25:34	2.5	0.042	0.042	12.785	11.5979	47.332	1.8102	0.336360666	
8	5/5/2010	11:25:34	3	0.050	0.050	12.776	11.5927	47.337	1.8154	0.3373271	
9	5/5/2010	11:25:35	3.5	0.058	0.058	12.78	11.6036	47.326	1.8045	0.335301725	
10	5/5/2010	11:25:35	4	0.067	0.067	12.771	11.6202	47.310	1.7879	0.332217209	
11	5/5/2010	11:25:36	4.5	0.075	0.075	12.775	11.6344	47.296	1.7737	0.329578648	
12	5/5/2010	11:25:36	5	0.083	0.083	12.766	11.6361	47.294	1.772	0.329262764	
13	5/5/2010	11:25:37	5.5	0.092	0.092	12.771	11.6445	47.286	1.7636	0.327701924	
14	5/5/2010	11:25:37	6	0.100	0.100	12.763	11.6514	47.279	1.7567	0.326419806	
15	5/5/2010	11:25:38	6.5	0.108	0.108	12.767	11.6587	47.271	1.7494	0.325063363	
16	5/5/2010	11:25:38	7	0.117	0.117	12.758	11.6626	47.267	1.7455	0.324338687	
17	5/5/2010	11:25:39	7.5	0.125	0.125	12.762	11.669	47.261	1.7391	0.323149476	
18	5/5/2010	11:25:39	8	0.133	0.133	12.752	11.6739	47.256	1.7342	0.322238887	
19	5/5/2010	11:25:40	8.5	0.142	0.142	12.758	11.6794	47.251	1.7287	0.321217009	
20	5/5/2010	11:25:40	9	0.150	0.150	12.749	11.6836	47.246	1.7245	0.320436589	
21	5/5/2010	11:25:41	9.5	0.158	0.158	12.753	11.6884	47.242	1.7197	0.319544681	
22	5/5/2010	11:25:41	10	0.167	0.167	12.743	11.6921	47.238	1.716	0.318857168	
23	5/5/2010	11:25:42	10.5	0.175	0.175	12.748	11.6969	47.233	1.7112	0.31796528	
24	5/5/2010	11:25:42	11	0.183	0.183	12.739	11.7013	47.229	1.7068	0.317147678	
25	5/5/2010	11:25:43	11.5	0.192	0.192	12.745	11.7049	47.225	1.7032	0.316478747	
26	5/5/2010	11:25:43	12	0.200	0.200	12.735	11.7092	47.221	1.6989	0.315679748	
27	5/5/2010	11:25:44	12.5	0.208	0.208	12.74	11.7131	47.217	1.695	0.31495507	
28	5/5/2010	11:25:44	13	0.217	0.217	12.731	11.7157	47.214	1.6924	0.314471983	
29	5/5/2010	11:25:45	13.5	0.225	0.225	12.735	11.7212	47.209	1.6869	0.313449975	
30	5/5/2010	11:25:45	14	0.233	0.233	12.726	11.7248	47.205	1.6833	0.312781044	
31	5/5/2010	11:25:46	14.5	0.242	0.075	12.731	11.7288	47.201	1.6793	0.312037787	
32	5/5/2010	11:25:46	15	0.250	0.250	12.722	11.7311	47.199	1.677	0.311610415	
33	5/5/2010	11:25:47	15.5	0.258	0.258	12.727	11.7354	47.195	1.6727	0.310811413	
34	5/5/2010	11:25:47	16	0.267	0.267	12.719	11.7394	47.191	1.6687	0.310068187	
35	5/5/2010	11:25:48	16.5	0.275	0.275	12.723	11.743	47.187	1.6651	0.309399228	
36	5/5/2010	11:25:48	17	0.283	0.283	12.713	11.7467	47.183	1.6614	0.308711713	
37	5/5/2010	11:25:49	17.5	0.292	0.292	12.718	11.75	47.180	1.6581	0.308098528	
38	5/5/2010	11:25:49	18	0.300	0.300	12.709	11.7529	47.177	1.6552	0.307559665	
39	5/5/2010	11:25:50	18.5	0.308	0.308	12.714	11.7568	47.173	1.6513	0.30683499	
40	5/5/2010	11:25:50	19	0.317	0.317	12.705	11.7612	47.169	1.6469	0.306017407	
41	5/5/2010	11:25:51	19.5	0.325	0.325	12.709	11.7641	47.166	1.644	0.305478546	

SIEVE ANALYSIS WORKSHEET

CLIENT:	CWLP Environmental Health & Safety	PROJECT:	Piezometer Installation CWLP Ash Ponds Springfield, IL
DATE:	April 26, 2010	PSI REPORT NO.	0020522-1 Page 1 of 8

GENERAL SAMPLE INFORMATION

SAMPLE TYPE: Clayey SILT, Some Fine to Coarse Sand	SAMPLED BY: PSI DATE SAMPLED: 4/21/2010
SAMPLE SOURCE: AP-1, 3'-7'	TESTED BY: Don Reed DATE TESTED: April 26, 2010
SPECIFICATIONS: ASTM C136	NOTES/OBSERVATIONS NP=Not Provided to PSI

SIEVE ANALYSIS DATA/RESULTS		TEST METHOD
Original "Wet" Sample Mass (OSM) + Pan:	996.3	ASTM C136
Pan Weight:	93.2	
Original "Wet" Sample Mass (OSM):	903.1	
Total "Dry" Sample Mass (TSM) + Pan:	820.4	
Pan Weight:	93.2	
Total "Dry" Sample Mass (TSM):	727.2	
Total "Dry" Washed Sample Mass (TWM) + Pan Wt.	182.6	
Pan Weight:	93.2	
Total "Dry" Washed Sample Mass (TWM), grams	89.4	

Sieve Size metric (English)	Individual Weight (g)	Cumulative Weight (g)	Percent Retained (%)	Percent Passing (%)	Specification
37.5 (1 1/2)	0.0	0.0	0.0	100.0	NP
25 (1)	0.0	0.0	0.0	100.0	NP
19 (3/4)	0.0	0.0	0.0	100.0	NP
16 (5/8)	0.0	0.0	0.0	100.0	NP
12.5 (1/2)	0.0	0.0	0.0	100.0	NP
9.5 (3/8)	0.0	0.0	0.0	100.0	NP
6.3 (1/4)	0.4	0.4	0.1	99.9	NP
4.75 (4)	1.2	1.6	0.2	99.8	NP
2.36 (8)	3.0	4.6	0.6	99.4	NP
1.18 (16)	2.1	6.7	0.9	99.1	NP
0.6 (30)	5.3	12.0	1.7	98.3	NP
0.425 (40)	0.0	12.0	1.7	98.3	NP
0.3 (50)	7.9	19.9	2.7	97.3	NP
0.15 (100)	27.4	47.3	6.5	93.5	NP
0.075 (200)	39.3	86.6	11.9	88.1	NP
Pan					

SIEVE ANALYSIS WORKSHEET

CLIENT:	CWLP Environmental Health & Safety	PROJECT:	Piezometer Installation CWLP Ash Ponds Springfield, IL
DATE:	April 26, 2010	PSI REPORT NO.	0020522-1 Page 2 of 8

GENERAL SAMPLE INFORMATION

SAMPLE TYPE: Clayey SILT, Some Fine to Coarse Sand	SAMPLED BY: PSI DATE SAMPLED: 4/21/2010
SAMPLE SOURCE: AP-1, 10'-15'	TESTED BY: Don Reed DATE TESTED: April 26, 2010
SPECIFICATIONS: ASTM C136	NOTES/OBSERVATIONS NP=Not Provided to PSI

SIEVE ANALYSIS DATA/RESULTS		TEST METHOD
Original "Wet" Sample Mass (OSM) + Pan:	1030.6	ASTM C136
Pan Weight:	93.5	
Original "Wet" Sample Mass (OSM):	937.1	
Total "Dry" Sample Mass (TSM) + Pan:	814.4	
Pan Weight:	93.5	
Total "Dry" Sample Mass (TSM):	720.9	
Total "Dry" Washed Sample Mass (TWM) + Pan Wt.	247.0	
Pan Weight:	93.5	
Total "Dry" Washed Sample Mass (TWM), grams	153.5	

Sieve Size metric (English)	Individual Weight (g)	Cumulative Weight (g)	Percent Retained (%)	Percent Passing (%)	Specification
37.5 (1 1/2)	0.0	0.0	0.0	100.0	NP
25 (1)	0.0	0.0	0.0	100.0	NP
19 (3/4)	0.0	0.0	0.0	100.0	NP
16 (5/8)	0.0	0.0	0.0	100.0	NP
12.5 (1/2)	0.0	0.0	0.0	100.0	NP
9.5 (3/8)	0.9	0.9	0.1	99.9	NP
6.3 (1/4)	0.9	1.8	0.2	99.8	NP
4.75 (4)	3.1	4.9	0.7	99.3	NP
2.36 (8)	21.1	26.0	3.6	96.4	NP
1.18 (16)	40.7	66.7	9.3	90.7	NP
0.6 (30)	31.2	97.9	13.6	86.4	NP
0.425 (40)	0.0	97.9	13.6	86.4	NP
0.3 (50)	14.4	112.3	15.6	84.4	NP
0.15 (100)	14.7	127.0	17.6	82.4	NP
0.075 (200)	25.6	152.6	21.2	78.8	NP
Pan					

SIEVE ANALYSIS WORKSHEET

CLIENT:	CWLP Environmental Health & Safety	PROJECT:	Piezometer Installation CWLP Ash Ponds Springfield, IL
DATE:	April 26, 2010	PSI REPORT NO.	0020522-1 Page 3 of 8

GENERAL SAMPLE INFORMATION

SAMPLE TYPE: Clayey SILT, Some Fine to Coarse Sand	SAMPLED BY: PSI DATE SAMPLED: 4/21/2010
SAMPLE SOURCE: AP-2, 3'-7'	TESTED BY: Don Reed DATE TESTED: April 26, 2010
SPECIFICATIONS: ASTM C136	NOTES/OBSERVATIONS NP=Not Provided to PSI

SIEVE ANALYSIS DATA/RESULTS		TEST METHOD
Original "Wet" Sample Mass (OSM) + Pan:	1706.4	ASTM C136
Pan Weight:	90.7	
Original "Wet" Sample Mass (OSM):	1615.7	
Total "Dry" Sample Mass (TSM) + Pan:	1381.0	
Pan Weight:	90.7	
Total "Dry" Sample Mass (TSM):	1290.3	
Total "Dry" Washed Sample Mass (TWM) + Pan Wt.	420.6	
Pan Weight:	90.7	
Total "Dry" Washed Sample Mass (TWM), grams	329.9	

Sieve Size metric (English)	Individual Weight (g)	Cumulative Weight (g)	Percent Retained (%)	Percent Passing (%)	Specification
37.5 (1 1/2)	0.0	0.0	0.0	100.0	NP
25 (1)	0.0	0.0	0.0	100.0	NP
19 (3/4)	0.0	0.0	0.0	100.0	NP
16 (5/8)	0.0	0.0	0.0	100.0	NP
12.5 (1/2)	0.0	0.0	0.0	100.0	NP
9.5 (3/8)	3.5	3.5	0.3	99.7	NP
6.3 (1/4)	2.3	5.8	0.4	99.6	NP
4.75 (4)	2.7	8.5	0.7	99.3	NP
2.36 (8)	6.6	15.1	1.2	98.8	NP
1.18 (16)	7.0	22.1	1.7	98.3	NP
0.6 (30)	8.0	30.1	2.3	97.7	NP
0.425 (40)	0.0	30.1	2.3	97.7	NP
0.3 (50)	18.1	48.2	3.7	96.3	NP
0.15 (100)	119.7	167.9	13.0	87.0	NP
0.075 (200)	156.2	324.1	25.1	74.9	NP
Pan					

SIEVE ANALYSIS WORKSHEET

CLIENT: CWLP
Environmental Health & Safety

PROJECT: Piezometer Installation
CWLP Ash Ponds
Springfield, IL

DATE: April 26, 2010

PSI REPORT NO. 0020522-1

GENERAL SAMPLE INFORMATION

SAMPLE TYPE: Clayey SILT, Some Fine to Coarse Sand	SAMPLED BY: PSI DATE SAMPLED: 4/21/2010
SAMPLE SOURCE: AP-2, 9'-16'	TESTED BY: Don Reed DATE TESTED: April 26, 2010
SPECIFICATIONS: ASTM C136	NOTES/OBSERVATIONS NP=Not Provided to PSI

SIEVE ANALYSIS DATA/RESULTS		TEST METHOD
Original "Wet" Sample Mass (OSM) + Pan:	1461.6	ASTM C136
Pan Weight:	173.0	
Original "Wet" Sample Mass (OSM):	1288.6	
Total "Dry" Sample Mass (TSM) + Pan:	1178.1	
Pan Weight:	173.0	
Total "Dry" Sample Mass (TSM):	1005.1	
Total "Dry" Washed Sample Mass (TWM) + Pan Wt.	319.2	
Pan Weight:	173.0	
Total "Dry" Washed Sample Mass (TWM), grams	146.2	

Sieve Size metric (English)	Individual Weight (g)	Cumulative Weight (g)	Percent Retained (%)	Percent Passing (%)	Specification
37.5 (1 1/2)	0.0	0.0	0.0	100.0	NP
25 (1)	0.0	0.0	0.0	100.0	NP
19 (3/4)	0.0	0.0	0.0	100.0	NP
16 (5/8)	0.0	0.0	0.0	100.0	NP
12.5 (1/2)	0.0	0.0	0.0	100.0	NP
9.5 (3/8)	0.0	0.0	0.0	100.0	NP
6.3 (1/4)	0.8	0.8	0.1	99.9	NP
4.75 (4)	1.2	2.0	0.2	99.8	NP
2.36 (8)	1.5	3.5	0.3	99.7	NP
1.18 (16)	2.8	6.3	0.6	99.4	NP
0.6 (30)	5.7	12.0	1.2	98.8	NP
0.425 (40)	0.0	12.0	1.2	98.8	NP
0.3 (50)	7.2	19.2	1.9	98.1	NP
0.15 (100)	42.1	61.3	6.1	93.9	NP
0.075 (200)	82.8	144.1	14.3	85.7	NP
Pan					

SIEVE ANALYSIS WORKSHEET

CLIENT:	CWLP Environmental Health & Safety	PROJECT:	Piezometer Installation CWLP Ash Ponds Springfield, IL
DATE:	April 26, 2010	PSI REPORT NO.	0020522-1 Page 5 of 8

GENERAL SAMPLE INFORMATION

SAMPLE TYPE: Clayey SILT, Some Fine to Coarse Sand, Trace Subround Gravel	SAMPLED BY: PSI DATE SAMPLED: 4/21/2010
SAMPLE SOURCE: AP-3, 3'-6'	TESTED BY: Don Reed DATE TESTED: April 26, 2010
SPECIFICATIONS: ASTM C136	NOTES/OBSERVATIONS NP=Not Provided to PSI

SIEVE ANALYSIS DATA/RESULTS		TEST METHOD
Original "Wet" Sample Mass (OSM) + Pan:	816.4	ASTM C136
Pan Weight:	94.6	
Original "Wet" Sample Mass (OSM):	721.8	
Total "Dry" Sample Mass (TSM) + Pan:	663.7	
Pan Weight:	94.6	
Total "Dry" Sample Mass (TSM):	569.1	
Total "Dry" Washed Sample Mass (TWM) + Pan Wt.	195.2	
Pan Weight:	94.6	
Total "Dry" Washed Sample Mass (TWM), grams	100.6	

Sieve Size metric (English)	Individual Weight (g)	Cumulative Weight (g)	Percent Retained (%)	Percent Passing (%)	Specification
37.5 (1 1/2)	0.0	0.0	0.0	100.0	NP
25 (1)	0.0	0.0	0.0	100.0	NP
19 (3/4)	0.0	0.0	0.0	100.0	NP
16 (5/8)	0.0	0.0	0.0	100.0	NP
12.5 (1/2)	0.0	0.0	0.0	100.0	NP
9.5 (3/8)	2.5	2.5	0.4	99.6	NP
6.3 (1/4)	0.4	2.9	0.5	99.5	NP
4.75 (4)	0.4	3.3	0.6	99.4	NP
2.36 (8)	1.3	4.6	0.8	99.2	NP
1.18 (16)	3.6	8.2	1.4	98.6	NP
0.6 (30)	7.6	15.8	2.8	97.2	NP
0.425 (40)	0.0	15.8	2.8	97.2	NP
0.3 (50)	10.2	26.0	4.6	95.4	NP
0.15 (100)	31.7	57.7	10.1	89.9	NP
0.075 (200)	41.5	99.2	17.4	82.6	NP
Pan					

SIEVE ANALYSIS WORKSHEET

CLIENT:	CWLP Environmental Health & Safety	PROJECT:	Piezometer Installation CWLP Ash Ponds Springfield, IL
DATE:	April 26, 2010	PSI REPORT NO.	0020522-1 Page 6 of 8

GENERAL SAMPLE INFORMATION

SAMPLE TYPE: Clayey SILT, Some Fine to Coarse Sand	SAMPLED BY: PSI DATE SAMPLED: 4/21/2010
SAMPLE SOURCE: AP-3, 10'-15'	TESTED BY: Don Reed DATE TESTED: April 26, 2010
SPECIFICATIONS: ASTM C136	NOTES/OBSERVATIONS NP=Not Provided to PSI

SIEVE ANALYSIS DATA/RESULTS		TEST METHOD
Original "Wet" Sample Mass (OSM) + Pan:	1010.5	ASTM C136
Pan Weight:	104.2	
Original "Wet" Sample Mass (OSM):	906.3	
Total "Dry" Sample Mass (TSM) + Pan:	812.2	
Pan Weight:	104.2	
Total "Dry" Sample Mass (TSM):	708.0	
Total "Dry" Washed Sample Mass (TWM) + Pan Wt.	250.7	
Pan Weight:	104.2	
Total "Dry" Washed Sample Mass (TWM), grams	146.5	

Sieve Size metric (English)	Individual Weight (g)	Cumulative Weight (g)	Percent Retained (%)	Percent Passing (%)	Specification
37.5 (1 1/2)	0.0	0.0	0.0	100.0	NP
25 (1)	0.0	0.0	0.0	100.0	NP
19 (3/4)	0.0	0.0	0.0	100.0	NP
16 (5/8)	0.0	0.0	0.0	100.0	NP
12.5 (1/2)	0.0	0.0	0.0	100.0	NP
9.5 (3/8)	0.0	0.0	0.0	100.0	NP
6.3 (1/4)	1.8	1.8	0.3	99.7	NP
4.75 (4)	0.4	2.2	0.3	99.7	NP
2.36 (8)	3.4	5.6	0.8	99.2	NP
1.18 (16)	5.5	11.1	1.6	98.4	NP
0.6 (30)	7.4	18.5	2.6	97.4	NP
0.425 (40)	0.0	18.5	2.6	97.4	NP
0.3 (50)	16.6	35.1	5.0	95.0	NP
0.15 (100)	52.0	87.1	12.3	87.7	NP
0.075 (200)	56.8	143.9	20.3	79.7	NP
Pan					

SIEVE ANALYSIS WORKSHEET

CLIENT:	CWLP Environmental Health & Safety	PROJECT:	Piezometer Installation CWLP Ash Ponds Springfield, IL
DATE:	April 26, 2010	PSI REPORT NO.	0020522-1 Page 7 of 8

GENERAL SAMPLE INFORMATION

SAMPLE TYPE: Composite of FLY ASH and Silty CLAY, With Fine to Coarse Sand, Trace Subround gravel	SAMPLED BY: PSI DATE SAMPLED: 4/20/2010
SAMPLE SOURCE: AP-4, 18'-23'	TESTED BY: Don Reed DATE TESTED: April 26, 2010
SPECIFICATIONS: ASTM C136	NOTES/OBSERVATIONS NP=Not Provided to PSI

SIEVE ANALYSIS DATA/RESULTS		TEST METHOD
Original "Wet" Sample Mass (OSM) + Pan:	1931.9	ASTM C136
Pan Weight:	147.6	
Original "Wet" Sample Mass (OSM):	1784.3	
Total "Dry" Sample Mass (TSM) + Pan:	1596.1	
Pan Weight:	147.6	
Total "Dry" Sample Mass (TSM):	1448.5	
Total "Dry" Washed Sample Mass (TWM) + Pan Wt.	752.6	
Pan Weight:	147.6	
Total "Dry" Washed Sample Mass (TWM), grams	605.0	

Sieve Size metric (English)	Individual Weight (g)	Cumulative Weight (g)	Percent Retained (%)	Percent Passing (%)	Specification
37.5 (1 1/2)	0.0	0.0	0.0	100.0	NP
25 (1)	0.0	0.0	0.0	100.0	NP
19 (3/4)	0.0	0.0	0.0	100.0	NP
16 (5/8)	8.2	8.2	5.6	94.4	NP
12.5 (1/2)	0.0	8.2	0.6	99.4	NP
9.5 (3/8)	2.5	10.7	0.7	99.3	NP
6.3 (1/4)	12.3	23.0	1.6	98.4	NP
4.75 (4)	10.8	33.8	2.3	97.7	NP
2.36 (8)	52.2	86.0	5.9	94.1	NP
1.18 (16)	144.3	230.3	15.9	84.1	NP
0.6 (30)	132.2	362.5	25.0	75.0	NP
0.425 (40)	0.0	362.5	25.0	75.0	NP
0.3 (50)	110.4	472.9	32.6	67.4	NP
0.15 (100)	75.1	548.0	37.8	62.2	NP
0.075 (200)	53.5	601.5	41.5	58.5	NP
Pan					

SIEVE ANALYSIS WORKSHEET

CLIENT:	CWLP Environmental Health & Safety	PROJECT:	Piezometer Installation CWLP Ash Ponds Springfield, IL
DATE:	April 26, 2010	PSI REPORT NO.	0020522-1 Page 8 of 8

GENERAL SAMPLE INFORMATION

SAMPLE TYPE: Clayey SILT With Fine to Coarse Sand, Trace Subround Gravel	SAMPLED BY: PSI DATE SAMPLED: 4/20/2010
SAMPLE SOURCE: AP-4, 45'-55'	TESTED BY: Don Reed DATE TESTED: April 26, 2010
SPECIFICATIONS: ASTM C136	NOTES/OBSERVATIONS NP=Not Provided to PSI

SIEVE ANALYSIS DATA/RESULTS		TEST METHOD
Original "Wet" Sample Mass (OSM) + Pan:	1855.4	ASTM C136
Pan Weight:	99.7	
Original "Wet" Sample Mass (OSM):	1755.7	
Total "Dry" Sample Mass (TSM) + Pan:	1509.0	
Pan Weight:	99.7	
Total "Dry" Sample Mass (TSM):	1409.3	
Total "Dry" Washed Sample Mass (TWM) + Pan Wt.	584.6	
Pan Weight:	99.7	
Total "Dry" Washed Sample Mass (TWM), grams	484.9	

Sieve Size metric (English)	Individual Weight (g)	Cumulative Weight (g)	Percent Retained (%)	Percent Passing (%)	Specification
37.5 (1 1/2)	0.0	0.0	0.0	100.0	NP
25 (1)	0.0	0.0	0.0	100.0	NP
19 (3/4)	0.0	0.0	0.0	100.0	NP
16 (5/8)	0.0	0.0	0.0	100.0	NP
12.5 (1/2)	0.0	0.0	0.0	100.0	NP
9.5 (3/8)	2.7	2.7	0.2	99.8	NP
6.3 (1/4)	6.7	9.4	0.7	99.3	NP
4.75 (4)	11.0	20.4	1.4	98.6	NP
2.36 (8)	31.4	51.8	3.7	96.3	NP
1.18 (16)	35.3	87.1	6.2	93.8	NP
0.6 (30)	55.9	143.0	10.1	89.9	NP
0.425 (40)	0.0	143.0	10.1	89.9	NP
0.3 (50)	162.8	305.8	21.7	78.3	NP
0.15 (100)	94.7	400.5	28.4	71.6	NP
0.075 (200)	82.5	483.0	34.3	65.7	NP
Pan					

ATTACHMENT C

Electronic Filing: Received, Clerk's Office 02/13/2020

RAPPS

BORING LOG

ENGINEERING and APPLIED SCIENCE
821 SOUTH DURKIN – SPRINGFIELD IL 62704 – (217)787-2118

Site Name: FGDS Development Landfill — Boring No: AW-3
Drilling Firm: Reynolds Drilling Corp. — Drilling Method: HSA — Surface Elev: 537.75
Logged By: KJM — Checked By: KJM — Date Started: 12/30/08 — Completed: 12/31/08

DEPTH	Material Description Classification System	Sampling Tube No.	Type	% Rec.	Tests OVM (ppm)	Qu t/sf PEN	Moist	Comments	Well	DEPTH
0	Dark brown clayey silt; Moist; Firm; Organic debris & plant roots	1	5' CONTINUOUS SAMPLER	100						0
	Gray to brown mottled silty clay; Moist; Firm; Trace sand; Laminated; Fe oxidation stains									
5		2		100						5
10		3		95				Wet seam @ 11.5'		10
15	Gray sandy clay; Moist; Firm; Finely laminated	4		95				Water on rods		15
20										20
	Dark gray sandy silt; Moist; Soft to firm; Some clay	5		80						
25		6		30				No recovery 26.5'–30'		25
30										30

Water Level_____ after_____ hrs.

Response to 1st RTP
CWLP - 01782

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RAPPS

ENGINEERING and APPLIED SCIENCE

BORING LOG

821 SOUTH DURKIN – SPRINGFIELD IL 62704 – (217)787-2118

Site Name: FGDS Development Landfill — Boring No: AW-3

Drilling Firm: Reynolds Drilling Corp. — Drilling Method: HSA — Surface Elev: 537.75

Logged By: KJM — Checked By: KJM — Date Started: 12/30/08 — Completed: 12/31/08

DEPTH	Material Description Classification System	Sampling Tube No.	Type	% Rec.	Tests OVM (ppm)	Qu t/sf PEN	Moist	Comments	Well	DEPTH
30	Dark gray silt; Trace sand	7	5' CONTINUOUS SAMPLER	100						30
35	Sandy									35
	Gray fine to medium silty sand; Wet; Gravelly @ base	8		100						
40	Gray shale	9		0				Broken shale in bit No recovery past 40' Refusal		40
	End of Boring @ 41.83'									
45										45
50										50
55										55
60										60

Water Level____ after____ hrs.

Sheet 2 of 2

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Illinois Environmental Protection Agency **Well Completion Report**

Site Number: 1678250020 County: Sangamon

Site Name: FGDS Development Landfill Well #: AW-3

State Plane Coordinate: X ____ Y ____ (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____ Borehole #: AW-3

Surveyed by: David Mihelsic IL Registration #: 3762

Drilling Contractor: Reynolds Drilling Corp. Driller: Andrew Rachford

Consulting Firm: Rapps Engineering & Applied Science Geologist: Ken Miller

Drilling Method: HSA Drilling Fluid (Type): NA

Logged By: Ken Miller Date Started: 12/30/08 Date Finished: 12/31/08

Report Form Completed By: Ken Miller Date: 5/18/09

ANNUAL SPACE DETAILS

Type of Surface Seal: Cement

Type of Annular Sealant: Bentonite Chips

Installation Method: Poured

Setting Time: >24 hrs

Type of Bentonite Seal - - Granular, (Pellet), Slurry (Choose One)

Installation Method: Poured

Setting Time: 16 hrs

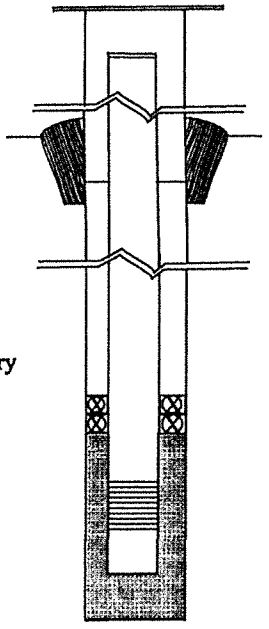
Type of Sand Pack: Quartz Sand

Grain Size: 50 (Sieve Size)

Installation Method: Poured

Type of Backfill Material: ____ (if applicable)

Installation Method: ____



	Elevations (MSL)*	Depths (BGS)	(.01ft.)
	____	____	Top of Protective Casing
	540.33	-2.58	Top of Riser Pipe
	537.75	0	Ground Surface
	534.75	3.00	Top of Annular Sealant
	____	____	Static Water Level (After Completion)
	511.32	26.43	Top of Seal
	508.32	29.43	Top of Sand Pack
	506.32	31.43	Top of Screen
	496.32	41.43	Bottom of Screen
	495.92	41.83	Bottom of Well
	495.92	41.83	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or (Other)
Riser Pipe Above W.T.	SS304, SS316, PTFE, (PVC), or Other
Riser Pipe Below W.T.	SS304, SS316, PTFE, (PVC), or Other
Screen	SS304, SS316, PTFE, (PVC), or Other

CASING MEASURMENTS

Diameter of Borehole (inches)	8.25
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	34.01
Bottom of Screen to End Cap (feet)	0.4
Screen Length (1st slot to last slot) (feet)	10
Total Length of Casing (feet)	44.41
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

Well Completion Form (revised 02/06/02)

White & Pink Copies:
Ill. Dept. of Public Health
Yellow Copy: Well Contractor
Golden Copy: Well Owner

Electronic Filing: Received, Clerk's Office 02/13/2020

See Attached For Details.

Well Construction Report

THIS FORM MUST BE COMPLETED WITHIN 30 DAYS
OF WELL COMPLETION AND SENT TO
THE ILLINOIS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
525 WEST JEFFERSON STREET
SPRINGFIELD, ILLINOIS 62761

GEOLOGICAL AND WATER SURVEYS WELL RECORD

1. Type of Well - Groundwater Monitor Well
   a. Bored X Hole Diam. 8 in. Depth 59.9 ft
      Buried Slab: Yes___ No___
   b. Driven___ Drive Pipe Diam.___in. Depth___ft
   c. Drilled___ Finished in Drift___ In Rock___
   d. Grout:

(KIND)	FROM (Ft.)	TO (Ft.)
Cement/		
Bentonite	3.0	37.0

2. Well furnishes water for human consumption? Yes___ No X
3. Date well drilled 07/12/93
4. Permanent pump installed? Yes ___ Date___ No X
   Manufacturer___ Type___
   Location___
   Capacity ___gpm. Depth of setting___ft.
5. Well top sealed? Yes X No___ Type Concrete
6. Pitless adapter installed? Yes___ No N/A
   Manufacturer___ Model No.___
   How attached to casing?___
7. Well disinfected? Yes___ No N/A
8. Pump and equipment disinfected Yes___ No N/A

IMPORTANT NOTICE

This State Agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Public Act 85-0863. Disclosiure of this information is mandatory. This form has been approved by the Forms Management Center.

PRESS FIRMLY WITH BLACK PEN OR TYPE
Do Not Use Felt Pen

IL482-0126

9. Driller AE Exploration Corporation License No. N/A
10. Well Site Address City Water, Light & Power/FGDS Landfill
11. Property Owner CWL&P/Springfield Well No. G-110
12. Permit No. N/A Date Issued___
13. Location: Site Coordinates: County Sangamon
    N 3728.6
    E 2315.7
    Sec. 12
    Twp. 15N
    Rge. 5W

Show location in section plat

14. Water from ___ at depth___ft to___ft

15. Casing and Liner Pipe

Diam.(in)	Kind and Weight	From (ft)	To (ft)
2	Stainless Steel 304	+2	44.5

16. Screen: Diam. 2 in, Length 120 in, Slot Size .01"
17. Size hole below casing N/A in. 18. Ground Elev. 554.5 ft msl.
19. Static level___ft below casing top which is ___ft. above ground level. Pumping level ___ft, pumping gpm for ___ hours.

20. Earth Materials Passed Through	Depth of Top	Depth of Bottom
Gray Silty Clay	0	38.8
Gray Silty Sand	38.8	45.5
Gray Clayey Sand	45.5	54.5
Gray Shale (massive)	54.5	59.5

Continue on separate sheet if necessary.

Signed Brad J. Hunsberger Date 09/03/93
For: Andrews Environmental Engineering, Inc.

Response to 1st RTP
CWLP - 01785

Andrews Environmental Engineering, Inc.

3535 Mayflower Boulevard, Springfield, IL 62707 (217) 787-2334

Electronic Filing: Received, Clerk's Office 02/13/2020

Field Boring Log

Site Information:
Name: City Water, Light, and Power
Location: Springfield, IL
County: Sangamon
Site No.: 1678250020
AEEI No.: 93-118

Location:
Coord. System: Site Coordinates
Northing: 3728.6
Easting: 2315.7

Boring Information:
Boring No.: G110
Well No.: G110
Surf. Elev.: 554.5
Depth Information:
Total: 59.5
Auger: 59.5
Rotary: N/A
Dates:
Start: 7/12/93
Finish: 7/12/93

Drilling Contractor:
Name: AE Exploration Corp.
City: Springfield, IL
Equipment: CME 55

Personel:
Geologist: B. Hunsberger
Driller: M. Moore
Helper (s): R. Smith

Sample Type: ▮ - Continuous Barrel ⊠ - Split Spoon ⧄ - Shelby Tube ▮ - Core ☐ - Blind Drill

Depth (ft.)	Run No.	Sample Type	Sample No.	Sample Recov.	Blow Count	q_u /[q_s] (in tsf)	% Moisture	Borehole Detail	Lithology	Description/*Comments*	USC	Elev. (MSL)
										Gravel backfill-*access road.*		554.5
	1		1A	3.2'		3.5		Concrete Plug		Dark gray silty CLAY, little sand and gravel, with rootlets.		
5						2.75						549.5
	2		2A			2.8						
			2B			2.5				Dark gray-black clayey SILT, some fine sand, rootlets.		
			2C	5.0'		0.8				Dark gray-black silty CLAY, soft, with rootlets, some fine sand.		
10	3			1.4'								544.5
	4		4A			0.7		Cement/Bentonite Grout				
				2.8'		0.5						
						0.65						
			5A			3.25				Dark gray, very moist silty CLAY-clayey SILT, numerous plant and wood fragments *(appears to be original grade).*		
15	5					2.75						539.5
						2.25						
			5B			2.0						
				4.8'		2.8						
	6					1.8						
20						2.2						
						1.8						534.5

NOTE: ▼ = groundwater encountered while drilling.

Response to ~~1st~~ RTP

Electronically Received, Clerk's Office 02/13/2020

Andrews Environmental Engineering, Inc.

3535 Mayflower Boulevard, Springfield, IL 62707 (217) 787-2334

Field Boring Log

Site Information:
Name: City Water, Light, and Power
Location: Springfield, IL
County: Sangamon
Site No.: 1678250020
AEEI No.: 93-118

Location:
Coord. System: Site Coordinates
Northing: 3728.6
Easting: 2315.7

Boring Information:
Boring No.: G110
Well No.: G110
Surf. Elev.: 554.5
Depth Information:
Total: 59.5
Auger: 59.5
Rotary: N/A
Dates:
Start: 7/12/93
Finish: 7/12/93

Drilling Contractor:
Name: AE Exploration Corp.
City: Springfield, IL
Equipment: CME 55

Personel:
Geologist: B. Hunsberger
Driller: M. Moore
Helper (s): R. Smith

Sample Type: ▮ - Continuous Barrel ☒ - Split Spoon ▨ - Shelby Tube ▮ - Core ☐ - Blind Drill

Depth (ft.)	Run No.	Sample Type	Sample No.	Sample Recov.	Blow Count	$q_u/[q_s]$ (in tsf)	% Moisture	Borehole Detail	Lithology	Description/*Comments*	USC	Elev. (MSL)
												534.5
	6		6A			1.7				Dark gray silty CLAY, moist, trace fine sand, little organics.		
			6B	5.0'		1.8				Gray mottled light gray-brown silty CLAY, little fine sand, some plant roots.		
	7											
25				2.0'								529.5
			8A			0.7						
	8					2.0						
			8B			1.2						
				3.0'		1.3						
						2.2						
30			9A			2.2				Gray mottled brown silty CLAY, trace fine sand, little organics.		524.5
	9					2.2						
						2.75						
						2.75						
			9B	5.0'		1.75				Gray clayey SILT.		
						0.75						
			10A			0.3						
35						0.2						519.5
	10					0.2				Gray CLAY, very soft, some organic clay strata present. *(* The clay was too soft for the pocket penetrometer).*		
						*						
						*						
				5.0'		*						
	11		11A									
40												514.5

Cement/Bentonite Grout

Bentonite Seal

NOTE: ▼ = groundwater encountered while drilling.

Response to 1st RTP
CWLP - 01787

Electronic Filing: Received, Clerk's Office 02/13/2020

Andrews Environmental Engineering, Inc.

3535 Mayflower Boulevard, Springfield, IL 62707 (217) 787-2334

Field Boring Log

Site Information:
Name: City Water, Light, and Power
Location: Springfield, IL
County: Sangamon
Site No.: 1678250020
AEEI No.: 93-118

Location:
Coord. System: Site Coordinates
Northing: 3728.6
Easting: 2315.7

Boring Information:
Boring No.: G110
Well No.: G110
Surf. Elev.: 554.5
Depth Information:
Total: 59.5
Auger: 59.5
Rotary: N/A
Dates:
Start: 7/12/93
Finish: 7/12/93

Drilling Contractor:
Name: AE Exploration Corp.
City: Springfield, IL
Equipment: CME 55

Personel:
Geologist: B. Hunsberger
Driller: M. Moore
Helper (s): R. Smith

Sample Type: Continuous Barrel; Split Spoon; Shelby Tube; Core; Blind Drill

Depth (ft.)	Run No.	Sample Type	Sample No.	Recov.	Blow Count	$q_u/[q_s]$ (in tsf)	% Moisture	Borehole Detail	Lithology	Description/*Comments*	USC	Elev. (MSL)
												514.5
	11		11B	5.0'				Bentonite Seal		Gray fine silty SAND, little clay.		
45			12A									509.5
	12		12B	5.0'				Filter Pack and/or Formation Sand		Gray, fine clayey SAND, some silt.		
50												504.5
	13		13A	5.0'								
55												499.5
	14			0.0'				Bentonite Seal		Gray shale with muscovite mica. *(Since there was no recovery in Run # 14, the bedrock contact was determined at the depth the down pressure increased from 300 psi to 1500 psi on the auger column.)*		
	15		15A		10							
			15A	0.7'	31							
60										*E.O.B.=59.5 feet*		494.5

NOTE: ▼ = groundwater encountered while drilling.

Electronic Filing: Received, Clerk's Office 02/13/2020

Illinois Environmental Protection Agency — Well Completion Report

Site #: 1678250020 County: Sangamon Well #: G-110

Site Name: EGDS Landfill/ City Water, Light and Power Grid Coordinate: Northing 3728.6 Easting 2315.7

Drilling Contractor: AE Exploration Corporation Date Drilled Start: 07/12/93

Driller: M. Moore Geologist: B. Hunsberger Date Completed: 07/12/93

Drilling Method: Hollow Stem Auger Drilling Fluids (type): None

Annular Space Details

Type of Surface Seal: Concrete

Type of Annular Sealant: Cement/Bentonite

Amount of cement: # of bags 8 lbs. per bag 94

Amount of bentonite: # of bags 1 lbs. per bag 50

Type of Bentonite Seal (Granular, Pellet): Grout

Amount of bentonite: # of Bags 1 lbs. per bag 50

Type of Sand Pack: #10-20 Silica Sand

Source of Sand: Best Environmental - Chardon, OH

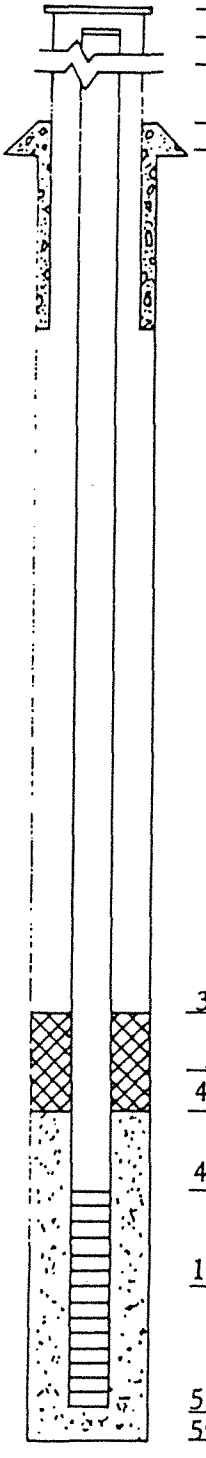
Amount of Sand: # of bags 10 lbs. per bag 50

Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint	Flush			
Riser pipe above w.t.	304			
Riser pipe below w.t.	304			
Screen	304			
Coupling joint screen to riser	Flush			
Protective casing				Steel

Measurements to .01 ft. (where applicable)

Riser pipe length	47.11'
Protective casing length	5.0'
Screen length	10.0'
Bottom of screen to end cap	0.21
Top of screen to first joint	0.065
Total length of casing	57.11'
Screen slot size	.01"
# of openings in screen	---
Diameter of borehole (in)	8.0"
D of riser pipe (in)	2.0"



Elevations — .01 ft.

557 20		MSL Top of Protective Casing
557 11		MSL Top of Riser Pipe
2 61		ft. Casing Stickup
554 50		MSL Ground Surface
3 0		ft. Top of annular sealant
37 0		ft. Top of Seal
5 0		ft. Total Seal Interval
42 0		ft. Top of Sand
44 5		ft. Top of Screen
10 0		ft. Total Screen Interval
54 5		ft. Bottom of Screen
59 5		ft. Bottom of Borehole

Completed by: Brad Hunsberger Surveyed by: City Water, Light and Power (Rich Davis) IL registration #: 2098

Response to 1st RTP
CWLP - 01789

Electronic Filing: Received, Clerk's Office 02/13/2020

Professional Service Industries, Inc.

RECORD OF SUBSURFACE EXPLORATION

Boring G-105

Project Name: Monitoring Well Installations Date of Boring: January 9, 1990

Site: CWLP Ash Disposal Facility Project No.: 020-05001

DESCRIPTION	DEPTH	SAMPLE	N	Q_u	Q_p	M_c	REMARKS
SURFACE							
Silty clay to clayey silt, trace organics, brown (fill)	5	1-SS	20%				
	10	2-SS	35%				
Silty clay, drak grey to black, some organics	15	3-SS	25%				
Silty clay to clay, grey, mottled brown, trace sand	20	4-SS	100%				
	25	5-SS	40%				
Silty clay with sand, fine to medium, brown	30	6-SS	35%				▽ While Drilling
	35	7-SS	40%				
	40	8-SS	100%				
Silty clay, trace sand, dark grey, fine	45	9-SS	100%				

PSI A-100-9

Electronic Filing: Received, Clerk's Office 02/13/2020

Professional Service Industries, Inc.

RECORD OF SUBSURFACE EXPLORATION

Boring G-105 (Continued)

Project Name: Monitoring Well Installations Date of Boring: January 9, 1990

Site: CWLP Ash Disposal Facility Project No.: 020-05001

DESCRIPTION	DEPTH	SAMPLE	N	Q_u	Q_p	M_c	REMARKS
Silty clay, some sand, fine, dark grey	45	10-SS	100%				
48'-48.7': Grey sand, fine to medium.	50						
Shale, grey, weathered		11-SS	80%				
End of Boring							

Electronic Filing: Received, Clerk's Office 02/13/2020

Illinois Environmental Protection Agency — Well Completion Report

Site #: 1678250020 County: Sangamon Well #: G-105

Site Name: CWLP - Ash Disposal Facility Grid Coordinate. Northing: 1641.61 Easting: 610.10

Drilling Contractor: Professional Service Industries, Inc. Date Drilled Start: January 9, 1990

Driller: B. Williamson Geologist: -- Date Completed: January 16, 19 (Re-Drilled w/4¼" I.D.)

Drilling Method: Hollow Stem Auger - 3¼" I.D & 4¼" I.D Drilling Fluids (type): None

Annular Space Details

Type of Surface Seal: Concrete

Type of Annular Sealant: Cement/Bentonite Grout

Amount of cement: # of bags 6 lbs. per bag 94

Amount of bentonite: # of bags 0.2 lbs. per bag 50

Type of Bentonite Seal (Granular, Pellet): Pellet

Amount of bentonite: # of Bags 0.5 lbs. per bag 50

Type of Sand Pack: Silica Sand (Marco-Sandblasting)

Source of Sand: Henry Nelch & Son Co., Springfield, IL

Amount of Sand: # of bags 1.8 lbs. per bag 100

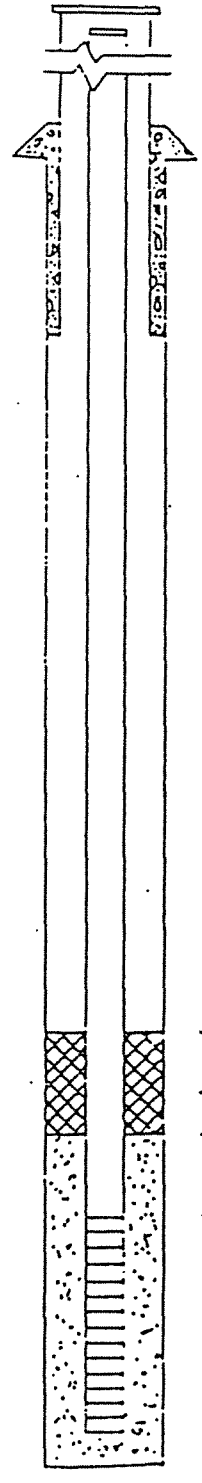
Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			--	
Riser pipe above w.t.			2"	
Riser pipe below w.t.			2"	
Screen			2"	
Coupling joint screen to riser			--	
Protective casing				6"X5' Steel

Measurements

to .01 ft. (where applicable)

Riser pipe length	43.9
Protective casing length	Flush Mount
Screen length	6'
Bottom of screen to end cap	0.3'
Top of screen to first joint	0.3'
Total length of casing	49.9
Screen slot size	0.010
# of openings in screen	--
Diameter of borehole (in)	8
ID of riser pipe (in)	2



Elevations — .01 ft.

553	49	MSL Top of Protective Casi
553	25	MSL Top of Riser Pipe
	+0.1	ft. Casing Stickup
553	49	MSL Ground Surface
	-2.9	ft. Top of annular sealant
	-40.5	ft. Top of Seal
	2.0	ft. Total Seal Interval
	-42.5	ft. Top of Sand
	-43.8	ft. Top of Screen
	6.0	ft. Total Screen Interval
	-49.8	ft. Bottom of Screen
	-53.0	ft. Bottom of Borehole

Completed by: Surveyed by: Ill. registration #

Response to 1st RTP

ATTACHMENT D

Electronic Filing: Received, Clerk's Office 02/13/2020

ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin • Morton Grove, IL 60053-3203
847.967.6666 • 800.246.0663 • fax: 847.967.6735 • www.emt.com

Sue Corcoran
City, Water, Light & Power
201 East Lake Shore Drive
Springfield, IL 62707

June 29, 2010

RE CWLP FGDS 2nd Quarter Groundwater

Lab Orders:
10050637

Dear Sue Corcoran:

Enclosed are the analytical reports for the EMT Lab Order listed. Also included with this analytical report is a copy of the chain of custody associated with these samples. If you have any questions, please contact me at 847-967-6666.

Sincerely,

Joe Pavilonis
Project Manager

Approved by,

Mitchell Ostrowski
Laboratory Director

This Report Contains 140 pages

The Contents of this report apply to the sample(s) analyzed. No duplication is allowed except in its entirety.

State of Illinois Chemical Analysis in Drinking Water Accredited Lab. No. 100256
State of Wisconsin Wastewater and Hazardous Waste No. 999888890

ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin • Morton Grove, IL 60053-3203
847.967.6666 • 800.246.0663 • fax: 847.967.6735 • www.emt.com

Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	R101
Lab Order:	10050637	**Report Date:**	6/29/2010
Project:	CWLP FGDS 2nd Quarter Groundwater	**Collection Date:**	6/7/2010 7:45:00 AM
Lab ID:	10050637-01	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Ammonia as N		**Method:**	**SM4500-NH3-B-C**			
Nitrogen, Ammonia (As N)	0.78	0.16	mg/L	5/27/10	58701	TTT
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	79.8	2.	mg/L	5/27/10	R141304	GSB
Nitrogen, Nitrate (As N)	0.2	0.2	mg/L	5/27/10	R141304	GSB
Sulfate	306.	10.	mg/L	5/27/10	R141304	GSB
BOD, 5 Day, 20°C		**Method:**	**SM5210 B**			
Biochemical Oxygen Demand	5.	2.	mg/L	5/26/10	R141432	AM2
Chemical Oxygen Demand		**Method:**	**HACH 8000**			
Chemical Oxygen Demand	< 10.	10.	mg/L	6/1/10	R141473	VT
Cyanide, Dissolved		**Method:**				
Cyanide	< 0.01	0.01	mg/L	5/27/10	58666	CS2
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01	mg/L	5/27/10	58666	CS2
Dissolved Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	79.5	2.	mg/L	5/26/10	R141296	GSB
Nitrogen, Nitrate (As N)	0.23	0.2	mg/L	5/26/10	R141296	GSB
Sulfate	305.	10.	mg/L	5/27/10	R141373	GSB
Fluoride		**Method:**	**SM4500-F C**			
Fluoride	< 0.5	0.5	mg/L	6/1/10	R141448	MF
Hexane Extractable Materials, (FOG)		**Method:**	**E1664A**			
Oil and Grease (HEM)	< 5.	5.	mg/L	5/27/10	R141409	TB2
Organic Carbon, Total		**Method:**	**SM5310-C B**			
Organic Carbon, Total	7.06	1.	mg/L	6/2/10	R141522	VT
Phenolics, Total		**Method:**	**SW9065 BY AQUACHEM**			
Phenolics, Total Recoverable	0.006	0.005	mg/L	5/27/10	58685	CS2
Soluble Ammonia as N		**Method:**	**4500-NH3-B-C**			

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
C - Laboratory not accredited for this parameter
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanitiation limits

ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin • Morton Grove, IL 60053-3203
847.967.6666 • 800.246.0663 • fax: 847.967.6735 • www.emt.com

Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	R101
Lab Order:	10050637	**Report Date:**	6/29/2010
Project:	CWLP FGDS 2nd Quarter Groundwater	**Collection Date:**	6/7/2010 7:45:00 AM
Lab ID:	10050637-01	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Nitrogen, Ammonia (As N)	< 0.16	0.16	mg/L	5/27/10	58701	TTT
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	894.	20.	mg/L	5/26/10	R141332	IR
Mercury in Groundwater, Dissolved		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	6/4/10	58866	IG
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	6/4/10	58863	IG
Metals, Dissolved		**Method:**	**SW6020A / SW3005A**			
Arsenic	< 0.00889	0.00889	mg/L	5/26/10 16:29	58669	AG
Boron	< 0.0556	0.0556	mg/L	5/27/10	58669	AG
Cadmium	< 0.00444	0.00444	mg/L	5/26/10 16:29	58669	AG
Chromium	0.0116	0.00889	mg/L	5/26/10 16:29	58669	AG
Iron	0.406	0.0889	mg/L	5/26/10 16:29	58669	AG
Lead	< 0.00667	0.00667	mg/L	5/26/10 16:29	58669	AG
Magnesium	64.8	1.11	mg/L	5/27/10	58669	AG
Zinc	< 0.02	0.02	mg/L	5/26/10 16:29	58669	AG
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Aluminum	0.664	0.05	mg/L	5/26/10 22:02	58676	AG
Antimony	< 0.006	0.006	mg/L	5/26/10 22:02	58676	AG
Arsenic	< 0.01	0.01	mg/L	5/26/10 22:02	58676	AG
Barium	0.0333	0.02	mg/L	5/26/10 22:02	58676	AG
Beryllium	< 0.003	0.003	mg/L	5/26/10 22:02	58676	AG
Boron	0.0748	0.04	mg/L	5/26/10 22:02	58676	AG
Cadmium	< 0.001	0.001	mg/L	5/26/10 22:02	58676	AG
Calcium	190.	2.5	mg/L	5/27/10	58676	AG
Chromium	< 0.07	0.07	mg/L	5/26/10 22:02	58676	AG
Cobalt	< 0.07	0.07	mg/L	5/26/10 22:02	58676	AG
Copper	< 0.06	0.06	mg/L	5/26/10 22:02	58676	AG
Iron	1.43	0.04	mg/L	5/26/10 22:02	58676	AG
Lead	< 0.005	0.005	mg/L	5/26/10 22:02	58676	AG

Qualifiers:

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Client Sample ID: R101
Lab Order: 10050637
Report Date: 6/29/2010
Project: CWLP FGDS 2nd Quarter Groundwater
Collection Date: 6/7/2010 7:45:00 AM
Lab ID: 10050637-01
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Magnesium	76.1	1.25		mg/L	5/27/10	58676	AG
Manganese	1.08	0.01		mg/L	5/26/10 22:02	58676	AG
Nickel	< 0.05	0.05		mg/L	5/26/10 22:02	58676	AG
Potassium	0.66	0.625		mg/L	5/26/10 22:02	58676	AG
Selenium	< 0.02	0.02		mg/L	5/26/10 22:02	58676	AG
Silver	< 0.05	0.05		mg/L	5/26/10 22:02	58676	AG
Sodium	30.6	4.5		mg/L	5/27/10	58676	AG
Thallium	< 0.002	0.002		mg/L	5/26/10 22:02	58676	AG
Vanadium	< 0.0125	0.0125		mg/L	5/26/10 22:02	58676	AG
Zinc	< 0.02	0.02		mg/L	5/26/10 22:02	58676	AG
Carbamates		**Method:**	**E531.1**				
Aldicarb	< 2.	2.	C	µg/L	6/7/10	R141681	LBI
Carbofuran	< 2.	2.	C	µg/L	6/7/10	R141681	LBI
EDB, DBCP and 123TCP by GC/ECD		**Method:**	**E504.1 / E504.1**				
1,2-Dibromo-3-chloropropane	< 0.004	0.004	C	µg/L	6/2/10 13:22	58881	MNN
1,2-Dibromoethane	< 0.004	0.004	C	µg/L	6/2/10 13:22	58881	MNN
Endothal		**Method:**	**E548.1**				
Endothal	< 2.	2.		µg/L	6/3/10	R141835	OUT
Haloacetic Acids		**Method:**	**E552.2 / E552.1**				
Dalapon	< 0.5	0.5	C	µg/L	6/7/10 20:30	58894	LP
Organochlorine Pesticides		**Method:**	**SW8081A / SW3510C**				
4,4'-DDT	< 0.01	0.01		µg/L	6/2/10 23:28	58653	LP
Alachlor	< 0.01	0.01		µg/L	6/2/10 23:28	58653	LP
Aldrin	< 0.01	0.01		µg/L	6/2/10 23:28	58653	LP
Atrazine	< 0.17	0.17		µg/L	6/2/10 23:28	58653	LP
Chlordane	< 0.13	0.13		µg/L	6/2/10 23:28	58653	LP
Dieldrin	< 0.01	0.01		µg/L	6/2/10 23:28	58653	LP
Endrin	< 0.01	0.01		µg/L	6/2/10 23:28	58653	LP
gamma-BHC	< 0.01	0.01		µg/L	6/2/10 23:28	58653	LP
Heptachlor	< 0.01	0.01		µg/L	6/2/10 23:28	58653	LP
Heptachlor epoxide	< 0.01	0.01		µg/L	6/2/10 23:28	58653	LP

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 10050637
Project: CWLP FGDS 2nd Quarter Groundwater
Lab ID: 10050637-01

Client Sample ID: R101
Report Date: 6/29/2010
Collection Date: 6/7/2010 7:45:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Methoxychlor	< 0.01	0.01		µg/L	6/2/10 23:28	58653	LP
Simazine	< 0.17	0.17		µg/L	6/2/10 23:28	58653	LP
Toxaphene	< 0.69	0.69		µg/L	6/2/10 23:28	58653	LP
Polychlorinated biphenyls (PCBs)		**Method:**		**SW8082 / SW3510C**			
Aroclor 1016	< 0.12	0.12		µg/L	5/28/10	58654	IP
Aroclor 1221	< 0.12	0.12		µg/L	5/28/10	58654	IP
Aroclor 1232	< 0.12	0.12		µg/L	5/28/10	58654	IP
Aroclor 1242	< 0.12	0.12		µg/L	5/28/10	58654	IP
Aroclor 1248	< 0.12	0.12		µg/L	5/28/10	58654	IP
Aroclor 1254	< 0.12	0.12		µg/L	5/28/10	58654	IP
Aroclor 1260	< 0.12	0.12		µg/L	5/28/10	58654	IP
PCB, Total	< 0.81	0.81		µg/L	5/28/10	58654	IP
Semivolatile Organic Compounds GC/MS		**Method:**		**SW8270D / SW3510C**			
Benzo(a)pyrene	< 3.32	3.32		µg/L	6/2/10 17:55	58788	MG3
Bis(2-ethylhexyl)phthalate	< 6.64	6.64		µg/L	6/2/10 17:55	58788	MG3
Bis(chloromethyl)ether	< 13.9	13.9	C	µg/L	6/2/10 17:55	58788	MG3
Butyl benzyl phthalate	< 1.33	1.33		µg/L	6/2/10 17:55	58788	MG3
Di-n-butyl phthalate	< 3.32	3.32	B	µg/L	6/2/10 17:55	58788	MG3
Diethyl phthalate	< 0.13	0.13		µg/L	6/2/10 17:55	58788	MG3
Dimethyl phthalate	< 0.13	0.13		µg/L	6/2/10 17:55	58788	MG3
Isophorone	< 0.13	0.13		µg/L	6/2/10 17:55	58788	MG3
m,p-Cresol	< 1.6	1.6		µg/L	6/2/10 17:55	58788	MG3
Naphthalene	< 0.13	0.13		µg/L	6/2/10 17:55	58788	MG3
Parathion	< 3.32	3.32	C	µg/L	6/2/10 17:55	58788	MG3
Phenol	< 1.12	1.12		µg/L	6/2/10 17:55	58788	MG3
Solvent Extractable Compounds by HPLC		**Method:**		**SW8321A / SW3510C**			
2,4,5-TP (Silvex)	< 0.19	0.19		µg/L	6/9/10	58934	LBI
2,4-D	< 0.31	0.31		µg/L	6/9/10	58934	LBI
Dinoseb	< 0.31	0.31		µg/L	6/9/10	58934	LBI
Pentachlorophenol	< 0.26	0.26	C	µg/L	6/9/10	58934	LBI
Picloram	< 0.12	0.12	C	µg/L	6/9/10	58934	LBI
Volatile Organic Compounds by GC/MS		**Method:**		**SW8260B / SW5030A**			

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Client Sample ID: R101
Lab Order: 10050637
Report Date: 6/29/2010
Project: CWLP FGDS 2nd Quarter Groundwater
Collection Date: 6/7/2010 7:45:00 AM
Lab ID: 10050637-01
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
1,1,1,2-Tetrachloroethane	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
1,1,1-Trichloroethane	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
1,1,2,2-Tetrachloroethane	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
1,1,2-Trichloroethane	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
1,1-Dichloroethane	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
1,1-Dichloroethene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
1,2,3-Trichlorobenzene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
1,2,3-Trichloropropane	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
1,2,4-Trimethylbenzene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
1,2-Dibromoethane	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
1,2-Dichlorobenzene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
1,2-Dichloroethane	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
1,2-Dichloropropane	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
1,3,5-Trimethylbenzene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
1,3-Dichlorobenzene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
1,3-Dichloropropane	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
1,4-Dichlorobenzene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
2,2-Dichloropropane	< 0.4	0.4	C	µg/L	5/26/10 20:35	58868	XN
2-Butanone	< 4.	4.		µg/L	5/26/10 20:35	58868	XN
2-Chlorotoluene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
2-Hexanone	< 4.	4.		µg/L	5/26/10 20:35	58868	XN
4-Chlorotoluene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
4-Methyl-2-pentanone	< 4.	4.		µg/L	5/26/10 20:35	58868	XN
Acetone	< 8.	8.		µg/L	5/26/10 20:35	58868	XN
Acrolein	< 4.	4.		µg/L	5/26/10 20:35	58868	XN
Acrylonitrile	< 4.	4.		µg/L	5/26/10 20:35	58868	XN
Benzene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Bromobenzene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Bromochloromethane	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Bromodichloromethane	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Bromoform	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Bromomethane	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Carbon disulfide	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Carbon tetrachloride	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Chlorobenzene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Client Sample ID: R101
Lab Order: 10050637
Report Date: 6/29/2010
Project: CWLP FGDS 2nd Quarter Groundwater
Collection Date: 6/7/2010 7:45:00 AM
Lab ID: 10050637-01
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Chloroethane	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Chloroform	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Chloromethane	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
cis-1,2-Dichloroethene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
cis-1,3-Dichloropropene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Dibromochloromethane	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Dibromomethane	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Dichlorodifluoromethane	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Ethylbenzene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Hexachlorobutadiene	< 0.4	0.4	C	µg/L	5/26/10 20:35	58868	XN
Iodomethane	< 0.4	0.4	C	µg/L	5/26/10 20:35	58868	XN
Isopropyl Toluene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Isopropylbenzene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
m,p-Xylene	< 0.8	0.8		µg/L	5/26/10 20:35	58868	XN
Methylene chloride	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
n-Butylbenzene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
n-Propylbenzene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
o-Xylene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
sec-Butylbenzene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Styrene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
tert-Butylbenzene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Tetrachloroethene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Tetrahydrofuran	< 4.	4.	C	µg/L	5/26/10 20:35	58868	XN
Toluene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
trans-1,2-Dichloroethene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
trans-1,3-Dichloropropene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
trans-1,4-Dichloro-2-butene	< 2.	2.	C	µg/L	6/8/10 15:03	58955	XN
Trichloroethene	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Trichlorofluoromethane	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Vinyl acetate	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
Vinyl chloride	< 0.4	0.4		µg/L	5/26/10 20:35	58868	XN
1,3-Dichloropropene, Total	< 0.8	0.8		µg/L	5/26/10 20:35	58868	XN
Xylenes, Total	< 1.2	1.2		µg/L	5/26/10 20:35	58868	XN

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	R101
Lab Order:	10050637	**Report Date:**	6/29/2010
Project:	CWLP FGDS 2nd Quarter Groundwater	**Collection Date:**	5/25/2010
Lab ID:	10050637-01	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Ammonia as N		**Method:**	**SM4500-NH3-B-C**			
Nitrogen, Ammonia (As N)	0.78	0.16	mg/L	5/27/10	58701	TTT
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	79.8	2.	mg/L	5/27/10	R141304	GSB
Nitrogen, Nitrate (As N)	0.2	0.2	mg/L	5/27/10	R141304	GSB
Sulfate	306.	10.	mg/L	5/27/10	R141304	GSB
BOD, 5 Day, 20°C		**Method:**	**SM5210 B**			
Biochemical Oxygen Demand	5.	2.	mg/L	5/26/10	R141432	AM2
Chemical Oxygen Demand		**Method:**	**HACH 8000**			
Chemical Oxygen Demand	< 10.	10.	mg/L	6/1/10	R141473	VT
Cyanide, Dissolved		**Method:**				
Cyanide	< 0.01	0.01	mg/L	5/27/10	58666	CS2
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01	mg/L	5/27/10	58666	CS2
Dissolved Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	79.5	2.	mg/L	5/26/10	R141296	GSB
Nitrogen, Nitrate (As N)	0.23	0.2	mg/L	5/26/10	R141296	GSB
Sulfate	305.	10.	mg/L	5/27/10	R141373	GSB
Fluoride		**Method:**	**SM4500-F C**			
Fluoride	< 0.5	0.5	mg/L	6/1/10	R141448	MF
Hexane Extractable Materials, (FOG)		**Method:**	**E1664A**			
Oil and Grease (HEM)	< 5.	5.	mg/L	5/27/10	R141409	TB2
Organic Carbon, Total		**Method:**	**SM5310-C B**			
Organic Carbon, Total	7.06	1.	mg/L	6/2/10	R141522	VT
Phenolics, Total		**Method:**	**SW9065 BY AQUACHEM**			
Phenolics, Total Recoverable	0.006	0.005	mg/L	5/27/10	58685	CS2
Soluble Ammonia as N		**Method:**	**4500-NH3-B-C**			

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	R101
Lab Order:	10050637	**Report Date:**	6/29/2010
Project:	CWLP FGDS 2nd Quarter Groundwater	**Collection Date:**	5/25/2010
Lab ID:	10050637-01	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Nitrogen, Ammonia (As N)	< 0.16	0.16	mg/L	5/27/10	58701	TTT
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	894.	20.	mg/L	5/26/10	R141332	IR
Mercury in Groundwater, Dissolved		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	6/4/10	58866	IG
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	6/4/10	58863	IG
Metals, Dissolved		**Method:**	**SW6020A / SW3005A**			
Arsenic	< 0.00889	0.00889	mg/L	5/26/10 16:29	58669	AG
Boron	< 0.0556	0.0556	mg/L	5/27/10	58669	AG
Cadmium	< 0.00444	0.00444	mg/L	5/26/10 16:29	58669	AG
Chromium	0.0116	0.00889	mg/L	5/26/10 16:29	58669	AG
Iron	0.406	0.0889	mg/L	5/26/10 16:29	58669	AG
Lead	< 0.00667	0.00667	mg/L	5/26/10 16:29	58669	AG
Magnesium	64.8	1.11	mg/L	5/27/10	58669	AG
Zinc	< 0.02	0.02	mg/L	5/26/10 16:29	58669	AG
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Aluminum	0.664	0.05	mg/L	5/26/10 22:02	58676	AG
Antimony	< 0.006	0.006	mg/L	5/26/10 22:02	58676	AG
Arsenic	< 0.01	0.01	mg/L	5/26/10 22:02	58676	AG
Barium	0.0333	0.02	mg/L	5/26/10 22:02	58676	AG
Beryllium	< 0.003	0.003	mg/L	5/26/10 22:02	58676	AG
Boron	0.0748	0.04	mg/L	5/26/10 22:02	58676	AG
Cadmium	< 0.001	0.001	mg/L	5/26/10 22:02	58676	AG
Calcium	190.	2.5	mg/L	5/27/10	58676	AG
Chromium	< 0.07	0.07	mg/L	5/26/10 22:02	58676	AG
Cobalt	< 0.07	0.07	mg/L	5/26/10 22:02	58676	AG
Copper	< 0.06	0.06	mg/L	5/26/10 22:02	58676	AG
Iron	1.43	0.04	mg/L	5/26/10 22:02	58676	AG
Lead	< 0.005	0.005	mg/L	5/26/10 22:02	58676	AG

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Client Sample ID: G110
Lab Order: 10050637
Report Date: 6/29/2010
Project: CWLP FGDS 2nd Quarter Groundwater
Collection Date: 5/25/2010
Lab ID: 10050637-02
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Ammonia as N		**Method:**	**SM4500-NH3-B-C**			
Nitrogen, Ammonia (As N)	4.37	0.16	mg/L	5/27/10	58701	TTT
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	5.59	2.	mg/L	5/27/10	R141304	GSB
Nitrogen, Nitrate (As N)	< 0.2	0.2	mg/L	5/27/10	R141304	GSB
Sulfate	< 5.	5.	mg/L	5/27/10	R141304	GSB
BOD, 5 Day, 20°C		**Method:**	**SM5210 B**			
Biochemical Oxygen Demand	5.	2.	mg/L	5/26/10	R141432	AM2
Chemical Oxygen Demand		**Method:**	**HACH 8000**			
Chemical Oxygen Demand	< 10.	10.	mg/L	6/1/10	R141473	VT
Cyanide, Dissolved		**Method:**				
Cyanide	< 0.01	0.01	mg/L	5/27/10	58666	CS2
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01	mg/L	5/27/10	58666	CS2
Dissolved Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	4.73	2.	mg/L	5/26/10	R141296	GSB
Nitrogen, Nitrate (As N)	< 0.2	0.2	mg/L	5/26/10	R141296	GSB
Sulfate	< 5.	5.	mg/L	5/26/10	R141296	GSB
Fluoride		**Method:**	**SM4500-F C**			
Fluoride	< 0.5	0.5	mg/L	6/1/10	R141448	MF
Hexane Extractable Materials, (FOG)		**Method:**	**E1664A**			
Oil and Grease (HEM)	< 5.	5.	mg/L	5/27/10	R141409	TB2
Organic Carbon, Total		**Method:**	**SM5310-C B**			
Organic Carbon, Total	9.15	1.	mg/L	6/2/10	R141522	VT
Phenolics, Total		**Method:**	**SW9065 BY AQUACHEM**			
Phenolics, Total Recoverable	< 0.005	0.005	mg/L	5/27/10	58685	CS2
Soluble Ammonia as N		**Method:**	**4500-NH3-B-C**			

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	G110
Lab Order:	10050637	**Report Date:**	6/29/2010
Project:	CWLP FGDS 2nd Quarter Groundwater	**Collection Date:**	5/25/2010
Lab ID:	10050637-02	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Nitrogen, Ammonia (As N)	3.86	0.16	mg/L	5/27/10	58701	TTT
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	526.	20.	mg/L	5/26/10	R141332	IR
Mercury in Groundwater, Dissolved		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	6/4/10	58866	IG
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	6/4/10	58863	IG
Metals, Dissolved		**Method:**	**SW6020A / SW3005A**			
Arsenic	< 0.00889	0.00889	mg/L	5/26/10 16:50	58669	AG
Boron	0.0817	0.0556	mg/L	5/27/10	58669	AG
Cadmium	< 0.00444	0.00444	mg/L	5/26/10 16:50	58669	AG
Chromium	0.0265	0.00889	mg/L	5/26/10 16:50	58669	AG
Iron	2.78	0.0889	mg/L	5/26/10 16:50	58669	AG
Lead	< 0.00667	0.00667	mg/L	5/26/10 16:50	58669	AG
Magnesium	58.6	1.11	mg/L	5/27/10	58669	AG
Zinc	< 0.02	0.02	mg/L	5/26/10 16:50	58669	AG
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Aluminum	0.178	0.05	mg/L	5/26/10 22:07	58676	AG
Antimony	< 0.006	0.006	mg/L	5/26/10 22:07	58676	AG
Arsenic	< 0.01	0.01	mg/L	5/26/10 22:07	58676	AG
Barium	0.18	0.02	mg/L	5/26/10 22:07	58676	AG
Beryllium	< 0.003	0.003	mg/L	5/26/10 22:07	58676	AG
Boron	0.123	0.04	mg/L	5/26/10 22:07	58676	AG
Cadmium	0.00258	0.001	mg/L	5/26/10 22:07	58676	AG
Calcium	118.	2.5	mg/L	5/27/10	58676	AG
Chromium	< 0.07	0.07	mg/L	5/26/10 22:07	58676	AG
Cobalt	< 0.07	0.07	mg/L	5/26/10 22:07	58676	AG
Copper	< 0.06	0.06	mg/L	5/26/10 22:07	58676	AG
Iron	6.71	0.04	mg/L	5/26/10 22:07	58676	AG
Lead	< 0.005	0.005	mg/L	5/26/10 22:07	58676	AG

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Client Sample ID: G110
Lab Order: 10050637
Report Date: 6/29/2010
Project: CWLP FGDS 2nd Quarter Groundwater
Collection Date: 5/25/2010
Lab ID: 10050637-02
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Magnesium	47.2	1.25		mg/L	5/27/10	58676	AG
Manganese	0.12	0.01		mg/L	5/26/10 22:07	58676	AG
Nickel	< 0.05	0.05		mg/L	5/26/10 22:07	58676	AG
Potassium	1.51	0.625		mg/L	5/26/10 22:07	58676	AG
Selenium	< 0.02	0.02		mg/L	5/26/10 22:07	58676	AG
Silver	< 0.05	0.05		mg/L	5/26/10 22:07	58676	AG
Sodium	17.3	4.5		mg/L	5/27/10	58676	AG
Thallium	< 0.002	0.002		mg/L	5/26/10 22:07	58676	AG
Vanadium	< 0.0125	0.0125		mg/L	5/26/10 22:07	58676	AG
Zinc	< 0.02	0.02		mg/L	5/26/10 22:07	58676	AG
Carbamates		**Method:**	**E531.1**				
Aldicarb	< 2.	2.	C	µg/L	6/7/10	R141681	LBI
Carbofuran	< 2.	2.	C	µg/L	6/7/10	R141681	LBI
EDB, DBCP and 123TCP by GC/ECD		**Method:**	**E504.1 / E504.1**				
1,2-Dibromo-3-chloropropane	< 0.004	0.004	C	µg/L	6/2/10 13:54	58881	MNN
1,2-Dibromoethane	< 0.004	0.004	C	µg/L	6/2/10 13:54	58881	MNN
Endothal		**Method:**	**E548.1**				
Endothal	< 2.	2.		µg/L	6/3/10	R141835	OUT
Haloacetic Acids		**Method:**	**E552.2 / E552.1**				
Dalapon	< 1.25	1.25	C	µg/L	6/7/10 21:14	58894	LP
Organochlorine Pesticides		**Method:**	**SW8081A / SW3510C**				
4,4'-DDT	< 0.01	0.01		µg/L	6/3/10 00:15	58653	LP
Alachlor	< 0.01	0.01		µg/L	6/3/10 00:15	58653	LP
Aldrin	< 0.01	0.01		µg/L	6/3/10 00:15	58653	LP
Atrazine	< 0.17	0.17		µg/L	6/3/10 00:15	58653	LP
Chlordane	< 0.13	0.13		µg/L	6/3/10 00:15	58653	LP
Dieldrin	< 0.01	0.01		µg/L	6/3/10 00:15	58653	LP
Endrin	< 0.01	0.01		µg/L	6/3/10 00:15	58653	LP
gamma-BHC	< 0.01	0.01		µg/L	6/3/10 00:15	58653	LP
Heptachlor	< 0.01	0.01		µg/L	6/3/10 00:15	58653	LP
Heptachlor epoxide	< 0.01	0.01		µg/L	6/3/10 00:15	58653	LP

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Client Sample ID: G110
Lab Order: 10050637
Report Date: 6/29/2010
Project: CWLP FGDS 2nd Quarter Groundwater
Collection Date: 5/25/2010
Lab ID: 10050637-02
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Methoxychlor	< 0.01	0.01		µg/L	6/3/10 00:15	58653	LP
Simazine	< 0.17	0.17		µg/L	6/3/10 00:15	58653	LP
Toxaphene	< 0.7	0.7		µg/L	6/3/10 00:15	58653	LP
Polychlorinated biphenyls (PCBs)		**Method:**		**SW8082 / SW3510C**			
Aroclor 1016	< 0.12	0.12		µg/L	5/28/10	58654	IP
Aroclor 1221	< 0.12	0.12		µg/L	5/28/10	58654	IP
Aroclor 1232	< 0.12	0.12		µg/L	5/28/10	58654	IP
Aroclor 1242	< 0.12	0.12		µg/L	5/28/10	58654	IP
Aroclor 1248	< 0.12	0.12		µg/L	5/28/10	58654	IP
Aroclor 1254	< 0.12	0.12		µg/L	5/28/10	58654	IP
Aroclor 1260	< 0.12	0.12		µg/L	5/28/10	58654	IP
PCB, Total	< 0.82	0.82		µg/L	5/28/10	58654	IP
Semivolatile Organic Compounds GC/MS		**Method:**		**SW8270D / SW3510C**			
Benzo(a)pyrene	< 3.32	3.32		µg/L	6/2/10 18:37	58788	MG3
Bis(2-ethylhexyl)phthalate	< 6.64	6.64		µg/L	6/2/10 18:37	58788	MG3
Bis(chloromethyl)ether	< 13.9	13.9	C	µg/L	6/2/10 18:37	58788	MG3
Butyl benzyl phthalate	< 1.33	1.33		µg/L	6/2/10 18:37	58788	MG3
Di-n-butyl phthalate	< 3.32	3.32		µg/L	6/2/10 18:37	58788	MG3
Diethyl phthalate	< 0.13	0.13		µg/L	6/2/10 18:37	58788	MG3
Dimethyl phthalate	< 0.13	0.13		µg/L	6/2/10 18:37	58788	MG3
Isophorone	< 0.13	0.13		µg/L	6/2/10 18:37	58788	MG3
m,p-Cresol	< 1.61	1.61		µg/L	6/2/10 18:37	58788	MG3
Naphthalene	< 0.13	0.13		µg/L	6/2/10 18:37	58788	MG3
Parathion	< 3.32	3.32	C	µg/L	6/2/10 18:37	58788	MG3
Phenol	< 1.12	1.12		µg/L	6/2/10 18:37	58788	MG3
Solvent Extractable Compounds by HPLC		**Method:**		**SW8321A / SW3510C**			
2,4,5-TP (Silvex)	< 0.19	0.19		µg/L	5/30/10	58755	LBI
2,4-D	< 0.31	0.31		µg/L	5/30/10	58755	LBI
Dinoseb	< 0.31	0.31		µg/L	5/30/10	58755	LBI
Pentachlorophenol	< 0.26	0.26	C	µg/L	5/30/10	58755	LBI
Picloram	< 0.13	0.13	C	µg/L	5/30/10	58755	LBI
Volatile Organic Compounds by GC/MS		**Method:**		**SW8260B / SW5030A**			

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Client Sample ID: G110
Lab Order: 10050637
Report Date: 6/29/2010
Project: CWLP FGDS 2nd Quarter Groundwater
Collection Date: 5/25/2010
Lab ID: 10050637-02
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
1,1,1,2-Tetrachloroethane	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
1,1,1-Trichloroethane	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
1,1,2,2-Tetrachloroethane	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
1,1,2-Trichloroethane	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
1,1-Dichloroethane	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
1,1-Dichloroethene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
1,2,3-Trichlorobenzene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
1,2,3-Trichloropropane	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
1,2,4-Trimethylbenzene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
1,2-Dibromoethane	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
1,2-Dichlorobenzene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
1,2-Dichloroethane	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
1,2-Dichloropropane	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
1,3,5-Trimethylbenzene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
1,3-Dichlorobenzene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
1,3-Dichloropropane	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
1,4-Dichlorobenzene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
2,2-Dichloropropane	< 0.4	0.4	C	µg/L	5/26/10 21:09	58868	XN
2-Butanone	< 4.	4.		µg/L	5/26/10 21:09	58868	XN
2-Chlorotoluene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
2-Hexanone	< 4.	4.		µg/L	5/26/10 21:09	58868	XN
4-Chlorotoluene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
4-Methyl-2-pentanone	< 4.	4.		µg/L	5/26/10 21:09	58868	XN
Acetone	< 8.	8.		µg/L	5/26/10 21:09	58868	XN
Acrolein	< 4.	4.		µg/L	5/26/10 21:09	58868	XN
Acrylonitrile	< 4.	4.		µg/L	5/26/10 21:09	58868	XN
Benzene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Bromobenzene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Bromochloromethane	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Bromodichloromethane	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Bromoform	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Bromomethane	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Carbon disulfide	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Carbon tetrachloride	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Chlorobenzene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Client Sample ID: G110
Lab Order: 10050637
Report Date: 6/29/2010
Project: CWLP FGDS 2nd Quarter Groundwater
Collection Date: 5/25/2010
Lab ID: 10050637-02
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Chloroethane	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Chloroform	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Chloromethane	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
cis-1,2-Dichloroethene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
cis-1,3-Dichloropropene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Dibromochloromethane	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Dibromomethane	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Dichlorodifluoromethane	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Ethylbenzene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Hexachlorobutadiene	< 0.4	0.4	C	µg/L	5/26/10 21:09	58868	XN
Iodomethane	< 0.4	0.4	C	µg/L	5/26/10 21:09	58868	XN
Isopropyl Toluene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Isopropylbenzene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
m,p-Xylene	< 0.8	0.8		µg/L	5/26/10 21:09	58868	XN
Methylene chloride	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
n-Butylbenzene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
n-Propylbenzene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
o-Xylene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
sec-Butylbenzene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Styrene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
tert-Butylbenzene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Tetrachloroethene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Tetrahydrofuran	< 4.	4.	C	µg/L	5/26/10 21:09	58868	XN
Toluene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
trans-1,2-Dichloroethene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
trans-1,3-Dichloropropene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
trans-1,4-Dichloro-2-butene	< 2.	2.	C	µg/L	6/8/10 15:36	58955	XN
Trichloroethene	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Trichlorofluoromethane	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Vinyl acetate	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
Vinyl chloride	< 0.4	0.4		µg/L	5/26/10 21:09	58868	XN
1,3-Dichloropropene, Total	< 0.8	0.8		µg/L	5/26/10 21:09	58868	XN
Xylenes, Total	< 1.2	1.2		µg/L	5/26/10 21:09	58868	XN

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	AW-3
Lab Order:	10050637	**Report Date:**	6/29/2010
Project:	CWLP FGDS 2nd Quarter Groundwater	**Collection Date:**	6/1/2010 8:00:00 AM
Lab ID:	10050637-07	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Ammonia as N		**Method:**	**SM4500-NH3-B-C**				
Nitrogen, Ammonia (As N)	3.92	0.8		mg/L	6/3/10	58839	TTT
Anions by Ion Chromatography		**Method:**	**SW9056**				
Chloride	24.4	2.		mg/L	6/2/10	R141509	MF
Nitrogen, Nitrate (As N)	< 0.5	0.5		mg/L	6/2/10	R141509	MF
Sulfate	< 5.	5.		mg/L	6/2/10	R141509	MF
BOD, 5 Day, 20°C		**Method:**	**SM5210 B**				
Biochemical Oxygen Demand	< 2.	2.	H	mg/L	6/7/10	R141957	IR
Chemical Oxygen Demand		**Method:**	**HACH 8000**				
Chemical Oxygen Demand	26.8	10.		mg/L	6/7/10	R141680	VT
Cyanide, Dissolved		**Method:**					
Cyanide	< 0.01	0.01		mg/L	6/3/10	58820	CS2
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**				
Cyanide	< 0.01	0.01		mg/L	6/3/10	58820	CS2
Dissolved Anions by Ion Chromatography		**Method:**	**SW9056**				
Chloride	25.4	2.		mg/L	6/2/10	R141577	MF
Nitrogen, Nitrate (As N)	< 0.2	0.2		mg/L	6/2/10	R141577	MF
Sulfate	< 5.	5.		mg/L	6/2/10	R141577	MF
Fluoride		**Method:**	**SM4500-F C**				
Fluoride	0.59	0.5		mg/L	6/8/10	R141750	MF
Hexane Extractable Materials, (FOG)		**Method:**	**E1664A**				
Oil and Grease (HEM)	< 5.	5.		mg/L	6/3/10	R141649	TB2
Organic Carbon, Total		**Method:**	**SM5310-C B**				
Organic Carbon, Total	10.3	1.		mg/L	6/2/10	R141522	VT
Phenolics, Total		**Method:**	**SW9065 BY AQUACHEM**				
Phenolics, Total Recoverable	< 0.005	0.005		mg/L	6/3/10	58818	CS2
Soluble Ammonia as N		**Method:**	**4500-NH3-B-C**				

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Client Sample ID: AW-3
Lab Order: 10050637
Report Date: 6/29/2010
Project: CWLP FGDS 2nd Quarter Groundwater
Collection Date: 6/1/2010 8:00:00 AM
Lab ID: 10050637-07
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Nitrogen, Ammonia (As N)	3.3	0.16	mg/L	6/3/10	58839	TTT
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	432.	20.	mg/L	6/2/10	R141593	IR
ICP Metals, Groundwater Dissolved		**Method:**	**SW6010B / SW3005A**			
Magnesium	31.7	0.111	mg/L	6/9/10	58810	CS2
ICP Metals, Groundwater Total		**Method:**	**SW6010B / SW3015**			
Magnesium	31.4	0.125	mg/L	6/9/10	58815	CS2
Mercury in Groundwater, Dissolved		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	6/4/10	58866	IG
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	6/4/10	58863	IG
Metals, Dissolved		**Method:**	**SW6020A / SW3005A**			
Arsenic	0.0653	0.00889	mg/L	6/7/10 19:09	58810	AG
Boron	< 0.278	0.278	mg/L	6/9/10	58810	AG
Cadmium	< 0.00444	0.00444	mg/L	6/7/10 19:09	58810	AG
Chromium	0.0182	0.00889	mg/L	6/7/10 19:09	58810	AG
Iron	4.23	0.0889	mg/L	6/7/10 19:09	58810	AG
Lead	< 0.00667	0.00667	mg/L	6/7/10 19:09	58810	AG
Zinc	< 0.02	0.02	mg/L	6/7/10 19:09	58810	AG
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Aluminum	0.343	0.05	mg/L	6/7/10 20:26	58815	AG
Antimony	< 0.006	0.006	mg/L	6/7/10 20:26	58815	AG
Arsenic	0.0879	0.01	mg/L	6/7/10 20:26	58815	AG
Barium	0.186	0.02	mg/L	6/7/10 20:26	58815	AG
Beryllium	< 0.003	0.003	mg/L	6/7/10 20:26	58815	AG
Boron	< 0.2	0.2	mg/L	6/9/10	58815	AG
Cadmium	< 0.001	0.001	mg/L	6/7/10 20:26	58815	AG
Calcium	92.1	2.5	mg/L	6/7/10 17:56	58815	AG
Chromium	< 0.07	0.07	mg/L	6/7/10 20:26	58815	AG

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Collection Date: 6/1/2010 8:00:00 AM
Lab ID: 10050637-07
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Cobalt	< 0.07	0.07		mg/L	6/7/10 20:26	58815	AG
Copper	< 0.06	0.06		mg/L	6/7/10 20:26	58815	AG
Iron	12.	0.4		mg/L	6/7/10 17:56	58815	AG
Iron	10.9	0.04		mg/L	6/7/10 20:26	58815	AG
Lead	< 0.005	0.005		mg/L	6/7/10 20:26	58815	AG
Manganese	0.348	0.01		mg/L	6/7/10 20:26	58815	AG
Nickel	< 0.05	0.05		mg/L	6/7/10 20:26	58815	AG
Potassium	1.35	0.625		mg/L	6/7/10 20:26	58815	AG
Selenium	< 0.02	0.02		mg/L	6/7/10 20:26	58815	AG
Silver	< 0.05	0.05		mg/L	6/7/10 20:26	58815	AG
Sodium	62.1	4.5		mg/L	6/7/10 17:56	58815	AG
Thallium	< 0.002	0.002		mg/L	6/7/10 20:26	58815	AG
Vanadium	< 0.0125	0.0125		mg/L	6/7/10 20:26	58815	AG
Zinc	0.0924	0.02		mg/L	6/7/10 20:26	58815	AG
Carbamates		**Method:**	**E531.1**				
Aldicarb	< 2.	2.	C	µg/L	6/8/10	R141744	LBI
Carbofuran	< 2.	2.	C	µg/L	6/8/10	R141744	LBI
EDB, DBCP and 123TCP by GC/ECD		**Method:**	**E504.1 / E504.1**				
1,2-Dibromo-3-chloropropane	< 0.004	0.004	C	µg/L	6/8/10 19:04	58941	LP
1,2-Dibromoethane	< 0.004	0.004	C	µg/L	6/8/10 19:04	58941	LP
Endothal		**Method:**	**E548.1**				
Endothal	< 5.	5.		µg/L	6/16/10	R142139	OUT
Haloacetic Acids		**Method:**	**E552.2 / E552.1**				
Dalapon	< 1.25	1.25	C	µg/L	6/8/10 00:56	58894	LP
Organochlorine Pesticides		**Method:**	**SW8081A / SW3510C**				
4,4'-DDT	< 0.01	0.01		µg/L	6/8/10 17:37	58900	LP
Alachlor	< 0.01	0.01		µg/L	6/8/10 17:37	58900	LP
Aldrin	< 0.01	0.01		µg/L	6/8/10 17:37	58900	LP
Atrazine	< 0.17	0.17		µg/L	6/8/10 17:37	58900	LP
Chlordane	< 0.13	0.13		µg/L	6/8/10 17:37	58900	LP
Dieldrin	< 0.01	0.01		µg/L	6/8/10 17:37	58900	LP

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Collection Date: 6/1/2010 8:00:00 AM
Lab ID: 10050637-07
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Endrin	< 0.01	0.01		µg/L	6/8/10 17:37	58900	LP
gamma-BHC	< 0.01	0.01		µg/L	6/8/10 17:37	58900	LP
Heptachlor	< 0.01	0.01		µg/L	6/8/10 17:37	58900	LP
Heptachlor epoxide	< 0.01	0.01		µg/L	6/8/10 17:37	58900	LP
Methoxychlor	< 0.01	0.01		µg/L	6/8/10 17:37	58900	LP
Simazine	< 0.17	0.17		µg/L	6/8/10 17:37	58900	LP
Toxaphene	< 0.7	0.7		µg/L	6/8/10 17:37	58900	LP
Polychlorinated biphenyls (PCBs)		**Method:**		**SW8082 / SW3510C**			
Aroclor 1016	< 0.12	0.12		µg/L	6/7/10	58902	IP
Aroclor 1221	< 0.12	0.12		µg/L	6/7/10	58902	IP
Aroclor 1232	< 0.12	0.12		µg/L	6/7/10	58902	IP
Aroclor 1242	< 0.12	0.12		µg/L	6/7/10	58902	IP
Aroclor 1248	< 0.12	0.12		µg/L	6/7/10	58902	IP
Aroclor 1254	< 0.12	0.12		µg/L	6/7/10	58902	IP
Aroclor 1260	< 0.12	0.12		µg/L	6/7/10	58902	IP
PCB, Total	< 0.82	0.82		µg/L	6/7/10	58902	IP
Semivolatile Organic Compounds GC/MS		**Method:**		**SW8270D / SW3510C**			
Benzo(a)pyrene	< 3.32	3.32		µg/L	6/7/10 18:17	58871	MG3
Bis(2-ethylhexyl)phthalate	< 6.63	6.63		µg/L	6/7/10 18:17	58871	MG3
Bis(chloromethyl)ether	< 13.9	13.9	C	µg/L	6/7/10 18:17	58871	MG3
Butyl benzyl phthalate	< 1.33	1.33		µg/L	6/7/10 18:17	58871	MG3
Di-n-butyl phthalate	< 3.32	3.32		µg/L	6/7/10 18:17	58871	MG3
Diethyl phthalate	< 0.13	0.13		µg/L	6/7/10 18:17	58871	MG3
Dimethyl phthalate	< 0.13	0.13		µg/L	6/7/10 18:17	58871	MG3
Isophorone	< 0.13	0.13		µg/L	6/7/10 18:17	58871	MG3
m,p-Cresol	< 1.6	1.6		µg/L	6/7/10 18:17	58871	MG3
Naphthalene	< 0.13	0.13		µg/L	6/7/10 18:17	58871	MG3
Parathion	< 3.32	3.32	C	µg/L	6/7/10 18:17	58871	MG3
Phenol	< 1.12	1.12		µg/L	6/7/10 18:17	58871	MG3
Solvent Extractable Compounds by HPLC		**Method:**		**SW8321A / SW3510C**			
2,4,5-TP (Silvex)	< 0.19	0.19		µg/L	6/9/10	58934	LBI
2,4-D	< 0.31	0.31		µg/L	6/9/10	58934	LBI

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Report of Laboratory Analysis

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Collection Date: 6/1/2010 8:00:00 AM
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Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Dinoseb	< 0.31	0.31		µg/L	6/9/10	58934	LBI
Pentachlorophenol	< 0.26	0.26	C	µg/L	6/9/10	58934	LBI
Picloram	< 0.12	0.12	C	µg/L	6/9/10	58934	LBI
Volatile Organic Compounds by GC/MS		**Method:**		**SW8260B / SW5030A**			
1,1,1,2-Tetrachloroethane	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
1,1,1-Trichloroethane	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
1,1,2,2-Tetrachloroethane	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
1,1,2-Trichloroethane	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
1,1-Dichloroethane	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
1,1-Dichloroethene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
1,2,3-Trichlorobenzene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
1,2,3-Trichloropropane	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
1,2,4-Trimethylbenzene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
1,2-Dibromoethane	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
1,2-Dichlorobenzene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
1,2-Dichloroethane	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
1,2-Dichloropropane	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
1,3,5-Trimethylbenzene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
1,3-Dichlorobenzene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
1,3-Dichloropropane	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
1,4-Dichlorobenzene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
2,2-Dichloropropane	< 0.4	0.4	C	µg/L	6/5/10 23:23	58924	XN
2-Butanone	< 4.	4.		µg/L	6/5/10 23:23	58924	XN
2-Chlorotoluene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
2-Hexanone	< 4.	4.		µg/L	6/5/10 23:23	58924	XN
4-Chlorotoluene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
4-Methyl-2-pentanone	< 4.	4.		µg/L	6/5/10 23:23	58924	XN
Acetone	< 8.	8.		µg/L	6/5/10 23:23	58924	XN
Acrolein	< 4.	4.		µg/L	6/5/10 23:23	58924	XN
Acrylonitrile	< 4.	4.		µg/L	6/5/10 23:23	58924	XN
Benzene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Bromobenzene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Bromochloromethane	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Bromodichloromethane	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Client Sample ID: AW-3
Lab Order: 10050637
Report Date: 6/29/2010
Project: CWLP FGDS 2nd Quarter Groundwater
Collection Date: 6/1/2010 8:00:00 AM
Lab ID: 10050637-07
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Bromoform	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Bromomethane	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Carbon disulfide	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Carbon tetrachloride	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Chlorobenzene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Chloroethane	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Chloroform	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Chloromethane	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
cis-1,2-Dichloroethene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
cis-1,3-Dichloropropene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Dibromochloromethane	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Dibromomethane	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Dichlorodifluoromethane	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Ethylbenzene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Hexachlorobutadiene	< 0.4	0.4	C	µg/L	6/5/10 23:23	58924	XN
Iodomethane	< 0.4	0.4	C	µg/L	6/5/10 23:23	58924	XN
Isopropyl Toluene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Isopropylbenzene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
m,p-Xylene	< 0.8	0.8		µg/L	6/5/10 23:23	58924	XN
Methylene chloride	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
n-Butylbenzene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
n-Propylbenzene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
o-Xylene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
sec-Butylbenzene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Styrene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
tert-Butylbenzene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Tetrachloroethene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Tetrahydrofuran	< 4.	4.	C	µg/L	6/5/10 23:23	58924	XN
Toluene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
trans-1,2-Dichloroethene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
trans-1,3-Dichloropropene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
trans-1,4-Dichloro-2-butene	< 2.	2.	C	µg/L	6/12/10 17:51	59033	XN
Trichloroethene	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Trichlorofluoromethane	< 0.4	0.4		µg/L	6/5/10 23:23	58924	XN
Vinyl acetate	< 2.	2.		µg/L	6/12/10 17:51	59033	XN

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Collection Date: 6/1/2010 8:00:00 AM
Lab ID: 10050637-07
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Vinyl chloride	< 2.	2.	µg/L	6/12/10 17:51	59033	XN
1,3-Dichloropropene, Total	< 0.8	0.8	µg/L	6/5/10 23:23	58924	XN
Xylenes, Total	< 1.2	1.2	µg/L	6/5/10 23:23	58924	XN

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Response to 1st RTP
CWLP - 01815

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Client Sample ID: G120
Lab Order: 10050637
Report Date: 6/29/2010
Project: CWLP FGDS 2nd Quarter Groundwater
Collection Date: 5/25/2010
Lab ID: 10050637-09
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Ammonia as N		**Method:**	**SM4500-NH3-B-C**			
Nitrogen, Ammonia (As N)	3.53	0.16	mg/L	6/3/10	58839	TTT
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	26.8	2.	mg/L	5/27/10	R141304	GSB
Nitrogen, Nitrate (As N)	< 0.2	0.2	mg/L	5/27/10	R141304	GSB
Sulfate	222.	5.	mg/L	5/27/10	R141304	GSB
BOD, 5 Day, 20°C		**Method:**	**SM5210 B**			
Biochemical Oxygen Demand	4.	2.	mg/L	5/26/10	R141432	AM2
Chemical Oxygen Demand		**Method:**	**HACH 8000**			
Chemical Oxygen Demand	13.7	10.	mg/L	6/7/10	R141680	VT
Cyanide, Dissolved		**Method:**				
Cyanide	< 0.01	0.01	mg/L	5/28/10	58735	CS2
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01	mg/L	5/28/10	58735	CS2
Dissolved Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	26.8	2.	mg/L	5/26/10	R141296	GSB
Nitrogen, Nitrate (As N)	< 0.2	0.2	mg/L	5/26/10	R141296	GSB
Sulfate	218.	5.	mg/L	5/26/10	R141296	GSB
Fluoride		**Method:**	**SM4500-F C**			
Fluoride	< 0.5	0.5	mg/L	6/1/10	R141448	MF
Hexane Extractable Materials, (FOG)		**Method:**	**E1664A**			
Oil and Grease (HEM)	< 5.	5.	mg/L	5/28/10	R141484	TB2
Organic Carbon, Total		**Method:**	**SM5310-C B**			
Organic Carbon, Total	7.05	1.	mg/L	6/2/10	R141522	VT
Phenolics, Total		**Method:**	**SW9065 BY AQUACHEM**			
Phenolics, Total Recoverable	0.018	0.005	mg/L	6/1/10	58758	CS2
Soluble Ammonia as N		**Method:**	**4500-NH3-B-C**			

Qualifiers:

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Client Sample ID: G120
Lab Order: 10050637
Report Date: 6/29/2010
Project: CWLP FGDS 2nd Quarter Groundwater
Collection Date: 5/25/2010
Lab ID: 10050637-09
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Nitrogen, Ammonia (As N)	3.58	0.16	mg/L	6/1/10	58777	TTT
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	872.	20.	mg/L	5/27/10	R141385	VT
Mercury in Groundwater, Dissolved		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	6/4/10	58866	IG
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	6/4/10	58866	IG
Metals, Dissolved		**Method:**	**SW6020A / SW3005A**			
Arsenic	0.0122	0.00889	mg/L	5/26/10 17:55	58669	AG
Boron	0.64	0.556	mg/L	5/27/10	58669	AG
Cadmium	< 0.00444	0.00444	mg/L	5/26/10 17:55	58669	AG
Chromium	< 0.00889	0.00889	mg/L	5/26/10 17:55	58669	AG
Iron	19.9	0.0889	mg/L	5/26/10 17:55	58669	AG
Lead	< 0.00667	0.00667	mg/L	5/26/10 17:55	58669	AG
Magnesium	97.4	1.11	mg/L	5/27/10	58669	AG
Zinc	< 0.02	0.02	mg/L	5/26/10 17:55	58669	AG
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Aluminum	2.2	0.05	mg/L	5/26/10 22:58	58676	AG
Antimony	< 0.006	0.006	mg/L	5/26/10 22:58	58676	AG
Arsenic	0.0148	0.01	mg/L	5/26/10 22:58	58676	AG
Barium	0.546	0.02	mg/L	5/26/10 22:58	58676	AG
Beryllium	< 0.003	0.003	mg/L	5/26/10 22:58	58676	AG
Boron	0.642	0.4	mg/L	5/27/10	58676	AG
Cadmium	< 0.001	0.001	mg/L	5/26/10 22:58	58676	AG
Calcium	263.	2.5	mg/L	5/27/10	58676	AG
Chromium	< 0.07	0.07	mg/L	5/26/10 22:58	58676	AG
Cobalt	< 0.07	0.07	mg/L	5/26/10 22:58	58676	AG
Copper	< 0.06	0.06	mg/L	5/26/10 22:58	58676	AG
Iron	28.6	0.04	mg/L	5/26/10 22:58	58676	AG
Lead	< 0.005	0.005	mg/L	5/26/10 22:58	58676	AG

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Client Sample ID: G120
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Report Date: 6/29/2010
Project: CWLP FGDS 2nd Quarter Groundwater
Collection Date: 5/25/2010
Lab ID: 10050637-09
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Magnesium	110.	1.25		mg/L	5/27/10	58676	AG
Manganese	0.354	0.01		mg/L	5/26/10 22:58	58676	AG
Nickel	< 0.05	0.05		mg/L	5/26/10 22:58	58676	AG
Potassium	2.02	0.625		mg/L	5/26/10 22:58	58676	AG
Selenium	< 0.02	0.02		mg/L	5/26/10 22:58	58676	AG
Silver	< 0.05	0.05		mg/L	5/26/10 22:58	58676	AG
Sodium	52.6	4.5		mg/L	5/27/10	58676	AG
Thallium	< 0.002	0.002		mg/L	5/26/10 22:58	58676	AG
Vanadium	< 0.0125	0.0125		mg/L	5/26/10 22:58	58676	AG
Zinc	0.0214	0.02		mg/L	5/26/10 22:58	58676	AG
Carbamates		**Method:**	**E531.1**				
Aldicarb	< 2.	2.	C	µg/L	6/8/10	R141744	LBI
Carbofuran	< 2.	2.	C	µg/L	6/8/10	R141744	LBI
EDB, DBCP and 123TCP by GC/ECD		**Method:**	**E504.1 / E504.1**				
1,2-Dibromo-3-chloropropane	< 0.004	0.004	C	µg/L	6/2/10 16:57	58881	MNN
1,2-Dibromoethane	< 0.004	0.004	C	µg/L	6/2/10 16:57	58881	MNN
Endothal		**Method:**	**E548.1**				
Endothal	< 2.	2.		µg/L	6/3/10	R141835	OUT
Haloacetic Acids		**Method:**	**E552.2 / E552.1**				
Dalapon	< 1.25	1.25	C	µg/L	6/8/10 02:24	58894	LP
Organochlorine Pesticides		**Method:**	**SW8081A / SW3510C**				
4,4'-DDT	< 0.01	0.01		µg/L	6/3/10 04:12	58653	LP
Alachlor	< 0.01	0.01		µg/L	6/3/10 04:12	58653	LP
Aldrin	< 0.01	0.01		µg/L	6/3/10 04:12	58653	LP
Atrazine	< 0.17	0.17		µg/L	6/3/10 04:12	58653	LP
Chlordane	< 0.13	0.13		µg/L	6/3/10 04:12	58653	LP
Dieldrin	< 0.01	0.01		µg/L	6/3/10 04:12	58653	LP
Endrin	< 0.01	0.01		µg/L	6/3/10 04:12	58653	LP
gamma-BHC	< 0.01	0.01		µg/L	6/3/10 04:12	58653	LP
Heptachlor	< 0.01	0.01		µg/L	6/3/10 04:12	58653	LP
Heptachlor epoxide	< 0.01	0.01		µg/L	6/3/10 04:12	58653	LP

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Report of Laboratory Analysis

CLIENT:	City, Water, Light & Power	**Client Sample ID:**	G120
Lab Order:	10050637	**Report Date:**	6/29/2010
Project:	CWLP FGDS 2nd Quarter Groundwater	**Collection Date:**	5/25/2010
Lab ID:	10050637-09	**Matrix:**	Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Methoxychlor	< 0.01	0.01		µg/L	6/3/10 04:12	58653	LP
Simazine	< 0.17	0.17		µg/L	6/3/10 04:12	58653	LP
Toxaphene	< 0.7	0.7		µg/L	6/3/10 04:12	58653	LP
Polychlorinated biphenyls (PCBs)		**Method:**		**SW8082 / SW3510C**			
Aroclor 1016	< 0.12	0.12		µg/L	5/28/10	58654	IP
Aroclor 1221	< 0.12	0.12		µg/L	5/28/10	58654	IP
Aroclor 1232	< 0.12	0.12		µg/L	5/28/10	58654	IP
Aroclor 1242	< 0.12	0.12		µg/L	5/28/10	58654	IP
Aroclor 1248	< 0.12	0.12		µg/L	5/28/10	58654	IP
Aroclor 1254	< 0.12	0.12		µg/L	5/28/10	58654	IP
Aroclor 1260	< 0.12	0.12		µg/L	5/28/10	58654	IP
PCB, Total	< 0.82	0.82		µg/L	5/28/10	58654	IP
Semivolatile Organic Compounds GC/MS		**Method:**		**SW8270D / SW3510C**			
Benzo(a)pyrene	< 3.33	3.33		µg/L	6/2/10 22:12	58788	MG3
Bis(2-ethylhexyl)phthalate	< 6.65	6.65		µg/L	6/2/10 22:12	58788	MG3
Bis(chloromethyl)ether	< 14.	14.	C	µg/L	6/2/10 22:12	58788	MG3
Butyl benzyl phthalate	< 1.33	1.33		µg/L	6/2/10 22:12	58788	MG3
Di-n-butyl phthalate	< 3.33	3.33	B	µg/L	6/2/10 22:12	58788	MG3
Diethyl phthalate	< 0.13	0.13		µg/L	6/2/10 22:12	58788	MG3
Dimethyl phthalate	< 0.13	0.13		µg/L	6/2/10 22:12	58788	MG3
Isophorone	< 0.13	0.13		µg/L	6/2/10 22:12	58788	MG3
m,p-Cresol	< 1.61	1.61		µg/L	6/2/10 22:12	58788	MG3
Naphthalene	< 0.13	0.13		µg/L	6/2/10 22:12	58788	MG3
Parathion	< 3.33	3.33	C	µg/L	6/2/10 22:12	58788	MG3
Phenol	< 1.12	1.12		µg/L	6/2/10 22:12	58788	MG3
Solvent Extractable Compounds by HPLC		**Method:**		**SW8321A / SW3510C**			
2,4,5-TP (Silvex)	< 0.19	0.19		µg/L	5/30/10	58755	LBI
2,4-D	< 0.31	0.31		µg/L	5/30/10	58755	LBI
Dinoseb	< 0.32	0.32		µg/L	5/30/10	58755	LBI
Pentachlorophenol	< 0.27	0.27	C	µg/L	5/30/10	58755	LBI
Picloram	< 0.13	0.13	C	µg/L	5/30/10	58755	LBI
Volatile Organic Compounds by GC/MS		**Method:**		**SW8260B / SW5030A**			

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Client Sample ID: G120
Lab Order: 10050637
Report Date: 6/29/2010
Project: CWLP FGDS 2nd Quarter Groundwater
Collection Date: 5/25/2010
Lab ID: 10050637-09
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
1,1,1,2-Tetrachloroethane	< 2.	2.		µg/L	6/8/10 17:31	59023	XN
1,1,1-Trichloroethane	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
1,1,2,2-Tetrachloroethane	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
1,1,2-Trichloroethane	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
1,1-Dichloroethane	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
1,1-Dichloroethene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
1,2,3-Trichlorobenzene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
1,2,3-Trichloropropane	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
1,2,4-Trimethylbenzene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
1,2-Dibromoethane	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
1,2-Dichlorobenzene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
1,2-Dichloroethane	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
1,2-Dichloropropane	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
1,3,5-Trimethylbenzene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
1,3-Dichlorobenzene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
1,3-Dichloropropane	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
1,4-Dichlorobenzene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
2,2-Dichloropropane	< 0.4	0.4	C	µg/L	5/26/10 23:58	58868	XN
2-Butanone	< 4.	4.		µg/L	5/26/10 23:58	58868	XN
2-Chlorotoluene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
2-Hexanone	< 4.	4.		µg/L	5/26/10 23:58	58868	XN
4-Chlorotoluene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
4-Methyl-2-pentanone	< 4.	4.		µg/L	5/26/10 23:58	58868	XN
Acetone	< 8.	8.		µg/L	5/26/10 23:58	58868	XN
Acrolein	< 4.	4.		µg/L	5/26/10 23:58	58868	XN
Acrylonitrile	< 4.	4.		µg/L	5/26/10 23:58	58868	XN
Benzene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Bromobenzene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Bromochloromethane	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Bromodichloromethane	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Bromoform	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Bromomethane	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Carbon disulfide	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Carbon tetrachloride	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Chlorobenzene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Client Sample ID: G120
Lab Order: 10050637
Report Date: 6/29/2010
Project: CWLP FGDS 2nd Quarter Groundwater
Collection Date: 5/25/2010
Lab ID: 10050637-09
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit		Units	Date Analyzed	Batch	Analyst
Chloroethane	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Chloroform	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Chloromethane	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
cis-1,2-Dichloroethene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
cis-1,3-Dichloropropene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Dibromochloromethane	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Dibromomethane	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Dichlorodifluoromethane	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Ethylbenzene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Hexachlorobutadiene	< 0.4	0.4	C	µg/L	5/26/10 23:58	58868	XN
Iodomethane	< 0.4	0.4	C	µg/L	5/26/10 23:58	58868	XN
Isopropyl Toluene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Isopropylbenzene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
m,p-Xylene	< 0.8	0.8		µg/L	5/26/10 23:58	58868	XN
Methylene chloride	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
n-Butylbenzene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
n-Propylbenzene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
o-Xylene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
sec-Butylbenzene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Styrene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
tert-Butylbenzene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Tetrachloroethene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Tetrahydrofuran	< 4.	4.	C	µg/L	5/26/10 23:58	58868	XN
Toluene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
trans-1,2-Dichloroethene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
trans-1,3-Dichloropropene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
trans-1,4-Dichloro-2-butene	< 2.	2.	C	µg/L	6/8/10 17:31	59023	XN
Trichloroethene	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Trichlorofluoromethane	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Vinyl acetate	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
Vinyl chloride	< 0.4	0.4		µg/L	5/26/10 23:58	58868	XN
1,3-Dichloropropene, Total	< 0.8	0.8		µg/L	5/26/10 23:58	58868	XN
Xylenes, Total	< 1.2	1.2		µg/L	5/26/10 23:58	58868	XN

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Sue Corcoran
City, Water, Light & Power
201 East Lake Shore Drive
Springfield, IL 62707

June 30, 2010

RE CWLP Ash Pond Table 1

Lab Orders:
10050636

Dear Sue Corcoran:

Enclosed are the analytical reports for the EMT Lab Order listed. Also included with this analytical report is a copy of the chain of custody associated with these samples. If you have any questions, please contact me at 847-967-6666.

Sincerely,

Joe Pavilonis
Project Manager

Approved by,

Mitchell Ostrowski
Laboratory Director

This Report Contains 12 pages

The Contents of this report apply to the sample(s) analyzed. No duplication is allowed except in its entirety.

State of Illinois Chemical Analysis in Drinking Water Accredited Lab. No. 100256
State of Wisconsin Wastewater and Hazardous Waste No. 999888890

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CLIENT: City, Water, Light & Power **Date:** *6/30/2010*

Project: CWLP Ash Pond Table 1 **CASE NARRATIVE**

Lab Order: 10050636

Unless otherwise noted, samples were analyzed using the methods outlined in the following references:
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition

Unless otherwise noted, all method blanks, laboratory spikes, and/or matrix spikes met quality assurance objectives.

Sample results relate only to the analytes of interest tested and to the sample received at the laboratory.

All results are reported on a wet weight basis, unless otherwise noted. Dry weight adjusted results, reporting limits, method detection limits and dilution factors are indicated by the notation "dry" in the Units column. If present, a dilution factor will adjust the method detection limits and reporting limits.

The test results contained in this report meet all of the requirements of NELAC. Accreditation by the State of Illinois or Wisconsin is not an endorsement or a guarantee of the validity of data generated. For specific information regarding EMT's scope of accreditation , please contact your EMT project manager.

The Reporting Limit listed on the Report of Laboratory Analysis is EMT's reporting limit for the analyte reported. For most test methods this reporting limit is primarily based upon the lowest point in the calibration curve.

Analyst's initials of "OUT" indicate that the analyte was analyzed by a subcontracted laboratory.

Method References:
SW=USEPA, Test Methods for Evaluating Solid Waste, SW-846.
E=USEPA Methods for the Determination of Inorganic Substances in Environmental Samples; Methods for Chemical Analysis of Water and Wastes; Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, 40 CFR Part 136, App A; methods for the Determination of Metals in Environmental Samples; Methods for the Determination of Organic Compounds in Drinking Water.
SM= APHA, Standard Methods for the Examination of Water and Wastewater.
D=ASTM, Annual Book of Standards

Batch numbers starting with a letter indicate an analytical batch while those that are exculsively numerals indicate a preparation batch.

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 10050636
Project: CWLP Ash Pond Table 1
Lab ID: 10050636-03

Client Sample ID: AW3
Report Date: 6/30/2010
Collection Date: 6/1/2010 8:00:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	25.5	2.	mg/L	6/2/10	R141509	MF
Nitrogen, Nitrate (As N)	< 0.5	0.5	mg/L	6/2/10	R141509	MF
Sulfate	< 5.	5.	mg/L	6/2/10	R141509	MF
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01	mg/L	6/7/10	58890	CS2
Fluoride		**Method:**	**SM4500-F C**			
Fluoride	0.52	0.5	mg/L	6/8/10	R141750	MF
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	< 20.	20.	mg/L	6/2/10	R141593	IR
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	6/7/10	58908	IG
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Antimony	< 0.006	0.006	mg/L	6/7/10 20:36	58815	AG
Arsenic	0.0936	0.01	mg/L	6/7/10 20:36	58815	AG
Barium	0.189	0.02	mg/L	6/7/10 20:36	58815	AG
Beryllium	< 0.003	0.003	mg/L	6/7/10 20:36	58815	AG
Boron	0.251	0.2	mg/L	6/9/10	58815	AG
Cadmium	< 0.001	0.001	mg/L	6/7/10 20:36	58815	AG
Chromium	< 0.07	0.07	mg/L	6/7/10 20:36	58815	AG
Cobalt	< 0.07	0.07	mg/L	6/7/10 20:36	58815	AG
Iron	11.2	0.04	mg/L	6/7/10 20:36	58815	AG
Lead	< 0.005	0.005	mg/L	6/7/10 20:36	58815	AG
Manganese	0.349	0.01	mg/L	6/7/10 20:36	58815	AG
Nickel	< 0.05	0.05	mg/L	6/7/10 20:36	58815	AG
Selenium	< 0.02	0.02	mg/L	6/7/10 20:36	58815	AG
Silver	< 0.05	0.05	mg/L	6/7/10 20:36	58815	AG
Thallium	< 0.002	0.002	mg/L	6/7/10 20:36	58815	AG
Zinc	< 0.02	0.02	mg/L	6/7/10 20:36	58815	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Client Sample ID: AP1
Lab Order: 10050636
Report Date: 6/30/2010
Project: CWLP Ash Pond Table 1
Collection Date: 6/1/2010 8:15:00 AM
Lab ID: 10050636-04
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	22.7	2.	mg/L	6/2/10	R141509	MF
Nitrogen, Nitrate (As N)	2.72	0.5	mg/L	6/2/10	R141509	MF
Sulfate	47.	5.	mg/L	6/2/10	R141509	MF
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01	mg/L	6/2/10	58804	CS2
Fluoride		**Method:**	**SM4500-F C**			
Fluoride	< 0.5	0.5	mg/L	6/8/10	R141751	MF
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	240.	20.	mg/L	6/2/10	R141593	IR
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	6/4/10	58863	IG
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Antimony	< 0.006	0.006	mg/L	6/7/10 21:17	58815	AG
Arsenic	< 0.01	0.01	mg/L	6/7/10 21:17	58815	AG
Barium	0.112	0.02	mg/L	6/7/10 21:17	58815	AG
Beryllium	< 0.003	0.003	mg/L	6/7/10 21:17	58815	AG
Boron	0.301	0.2	mg/L	6/9/10	58815	AG
Cadmium	< 0.001	0.001	mg/L	6/7/10 21:17	58815	AG
Chromium	< 0.07	0.07	mg/L	6/7/10 21:17	58815	AG
Cobalt	< 0.07	0.07	mg/L	6/7/10 21:17	58815	AG
Iron	5.68	0.04	mg/L	6/7/10 21:17	58815	AG
Lead	< 0.005	0.005	mg/L	6/7/10 21:17	58815	AG
Manganese	0.27	0.01	mg/L	6/7/10 21:17	58815	AG
Nickel	< 0.05	0.05	mg/L	6/7/10 21:17	58815	AG
Selenium	< 0.02	0.02	mg/L	6/7/10 21:17	58815	AG
Silver	< 0.05	0.05	mg/L	6/7/10 21:17	58815	AG
Thallium	< 0.002	0.002	mg/L	6/7/10 21:17	58815	AG
Zinc	< 0.02	0.02	mg/L	6/7/10 21:17	58815	AG

Qualifiers:
B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 10050636
Project: CWLP Ash Pond Table 1
Lab ID: 10050636-05

Client Sample ID: AP2
Report Date: 6/30/2010
Collection Date: 6/1/2010 8:25:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	31.7	2.	mg/L	6/2/10	R141509	MF
Nitrogen, Nitrate (As N)	< 0.5	0.5	mg/L	6/2/10	R141509	MF
Sulfate	132.	5.	mg/L	6/2/10	R141509	MF
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01	mg/L	6/2/10	58804	CS2
Fluoride		**Method:**	**SM4500-F C**			
Fluoride	< 0.5	0.5	mg/L	6/8/10	R141751	MF
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	620.	20.	mg/L	6/2/10	R141593	IR
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	6/4/10	58863	IG
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Antimony	< 0.006	0.006	mg/L	6/7/10 21:22	58815	AG
Arsenic	< 0.01	0.01	mg/L	6/7/10 21:22	58815	AG
Barium	0.109	0.02	mg/L	6/7/10 21:22	58815	AG
Beryllium	< 0.003	0.003	mg/L	6/7/10 21:22	58815	AG
Boron	2.63	0.2	mg/L	6/9/10	58815	AG
Cadmium	< 0.001	0.001	mg/L	6/7/10 21:22	58815	AG
Chromium	< 0.07	0.07	mg/L	6/7/10 21:22	58815	AG
Cobalt	< 0.07	0.07	mg/L	6/7/10 21:22	58815	AG
Iron	2.37	0.04	mg/L	6/7/10 21:22	58815	AG
Lead	< 0.005	0.005	mg/L	6/7/10 21:22	58815	AG
Manganese	2.	0.01	mg/L	6/7/10 21:22	58815	AG
Nickel	< 0.05	0.05	mg/L	6/7/10 21:22	58815	AG
Selenium	< 0.02	0.02	mg/L	6/7/10 21:22	58815	AG
Silver	< 0.05	0.05	mg/L	6/7/10 21:22	58815	AG
Thallium	< 0.002	0.002	mg/L	6/7/10 21:22	58815	AG
Zinc	0.0216	0.02	mg/L	6/7/10 21:22	58815	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Lab Order: 10050636
Project: CWLP Ash Pond Table 1
Lab ID: 10050636-06

Client Sample ID: AP3
Report Date: 6/30/2010
Collection Date: 6/1/2010 8:45:00 AM
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	87.6	2.	mg/L	6/2/10	R141509	MF
Nitrogen, Nitrate (As N)	< 0.5	0.5	mg/L	6/2/10	R141509	MF
Sulfate	319.	12.5	mg/L	6/2/10	R141509	MF
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01	mg/L	6/2/10	58804	CS2
Fluoride		**Method:**	**SM4500-F C**			
Fluoride	< 0.5	0.5	mg/L	6/8/10	R141751	MF
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	1090.	20.	mg/L	6/2/10	R141593	IR
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	6/7/10	58908	IG
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Antimony	< 0.006	0.006	mg/L	6/7/10 21:28	58815	AG
Arsenic	0.0144	0.01	mg/L	6/7/10 21:28	58815	AG
Barium	0.135	0.02	mg/L	6/7/10 21:28	58815	AG
Beryllium	< 0.003	0.003	mg/L	6/7/10 21:28	58815	AG
Boron	11.9	0.2	mg/L	6/9/10	58815	AG
Cadmium	< 0.001	0.001	mg/L	6/7/10 21:28	58815	AG
Chromium	< 0.07	0.07	mg/L	6/7/10 21:28	58815	AG
Cobalt	< 0.07	0.07	mg/L	6/7/10 21:28	58815	AG
Iron	10.1	0.04	mg/L	6/7/10 21:28	58815	AG
Lead	< 0.005	0.005	mg/L	6/7/10 21:28	58815	AG
Manganese	9.25	0.01	mg/L	6/7/10 21:28	58815	AG
Nickel	< 0.05	0.05	mg/L	6/7/10 21:28	58815	AG
Selenium	< 0.02	0.02	mg/L	6/7/10 21:28	58815	AG
Silver	< 0.05	0.05	mg/L	6/7/10 21:28	58815	AG
Thallium	< 0.002	0.002	mg/L	6/7/10 21:28	58815	AG
Zinc	< 0.02	0.02	mg/L	6/7/10 21:28	58815	AG

Qualifiers:

B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanitiation limits

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Report of Laboratory Analysis

CLIENT: City, Water, Light & Power
Client Sample ID: AP4
Lab Order: 10050636
Report Date: 6/30/2010
Project: CWLP Ash Pond Table 1
Collection Date: 6/1/2010 9:05:00 AM
Lab ID: 10050636-07
Matrix: Groundwater

Analyses	Result	EMT Reporting Limit	Units	Date Analyzed	Batch	Analyst
Anions by Ion Chromatography		**Method:**	**SW9056**			
Chloride	13.	2.	mg/L	6/2/10	R141509	MF
Nitrogen, Nitrate (As N)	< 0.5	0.5	mg/L	6/2/10	R141509	MF
Sulfate	< 5.	5.	mg/L	6/2/10	R141509	MF
Cyanide, Total		**Method:**	**SW9010B/9014 BY AQUACHEM**			
Cyanide	< 0.01	0.01	mg/L	6/2/10	58804	CS2
Fluoride		**Method:**	**SM4500-F C**			
Fluoride	< 0.5	0.5	mg/L	6/8/10	R141751	MF
Total Dissolved Solids		**Method:**	**SM2540C**			
Total Dissolved Solids (Residue, Filterable)	522.	20.	mg/L	6/2/10	R141593	IR
Mercury, Total		**Method:**	**SW7470A / HG PREP**			
Mercury	< 0.0005	0.0005	mg/L	6/4/10	58863	IG
Metals, Total.		**Method:**	**SW6020A / SW3015**			
Antimony	< 0.006	0.006	mg/L	6/7/10 21:33	58815	AG
Arsenic	0.0225	0.01	mg/L	6/7/10 21:33	58815	AG
Barium	0.374	0.02	mg/L	6/7/10 21:33	58815	AG
Beryllium	< 0.003	0.003	mg/L	6/7/10 21:33	58815	AG
Boron	0.687	0.2	mg/L	6/9/10	58815	AG
Cadmium	< 0.001	0.001	mg/L	6/7/10 21:33	58815	AG
Chromium	< 0.07	0.07	mg/L	6/7/10 21:33	58815	AG
Cobalt	< 0.07	0.07	mg/L	6/7/10 21:33	58815	AG
Iron	11.2	0.04	mg/L	6/7/10 21:33	58815	AG
Lead	< 0.005	0.005	mg/L	6/7/10 21:33	58815	AG
Manganese	0.503	0.01	mg/L	6/7/10 21:33	58815	AG
Nickel	< 0.05	0.05	mg/L	6/7/10 21:33	58815	AG
Selenium	< 0.02	0.02	mg/L	6/7/10 21:33	58815	AG
Silver	< 0.05	0.05	mg/L	6/7/10 21:33	58815	AG
Thallium	< 0.002	0.002	mg/L	6/7/10 21:33	58815	AG
Zinc	< 0.02	0.02	mg/L	6/7/10 21:33	58815	AG

Qualifiers:
B - Analyte detected in the associated Method Blank
E - Estimated
H - Holding Time Exceeded
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
J - Analyte detected below quanititation limits

Response to 1st RTP
CWLP - 01828

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Chain of Custody Record

Scheduled Sampling Date: 05/17/2010
Due Date: 05/24/2010

COC # 503747

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP Ash Pond Table 1

SAMPLE TYPE:
0. Water 0. Fat 0. Liquid
0. Process Water 1. DI Water 2. Drinking Water
3. Soil 4. Extract 5. Wastewater
6. Oil 7. Sludge 8. Solid
9. Air 10. Chemical Waste 11. Wipe
12. Groundwater 13. eProduct 14. Groundwater(Filter)
15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Other

Analysis
1. Anions by Ion Chromatography
2. Solids, Total Dissolved (TDS)
3. Fluoride by Electrode (ISE)
4. Cyanide, Total
5. ICP MS Metals, Total
6. Mercury, Groundwater Total

EMT USE ONLY
EMT WORKORDER #L05042610

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP1	GRAB	12	1 liter	P	1	SR	6/1/10	8:15	7.44	1											
AP1	GRAB	5	1 liter	P	1					1											
AP1	GRAB	12	500 ml	P	1					4											
AP1	GRAB	12	500 ml	P	1					3											

Relinquished By:	Date:	Time:	Received By:	Date:	Time:
	6-1-10	9:45		6-1-10	09:45
	6-1-10	17:20		- -	: :
	- -	: :		6/1/10	17:20

EMT USE ONLY
Client ID: SPRING
Client Contact: Joe Pavlicek
EMT Project ID: CWLP Ash Pond Table 1
Jar Lot No.

SAMPLE RECEIVED ON ICE
TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs prior to sample receipt)

SPECIAL INSTRUCTIONS: TEMP 68.4°F Condo 327

5/17/2010 3:06:20 PM
Page 1

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Chain of Custody Record

Scheduled Sampling Date: 05/17/2010
Due Date: 05/24/2010

COC # 503747

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP Ash Pond Table 1

SAMPLE TYPE:
0. Water 0. Fat 0. Liquid
0. Process Water 1. DI Water 2. Drinking Water
3. Soil 4. Extract 5. Wastewater
6. Oil 7. Sludge 8. Solid
9. Air 10. Chemical Waste 11. Wipe
12. Groundwater 13. eProduct 14. Groundwater(Filter)
15. Other

CONTAINER TYPE:
P - Plastic V - VOC Vial G - Glass
B - Tedlar Bag O - Other

PRESERVATIVE:
1. None 2. H2SO4 3. HNO3
4. NaOH 5. HCL 6. MeOH
7. Zn Ace 8. Other

Analysis
1. Anions by Ion Chromatography
2. Solids, Total Dissolved (TDS)
3. Fluoride by Electrode (ISE)
4. Cyanide, Total
5. ICP MS Metals, Total
6. Mercury, Groundwater Total

EMT USE ONLY
EMT WORKORDER: 1005A26

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP2	GRAB	12	1 liter	P	1	SC	6/1/10	8:25	7.89	1											
AP2	GRAB	5	1 liter	P	1	↓	↓	↓	↓	1											
AP2	GRAB	12	500 ml	P	1	↓	↓	↓	↓	4											
AP2	GRAB	12	500 ml	P	1	↓	↓	↓	↓	3											

Relinquished By:	Date:	Time:	Received By:	Date:	Time:
[signature]	6-1-10	9:45	[signature]	6-1-10	09:45
[signature]	6-1-10	17:20		- -	: :
	- -	: :	[signature]	6/1/10	1720

EMT USE ONLY
ClientID: SPRING
Client Contact: Joe Pinglowski
EMT Project ID: CWLP Ash Pond Table 1
Air Lot No.

SAMPLE RECEIVED ON ICE
TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs prior to analysis receipt)
[signature]

SPECIAL INSTRUCTIONS: TEMP 68.7°F Condo 742

5/17/2010 3:06:20 PM
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Chain of Custody Record

Scheduled Sampling Date: 05/17/2010
Due Date: 05/24/2010

COC # 503747

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP Ash Pond Table 1

SAMPLE TYPE:
0. Water | 0. Fat | 0. Liquid
0. Process Water | 1. DI Water | 2. Drinking Water
3. Soil | 4. Extract | 5. Wastewater
6. Oil | 7. Sludge | 8. Solid
9. Air | 10. Chemical Waste | 11. Wipe
12. Groundwater | 13. eProduct | 14. Groundwater(Filter)
15. Other

CONTAINER TYPE:
P - Plastic | V - VOC Vial | G - Glass
B - Tedlar Bag | O - Other

PRESERVATIVE:
1. None | 2. H2SO4 | 3. HNO3
4. NaOH | 5. HCL | 6. MeOH
7. Zn Ace | 8. Other

Analysis
1. Anions by Ion Chromatography
2. Solids, Total Dissolved (TDS)
3. Fluoride by Electrode (ISE)
4. Cyanide, Total
5. ICP MS Metals, Total
6. Mercury, Groundwater Total

EMT USE ONLY
EMT WORKORDER #00526240

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP3	GRAB	12	1 liter	P	1	[illegible]	6/1/10	8:[illegible]	6.73	1											[illegible]
AP3	GRAB	5	1 liter	P	1	↓	↓	↓	↓	1											
AP3	GRAB	12	500 ml	P	1	↓	↓	↓	↓	4											
AP3	GRAB	12	500 ml	P	1	↓	↓	↓	↓	3											

Relinquished By:	Date:	Time:	Received By:	Date:	Time:
[signature]	6-1-10	9:45	[signature]	6-1-10	09:45
[signature]	6-1-10	17:20		- -	: :
	- -	: :	[signature]	6-1-10	17:20

EMT USE ONLY
Client ID: SPRING
Client Contact: Jim Pavilonis
EMT Project ID: CWLP Ash Pond Table 1
Jar Lot No.

SAMPLE RECEIVED ON ICE
TEMPERATURE
(Must be recorded if sampling was greater than 6 hrs. prior to sample receipt)
2C

SPECIAL INSTRUCTIONS: TEMP 67.7°F Condo 1128

5/17/2010 3:06:20 PM
Page 3

ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.
8100 North Austin Avenue Morton Grove, IL 60053-3203 (847) 967-6666 FAX:(847) 967-6735 www.emt.com

Chain of Custody Record

Scheduled Sampling Date: 05/17/2010
Due Date: 05/24/2010

COC # 503747

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP Ash Pond Table 1

SAMPLE TYPE:
0. Water | 0. Fat | 0. Liquid
0. Process Water | 1. DI Water | 2. Drinking Water
3. Soil | 4. Extract | 5. Wastewater
6. Oil | 7. Sludge | 8. Solid
9. Air | 10. Chemical Waste | 11. Wipe
12. Groundwater | 13. eProduct | 14. Groundwater(Filter)
15. Other

CONTAINER TYPE:
P - Plastic | V - VOC Vial | G - Glass
B - Tedlar Bag | O - Other

PRESERVATIVE:
1. None | 2. H2SO4 | 3. HNO3
4. NaOH | 5. HCL | 6. MeOH
7. Zn Ace | 8. Other

Analysis
1. Anions by Ion Chromatography
2. Solids, Total Dissolved (TDS)
3. Fluoride by Electrode (ISE)
4. Cyanide, Total
5. ICP MS Metals, Total
6. Mercury, Groundwater Total

EMT USE ONLY
EMT WORKORDER: 10Soil310

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AP4	GRAB	12	1 liter	P	1		6/1/10	9:05	6.91	1											1
AP4	GRAB	5	1 liter	P	1					1											2
AP4	GRAB	12	500 ml	P	1					4											3
AP4	GRAB	12	500 ml	P	1					3											4

Relinquished By:	Date: 6-1-10 Time: 9:45	Received By:	Date: 6-1-10 Time: 09:45
Relinquished By:	Date: 6-1-10 Time: 17:20	Received By:	Date: - - Time: : :
Relinquished By:	Date: - - Time: : :	Received By:	Date: 6/1/10 Time: 17:20

EMT USE ONLY
ClientID: SPRING
Client Contact: Joe Pavlonis
EMT Project ID: CWLP Ash Pond Table 1
Jar Lot No.

SAMPLE RECEIVED ON ICE
TEMPERATURE
(Must be recorded if sampling was greater than 6 hours prior to sample receipt)

SPECIAL INSTRUCTIONS: TEMP 67.9°F Condo 708

5/17/2010 3:06:21 PM
Page 4

ENVIRONMENTAL MONITORING & TECHNOLOGIES, INC.
8100 North Austin Avenue Morton Grove, IL 60053-3203 (847) 967-6666 FAX:(847) 967-6735 www.emt.com

Chain of Custody Record

Scheduled Sampling Date: 05/17/2010
Due Date: 05/24/2010

COC # 503747

Company: City, Water, Light & Power
Contact:
Address: 201 East Lake Shore Drive
Springfield, IL 62707
Phone: (217) 757-8610
P.O. #: _____ Proj. #: _____
Project /Location: CWLP Ash Pond Table 1

SAMPLE TYPE:
0. Water | 0. Fat | 0. Liquid
0. Process Water | 1. DI Water | 2. Drinking Water
3. Soil | 4. Extract | 5. Wastewater
6. Oil | 7. Sludge | 8. Solid
9. Air | 10. Chemical Waste | 11. Wipe
12. Groundwater | 13. eProduct | 14. Groundwater(Filter)
15. Other

CONTAINER TYPE:
P - Plastic | V - VOC Vial | G - Glass
B - Tedlar Bag | O - Other

PRESERVATIVE:
1. None | 2. H2SO4 | 3. HNO3
4. NaOH | 5. HCL | 6. MeOH
7. Zn Ace | 8. Other

Analysis
1. Anions by Ion Chromatography
2. Solids, Total Dissolved (TDS)
3. Fluoride by Electrode (ISE)
4. Cyanide, Total
5. ICP MS Metals, Total
6. Mercury, Groundwater Total

EMT USE ONLY
EMT WORKORDER # 100516B0

Sample I.D.	Sample Type	Container Size	Container Type	Container No.	Sampling By	Sampling Date	Sampling Time	Sampling pH	Preservation Field	Preservation Lab	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Lab Sample I.D.
AW3 GRAB	12	1 liter	P	1	SC	6/1/10	8:40	6.63	1												3A
AW3 GRAB	5	1 liter	P	1	"	"	"	"	1												A
AW3 GRAB	12	500 ml	P	1	"	"	"	"	4												B
AW3 GRAB	12	500 ml	P	1	"	"	"	"	3												C

Relinquished By:	Date:	Time:	Received By:	Date:	Time:
[signature]	6-1-10	9:45	[signature]	6-1-10	09:45
[signature]	6-1-10	17:20			
			[signature]	6/1/10	1720

EMT USE ONLY
Client ID: SPRING
Client Contact: Joe Pavlenda
EMT Project ID: CWLP Ash Pond Table 1
Jar Lot No.

SAMPLE RECEIVED ON ICE
TEMPERATURE 2°C

SPECIAL INSTRUCTIONS: TEMP 71.1°F Condo 616

5/17/2010 3:06:21 PM
Page 5

6.5

6.5	1/31/2018 – CWLP uploaded Annual Groundwater Monitoring and Corrective Action Reports for Dallman and Lakeside CCR Surface Impoundments and Landfill	Annual Groundwater Monitoring and Corrective Action Report Year Ending December 31, 2017	CWLP	02027	02036

Electronic Filing: Received, Clerk's Office 02/13/2020

City Water, Light & Power
Coal Combustion Residuals Surface Impoundments

Annual Groundwater Monitoring and Corrective Action Report Year Ending December 31, 2017

January 2018

Prepared for:
City Water, Light & Power
201 E. Lake Shore Drive
Springfield, Illinois

Prepared by:

ANDREWS ENGINEERING INC
3300 Ginger Creek Drive
Springfield, IL 62711
Tel: 217.787-2334

Response to 1st RTP
CWLP - 02027

TABLE OF CONTENTS

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2. GROUNDWATER MONITORING PROGRAM 1

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   - 3.2 Problems Encountered 2
   - 3.3 Key Activities for Upcoming Year (2018) 2

4. 40 CFR 257.90(**e**)(1) – (5) 2

5. CONCLUSION 3

FIGURES

FIGURE 1: SITE LOCATION
FIGURE 2: GROUNDWATER MONITORING SYSTEM

TABLES

TABLE 1: NOVEMBER 2017 DETECTION MONITORING RESULTS

1. INTRODUCTION

In accordance with 40 CFR 257.90(e), provided herein is the Annual Groundwater Monitoring and Corrective Action Report for year ending December 31, 2017. Given the regulatory timelines, this is the first annual report required for groundwater monitoring and corrective action.

City Water, Light and Power (CWLP) owns and operates two (2) existing coal combustion residual (CCR) surface impoundments. The CWLP CCR surface impoundments are located north and east of the former Lakeside Power Generating Station and Dallman Power Generating Station in the Eastern ½ of Section 12, Township 15 North, Range 5 West, in Springfield, Illinois (see Figure 1). These CCR surface impoundments are identified as the Lakeside Ash Pond and the Dallman Ash Pond (see Figure 2).

The former Lakeside Power Generating Station and Dallman Power Generating Station are situated on the northwestern bank of Lake Springfield in Springfield, Illinois. The Lakeside Ash Pond is immediately south of Spaulding Dam at the northern end of Lake Springfield. The Dallman Ash Pond is immediately northwest of the Lakeside Ash Pond. Placed into service prior to 1958, the Lakeside Ash Pond is primarily a diked embankment. The Lakeside Ash Pond consists of four separate ponds (i.e., three lime softening ponds and a settling pond) totaling approximately 35.0 acres. The Lakeside Ash Pond ceased receiving ash in 2009. The Dallman Ash Pond was placed into service in approximately 1976 and is also a diked embankment. The Dallman Ash Pond is approximately 34.5 acres. Fly ash and bottom ash are sluiced to the Dallman Ash Pond with raw lake water.

2. GROUNDWATER MONITORING PROGRAM

As required by 40 CFR 257.90(b), the facility developed a Groundwater Sampling and Analysis Program by October 17, 2017 and placed it in the facility operating record. The detection monitoring program was initiated with the first sampling event on November 9, 2017.

The monitoring network includes two upgradient wells (wells AP-4 and AP-5) and four downgradient wells (AP-1, AP-2, AP-3, and AW-3). The well locations are depicted in Figure 2. Pursuant to 40 CFR 257.94(a), the Detection Monitoring Program includes, at a minimum, groundwater monitoring for all constituents listed in Appendix III to Part 257, including boron, calcium, chloride, fluoride, pH, sulfate, and total dissolved solids (TDS). The long-term monitoring frequency for the Appendix III constituents under 40 CFR 257.94(b) will be semiannual during the active life of the CCR unit and the post-closure period.

Pursuant to 40 CFR 257.94(b), eight (8) independent samples were collected from each background and downgradient well and analyzed for the constituents listed in Appendix III to Part 257 including boron, calcium, chloride, fluoride, pH, sulfate, and total dissolved solids (TDS); and for the constituents listed in Appendix IV to Part 257 including antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, selenium, thallium, and radium 226 & 228 combined. The initial 8 independent sampling events were completed over the second quarter 2015 through first quarter 2017 (40 CFR 257.94(b)). This schedule allowed the capture of seasonal variability in quality and potentiometric surface conditions. Pursuant to 40 CFR 257.93(f)(3), a prediction interval procedure has been selected in order to evaluate any changes in groundwater during detection monitoring.

The following sections of the report address the annual groundwater monitoring and corrective action report requirements outlined in 40 CFR 257.90(e).

3. 40 CFR 257.90(e): KEY ACTIONS, PROBLEMS ENCOUNTERED, AND KEY ACTIVITIES FOR 2018

3.1 Key Actions

Key actions that occurred in 2017 include the initiation of the groundwater monitoring program and statistical analysis plan. Both plans were completed by October 17, 2017 and placed in the facility operating record. The first detection monitoring semiannual event was completed on November 9, 2017.

3.2 Problems Encountered

No problems were encountered with the groundwater monitoring program in 2017.

3.3 Key Activities for Upcoming Year (2018)

Based on exceedances of the statistical limits identified as part of the November semiannual sampling event, derivation and implementation of an Assessment Monitoring Program pursuant to 40 CFR 257.95 is anticipated in the first half of 2018. Given that no further information is available at this time, no additional activities can be detailed.

4. 40 CFR 257.90(e)(1) – (5)

Additional requirements for the Annual Groundwater Monitoring and Corrective Action Report are detailed in 40 CFR 257.90(e)(1)-(5). Each of the requirements is reproduced below along with the response.

(1) A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers that are part of the groundwater monitoring program for the CCR unit.

A map of the key features required above is provided as Figure 2 to this annual report.

(2) Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken.

No new monitoring wells were installed during 2017 as part of the monitoring program. Additionally, no wells were decommissioned.

(3) All data collected as part of the detection or assessment monitoring programs in 2017.

Detection monitoring data collected from the initiation of the groundwater monitoring program on November 9, 2017 is provided in Table 1.

(4) Discussion of any transition between monitoring programs including the dates of the transition and the identification of the constituent(s) that necessitated the initiation of assessment monitoring.

Only one set of detection monitoring data has been collected to date. Therefore, there are no transitions between monitoring programs to discuss for 2017.

(5) Other information required to be included in the annual report as specified in 40 CFR 257.90 through 257.98.

a. Alternative monitoring frequency certification in accordance with 40 CFR 257.94(d)(3) and 40 CFR 257.95(c)(3).

- No alternative monitoring frequency has been requested at this time. Therefore; no certification is required at this time.

b. Any alternate source demonstration completed in response to any statistically significant increases completed during the previous year in accordance with 40 257.94(e)(2) and 40 CFR 257.95(g)(3)(ii).

- No alternate source demonstrations were completed during 2017.

c. Assessment of corrective measures completed during the previous year in accordance with 40 CFR 257.96(a).

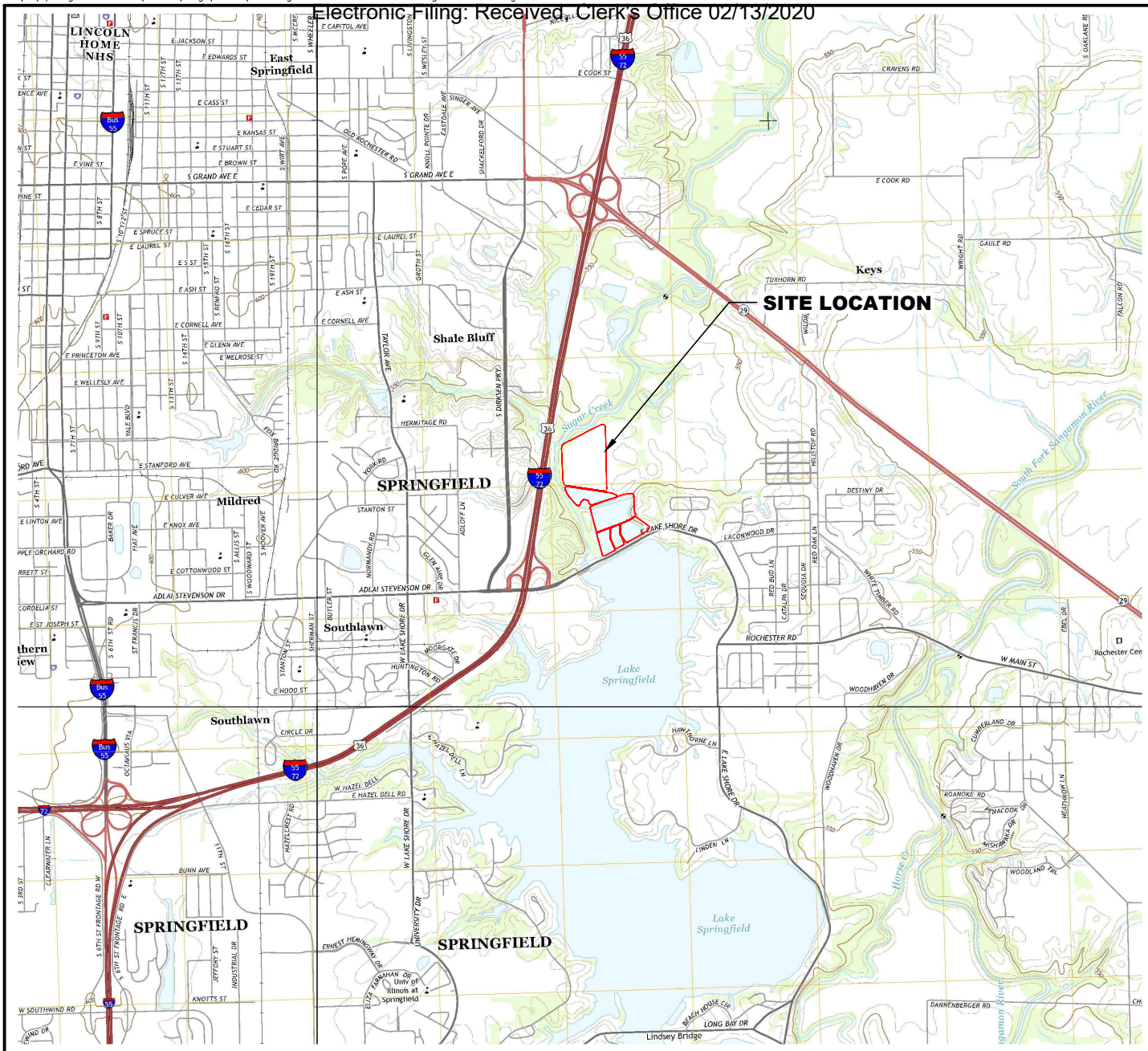
- No assessment of corrective measures was completed during 2017.

5. CONCLUSION

This annual groundwater monitoring and corrective action report has been provided in accordance with 40 CFR 257.90(e). The annual report for monitoring year 2018 will be provided by January 31, 2019.

FIGURES

Electronic Filing: Received, Clerk's Office 02/13/2020





N

0 200 4000 8000

SCALE: IN FEET

NOTE:
BACKGROUND IMAGE COURTESY OF
UNITED STATES GEOLOGICAL SURVEY.

ANDREWS
ENGINEERING, INC.
3300 GINGER CREEK DRIVE
SPRINGFIELD, ILLINOIS 62711-7233
PH (217) 787-2334 FAX (217) 787-9495
PONTIAC, IL • LOMBARD, IL • INDIANAPOLIS, IN • WARRENTON, MO
PROFESSIONAL DESIGN ENGINEERING AND LAND SURVEYING FIRM #184-001541

APPROVED BY: MTH | DESIGNED BY: MTH | DRAWN BY: RMC

SITE LOCATION

PLANS PREPARED FOR

CITY, WATER, LIGHT & POWER

SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: JANUARY 2018

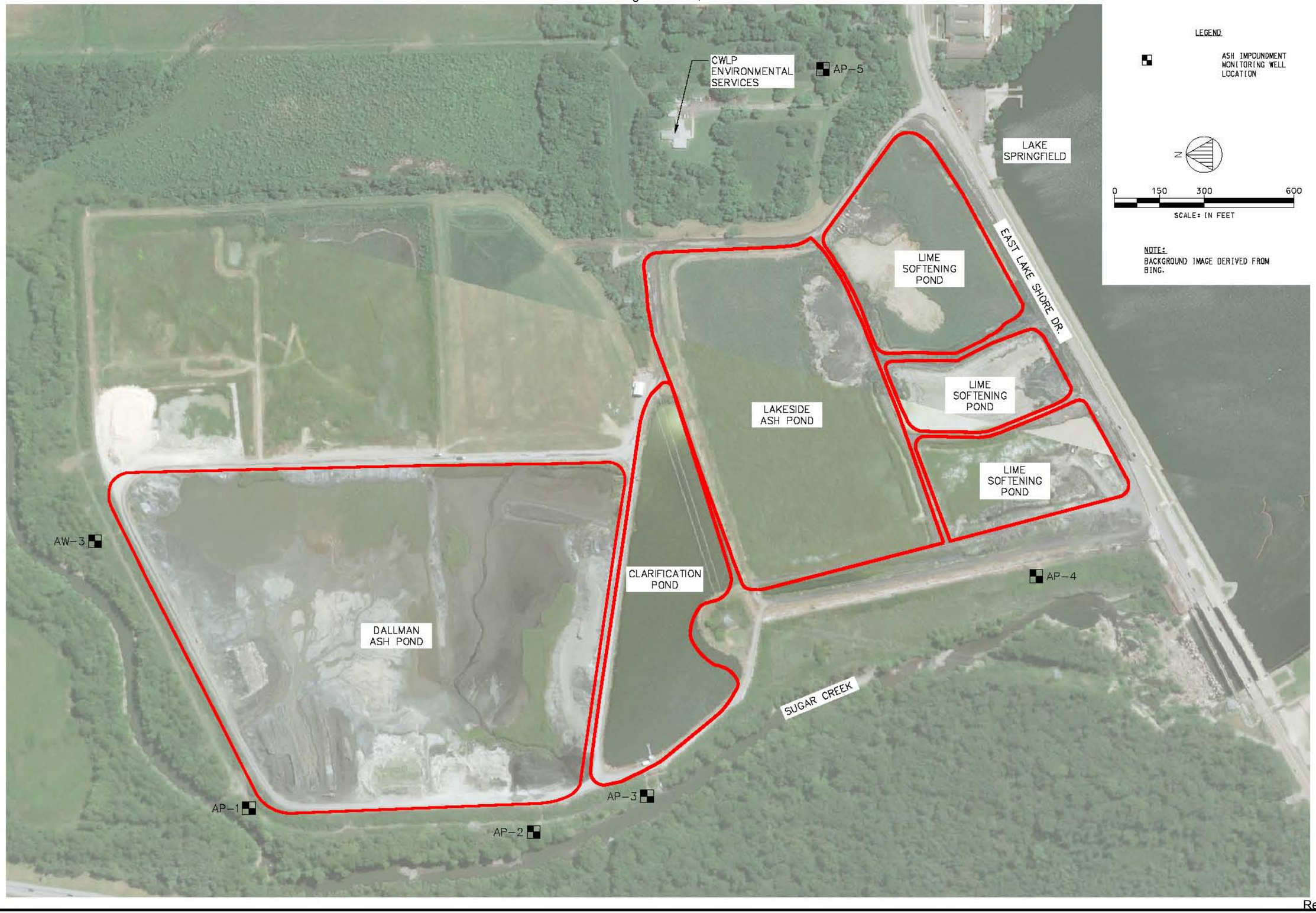
PROJECT ID: 170306/0001

SHEET NUMBER:

FIGURE 1

© 2018 Andrews Engineering, Inc.

Electronic Filing: Received, Clerk's Office 02/13/2020



LEGEND

ASH IMPOUNDMENT MONITORING WELL LOCATION

N

0 150 300 600

SCALE: IN FEET

NOTE:
BACKGROUND IMAGE DERIVED FROM BING.

NO.	DATE	REVISIONS DESCRIPTION	BY

ANDREWS ENGINEERING, INC.
3300 GINGER CREEK DRIVE
SPRINGFIELD, ILLINOIS 62711-7233
PH (217) 787-2334 FAX (217) 787-9495
POINTIAC, IL • LOMBARD, IL • INDIANAPOLIS, IN • WARRENTON, MO
PROFESSIONAL DESIGN ENGINEERING AND LAND SURVEYING FIRM #184-001541

DESIGNED BY: MTH | DRAWN BY: RMC | APPROVED BY: MTH

GROUNDWATER MONITORING SYSTEM

PLANS PREPARED FOR
CITY, WATER, LIGHT & POWER
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: JANUARY 2018

PROJECT ID: 170308/0001

SHEET NUMBER:

FIGURE 2

© 2018 Andrews Engineering, Inc.

J:\S\Springfield CWLP\CWLP\dwg\2018\Existing Groundwater Monitoring Network.dwg Tab: FIGURE 3 Last Saved: January 19, 2018, by Mike Nguyen Plotted: Friday, January 19, 2018 11:28:30 AM

TABLE

TABLE 1
City Water, Light and Power - Coal Combustion Residual Surface Impoundments
November 9, 2017 Detection Monitoring Results

Well	Parameter	Units	11/9/2017
Appendix III			
AP-1	Boron, total	mg/l	20.3
AP-2	Boron, total	mg/l	3.16
AP-3	Boron, total	mg/l	19.2
AP-4	Boron, total	mg/l	0.129
AP-5	Boron, total	mg/l	0.073
AW-3	Boron, total	mg/l	0.206
AP-1	Calcium, total	mg/l	259
AP-2	Calcium, total	mg/l	203
AP-3	Calcium, total	mg/l	176
AP-4	Calcium, total	mg/l	141
AP-5	Calcium, total	mg/l	118
AW-3	Calcium, total	mg/l	77.7
AP-1	Chloride, total	mg/l	54.1
AP-2	Chloride, total	mg/l	48.6
AP-3	Chloride, total	mg/l	40.9
AP-4	Chloride, total	mg/l	12.1
AP-5	Chloride, total	mg/l	< 30
AW-3	Chloride, total	mg/l	26.2
AP-1	Fluoride, total	mg/l	< 0.5
AP-2	Fluoride, total	mg/l	< 0.5
AP-3	Fluoride, total	mg/l	< 0.5
AP-4	Fluoride, total	mg/l	< 0.5
AP-5	Fluoride, total	mg/l	< 0.5
AW-3	Fluoride, total	mg/l	1.1
AP-1	pH (field)	STD units	6.89
AP-2	pH (field)	STD units	6.78
AP-3	pH (field)	STD units	6.95
AP-4	pH (field)	STD units	7.12
AP-5	pH (field)	STD units	7.19
AW-3	pH (field)	STD units	6.92
AP-1	Sulfate, total	mg/l	664
AP-2	Sulfate, total	mg/l	348
AP-3	Sulfate, total	mg/l	319
AP-4	Sulfate, total	mg/l	< 5
AP-5	Sulfate, total	mg/l	55.3
AW-3	Sulfate, total	mg/l	< 5
AP-1	Total Dissolved Solids	mg/l	1420
AP-2	Total Dissolved Solids	mg/l	966
AP-3	Total Dissolved Solids	mg/l	848
AP-4	Total Dissolved Solids	mg/l	544
AP-5	Total Dissolved Solids	mg/l	470
AW-3	Total Dissolved Solids	mg/l	424

6.13

6.13	May 2019 to July 2019 CWLP performed Assessment Investigation for well RW-3	Temporary Wells Arsenic Data	CWLP	27466	27517

Prairie Analytical Systems, INCORPORATED

Wednesday, August 9, 2017

Ms. Sue Corcoran
City, Water, Light & Power
3100 Stevenson Drive
Springfield, IL 62707
TEL: (217) 757-8610
FAX: (217) 757-8615

RE: Landfill PAS WO: 17H0059

Prairie Analytical Systems, Inc. received 3 sample(s) on 8/2/2017 for the analyses presented in the following report.

All applicable quality control procedures met method specific acceptance criteria unless otherwise noted.

This report shall not be reproduced, except in full, without the prior written consent of Prairie Analytical Systems, Inc.

If you have any questions, please feel free to contact me at (224) 253-1348.

Respectfully submitted,



Christina E. Pierce
Project Manager

Certifications: NELAP/NELAC - IL #100323

Prairie Analytical Systems, Inc. **Date:** 8/9/2017

LABORATORY RESULTS

Client: City, Water, Light & Power
Project: Landfill **Lab Order:** 17H0059
Client Sample ID: TW3W **Lab ID:** 17H0059-01
Collection Date: 8/2/17 8:15 **Matrix:** Water

Analyses	Result	Limit	Qual	Units	DF	Date Prepared	Date Analyzed	Method	Analyst
Metals by ICP									
*Arsenic	U	0.0100		mg/L	1	8/4/17 12:20	8/6/17 14:18	SW6010B	JTC
***Iron**	**2.68**	0.0500		mg/L	1	8/4/17 12:20	8/6/17 14:18	SW6010B	JTC
***Magnesium**	**153**	10.0		mg/L	100	8/4/17 12:20	8/6/17 18:54	SW6010B	JTC

Client Sample ID: TW3E **Lab ID:** 17H0059-02
Collection Date: 8/2/17 9:00 **Matrix:** Water

Analyses	Result	Limit	Qual	Units	DF	Date Prepared	Date Analyzed	Method	Analyst
Metals by ICP									
*Arsenic	U	0.0100		mg/L	1	8/4/17 12:20	8/6/17 14:23	SW6010B	JTC
***Iron**	**0.241**	0.0500		mg/L	1	8/4/17 12:20	8/6/17 14:23	SW6010B	JTC
***Magnesium**	**7.74**	0.100		mg/L	1	8/4/17 12:20	8/6/17 14:23	SW6010B	JTC

Client Sample ID: TW3N **Lab ID:** 17H0059-03
Collection Date: 8/2/17 7:30 **Matrix:** Water

Analyses	Result	Limit	Qual	Units	DF	Date Prepared	Date Analyzed	Method	Analyst
Metals by ICP									
*Arsenic	U	0.0100		mg/L	1	8/4/17 12:20	8/6/17 14:29	SW6010B	JTC
***Iron**	**0.0739**	0.0500		mg/L	1	8/4/17 12:20	8/6/17 14:29	SW6010B	JTC
***Magnesium**	**26.1**	1.00		mg/L	10	8/4/17 12:20	8/6/17 18:48	SW6010B	JTC

Prairie Analytical Systems, Inc. **Date:** 8/9/2017

LABORATORY RESULTS

Client: City, Water, Light & Power
Project: Landfill **Lab Order:** 17H0059

Metals by ICP - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch A004594 - SW 3005A Metals										
Blank (A004594-BLK1)				Prepared: 08/04/201 Analyzed: 08/06/201						
Arsenic	U	0.0100	mg/L							
Iron	U	0.0500	mg/L							
Magnesium	U	0.100	mg/L							
LCS (A004594-BS1)				Prepared: 08/04/201 Analyzed: 08/06/201						
Arsenic	0.527	0.0100	mg/L	0.50000		105	80-120			
Iron	5.03	0.0500	mg/L	5.0000		101	80-120			
Magnesium	4.99	0.100	mg/L	5.0000		100	80-120			
Matrix Spike (A004594-MS1)	**Source: 17H0024-01**			Prepared: 08/04/201 Analyzed: 08/06/201						
Arsenic	0.525	0.0100	mg/L	0.50000	0.00965	103	75-125			
Iron	5.12	0.0500	mg/L	5.0000	0.214	98	75-125			
Magnesium	27.9	0.100	mg/L	5.0000	24.1	75	75-125			E
Matrix Spike Dup (A004594-MSD1)	**Source: 17H0024-01**			Prepared: 08/04/201 Analyzed: 08/06/201						
Arsenic	0.525	0.0100	mg/L	0.50000	0.00965	103	75-125	0	20	
Iron	5.12	0.0500	mg/L	5.0000	0.214	98	75-125	0	20	
Magnesium	27.9	0.100	mg/L	5.0000	24.1	75	75-125	0	20	E

Prairie Analytical Systems, Inc. **Date:** 8/9/2017

LABORATORY RESULTS

Client: City, Water, Light & Power
Project: Landfill **Lab Order:** 17H0059

Notes and Definitions

E	Result above quantitation range.
*	NELAC certified compound.
U	Analyte not detected (i.e. less than RL or MDL).

Chain of Custody Record

Central IL - 1210 Capital Airport Drive - Springfield, IL 62707-8490 - Phone (217) 753-1148 - Facsimile (217) 753-1152
Chicago IL Office - 9114 Virginia Rd., Ste 112 - Lake in the Hills, IL 60156 - Phone (847) 651-2604 - Facsimile (847) 458-9680
Central / Southern IL Contact - Phone (217) 414-7762 - Facsimile (217) 753-1152

Prairie Analytical Systems, INCORPORATED
www.prairieanalytical.com

Client	CWLP
Address	201 E Lake Shore Drive
City, State, Zip Code	Springfield IL
Phone / Facsimile	757-8610
Project Name / Number	Landfill
Project Location	
P.O. # or Invoice To	CWLP
Contact Person	Sam Dennison

Reporting: TACO ☐ CCDD ☐ Residential ☐ Industrial / Commercial; CALM ☐ A ☐ B ☐ C ☐ D ☐ E ☐ F; RISC ☐ Residential ☐ Industrial

Sample Description	Sampling Date	Sampling Time	Matrix Code	Preserv Code	No. of Containers	Sample Type Comp	Sample Type Grab	Analysis and/or Method Requested: As total	Fe total	Mg total	Sampler Comments
TW3W	8/2/17	8:15	A	3	1		X	X	X	X	
TW3E	8/2/17	9:00	A	↓	↓		↓	↓	↓	↓	
TW3N	8/2/17	7:30	A	↓	↓		↓	↓	↓	↓	

Matrix Code	A - Aqueous	DW - Drinking Water	GW - Ground Water	NA - Non-Aqueous Liquid	S - Solid	O - Oil	X - Other (Specify)
Preservative Code	0 - None	1 - HCl	2 - H2SO4	3 - HNO3	4 - NaOH	5 - 5035 Kit	X - Other (Specify)

Relinquished By	Date	Time	Received By	Date	Time	Method of Shipment
[signature]	8/2/17	10:20				
			[signature]	8/2/17	1020	HAND

Special Instructions:

Turnaround Time: Standard ☑ Rush ☐
Date Required:

QC Level: 1 ☑ 2 ☐ 3 ☐ 4 ☐

On wet ice? ☑ Yes ☐ No

Temperature (°C): 17.2

Copies: White - Client / Yellow - PAS, Inc. / Pink - Sampler
PAS COC - Chemical

Revision 4
February 20, 2017

CWLP - 27470
Resp. to 3rd RTP
Page 5 of 5
Electronic Filing: Received, Clerk's Office 02/13/2020

Prairie Analytical Systems, INCORPORATED

Tuesday, October 24, 2017

Eric Staley
City, Water, Light & Power
3100 Stevenson Drive
Springfield, IL 62707
TEL: (217) 757-8610
FAX: (217) 757-8615

RE: Arsenic Testing PAS WO: 17J0414

Prairie Analytical Systems, Inc. received 4 sample(s) on 10/13/2017 for the analyses presented in the following report.

All applicable quality control procedures met method specific acceptance criteria unless otherwise noted.

This report shall not be reproduced, except in full, without the prior written consent of Prairie Analytical Systems, Inc.

If you have any questions, please feel free to contact me at (224) 253-1348.

Respectfully submitted,



Christina E. Pierce
Project Manager

Certifications: NELAP/NELAC - IL #100323

Prairie Analytical Systems, Inc. **Date:** 10/24/2017

LABORATORY RESULTS

Client: City, Water, Light & Power
Project: Arsenic Testing **Lab Order:** 17J0414
Client Sample ID: TW3W **Lab ID:** 17J0414-01
Collection Date: 10/12/17 10:00 **Matrix:** Water

Analyses	Result	Limit	Qual	Units	DF	Date Prepared	Date Analyzed	Method	Analyst
Metals by ICP									
***Arsenic**	**0.0125**	0.0100		mg/L	1	10/17/17 12:30	10/17/17 18:20	EPA200.7	KSH

Client Sample ID: AW3 **Lab ID:** 17J0414-02
Collection Date: 10/12/17 10:10 **Matrix:** Water

Analyses	Result	Limit	Qual	Units	DF	Date Prepared	Date Analyzed	Method	Analyst
Metals by ICP									
***Arsenic**	**0.210**	0.0100		mg/L	1	10/17/17 12:30	10/17/17 18:25	EPA200.7	KSH

Client Sample ID: TW3N **Lab ID:** 17J0414-03
Collection Date: 10/12/17 10:20 **Matrix:** Water

Analyses	Result	Limit	Qual	Units	DF	Date Prepared	Date Analyzed	Method	Analyst
Metals by ICP									
***Arsenic**	**0.0355**	0.0100		mg/L	1	10/17/17 12:30	10/17/17 18:31	EPA200.7	KSH

Client Sample ID: TW3E **Lab ID:** 17J0414-04
Collection Date: 10/12/17 10:30 **Matrix:** Water

Analyses	Result	Limit	Qual	Units	DF	Date Prepared	Date Analyzed	Method	Analyst
Metals by ICP									
***Arsenic**	**0.0307**	0.0100		mg/L	1	10/17/17 12:30	10/17/17 18:37	EPA200.7	KSH

Prairie Analytical Systems, Inc. **Date:** 10/24/2017

LABORATORY RESULTS

Client: City, Water, Light & Power
Project: Arsenic Testing **Lab Order:** 17J0414

Notes and Definitions

S	Spike recovery outside acceptance limits.
*	NELAC certified compound.
U	Analyte not detected (i.e. less than RL or MDL).

Chain of Custody Record

Central IL - 1210 Capital Airport Drive - Springfield, IL 62707-8490 - Phone (217) 753-1148 - Facsimile (217) 753-1152
Chicago IL Office - 9114 Virginia Rd., Ste 112 - Lake in the Hills, IL 60156 - Phone (847) 651-2604 - Facsimile (847) 458-9680
Central / Southern IL Contact - Phone (217) 414-7762 - Facsimile (217) 753-1152

Prairie Analytical Systems, INCORPORATED
www.prairieanalytical.com

Client	CWLP
Address	201 E Lake Shore Dr
City, State, Zip Code	Spfld IL 62712
Phone / Facsimile	217 757 8610
Project Name / Number	
Project Location	
P.O. # or Invoice To	
Contact Person	Eric Staley

Reporting: TACO ☐ CCDD ☐ Residential ☐ Industrial / Commercial; CALM ☐ A ☐ B ☐ C ☐ D ☐ E ☐ F; RISC ☐ Residential ☐ Industrial

Sample Description	Sampling Date	Sampling Time	Matrix Code	Preserv Code	No. of Containers	Sample Type Comp	Sample Type Grab	Total Arsenic	Sampler Comments
TW3W	10-12-17	1000	A	3	1		X	✓	
AW3		1010	A	3	1		X	✓	
TW3N		1020	A	3	1		X	✓	
TW3E		1030	A	3	1		X	✓	

Resp. to 3rd RTP

CWLP - 27474

Matrix Code	A - Aqueous	DW - Drinking Water	GW - Ground Water	NA - Non-Aqueous Liquid	S - Solid	O - Oil	X - Other (Specify)
Preservative Code	0 - None	1 - HCl	2 - H2SO4	3 - HNO3	4 - NaOH	5 - 5035 Kit	X - Other (Specify)

Relinquished By	Date	Time	Received By	Date	Time	Method of Shipment
Eric Staley to storage	10-12-17	1045				
	10/13/17	9:30		10-13-17	9:30	Hand

Special Instructions:

Turnaround Time: Standard ☐ Rush ☐
Date Required:

QC Level: 1 ☒ 2 ☐ 3 ☐ 4 ☐

On wet ice? ☒ Yes ☐ No

Temperature (°C): 4.6

Copies: White - Client / Yellow - PAS, Inc. / Pink - Sampler
PAS COC - Chemical

Page ___ of 1

Revision 4
February 20, 2017

Page 4 of 4

Electronic Filing: Received, Clerk's Office 02/13/2020

Teklab, Inc.
Environmental Laboratory
http://www.teklabinc.com/

November 20, 2017

Sue Corcoran
City Water, Light & Power
201 E. Lake Shore Drive
Springfield, IL 62712
TEL: (217) 757-8610
FAX:

RE: Low level mercury **WorkOrder:** 17110889

Dear Sue Corcoran:

TEKLAB, INC received 3 samples on 11/14/2017 12:08:00 PM 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,

Michael L. Austin
Project Manager
(618)344-1004 ex 16
MAustin@teklabinc.com

Resp. to 3rd RTP
CWLP - 27475

Report Contents

Teklab, Inc.
Environmental Laboratory
http://www.teklabinc.com/

Client: City Water, Light & Power
Client Project: Low level mercury

Work Order: 17110889
Report Date: 20-Nov-17

This reporting package includes the following:

Cover Letter	1
Report Contents	2
Definitions	3
Case Narrative	4
Accreditations	5
Laboratory Results	6
Receiving Check List	9
Chain of Custody	Appended

Definitions

Client: City Water, Light & Power

Work Order: 17110889

Client Project: Low level mercury

Report Date: 20-Nov-17

Abbr Definition

Abbr	Definition
CCV	Continuing calibration verification is a check of a standard to determine the state of calibration of an instrument between recalibration.
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 dilutions factors.
DNI	Did not ignite
DUP	Laboratory duplicate is an aliquot of a sample taken from the same container under laboratory conditions for independent processing and analysis independently of the original aliquot.
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, spiked with verified known amounts of analytes, is 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. The acceptable recovery range is in the QC Package (provided upon request).
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	Method detection limit means the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero.
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
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. The acceptable recovery range is listed in the QC Package (provided upon request).
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)

Qualifiers

# -	Unknown hydrocarbon	B -	Analyte detected in associated Method Blank
E -	Value above quantitation range	H -	Holding times exceeded
I -	Associated internal standard was outside method criteria	J -	Analyte detected below quantitation limits
M -	Manual Integration used to determine area response	ND -	Not Detected at the Reporting Limit
R -	RPD outside accepted recovery limits	S -	Spike Recovery outside recovery limits
T -	TIC(Tentatively identified compound)	X -	Value exceeds Maximum Contaminant Level

Resp. to 3rd RTP

CWLP - 27477

Case Narrative

http://www.teklabinc.com/

Client: City Water, Light & Power
Client Project: Low level mercury

Work Order: 17110889
Report Date: 20-Nov-17

Cooler Receipt Temp: 1.22 °C

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: City Water, Light & Power
Client Project: Low level mercury

Work Order: 17110889
Report Date: 20-Nov-17

State	Dept	Cert #	NELAP	Exp Date	Lab
Illinois	IEPA	100226	NELAP	1/31/2018	Collinsville
Kansas	KDHE	E-10374	NELAP	4/30/2018	Collinsville
Louisiana	LDEQ	166493	NELAP	6/30/2018	Collinsville
Louisiana	LDEQ	166578	NELAP	6/30/2018	Collinsville
Texas	TCEQ	T104704515-12-1	NELAP	7/31/2018	Collinsville
Arkansas	ADEQ	88-0966		3/14/2018	Collinsville
Illinois	IDPH	17584		5/31/2019	Collinsville
Indiana	ISDH	C-IL-06		1/31/2018	Collinsville
Kentucky	KDEP	98006		12/31/2017	Collinsville
Kentucky	UST	0073		1/31/2018	Collinsville
Louisiana	LDPH	LA170027		12/31/2017	Collinsville
Missouri	MDNR	930		1/31/2018	Collinsville
Missouri	MDNR	00930		5/31/2017	Collinsville
Oklahoma	ODEQ	9978		8/31/2018	Collinsville
Tennessee	TDEC	04905		1/31/2018	Collinsville

Laboratory Results

http://www.teklabinc.com/

Client: City Water, Light & Power
Work Order: 17110889
Client Project: Low level mercury
Report Date: 20-Nov-17
Lab ID: 17110889-001
Client Sample ID: TW3N
Matrix: GROUNDWATER
Collection Date: 11/13/2017 9:00

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Arsenic	NELAP	1.0		**50.8**	µg/L	5	11/15/2017 18:13	136215

Teklab, Inc. Environmental Laboratory

Laboratory Results

http://www.teklabinc.com/

Client: City Water, Light & Power
Work Order: 17110889
Client Project: Low level mercury
Report Date: 20-Nov-17
Lab ID: 17110889-002
Client Sample ID: TW3E
Matrix: GROUNDWATER
Collection Date: 11/13/2017 9:20

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Arsenic	NELAP	1.0		**32.8**	µg/L	5	11/15/2017 18:47	136215

Teklab, Inc. Environmental Laboratory

Laboratory Results

http://www.teklabinc.com/

Client: City Water, Light & Power
Work Order: 17110889
Client Project: Low level mercury
Report Date: 20-Nov-17
Lab ID: 17110889-003
Client Sample ID: TW3W
Matrix: GROUNDWATER
Collection Date: 11/13/2017 9:40

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Arsenic	NELAP	1.0		**1.2**	µg/L	5	11/16/2017 15:34	136215

Teklab, Inc. Environmental Laboratory

Receiving Check List

http://www.teklabinc.com/

Client: City Water, Light & Power
Client Project: Low level mercury

Work Order: 17110889
Report Date: 20-Nov-17

Carrier: Paul Reeves

Received By: AMD

Completed by: Amber M. Dilallo
On: 14-Nov-17

Reviewed by: Elizabeth A. Hurley
On: 14-Nov-17

Pages to follow: Chain of custody 1 Extra pages included 0

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐	Temp °C 1.22
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.

CHAIN OF CUSTODY

pg. 1 of 1 Work order # 17110889

TEKLAB, INC. 5445 Horseshoe Lake Road - Collinsville, IL 62234 - Phone: (618) 344-1004 - Fax: (618) 344-1005

Client:	City Water, Light & Power
Address:	201 E. Lake Shore Drive
City / State / Zip	Springfield, IL 62712
Contact:	~~Sue Corcoran~~ Eric Staley **Phone:** (217) 757-8610
E-Mail:	sue.corcoran@cwlp.com **Fax:**

Samples on: ☑ ICE ☐ BLUE ICE ☐ NO ICE 1.22 °C

Preserved in: ☐ LAB ☑ FIELD

Lab Notes DM 11/14/17

FOR LAB USE ONLY

Client Comments: eric.staley@cwlp.com

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

Project Name/Number: Stock

Sample Collector's Name: Eric Staley

Results Requested: ☐ Standard ☐ 1-2 Day (100% Surcharge) ☐ Other ____ ☐ 3 Day (50% Surcharge)

Billing Instructions

Lab Use Only	Sample Identification	Date/Time Sampled	# and Type of Containers: UNPRES	HNO3	NaOH	H2SO4	HCL	MeOH	NaHSO4	OTHER	MATRIX: Aqueous	Drinking Water	Soil	Sludge	Special Waste	Groundwater	INDICATE ANALYSIS REQUESTED: Mercury by 1631E	Total Arsenic
17110889-001	TW3N	11-13-17 9:00		1												✓		✓
002	TW3E	9:20		1												✓		✓
003	TW3W	9:40		1												✓		✓

TEKLAB

Courier

Relinquished By	Date/Time	Received By	Date/Time
Eric Staley to Storage	11-13-17 13:50	Paul M Yan	11/14/17 0910
Paul M Yan	11-14-17 1208	Amber DiCarlo	11/14/17 1208

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.

BottleOrder: 33854

DM 11/14/17

Electronic Filing: Received, Clerk's Office 02/18/2020

CWLP - 27484

Teklab, Inc.
Environmental Laboratory
http://www.teklabinc.com/

December 20, 2017

Eric Staley
City Water, Light & Power
201 E. Lake Shore Drive
Springfield, IL 62712
TEL: (217) 757-8610
FAX: (217) 757-8615

RE: Internal Evaluation **WorkOrder:** 17120717

Dear Eric Staley:

TEKLAB, INC received 4 samples on 12/12/2017 12:40:00 PM 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,

Michael L. Austin
Project Manager
(618)344-1004 ex 16
MAustin@teklabinc.com

Report Contents

http://www.teklabinc.com/

Client: City Water, Light & Power
Work Order: 17120717
Client Project: Internal Evaluation
Report Date: 20-Dec-17

This reporting package includes the following:

Cover Letter	1
Report Contents	2
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Case Narrative	4
Accreditations	5
Laboratory Results	6
Receiving Check List	10
Chain of Custody	Appended

Definitions

Teklab, Inc. Environmental Laboratory
http://www.teklabinc.com/

Client: City Water, Light & Power
Work Order: 17120717
Client Project: Internal Evaluation
Report Date: 20-Dec-17

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.
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 dilutions factors.
DNI	Did not ignite
DUP	Laboratory duplicate is an aliquot of a sample taken from the same container under laboratory conditions for independent processing and analysis independently of the original aliquot.
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, spiked with verified known amounts of analytes, is 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. The acceptable recovery range is in the QC Package (provided upon request).
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	Method detection limit means the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero.
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
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. The acceptable recovery range is listed in the QC Package (provided upon request).
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)

Qualifiers

# -	Unknown hydrocarbon	B -	Analyte detected in associated Method Blank
E -	Value above quantitation range	H -	Holding times exceeded
I -	Associated internal standard was outside method criteria	J -	Analyte detected below quantitation limits
M -	Manual Integration used to determine area response	ND -	Not Detected at the Reporting Limit
R -	RPD outside accepted recovery limits	S -	Spike Recovery outside recovery limits
T -	TIC(Tentatively identified compound)	X -	Value exceeds Maximum Contaminant Level

Case Narrative

http://www.teklabinc.com/

Client: City Water, Light & Power
Client Project: Internal Evaluation

Work Order: 17120717
Report Date: 20-Dec-17

Cooler Receipt Temp: 1.82 °C

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: City Water, Light & Power

Client Project: Internal Evaluation

Work Order: 17120717

Report Date: 20-Dec-17

State	Dept	Cert #	NELAP	Exp Date	Lab
Illinois	IEPA	100226	NELAP	1/31/2018	Collinsville
Kansas	KDHE	E-10374	NELAP	4/30/2018	Collinsville
Louisiana	LDEQ	166493	NELAP	6/30/2018	Collinsville
Louisiana	LDEQ	166578	NELAP	6/30/2018	Collinsville
Texas	TCEQ	T104704515-12-1	NELAP	7/31/2018	Collinsville
Arkansas	ADEQ	88-0966		3/14/2018	Collinsville
Illinois	IDPH	17584		5/31/2019	Collinsville
Indiana	ISDH	C-IL-06		1/31/2018	Collinsville
Kentucky	KDEP	98006		12/31/2017	Collinsville
Kentucky	UST	0073		1/31/2018	Collinsville
Louisiana	LDPH	LA170027		12/31/2017	Collinsville
Missouri	MDNR	930		1/31/2018	Collinsville
Missouri	MDNR	00930		5/31/2017	Collinsville
Oklahoma	ODEQ	9978		8/31/2018	Collinsville
Tennessee	TDEC	04905		1/31/2018	Collinsville

Laboratory Results

Teklab, Inc. Environmental Laboratory
http://www.teklabinc.com/

Client: City Water, Light & Power
Work Order: 17120717
Client Project: Internal Evaluation
Report Date: 20-Dec-17
Lab ID: 17120717-001
Client Sample ID: TW3N
Matrix: AQUEOUS
Collection Date: 12/11/2017 12:40

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
EPA 600 4.1.4, 200.7R4.4, METALS BY ICP (TOTAL)								
Arsenic	NELAP	0.0250		**0.0425**	mg/L	1	12/14/2017 17:42	137183

Laboratory Results

Teklab, Inc. Environmental Laboratory
http://www.teklabinc.com/

Client: City Water, Light & Power
Work Order: 17120717
Client Project: Internal Evaluation
Report Date: 20-Dec-17
Lab ID: 17120717-002
Client Sample ID: TW3E
Matrix: AQUEOUS
Collection Date: 12/11/2017 12:50

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
EPA 600 4.1.4, 200.7R4.4, METALS BY ICP (TOTAL)								
Arsenic	NELAP	0.0250		**0.0251**	mg/L	1	12/14/2017 17:46	137183

Laboratory Results

Teklab, Inc. Environmental Laboratory
http://www.teklabinc.com/

Client: City Water, Light & Power
Work Order: 17120717
Client Project: Internal Evaluation
Report Date: 20-Dec-17
Lab ID: 17120717-003
Client Sample ID: TW3W
Matrix: AQUEOUS
Collection Date: 12/11/2017 13:00

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
EPA 600 4.1.4, 200.7R4.4, METALS BY ICP (TOTAL)								
Arsenic	NELAP	0.0250		**< 0.0250**	mg/L	1	12/14/2017 17:49	137183

Laboratory Results

http://www.teklabinc.com/

Client: City Water, Light & Power
Work Order: 17120717
Client Project: Internal Evaluation
Report Date: 20-Dec-17
Lab ID: 17120717-004
Client Sample ID: AW3
Matrix: AQUEOUS
Collection Date: 12/11/2017 0:00

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
EPA 600 4.1.4, 200.7R4.4, METALS BY ICP (TOTAL)								
Arsenic	NELAP	0.0250		**0.130**	mg/L	1	12/18/2017 10:13	137280

Teklab, Inc.
Environmental Laboratory

Receiving Check List

http://www.teklabinc.com/

Client: City Water, Light & Power
Client Project: Internal Evaluation

Work Order: 17120717
Report Date: 20-Dec-17

Carrier: Paul Reeves

Received By: AMD

Completed by: Kalyn Foecke
On: 12-Dec-17

Reviewed by: Elizabeth A. Hurley
On: 12-Dec-17

Pages to follow: Chain of custody 1 Extra pages included 0

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐	Temp °C 1.82
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.

TW3N and AW3 were partially frozen upon arrival at the laboratory. Eric Staley was notified of this error via work order summary. AMD/KF 12/12/17

AW3 was received but struck from the chain of custody in the field. Eric Staley could not be reached via voicemail; he will be notified via work order summary. AMD/KF 12/12/17

Resp. to 3rd RTP
CWLP - 27494

Print Form

Teklab Chain of Custody

Pg. 1 of 1 Workorder 17120717

5445 Horseshoe Lake Road ~ Collinsville, IL 62234 ~ Phone: (618)344-1004 ~ Fax:(618)344-1005

City Water Light and Power

201 E Lake Shore Drive

Springfield | IL | 62712

Project Name/Number: Internal Evaluation

Are the samples chilled? (x) Yes ( ) No with: (x) Ice ( ) Blue ice Preserved in ( ) Lab (x) Field

Cooler Temp 1.8 Sampler Eric Staley

* per container.

Comments: Received AW3. Dmo 12/13/17

TW3N & AW3 received partially frozen. Dmo 12/13/17

Contact Eric Staley eMail eric.staley@cwlp.com Phone 217-836-1266 Requested Due Date Billing/PO PD-400-50723

Lab Use	Sample ID	Sample Date/Time	Preservative	Matrix	Total Arsenic													
17120717-001	TW3N	12-11-17 1240	HNO3	Aqueous	X													
002	TW3E	1250	HNO3	Aqueous	X													
003	TW3W	1300	HNO3	Aqueous	X													
004	AW3	*	HNO3	Aqueous														
			Unpres	Aqueous														
			Unpres	Aqueous														
			Unpres	Aqueous														
			Unpres	Aqueous														

TEKLAB Courier

Electronic Filing: Received, Docket, 56495, Date: 02/13/2020

CWLP - 27495

Relinquished By *	Date/Time	Received By	Date/Time
Eric Staley to Storage	12-11-17 1330	Paul M Rue	12/12/17 0800
Paul M Rue	12/12/17 1240	Amber Villalpando	12/12/17 1240

* The individual signing this agreement on behalf of client acknowledges that they have read and understand the terms of this agreement and that they have the authority to sign on behalf of client.

Dmo 12/13/17

Teklab, Inc.
Environmental Laboratory
http://www.teklabinc.com/

March 13, 2018

Sue Corcoran
City Water, Light & Power
201 E. Lake Shore Drive
Springfield, IL 62712
TEL: (217) 757-8610
FAX:

RE: Groundwater Arsenic **WorkOrder:** 18030426

Dear Sue Corcoran:

TEKLAB, INC received 4 samples on 3/7/2018 1:07:00 PM 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,

Michael L. Austin
Project Manager
(618)344-1004 ex 16
MAustin@teklabinc.com

Report Contents

http://www.teklabinc.com/

Client: City Water, Light & Power
Work Order: 18030426
Client Project: Groundwater Arsenic
Report Date: 13-Mar-18

This reporting package includes the following:

Cover Letter	1
Report Contents	2
Definitions	3
Case Narrative	4
Accreditations	5
Laboratory Results	6
Receiving Check List	10
Chain of Custody	Appended

Teklab, Inc. Environmental Laboratory

Definitions

http://www.teklabinc.com/

Client: City Water, Light & Power **Work Order:** 18030426

Client Project: Groundwater Arsenic **Report Date:** 13-Mar-18

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.
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 dilutions factors.
DNI	Did not ignite
DUP	Laboratory duplicate is an aliquot of a sample taken from the same container under laboratory conditions for independent processing and analysis independently of the original aliquot.
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, spiked with verified known amounts of analytes, is 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. The acceptable recovery range is in the QC Package (provided upon request).
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	Method detection limit means the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero.
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
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. The acceptable recovery range is listed in the QC Package (provided upon request).
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)

Qualifiers

# -	Unknown hydrocarbon	B -	Analyte detected in associated Method Blank
E -	Value above quantitation range	H -	Holding times exceeded
I -	Associated internal standard was outside method criteria	J -	Analyte detected below quantitation limits
M -	Manual Integration used to determine area response	ND -	Not Detected at the Reporting Limit
R -	RPD outside accepted recovery limits	S -	Spike Recovery outside recovery limits
T -	TIC(Tentatively identified compound)	X -	Value exceeds Maximum Contaminant Level

Case Narrative

http://www.teklabinc.com/

Client: City Water, Light & Power
Client Project: Groundwater Arsenic

Work Order: 18030426
Report Date: 13-Mar-18

Cooler Receipt Temp: 0.82 °C

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: City Water, Light & Power
Client Project: Groundwater Arsenic

Work Order: 18030426
Report Date: 13-Mar-18

State	Dept	Cert #	NELAP	Exp Date	Lab
Illinois	IEPA	100226	NELAP	1/31/2019	Collinsville
Kansas	KDHE	E-10374	NELAP	4/30/2018	Collinsville
Louisiana	LDEQ	166493	NELAP	6/30/2018	Collinsville
Louisiana	LDEQ	166578	NELAP	6/30/2018	Collinsville
Texas	TCEQ	T104704515-12-1	NELAP	7/31/2018	Collinsville
Arkansas	ADEQ	88-0966		3/14/2018	Collinsville
Illinois	IDPH	17584		5/31/2019	Collinsville
Indiana	ISDH	C-IL-06		1/31/2019	Collinsville
Kentucky	KDEP	98006		12/31/2018	Collinsville
Kentucky	UST	0073		1/31/2019	Collinsville
Louisiana	LDPH	LA170027		12/31/2018	Collinsville
Missouri	MDNR	930		1/31/2019	Collinsville
Missouri	MDNR	00930		5/31/2019	Collinsville
Oklahoma	ODEQ	9978		8/31/2018	Collinsville
Tennessee	TDEC	04905		1/31/2019	Collinsville

Laboratory Results

Teklab, Inc. Environmental Laboratory
http://www.teklabinc.com/

Client: City Water, Light & Power
Work Order: 18030426
Client Project: Groundwater Arsenic
Report Date: 13-Mar-18
Lab ID: 18030426-001
Client Sample ID: AW3
Matrix: GROUNDWATER
Collection Date: 02/26/2018 13:00

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Arsenic	NELAP	1.0		**103**	µg/L	5	03/08/2018 15:32	139702

Laboratory Results

http://www.teklabinc.com/

Client: City Water, Light & Power
Work Order: 18030426
Client Project: Groundwater Arsenic
Report Date: 13-Mar-18
Lab ID: 18030426-002
Client Sample ID: TW3N
Matrix: GROUNDWATER
Collection Date: 02/26/2018 13:15

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Arsenic	NELAP	1.0		**57.0**	µg/L	5	03/08/2018 15:41	139702

Laboratory Results

http://www.teklabinc.com/

Client: City Water, Light & Power
Work Order: 18030426
Client Project: Groundwater Arsenic
Report Date: 13-Mar-18
Lab ID: 18030426-003
Client Sample ID: TW3E
Matrix: GROUNDWATER
Collection Date: 02/26/2018 13:30

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Arsenic	NELAP	1.0		**45.9**	µg/L	5	03/08/2018 15:49	139702

Laboratory Results

http://www.teklabinc.com/

Client: City Water, Light & Power
Work Order: 18030426
Client Project: Groundwater Arsenic
Report Date: 13-Mar-18
Lab ID: 18030426-004
Client Sample ID: TW3W
Matrix: GROUNDWATER
Collection Date: 02/26/2018 13:45

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Arsenic	NELAP	1.0		**2.2**	µg/L	5	03/08/2018 15:57	139702

Teklab, Inc. Environmental Laboratory

Receiving Check List

http://www.teklabinc.com/

Client: City Water, Light & Power
Work Order: 18030426
Client Project: Groundwater Arsenic
Report Date: 13-Mar-18

Carrier: Paul Reeves
Received By: KF

Completed by: Kalyn Foecke
On: 07-Mar-18

Reviewed by: Elizabeth A. Hurley
On: 07-Mar-18

Pages to follow: Chain of custody 1 Extra pages included 0

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐	Temp °C	0.82
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.

Samples were partially frozen upon arrival at the laboratory. Eric Staley was notified of this error via work order summary. AMD/EAH 3/7/18

Resp. to 3rd RTP
CWLP - 27505

CHAIN OF CUSTODY

pg. 1 of 1 Work order # 1803042G

TEKLAB, INC. 5445 Horseshoe Lake Road - Collinsville, IL 62234 - Phone: (618) 344-1004 - Fax: (618) 344-1005

Client:	City Water, Light & Power
Address:	201 E. Lake Shore Drive
City / State / Zip	Springfield, IL 62712
Contact:	Eric Staley
Phone:	(217) 757-8610
E-Mail:	eric.staley@cwlp.com
Fax:	(217) 757-8615

Samples on: [X] ICE [ ] BLUE ICE [ ] NO ICE 0.8° °C

Preserved in: [ ] LAB [X] FIELD

FOR LAB USE ONLY

Lab Notes emo 3/7/18

Partially frozen upon receipt. emo 3/7/18

Client Comments:

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

Project Name/Number: Groundwater Arsenic

Sample Collector's Name:

Results Requested: [ ] Standard [ ] 1-2 Day (100% Surcharge) [ ] Other ____ [ ] 3 Day (50% Surcharge)

Billing Instructions:

Lab Use Only	Sample Identification	Date/Time Sampled	# and Type of Containers: UNPRES	HNO3	NaOH	H2SO4	HCL	MeOH	NaHSO4	OTHER	MATRIX: Aqueous	Drinking Water	Soil	Sludge	Special Waste	Groundwater	INDICATE ANALYSIS REQUESTED: Arsenic 6020
1803042G 001	AW3	2-26-18 1300		1												X	
002	TW3N	1315		1												X	
003	TW3E	1330		1												X	
004	TW3W	1345		1												X	

Courier

Electronic Filing: Received, Clerk's Office 02/18/2020

CWLP - 27506

Relinquished By	Date/Time	Received By	Date/Time
Eric Staley to Storage	2-26-18 14:08		2-26-18 1408
Paul Mn	3/7/18 1307	K Keeler	3/7/18 1307

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: 40862

emo 3/7/18

Teklab, Inc.
Environmental Laboratory
http://www.teklabinc.com/

April 12, 2018

Eric Staley
City Water, Light & Power
201 E. Lake Shore Drive
Springfield, IL 62712
TEL: (217) 757-8610
FAX: (217) 757-8615

RE: Oil Sampling **WorkOrder:** 18040505

Dear Eric Staley:

TEKLAB, INC received 4 samples on 4/9/2018 2:00:00 PM 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,

Michael L. Austin
Project Manager
(618)344-1004 ex 16
MAustin@teklabinc.com

Report Contents

http://www.teklabinc.com/

Client: City Water, Light & Power
Work Order: 18040505
Client Project: Oil Sampling
Report Date: 12-Apr-18

This reporting package includes the following:

Cover Letter	1
Report Contents	2
Definitions	3
Case Narrative	4
Accreditations	5
Laboratory Results	6
Receiving Check List	10
Chain of Custody	Appended

Teklab, Inc. Environmental Laboratory

Definitions

http://www.teklabinc.com/

Client: City Water, Light & Power **Work Order:** 18040505

Client Project: Oil Sampling **Report Date:** 12-Apr-18

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.
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 dilutions factors.
DNI	Did not ignite
DUP	Laboratory duplicate is an aliquot of a sample taken from the same container under laboratory conditions for independent processing and analysis independently of the original aliquot.
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, spiked with verified known amounts of analytes, is 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. The acceptable recovery range is in the QC Package (provided upon request).
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	Method detection limit means the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero.
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
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. The acceptable recovery range is listed in the QC Package (provided upon request).
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)

Qualifiers

# -	Unknown hydrocarbon	B -	Analyte detected in associated Method Blank
E -	Value above quantitation range	H -	Holding times exceeded
I -	Associated internal standard was outside method criteria	J -	Analyte detected below quantitation limits
M -	Manual Integration used to determine area response	ND -	Not Detected at the Reporting Limit
R -	RPD outside accepted recovery limits	S -	Spike Recovery outside recovery limits
T -	TIC(Tentatively identified compound)	X -	Value exceeds Maximum Contaminant Level

Case Narrative

http://www.teklabinc.com/

Client: City Water, Light & Power
Client Project: Oil Sampling

Work Order: 18040505
Report Date: 12-Apr-18

Cooler Receipt Temp: 2.42 °C

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: City Water, Light & Power
Client Project: Oil Sampling

Work Order: 18040505
Report Date: 12-Apr-18

State	Dept	Cert #	NELAP	Exp Date	Lab
Illinois	IEPA	100226	NELAP	1/31/2019	Collinsville
Kansas	KDHE	E-10374	NELAP	4/30/2018	Collinsville
Louisiana	LDEQ	166493	NELAP	6/30/2018	Collinsville
Louisiana	LDEQ	166578	NELAP	6/30/2018	Collinsville
Texas	TCEQ	T104704515-12-1	NELAP	7/31/2018	Collinsville
Arkansas	ADEQ	88-0966		3/14/2019	Collinsville
Illinois	IDPH	17584		5/31/2019	Collinsville
Indiana	ISDH	C-IL-06		1/31/2019	Collinsville
Kentucky	KDEP	98006		12/31/2018	Collinsville
Kentucky	UST	0073		1/31/2019	Collinsville
Louisiana	LDPH	LA170027		12/31/2018	Collinsville
Missouri	MDNR	930		1/31/2019	Collinsville
Missouri	MDNR	00930		5/31/2019	Collinsville
Oklahoma	ODEQ	9978		8/31/2018	Collinsville
Tennessee	TDEC	04905		1/31/2019	Collinsville

Laboratory Results

Teklab, Inc. Environmental Laboratory
http://www.teklabinc.com/

Client: City Water, Light & Power
Work Order: 18040505
Client Project: Oil Sampling
Report Date: 12-Apr-18
Lab ID: 18040505-001
Client Sample ID: TW3W
Matrix: AQUEOUS
Collection Date: 04/06/2018 13:00

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Arsenic	NELAP	1.0	J	**0.8**	µg/L	5	04/10/2018 11:53	140651

Laboratory Results

Teklab, Inc. Environmental Laboratory
http://www.teklabinc.com/

Client: City Water, Light & Power
Work Order: 18040505
Client Project: Oil Sampling
Report Date: 12-Apr-18
Lab ID: 18040505-002
Client Sample ID: AW3
Matrix: AQUEOUS
Collection Date: 04/06/2018 13:10

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Arsenic	NELAP	1.0		**168**	µg/L	5	04/10/2018 12:01	140651

Laboratory Results

Teklab, Inc. Environmental Laboratory
http://www.teklabinc.com/

Client: City Water, Light & Power
Work Order: 18040505
Client Project: Oil Sampling
Report Date: 12-Apr-18
Lab ID: 18040505-003
Client Sample ID: TW3N
Matrix: AQUEOUS
Collection Date: 04/06/2018 13:20

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Arsenic	NELAP	1.0		**21.3**	µg/L	5	04/10/2018 12:09	140651

Teklab, Inc. Environmental Laboratory

Laboratory Results

http://www.teklabinc.com/

Client: City Water, Light & Power
Work Order: 18040505
Client Project: Oil Sampling
Report Date: 12-Apr-18
Lab ID: 18040505-004
Client Sample ID: TW3E
Matrix: AQUEOUS
Collection Date: 04/06/2018 13:30

Analyses	Certification	RL	Qual	Result	Units	DF	Date Analyzed	Batch
SW-846 3005A, 6020A, METALS BY ICPMS (TOTAL)								
Arsenic	NELAP	1.0		**21.2**	µg/L	5	04/10/2018 12:17	140651

Teklab, Inc.
Environmental Laboratory

Receiving Check List

http://www.teklabinc.com/

Client: City Water, Light & Power
Client Project: Oil Sampling

Work Order: 18040505
Report Date: 12-Apr-18

Carrier: Paul Reeves

Received By: SAH

Completed by: Kalyn Foecke
On: 09-Apr-18

Reviewed by: Elizabeth A. Hurley
On: 09-Apr-18

Pages to follow: Chain of custody 1 Extra pages included 0

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐	Temp °C	2.42
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.

Print Form

Teklab Chain of Custody

Pg. 1 of 1 Workorder 1804050S

5445 Horseshoe Lake Road ~ Collinsville, IL 62234 ~ Phone: (618)344-1004 ~ Fax:(618)344-1005

City Water, Light and Power

201 E Lake Shore Drive

Springfield | IL | 62712

Oil sampling

Are the samples chilled? ✓ Yes ○ No with: ✓ Ice ○ Blue ice

Preserved in ○ Lab ✓ Field

Cooler Temp 2.0 Sampler Staley

Comments: **Courier**

Contact Eric Staley eMail eric.staley@cwlp.com Phone 2177578610 Requested Due Date standard Billing/PO pd-400 0540723

Electronic Filing: Received, Docket, Date 02/13/2020

CWLP - 27517

Lab Use	Sample ID	Sample Date/Time	Preservative	Matrix	Arsenic, total											
1804050S-001	TW3W	4-6-18 1300	HNO3	Aqueous	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
002	AW3	4-6-18 1310	HNO3	Aqueous	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
003	TW3N	4-6-18 1320	HNO3	Aqueous	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
004	TW3E	4-6-18 1330	HNO3	Aqueous	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
			Unpres	Aqueous	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
			Unpres	Aqueous	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
			Unpres	Aqueous	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
			Unpres	Aqueous	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Relinquished By *	Date/Time	Received By	Date/Time
Staley to storage	4.6.18 1430		
	4/9/18 1400	Shelby Hennessy	4/9/18 1400

* The individual signing this agreement on behalf of client acknowledges that they have read and understand the terms of this agreement and that they have the authority to sign on behalf of client.

10.15

10.15	10/17/2017 - CCR Surface Impoundment Groundwater Monitoring Program	CCR Surface Impoundments Groundwater Monitoring Program	CWLP	08643	08715

Electronic Filing: Received, Clerk's Office 02/13/2020

City Water, Light & Power
Coal Combustion Residuals Surface Impoundments

Groundwater Monitoring Program

Prepared for:
City Water, Light & Power
201 E. Lake Shore Drive
Springfield, Illinois

Prepared by:

ANDREWS ENGINEERING INC
3300 Ginger Creek Drive
Springfield, IL 62711
Tel: (217) 787-2334
Fax: (217) 787-9495

Response to 1st RTP
CWLP - 008643

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APPENDICES

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1. INTRODUCTION

City Water, Light and Power (CWLP) owns and operates two (2) existing coal combustion residual (CCR) surface impoundments and intends to comply with the rules promulgated by the U.S. Environmental Protection Agency (EPA) pertaining to Disposal of CCR from Electric Utilities published in 40 CFR Part 257 on April 17, 2015 in Federal Register, Volume 80, No. 74; and with the Technical Amendments published on July 2, 2015 in Federal Register, Volume 80, No. 127.

The CWLP CCR surface impoundments are located north and east of the former Lakeside Power Generating Station and Dallman Power Generating Station in the Eastern ½ of Section 12, Township 15 North, Range 5 West, in Springfield, Illinois (see Figure 1). These CCR surface impoundments are identified as the Lakeside Ash Pond and the Dallman Ash Pond (see Figure 2).

The former Lakeside Power Generating Station and Dallman Power Generating Station are situated on the northwestern bank of Lake Springfield in Springfield, Illinois. The Lakeside Ash Pond is immediately south of Spaulding Dam at the northern end of Lake Springfield. The Dallman Ash Pond is immediately northwest of the Lakeside Ash Pond.

Placed into service prior to 1958, the Lakeside Ash Pond is primarily a diked embankment. The Lakeside Ash Pond consists of four separate ponds (i.e., three lime softening ponds and a settling pond) totaling approximately 35.0 acres. The Lakeside Ash Pond ceased receiving ash in 2009.

The Dallman Ash Pond was placed into service in approximately 1976 and is also a diked embankment. The Dallman Ash Pond is approximately 34.5 acres. Fly ash and bottom ash are sluiced to the Dallman Ash Pond with raw lake water.

This Groundwater Monitoring Program (GMP) was prepared to meet the groundwater monitoring and corrective action requirements of the Federal CCR Rule Part 257.90-98. The federal rules are specifically addressed in Section 3 and referenced throughout this document.

1.1 REGULATIONS

The two (2) CCR surface impoundments are regulated by Federal CCR Rule 40 CFR Part 257 Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities (EPA, 2015). As indicated above, the groundwater monitoring and corrective action requirements of the Federal CCR Rule Part 257.90-98 apply to both impoundments.

1.2 SITE DEVELOPMENT

The Lakeside Ash Pond was placed into service prior to 1958 and ceased receiving ash in 2009. The Dallman Ash Pond was placed into service in approximately 1976 and continues to receive ash. The most recent change made to the CCR surface impoundments was a vertical expansion to the Lakeside Ash Pond system in 1988. The vertical expansion consists of berms built on top and inside of the existing embankments in such a way that the toe of the outer slope of the expansion berms matches up with the top of the inner slope of the existing embankments. The vertical expansion berms are approximately ten feet in height.

2. SUBSURFACE CONDITIONS AT THE CCR SURFACE IMPOUNDMENTS

The subsurface conditions of the area in and surrounding the CCR surface impoundments have been characterized through multiple subsurface investigations, including those prior to the impoundment development, along the perimeter of the impoundments and including the hydrogeologic investigation at the permitted Subtitle D CCR landfill located north of the Lakeside Ash Pond and east of the Dallman Ash Pond. These investigations were as follows:

- Professional Service Industries (PSI), June 1989. This investigation consisted of five soil borings within the east section of the south cell (Cell 1).
- Andrews Environmental Engineering, Inc. (AEEI), February 1990. This investigation was performed for Cell 2 and consisted of 13 soil borings. The drilling and testing were completed by PSI.
- Andrews Environmental Engineering, Inc. (AEEI), March 1990. This investigation was performed to install six wells at the Facility. The drilling and testing were completed by PSI.
- Patrick Engineering, Inc. (PEI), July 1992. This investigation was performed to further characterize the hydrogeology of the landfill setting. Approximately 44 soil borings and piezometers were installed by PEI.
- Stabilize, Inc. (SI), December 2008. This investigation installed three new monitoring wells as part of an assessment program for the landfill. The drilling, soil testing, and well construction were performed by Reynolds Well Drilling.
- City Water, Light and Power (CWLP), April 2010. This investigation was performed to install four piezometers on the west side of the CCR surface impoundments along Sugar Creek. The drilling and testing were completed by PSI.
- Stabilize, Inc. (SI), May 2011. This investigation installed four new monitoring wells to further the characterization of the CCR surface impoundments. The drilling, soil testing, and well construction were performed by PSI.
- Andrews Engineering, Inc. (AEI), January 2012. This investigation was performed to replace CCR surface impoundment wells and install an additional background well. The drilling and well installation were completed by TerraDrill.
- Andrews Engineering, Inc. (AEI), July 2017. This project included drilling peripheral to the Dallman Ash Pond.

The summary discussion below of the subsurface conditions is presented in context of the 2015 Federal CCR Rule requirements for groundwater monitoring systems. Emphasis is placed on characterizing the existing wells and hydrogeologic conditions of the uppermost aquifer and underlying confining aquitard. The uppermost aquifer is the required unit for groundwater quality monitoring under the Federal CCR rule.

The occurrence of the deposits discussed below is highly variable due to the meandering nature of Sugar Creek prior to the development of Lake Springfield and Spaulding Dam. The meandering creek has resulted in sequential erosion and deposition (scour and fill) throughout much of the creek drainage system, both laterally and vertically.

2.1 SURFICIAL DEPOSITS

The shallow stratigraphy and lithology at the CCR surface impoundments include approximately 20 to 50 feet of Pleistocene sediments, dependent upon location. In ascending order these materials are identified as basal sand, lower cohesive deposit, shallow sand, upper cohesive deposit and fill material.

The overall tendency is for the finer-grained materials (clays, silty clays and silts) to overlie the coarser-grained materials (sands and gravels). This coarsening downward is present throughout much of the site. At the majority of the borehole locations, the coarser materials rest directly on top of the weathered bedrock surface. It is this coarser material, the basal sand, which is characterized as the uppermost aquifer.

Basal Sand

In most locations, the basal sand is the lower-most surficial deposit. The basal sand is a gray colored, poorly graded, silty to clayey fine sand to well graded sand with minor amounts of fine gravel. This unit was encountered in a medium dense to dense condition. The top elevation of the basal sand varies from 491 to 513 feet mean sea level (MSL) and the thickness ranges from about 0 to 12.3 feet. The unit was not encountered consistently, likely due to excessive erosion of the creek bottom.

The basal sand generally overlies the bedrock surface and underlies the lower cohesive deposit. There are some pockets of very hard, fine grained silty clay to clay overlying bedrock in a few areas. The basal sand is present above these pockets of clayey deposits, thought to be weathered bedrock.

The basal sand generally consists of 0% to 34% gravel, 50% to 91% sand, and 6% to 44% silt/clay; and exhibits a mean field hydraulic conductivity of 1.73×10^{-2} cm/sec. The basal sand was saturated in all locations where it was encountered.

Lower Cohesive Deposit

The lower cohesive deposit consists of brown, gray, and brownish gray silty clays, clayey silts, and clays, having very soft to stiff consistency. The lower cohesive deposit ranges in thickness from 0 to 22 feet with an average thickness of about 15 feet. The deposit was not encountered in isolated areas along the abandoned creek, possibly due to excessive erosion of creek bottom in these areas.

The lower cohesive deposit is generally overlain by the shallow sand and underlain by the basal sand. However, within the abandoned creek area, the lower cohesive deposit was encountered directly below the creek fill. In some areas the basal sand is not present and the lower cohesive deposit directly overlies the bedrock.

The soils in the lower cohesive deposit can be similar in color and texture to the soils in the upper cohesive deposit. The distinction between the two deposits was based on the presence or changes in soil consistency (as measured with a calibrated hand held penetrometer) and a marked difference in moisture content. The lower cohesive deposit is not exposed at the ground surface in the investigated area.

The lower cohesive deposit consists of 0% gravel, 8% to 48% sand, and 52% to 95% silt/clay; and has a relatively low hydraulic conductivity. The vertical hydraulic conductivity ranges from

1.3 x 10^{-8} to 1.8 x 10^{-6} cm/sec (triaxial permeameter). The horizontal hydraulic conductivity ranges from 4.6 x 10^{-5} to 7.6 x 10^{-5} cm/sec (field slug tests).

Shallow Sand

The shallow sand overlies the lower cohesive deposit and underlies the upper cohesive deposit. The unit consists of a brown to gray silty to clayey fine sand. It contains small lenses of silty clay and clayey silt. This unit is not continuous over the entire site. Its thickness ranges from one to three feet over most of the investigated area.

Laboratory tests performed on representative samples collected from the shallow sand unit during this and previous investigations indicate the shallow sand contains 0% gravel, 50% to 52% sand, and 48% to 50% silt/clay. Two landfill piezometers were screened in the shallow sand unit to obtain potentiometric surface information and conduct field hydraulic conductivity tests. The hydraulic conductivity of this unit based on the slug test results ranges from 3.6 x 10^{-3} to 2.9 x 10^{-2} cm/sec.

Upper Cohesive Deposit

The upper cohesive deposit has a relatively low hydraulic conductivity in the vertical direction as determined by laboratory triaxial hydraulic conductivity tests from borings taken from the landfill investigation. The hydraulic conductivity values determined from the laboratory tests ranged from 1.6 x 10^{-5} cm/sec to 5.2 x 10^{-7} cm/sec. However, the upper cohesive deposit is an alluvial deposit and it is expected that the horizontal coefficient of hydraulic conductivity will be greater than the vertical coefficient. Based on test results for the lower cohesive deposit, it is anticipated that the horizontal hydraulic conductivity for the upper cohesive deposit is in the range of 10^{-6} to 10^{-5} cm/sec.

Creek Fill Material

The· borings made along the abandoned creek locations indicate that the creek fill materials consist of variable soils ranging from silty clays to silty sands. Cohesive soils characterized as silty clays to organic silty clay were typically encountered. In some areas, the cohesive fill materials extended down to the top of bedrock. The granular fill materials are typically poorly graded silty to clayey sands and contain organics or wood fragments. In some areas, the granular fill materials also extended down to the top of bedrock.

The cohesive fill material contains 0% gravel, 2% to 48% sand, and 52% to 98% silt/clay. The vertical hydraulic conductivity ranges from 7.6 x 10^{-8} cm/sec to.2.1x10^{-5} cm/sec. The granular fill materials contain 0 to 2% gravel, 55% to 65% sand and 33% to 45% silt/clay. Based on one laboratory hydraulic conductivity test performed on a Shelby tube sample obtained from berm fill, the hydraulic conductivity of the granular fill material is 3.3 x 10^{-8} cm/sec.

The creek fill materials identified during the previous landfill investigations have a significant effect on the site hydrogeologic conditions. In some areas the till materials, consisting of either granular soils or organic silty clays, extend from existing grade to the bedrock surface and locally interconnect all three water bearing units. The upper and lower cohesive deposits are considered to act as aquitards (where present) which restrict vertical flow into the water bearing units. For all practical purposes, the bedrock is considered to be an aquiclude.

Fill materials encountered in the landfill borings range from silty clays and organic silty clays to silty sands and clayey sands. These water level measurements indicate that groundwater

movement within the creek fill materials is complicated because of the highly variable hydraulic characteristics of the fill materials and their random placement. In some areas, there appears to be direct hydraulic communication between fill materials, shallow sand, and basal sand.

Four landfill piezometers are screened into the fill materials. Of these, one piezometer was installed into cohesive fill material and the other piezometers were installed in granular till materials. Hydraulic conductivity of the granular fill materials is based on one field test resulting in a value of 6.1×10^{-2} cm/sec. The hydraulic conductivity of the cohesive fill material ranged from 7.1×10^{-5} cm/sec to 1.1×10^{-4} cm/sec. These values represent the hydraulic conductivity in the horizontal direction.

Laboratory hydraulic conductivity test performed on landfill cohesive fill materials ranged from 2.1×10^{-3} cm/sec to 3.3×10^{-8} cm/sec. The higher hydraulic conductivity values are believed to be typical of soils which contain organic matter (e.g. wood fragments). The hydraulic conductivity values based on laboratory tests are generally considered to be representative of the coefficient of hydraulic conductivity in the vertical direction because of the sample configuration during testing. However, because of the randomness of the fill, it is more likely that the hydraulic conductivity is within the range of 10^{-5} to 10^{-4} cm/sec.

2.2 UPPERMOST BEDROCK

The bedrock at the project site consists of Pennsylvanian shales which are gray in color. The bedrock surface elevation varies from approximately 492 feet MSL near the center of the existing landfill, to approximately 554 feet MSL located on a bedrock outcrop near the landfill area (southeast corner of Cell 1). In general, the bedrock surface slopes from the east and west towards the center of the landfill area.

Rock Quality Designation (RQD) measurements were performed on all core samples taken from the landfill area. RQDs measured from core samples collected during this investigation ranges from 80% to 100%. The RQD values indicate that the bedrock is not highly fractured. Two in situ hydraulic conductivity tests were performed to determine the hydraulic conductivity of the upper portions of the bedrock. Test results indicate hydraulic conductivity values of 1.8×10^{-7} cm/sec and 1.3×10^{-6} cm/sec. This shows that the bedrock encountered at the project site is relatively impermeable. There is good correlation between the lithology of the rocks tested and the hydraulic conductivity values obtained. The upper bedrock beneath the impoundments is expected to exhibit the same characteristics as encountered at the landfill.

2.3 HYDROGEOLOGIC UNITS

The uppermost aquifer and underlying confining unit control groundwater movement and the potential for CCR impacted groundwater migration at the site. A description of the uppermost aquifer and the underlying confining unit follows:

Uppermost Aquifer

The uppermost aquifer is characterized as the basal sand overlying the shale bedrock. In some locations the creek fill materials, ranging from silty clays and organic silty clays to silty sands and clayey sands, were found to be in direct hydraulic communication with the basal sand that directly overlies the bedrock surface. Due to the highly variable hydraulic characteristics and random placement of the creek fill materials, further characterization is difficult.

As indicated above, the hydraulic conductivity of the basal sand ranges from 5.6 x 10^{-4} to 3.6 x 10^{-2} cm/sec. The groundwater in the basal sand appears to be under confined, semi-confined, or unconfined conditions dependent upon location. The upper limit of the uppermost aquifer is dependent upon the seasonally fluctuating groundwater table. The potentiometric surface of the basal sand varies from 565 feet MSL at upgradient locations, south of the Lakeside Ash Pond, to 525 feet MSL at downgradient locations near Sugar Creek, north of the Dallman Ash Pond. As a result, the saturated thickness is variably dependent upon the location and the seasonal variation in the groundwater table.

Lower Confining Unit

The uppermost bedrock at the project site is primarily Pennsylvanian age shale with isolated thin coal layers. The Pennsylvanian shale functions as a lower confining unit due to its low permeability and effective porosity. The lower confining unit represents a natural hydrogeologic barrier (i.e., aquitard) to the vertical movement of groundwater.

In situ hydraulic conductivity test (slug tests) indicate that the hydraulic conductivity for the upper portions of the bedrock range from 1.8 x 10^{-7} to 1.3 x 10^{-6} cm/sec. There appears to be good correlation between the rock lithology and the measured values of hydraulic conductivity. The bedrock over most of the site will act as an aquiclude and prevent the downward movement of groundwater.

2.4 GROUNDWATER MOVEMENT

Groundwater movement is controlled by recharge along topographic highs and discharge along the original stream valley. The pre-surface impoundment flow direction in the uppermost aquifer was dominantly horizontal from the adjacent banks toward the natural convergence along Sugar Creek, which formerly drained the site. This was overall from south to north with local deviations. This dominant flow pattern persists under present day conditions but with localized variation introduced by the hydrologic discontinuity created upon construction of the CCR surface impoundments.

Existing wells at the site, including wells from the Flue Gas Desulfurization Systems (FGDS) Landfill, were used to derive potentiometric surface maps for 2016 and 2017. As shown, overall groundwater movement is from south to north (see Appendix A). The east perimeter of the Lakeside Pond is largely upgradient, and the west side is largely sidegradient where groundwater movement is parallel to the perimeter. Excavated areas within the landfill boundary act as a groundwater sink along the east side of the Dallman Ash Pond. Groundwater generally moves northward from the Dallman Ash Pond but also moves easterly towards the FGDS Landfill and westerly towards Sugar Creek.

3. GROUNDWATER MONITORING AND CORRECTIVE ACTION – 40 CFR §257.90 THROUGH §257.98

The following sections specifically address the sub rules pertaining to Groundwater Monitoring and Corrective Action under sections Applicability (§257.90), Groundwater Monitoring Systems (§257.91), Groundwater Sampling and Analysis Requirements (§257.93), Detection Monitoring Program (§257.94), Assessment Monitoring Program (§257.95), Assessment of Corrective Measures (§257.96), Selection of Remedy (§257.97), and Implementation of the Corrective Action Program (§257.98).

3.1 APPLICABILITY – §257.90

Owners of existing CCR surface impoundments are required to install groundwater monitoring systems, develop a sampling and analysis program to include statistical procedures to be used for evaluating monitoring data, and initiate detection monitoring and evaluation of data for "statistically significant increases (SSI)" over background levels for selected constituents. If detected constituents are measured at a "statistically significant level (SSL)" over the established background level, the facility must conduct assessment monitoring, and if necessary, initiate corrective action responses to control the release.

The facility must make available an annual groundwater monitoring and corrective action report, the first of which is due no later than January 31, 2018. The report must document the status the groundwater monitoring and corrective action program, summarize actions completed, describe problems encountered, and identify activities for the upcoming year. The content of the report is prescribed in §257.90(e). The report must be placed in the facility's operating record and comply with the recordkeeping requirements in §257.105(h), notification requirements in §257.106(h), and internet requirements in §257.107(h).

3.2 GROUNDWATER MONITORING SYSTEM – §257.91

The rule for Groundwater Monitoring Systems (GMS) is a performance standard (§257.91(a)), where the system must consist of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that: (1) accurately represent the quality of background groundwater that has not been affected by leakage from a CCR unit, and (2) accurately represent the quality of groundwater passing the impoundment boundary of the CCR unit to monitor potential contaminant pathways in the uppermost aquifer.

Under §257.91(b-c) the number, spacing, and depths of the groundwater monitoring wells have been determined based upon site-specific technical information to meet the rule's performance standard, including the subsurface conditions observed at the site as summarized in Section 2 of this document. This includes a characterization of the uppermost aquifer.

The monitoring well locations take into consideration the natural (pre-surface impoundment) and current convergence of groundwater flow paths. The wells are located as close as feasible to the downgradient CCR surface impoundments based on topography, surface impoundment construction, and operations. The existing monitor well network (number of wells, locations, and screen interval) was installed pursuant to recommendations of the Illinois EPA Bureau of Water. The network consists of six monitor wells screening the silt, sand, and gravel at the bedrock interface. The direction of groundwater movement, as described above, is to the west-northwest; therefore, the northern and western boundaries of the impoundments will be downgradient, and the southern and eastern boundaries will be upgradient. The monitoring network includes two upgradient wells (wells AP-4 and AP-5) and four downgradient wells (AP-1, AP-2, AP-3, and AW-3). The well locations are depicted in Figure 2 and Figure 3. Table 1 provides a summary of well construction and the approximate screened intervals. Appendix B contains the well completion reports.

Pursuant to §257.91(e), the monitoring wells are constructed in a manner that maintains the integrity of the monitoring well and borehole. All wells were installed pursuant to the Illinois Department of Public Health Water Well Construction Code (77 IAC 920) for monitoring well construction standards. All monitoring well installations were documented in the respective reports. Well construction details are provided in Appendix B. All drilling and groundwater

monitoring well construction was completed under the direct supervision of an Illinois Licensed Professional Geologist.

Background Quality – §257.91(1)

Two (2) groundwater monitoring wells are representative of background (ambient) groundwater quality conditions of the uppermost aquifer. These wells are identified as AP-4 and AP-5. Background concentrations are chemical concentrations or parameter values that represent naturally-occurring groundwater that has not been impacted by the surface impoundment or other facility activities.

Monitoring well AP-4 is located in an upgradient position, southwest of the CCR surface impoundments and along the eastern bank of Sugar Creek, immediately north of Lake Springfield dam. The well screen elevation is approximately 494.9 to 504.9 feet MSL at the surface of the Pennsylvanian shale, screening the basal sand. This well is not upgradient of the subject CCR surface impoundments in a hydrologic sense but it is located on available CWLP property where it provides representative background groundwater quality, as allowed under §257.91(a)(1)ii.

Monitoring well AP-5 is located in an upgradient position, southeast of the CCR surface impoundments and in a topographically slightly higher position. The well screen elevation is approximately 554.44 to 563.78 feet MSL. The screened section of AP-5 is also located at the top of Pennsylvanian shale and screened across the basal sand at this location. This well monitors the upgradient groundwater quality of the uppermost aquifer at this location.

Background concentrations for AP-4 and AP-5 were developed from samples collected for eight consecutive quarters, allowing the statistical method employed to account for seasonal/temporal variability. The chemical constituents include only those parameters Contained in Appendices III and IV of Part 257 (Tables III-2 and III-3, respectively).

The background concentrations are statistically analyzed to establish site-specific upper confidence limits for each chemical or parameter. The statistical methodology utilized for derivation of the background concentrations is provided in Appendix C. The data, calculations and resulting background concentrations are provided in Appendix D.

Results from the background wells (AP-4 and AP-5) will be continually evaluated. If the groundwater quality significantly changes, it will become necessary to revise the background concentrations. In such an event, the statistical method contained in Appendix C will be utilized for such revision. Details for any revision will be placed in the facility record.

Downgradient Quality - §257.91(2)

Four (4) groundwater wells allow monitoring of the downgradient groundwater quality conditions in the uppermost aquifer. These wells are identified as AP-1, AP-2, AP-3 and AW-3. The locations and depths of these wells accurately represent the quality of groundwater passing the impoundment boundaries of the CCR units and reasonably make possible the detection of geochemical changes in the uppermost aquifer. These groundwater monitoring wells are all screened at the top of the weathered bedrock surface. Monitoring wells AP-1, AP-2, AP-3 and AW-3 are located along the toe of the CCR surface impoundments and adjacent to Sugar Creek. Further details are listed below:

Monitoring well AP-1 is screened from approximately 504.63 to 514.01 feet MSL. The screened zone consists of a sand at the surface of the Pennsylvanian shale.

Monitoring well AP-2 is screened from approximately 515.54 to 525.19 feet MSL. The screened zone consists of a clayey sand to sand at the surface of the Pennsylvanian shale.

Monitoring well AP-3 is screened from approximately 514.7 to 524.7 feet MSL. The screened zone consists of a clayey silt at the surface of the Pennsylvanian shale.

Monitoring well AW-3 is screened from approximately 496.32 to 506.32 feet MSL. The screened zone consists of a silt and silty sand at the surface of the Pennsylvanian shale.

3.3 GROUNDWATER SAMPLING AND ANALYSIS REQUIREMENTS – §257.93

The Groundwater Monitoring Program (GMP) includes consistent sampling and analysis procedures to provide accurate representation of groundwater quality (§257.93(a)). The activities include sample collection, preservation and shipment, analytical procedures, chain of custody, and quality assurance and quality control.

Groundwater is sampled for the constituents listed in Appendices III and IV of Part 257 (§257.93(b)). For detection monitoring, these constituents include boron, calcium, chloride, fluoride, pH, sulfate, and total dissolved solids from Appendix III Part 257 (Table III-2); and for assessment monitoring (if necessary) these constituents include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, selenium, thallium, and radium 226 & 228 combined from Appendix IV Part 257 (Table III-3). All constituents are analyzed as total recoverable, where samples are not field filtered.

Pursuant to §257.93(c), groundwater levels will be measured in each groundwater monitoring well immediately prior to purging, and each time groundwater is sampled. Other wells may be retained as water level measurement points. Levels will be measured to the nearest 0.01 feet (1/100 hundredth) and used to determine rate and direction of groundwater movement each time groundwater is sampled. In addition, a water table map/potentiometric surface map for the uppermost aquifer will be generated using the measured water levels obtained from each sampling event. The contours on these maps will allow for a quantitative assessment of flow rate and direction. Measurements of well depths will also be obtained during each sampling event to verify that the wells are physically intact and not filling with sediment, except where such measurements are not possible due to the presence of dedicated sampling equipment in the well.

Pursuant to §257.93(d), the background groundwater quality has been established for each of the constituents listed in Appendices III and IV of Part 257 (see Tables III-2 and III-3) by using the upgradient and background wells described under §257.91(a)(1), as applicable for detection (§257.94(a)) or assessment (§257.95(a)) monitoring requirements. The upgradient and background wells include AP-4 and AP-5.

The number of samples collected under detection and assessment monitoring, if necessary (for both downgradient and background wells), will be consistent with the statistical procedures selected under §257.93(f) and the performance standard under §257.93(g). The sampling procedures are consistent with that specified under §257.94(b-d) for detection monitoring and §257.95(b-d) for assessment monitoring, and §257.96(b) for corrective action.

Pursuant to §257.93(f), the selected statistical method to be used during detection monitoring in evaluating groundwater monitoring data for each constituent is the Prediction Interval Procedure under §257.93(f)(3). For this procedure, an interval for each constituent is established from the distribution of the background data and then the level of each constituent in each compliance well (i.e., well/constituent) is compared to the upper prediction limit to assess if a statistically significant increase (SSI) over background has occurred.

The selected method to evaluate concentrations obtained as part of the detection monitoring program is appropriate to determine the occurrence of statistically significant changes in the groundwater quality data and complies with the performance standards under §257.93(g), including:

(1) §257.93(g)(1) addressing the distribution of constituents where normal distributions will use parametric methods and non-normal distributions will use non-parametric methods.

(2) §257.93(g)(4) addressing the effectiveness of this approach by considering the number of samples in the background database, the data distribution, and the range of concentrations values for each constituent of concern.

(3) §257.93(g)(5) establishing the practical quantitation limit as the lowest concentration level that can be reliably achieved during routine laboratory operating conditions.

(4) §257.93(g)(6) allowing for the correction of seasonal and spatial variability as well as temporal correlation in the data.

The methodology to screen background data and establish background constituent levels is provided in Appendix A. This selected statistical approach will be effective in detecting changes in groundwater quality based on the use of interwell prediction limits (EPA, Unified Guidance, 2009). The statistically calculated interwell prediction limits (Appendix D) will be used during detection monitoring to statistically analyze detected inorganic constituents at each monitoring well (i.e., well/constituents) to determine under §257.93(h) whether or not there is a statistically significant increase (SSI) over background values. The SSI determination(s) will be completed within 90 days of completing sampling and analysis, where under §257.93(h)(2)(i), analysis is for total recoverable metals of non-field filtered samples. Volatile organic compounds and synthetic compounds are not applicable to this CCR site. Inorganic well/constituent pairs with confirmed SSI (i.e., interwell prediction limit exceedances) will then be placed into the Assessment Monitoring Program under §257.95.

3.4 DETECTION MONITORING PROGRAM – §257.94

Pursuant to §257.94(a), the Detection Monitoring Program includes, at a minimum, groundwater monitoring for all constituents listed in Appendix III to Part 257, including boron, calcium, chloride, fluoride, pH, sulfate, and total dissolved solids (TDS). The long-term monitoring frequency for the Appendix III constituents under §257.94(b) will be semiannual during the active life of the CCR unit and the post closure period.

Pursuant to §257.94(b), eight (8) independent samples were collected from each background and downgradient well and analyzed for the constituents listed in Appendix III to Part 257 including boron, calcium, chloride, fluoride, pH, sulfate, and total dissolved solids (TDS); and for the constituents listed in Appendix IV to Part 257 including antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, selenium, thallium, and radium 226 & 228 combined. The initial eight (8) independent sampling events were

completed over the second quarter 2015 through first quarter 2017 (§257.94(b)). This schedule allowed the capture of seasonal variability in quality and groundwater flow conditions. Details for derivation of the background concentrations were discussed in Section 3.2 above.

The number of samples collected and analyzed are consistent with the sampling and statistical procedures referenced in §257.93(e) and account for any unique characteristics of the site (§257.94(c)). Sampling for detection monitoring will occur on a semi-annual basis.

Alternative monitoring frequency for repeated sampling and analyses for constituents listed in Appendix III of Part 257 during the active life and the post-closure period based on the availability of groundwater may be implemented pursuant to §257.94(d). However, as stated above, detection monitoring will occur on a semi-annual basis, beginning in October/November 2017 such that the first Groundwater Monitoring and Corrective Action Report can be completed by January 31, 2018.

Pursuant to §257.94(e), if the facility determines pursuant to §257.93(h) that there is a statistically significant increase (SSI) over background levels for one or more of the constituents listed in Appendix III to Part 257 at any monitoring well, within 90 days of this determination the facility will establish an assessment monitoring program meeting the requirements of §257.95 and prepare a notification for the facility's operating record stating that an assessment monitoring program has been established. Such a determination for SSI will occur under the Detection Monitoring Program after completion of the initial 8 independent sampling events and the initial statistical evaluation. As applicable, the facility may also demonstrate that a source other than the CCR unit(s) caused the SSI, or that the SSI was the result of error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The demonstration must be in writing and completed within 90 days of detecting the SSI. If the demonstration is successful, then detection monitoring may continue.

Given the variability of the groundwater chemistry within the facility area, confirmation sampling may be conducted within 90 days of the observation of the SSI. This aids in preventing false positives and prematurely implementing an assessment monitoring program. If resampling occurs due to a SSI, then the SSI will be recorded in the facility record noting that resampling will occur. Within 90 days of the initial observed SSI, the results of the resample event must be placed in the facility record. If the SSI is not confirmed, detection monitoring will continue. If the SSI is confirmed, assessment monitoring pursuant to §257.95 must be initiated.

3.5 ASSESSMENT MONITORING PROGRAM – §257.95

Except as stated above, assessment monitoring is required pursuant to §257.95(a) whenever a SSI has been detected during detection monitoring for one or more of the constituents in Appendix III of Part 257. Under §257.95(b), within 90 days of triggering an assessment monitoring program, and annually thereafter, the facility must sample and analyze the groundwater for all constituents listed in Appendix IV to Part 257 until detection monitoring resumes. An alternative monitoring frequency may be considered if documented under the requirements of §257.95(c).

After obtaining the results from the initial and subsequent sampling events required under §257.95(b), the facility must within 90 days of obtaining the results, and on at least a semiannual basis thereafter, resample all wells that were installed pursuant to §257.91 and conduct analyses for all constituents in Appendix III and for those constituents in Appendix IV to Part 257 that are detected. The results must then be placed in the operating record.

Groundwater Protection Standards (GWPS) will be established for all constituents detected pursuant to §257.95(b or d) and in accordance with the requirements of §257.95(h). These activities and results will be summarized in the annual groundwater monitoring and corrective action report required under §257.90(e).

Pursuant to §257.95(e), if the concentration of all constituents listed in Appendix III and Appendix IV of Part 257 are shown to be at or below background values, using the statistical procedures in §257.93(g), for two consecutive sampling events, the facility may return to the detection monitoring and place notification in the operating record. If the concentrations of any constituent in Appendix III and Appendix IV to Part 257 are above background values, but all concentrations are below the GWPS, assessment monitoring must continue (§257.95(f)).

If one or more constituents in Appendix IV to Part 257 are detected at statistically significant levels (SSL) above the GWPS, the facility must place notification in the operating record and proceed to characterize the nature and extent of the release and any relevant site conditions that may affect the remedy ultimately selected (§257.95(g)). The characterization must meet the requirements of §257.95(g)(1) and the public notification the requirements of §257.95(g)(2). Under §257.95(g)(3), within 90 days of finding that any of the constituents listed in Appendix IV to Part 257 have been detected at a SSL exceeding the GWPS, the facility must either initiate an assessment of corrective measures under §257.96, or demonstrate an error in any such determination.

A GWPS must be established for each constituent in Appendix IV to Part 257 detected in the groundwater. The GWPS shall be: (1) for constituents for which a maximum contaminant level (MCL) has been established, the MCL for that constituent, or (2) for constituents for which an MCL has not been established, the background concentration for the constituent established from wells in accordance with §257.91, or (3) for constituents for which the background level is higher than the MCL identified under §257.95(h)(1), the background concentration shall be the GWPS.

3.6 ASSESSMENT OF CORRECTIVE MEASURES – §257.96

Within 90 days of determining that any constituent listed in Appendix IV of Part 257 has been detected at a SSL exceeding the GWPS, or immediately upon detection of a release, the facility must initiate an assessment of corrective measures to prevent further releases, to remediate releases, and to restore the affected area to original conditions (§257.96(a)). The assessment must be completed within 90 days unless a time extension of not more than 60 days is needed to complete the assessment, as demonstrated by the facility. The facility will include any such demonstration in the annual groundwater monitoring and corrective action report required under §257.90(e). The CCR unit will continue to monitor groundwater in accordance with the Assessment Monitoring Program during the assessment of corrective measures.

The assessment of corrective measures will evaluate the effectiveness of potential corrective measures in meeting the requirements and objectives of the remedy as described under §257.97, including performance, reliability, ease of implementation, impacts, exposure, time required, permitting, etc. (§257.96(c)).

The completed assessment of corrective measures will be placed in the operating record; discussed at a public meeting at least 30 days prior to the selection of a remedy under §257.97; and recordkeeping, notification, and internet requirements will be met.

3.7 SELECTION OF REMEDY – §257.97

Based on the results of the assessment of corrective measures, a remedy will be selected as soon as feasible that meets the standards listed in §257.97(b), including being protective of human health and environment, attain the GWPS, control the source(s) of release so as to reduce or eliminate, to the extent feasible, further releases on constituents in Appendix IV of Part 257, remove from the environment as much of the contaminated material as feasible, and comply with standards for management of wastes under §257.98(d). In selecting the remedy, the facility will consider the requirements of §257.97(c) and establish a schedule for implementing and completing remedial activities under §257.97(d).

3.8 IMPLEMENTATION OF THE CORRECTIVE ACTION PROGRAM – §257.98

Pursuant to §257.98(a), within 90 days of selecting the remedy, the facility will initiate remedial activities. Based on the schedule provided under §257.97(d) for implementation of remedial activities, the facility must establish and implement a corrective action groundwater monitoring program that meets the requirements of an assessment monitoring program under §257.95, implement the corrective action remedy selected under §257.97, and address any interim measures that might be needed to reduce the contaminants leaching from the CCR unit. If at any time the facility determines that compliance with the requirements of §257.97(b) is not being achieved through the remedy selected, other methods or techniques that could feasibly achieve compliance should be evaluated and implemented (§257.98(b)).

Pursuant to §257.98(c), the remedy will be considered complete when compliance with the GWPS has been achieved at all points within the plume of contamination that lie beyond the groundwater monitoring well system and concentrations of constituents listed in Appendix IV of Part 257 have not exceeded the GWPS for a period of three consecutive years. Table III-7 depicts the methodology for corrective action, where the effectiveness of the remedial actions will be evaluated based on the confidence intervals constructed for applicable well/constituent pairs as compared to a specified clean-up standard which is the GWPS. When the entire interval is determined to be below the standard under §257.98(c) for three consecutive years, that well/constituent pair will be declared to be in compliance, and inorganic well/constituent pairs will be moved back into detection monitoring and appropriate limit-based statistics will resume.

All CCR units that are managed pursuant to a remedy required under §257.97 will be managed in a manner that complies with applicable RCRA requirements (§257.98(d)). Pursuant to §257.98(e), upon completion of the remedy the facility will prepare a notification stating that the remedy has been completed and obtain a certification from a qualified professional engineer.

4. RECORDKEEPING, NOTIFICATION, AND POSTING OF INFORMATION – FEDERAL RULE §257.105 THROUGH §257.107

4.1 RECORDKEEPING REQUIREMENTS – §257.105

CWLP, as owner of an existing CCR unit, will maintain files in its operating record as required under §257.105(h) – groundwater monitoring and corrective action – for a period of no less than five years. This includes:

1. annual groundwater monitoring report,
2. documentation pertaining to monitoring wells,

3. groundwater monitoring certification,
4. selection of statistical method certification,
5. notification within 30 days of establishing an assessment monitoring program,
6. analytical results of Appendices III and IV to Part 257,
7. notification within 30 days of returning to a detection monitoring program,
8. notification within 30 days of detecting of constituents in Appendix IV of Part 257 at statistically significant levels above the groundwater protection standard,
9. notification within 30 days of initiating the assessment of corrective measures,
10. the completed assessment of corrective measures,
11. documentation recording the public meeting for the corrective measures assessment,
12. the semiannual report describing the progress in selecting and designing the remedy and the selection of remedy report, and
13. notification within 30 days of completing the remedy.

4.2 NOTIFICATION REQUIREMENTS – §257.106

Notifications required under §257.106(h) – groundwater monitoring and corrective action – will be sent to the relevant regulatory authority, including for (1) availability of:

1. the annual groundwater report,
2. availability of the groundwater monitoring system certification,
3. selection of a statistical method certification,
4. that an assessment monitoring program has been established,
5. that the CCR unit is returning to a detection monitoring program,
6. that constituent(s) in Appendix IV to Part 257 have been detected at statistically significant levels above the groundwater protection standard and notifications to landowners,
7. that an assessment of corrective measures has been initiated,
8. availability of assessment of corrective measures,
9. the availability of the semiannual report describing the progress in selecting and designing the remedy and the selection of remedy report, and
10. completion of the remedy.

4.3 PUBLICALY ACCESSIBLE INTERNET SITE REQUIREMENTS – §257.107

CWLP will maintain a publicly accessible Internet site (CCR website) containing the information specified in §257.107(h) – groundwater monitoring and corrective action.

http://ehs.cwlp.com/

V. REFERENCES CITED

U.S. Environmental Protection Agency (EPA), March 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance. Office of Resource Conservation and Recovery Program Implementation and Information Division, U.S. Environmental Protection Agency, Washington, DC.

U.S. Environmental Protection Agency (EPA), 2015. Published in Federal Register Volume 80, No. 74 published on April 17, 2015, *Final Rule 40 CFR Part 257 Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities*; and *Technical Amendments* (correcting the effective date) published in Federal Register Volume 80, No. 127 on July 2, 2015.

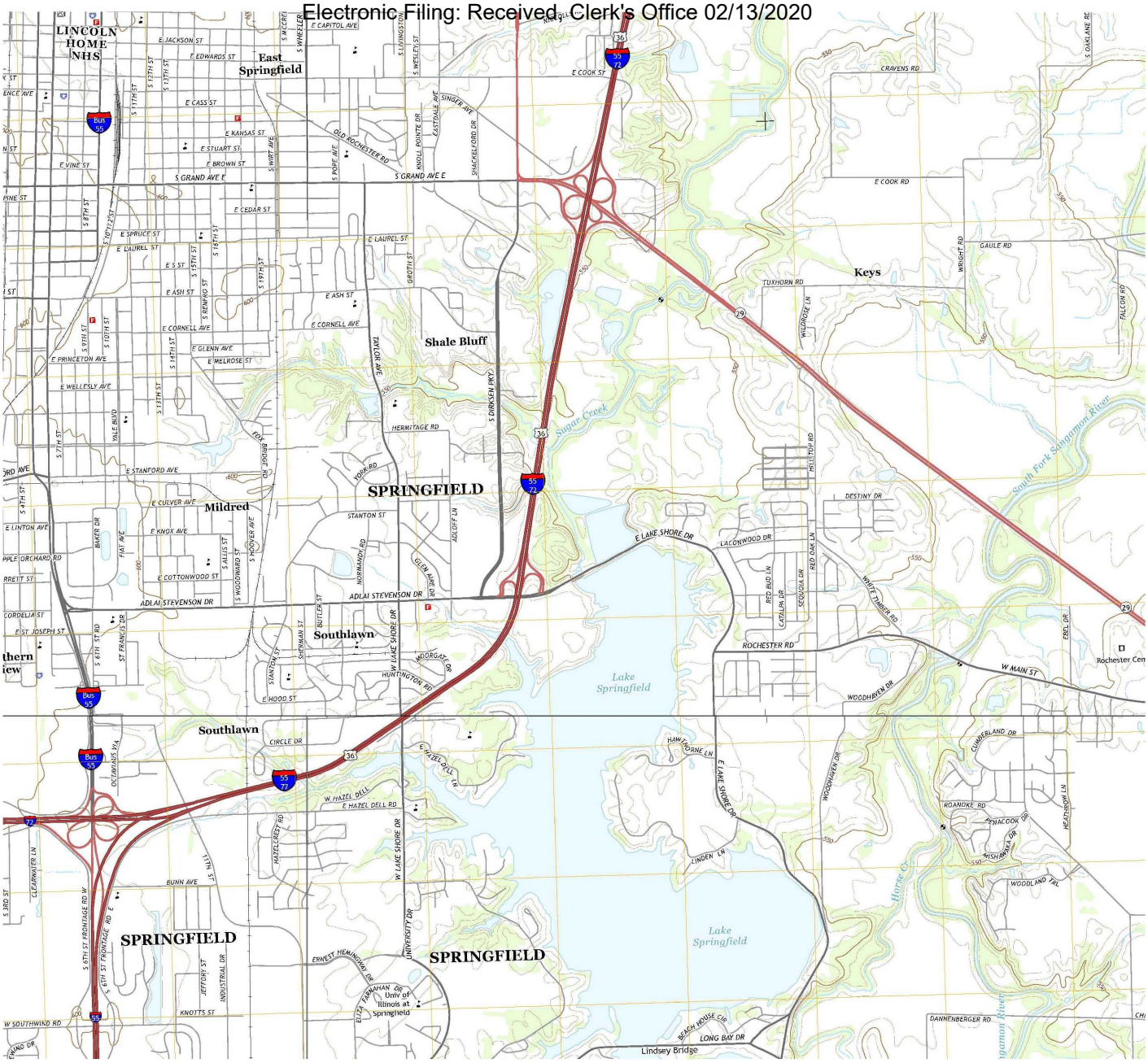
TABLES

Table 1 Well Construction Summary

Well ID	Monitoring Position	Material Screened	Top of Casing (feet MSL)	Ground Surface (feet MSL)	Top of Screen (feet MSL)	Bottom of Screen (feet MSL)
AP-1	Downgradient	Bedrock/Unconsolidated Interface	535.60	533.10	514.01	504.63
AP-2	Downgradient	Bedrock/Unconsolidated Interface	536.10	533.60	525.19	515.54
AP-3	Downgradient	Bedrock/Unconsolidated Interface	535.40	533.70	524.7	514.7
AP-4	Upgradient	Bedrock/Unconsolidated Interface	559.20	553.90	504.9	494.9
AP-5	Upgradient	Bedrock/Unconsolidated Interface	583.90	581.60	563.78	554.44
AW-3	Downgradient	Bedrock/Unconsolidated Interface	540.33	537.75	506.32	496.32

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CWLP - 008661

FIGURES


LINCOLN HOME NHS
East Springfield
Shale Bluff
SPRINGFIELD
Mildred
Southlawn
Keys
Lake Springfield
Sugar Creek
South Fork Sangamon River
Horse Cr
Univ of Illinois at Springfield
Lindsey Bridge
E LAKE SHORE DR
ADLAI STEVENSON DR
E COOK ST
E COOK RD
CRAVENS RD
GAULE RD
TUXHORN RD
DESTINY DR
LACONWOOD DR
ROCHESTER RD
W MAIN ST
WOODHAVEN DR
CUMBERLAND DR
ROANOKE RD
WOODLAND TRL
DANNENBERGER RD
E HAZEL DELL RD
W HAZEL DELL
W LAKE SHORE DR
LINDEN LN
HAWTHORNE LN
CIRCLE DR
BUNN AVE
W SOUTHWIND RD
LONG BAY DR
BEACH HOUSE CIR
HERMITAGE RD
STANTON ST
E HOOD ST
E CULVER AVE
E STANFORD AVE
E CORNELL AVE
E GLENN AVE
E MELROSE ST
E PRINCETON AVE
E WELLESLY AVE
E ASH ST
E CEDAR ST
E LAUREL ST
E SPRUCE ST
E CASS ST
E KANSAS ST
E STUART ST
E BROWN ST
E VINE ST
S GRAND AVE E
E JACKSON ST
E EDWARDS ST
E CAPITOL AVE
E CAPITOL ST
E KNOX AVE
E COTTONWOOD ST
E ST JOSEPH ST
E LINTON AVE
OLD ROCHESTER RD
TAYLOR AVE
S DIRKSEN PKY
YORK RD
NORMANDY RD
GLEN ARK DR
ADELOFF LN
SHERMAN ST
BUTLER ST
HUNTINGTON RD
DOORGATE DR
HAZELCREST RD
UNIVERSITY DR
ERNEST HEMINGWAY DR
ELIZA TAMPAHAN DR
S 6TH ST FRONTAGE RD W
S 6TH ST FRONTAGE RD E
INDUSTRIAL DR
JEFFORY ST
KNOTTS ST
CLEARWATER LN
OCTAVIAS WY
ST FRANCIS DR
BAKER DR
HAY AVE
S ALLIS ST
S WOODWARD ST
S HOOVER AVE
FOX BRIDGE RD
S RENFRO ST
S WHEELER
S WCREEL
S LIVINGSTON
S WESLEY ST
S POPE AVE
S SWIFT AVE
KNOLL POINTE DR
EASTDALE AVE
SINGER AVE
SHACKELFORD DR
WILDROSE LN
HILLTOP RD
WRIGHT RD
FALCON RD
S OAKLANE RD
RED BUD LN
CATALPA DR
SEQUOIA DR
RED OAK LN
WHITE TIMBER RD
EBEL DR
WOODBRIDGE DR
WOODHAVEN DR
HEATHROW LN
KISHWAUKEE DR
KENACOOK DR
Rochester Cem
Bus 55
55 72
36
29
72

ILLINOIS

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LEGEND

- ASH IMPOUNDMENT MONITORING WELL LOCATION
- PIEZOMETER LOCATION
- LANDFILL MONITORING WELL LOCATION

N

0 200 400 800

SCALE: IN FEET

NOTE:
BACKGROUND IMAGE DERIVED FROM BING.

NO.	DATE	REVISIONS DESCRIPTION	BY

ANDREWS ENGINEERING, INC.
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PROFESSIONAL DESIGN ENGINEERING AND LAND SURVEYING FIRM #184-001541

DESIGNED BY: MTH | DRAWN BY: RMC | APPROVED BY: MTH

SITE FACILITIES

PLANS PREPARED FOR
CITY, WATER, LIGHT & POWER
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: OCTOBER 2017

PROJECT ID: 170306/0001

SHEET NUMBER:
FIGURE 2

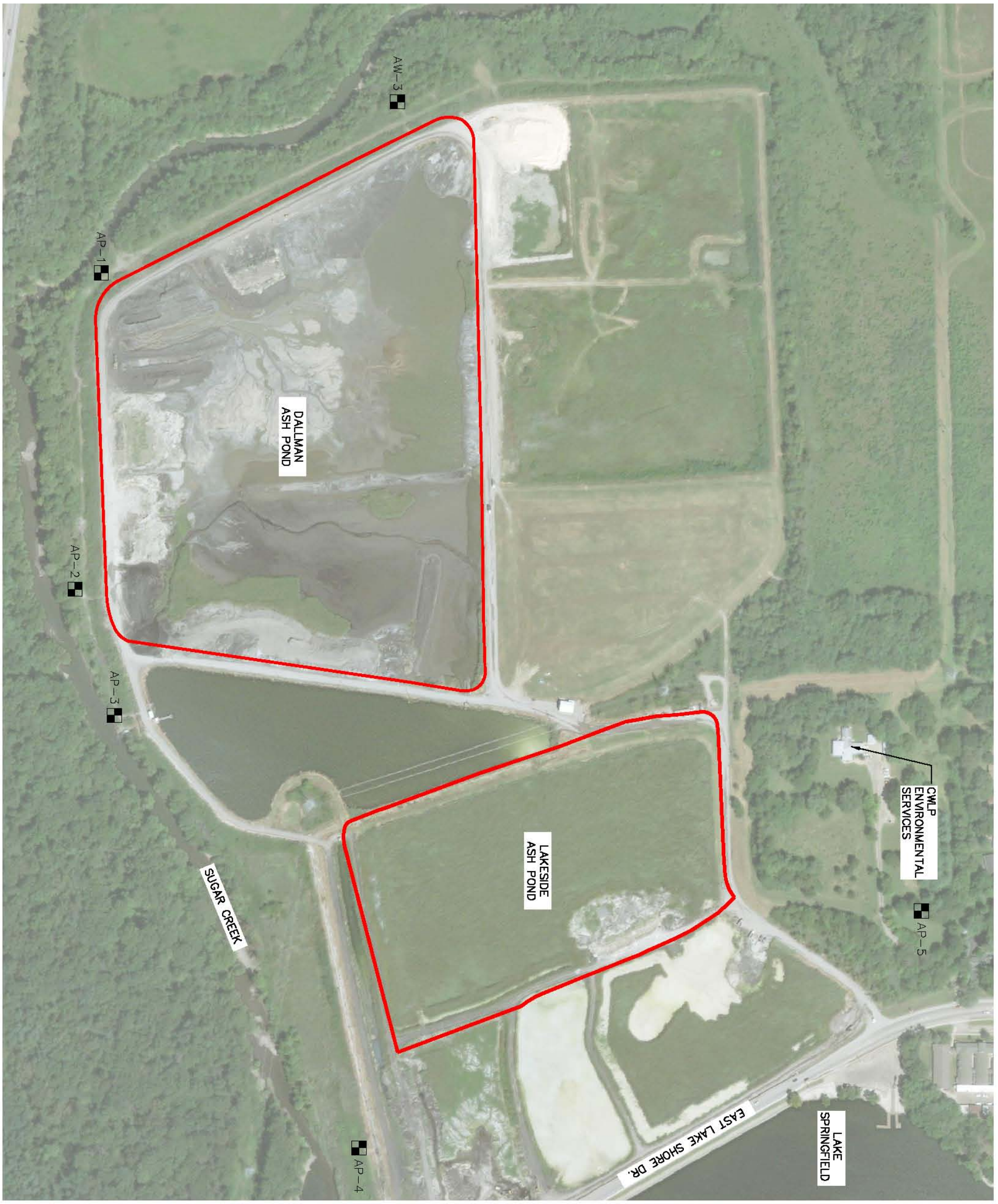
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J:\S\Springfield CWLP\CWLP\dwg\2017\Existing Groundwater Monitoring Network.dwg Tab: FIGURE 2 Last Saved: October 4, 2017, by Ryan Curtis Plotted: Thursday, October 05, 2017 1:10:23 PM

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J:\S\Springfield CWLP\CWLP\dwg\2017\Existing Groundwater Monitoring Network.dwg Tab: FIGURE 3 Last Saved: October 4, 2017, by Ryan Curtis Plotted: Thursday, October 05, 2017 1:09:35 PM



NOTE: BACKGROUND IMAGE DERIVED FROM BING.

0 150 300 600
SCALE: IN FEET

N

LEGEND

ASH IMPOUNDMENT MONITORING WELL LOCATION

FIGURE 3

SHEET NUMBER:

PROJECT ID: 170306/0001

DATE: OCTOBER 2017

GROUNDWATER MONITORING SYSTEM

PLANS PREPARED FOR

CITY, WATER, LIGHT & POWER

SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

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PROFESSIONAL DESIGN ENGINEERING AND LAND SURVEYING FIRM #184-001541

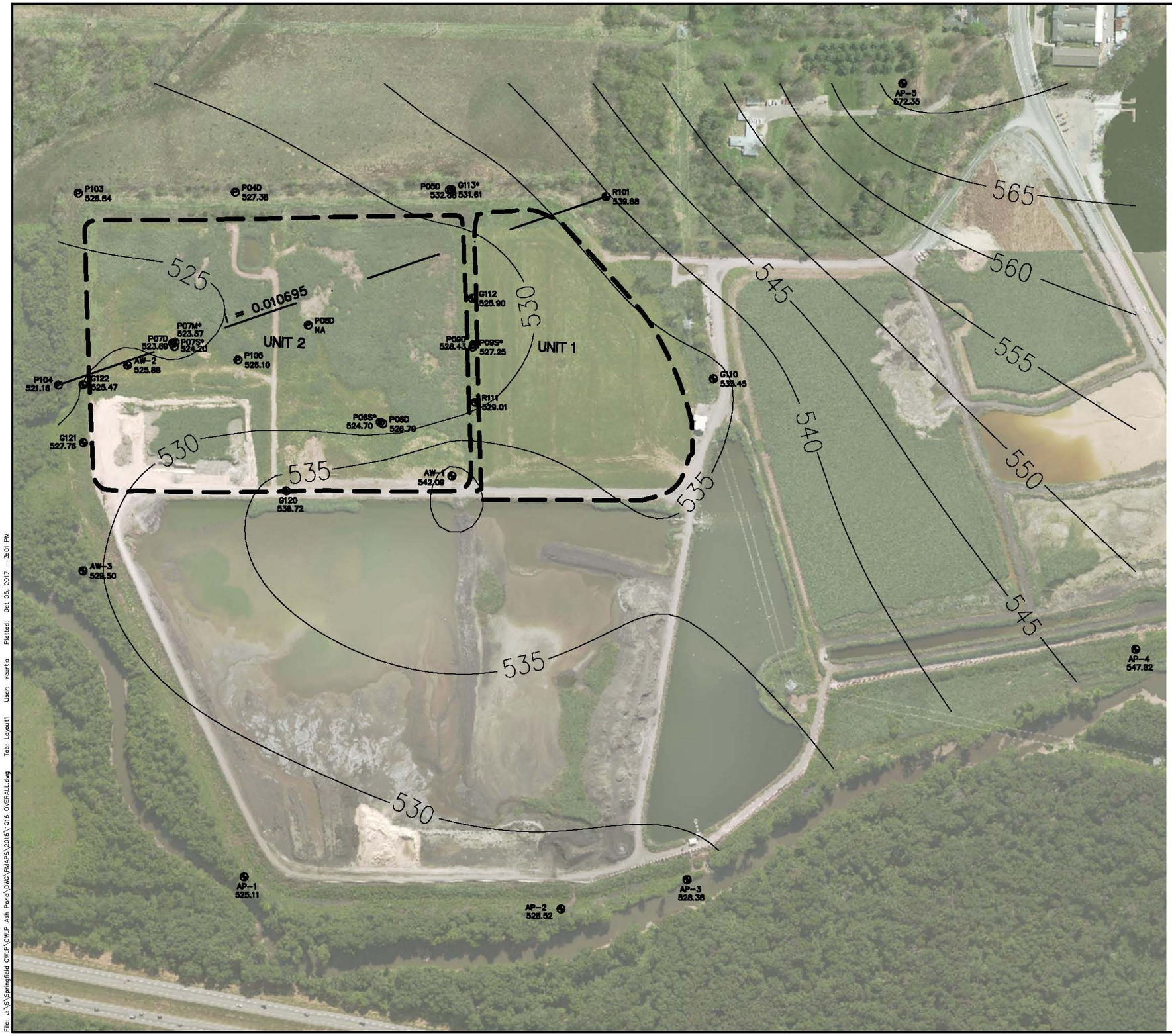
APPROVED BY: MTH | DESIGNED BY: MTH | DRAWN BY: RMC

REVISIONS			
NO.	DATE	DESCRIPTION	BY

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APPENDIX A
POTENTIOMETRIC SURFACE MAPS



LEGEND:

- LANDFILL MONITORING WELL LOCATION
- PIEZOMETER

NOTES:

1. SAMPLING DATE: FEBRUARY 25, 2016.
2. CONTOUR INTERVAL = 5 FEET.
3. i = HYDRAULIC GRADIENT
4. NA = GROUNDWATER ELEVATION NOT AVAILABLE.
5. * IN THE CASE OF NESTED WELLS, THE GROUNDWATER ELEVATIONS FROM DEEPER WELLS (BASAL SAND) WERE USED IN THE COMPILATION OF POTENTIOMETRIC CONTOURS.

N

300 0 300 600

SCALE: IN FEET

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APPROVED BY: CRM | DESIGNED BY: CRM | DRAWN BY: MPN

POTENTIOMETRIC SURFACE MAP
1ST QUARTER 2016

PLANS PREPARED FOR
CITY, WATER, LIGHT, AND POWER
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

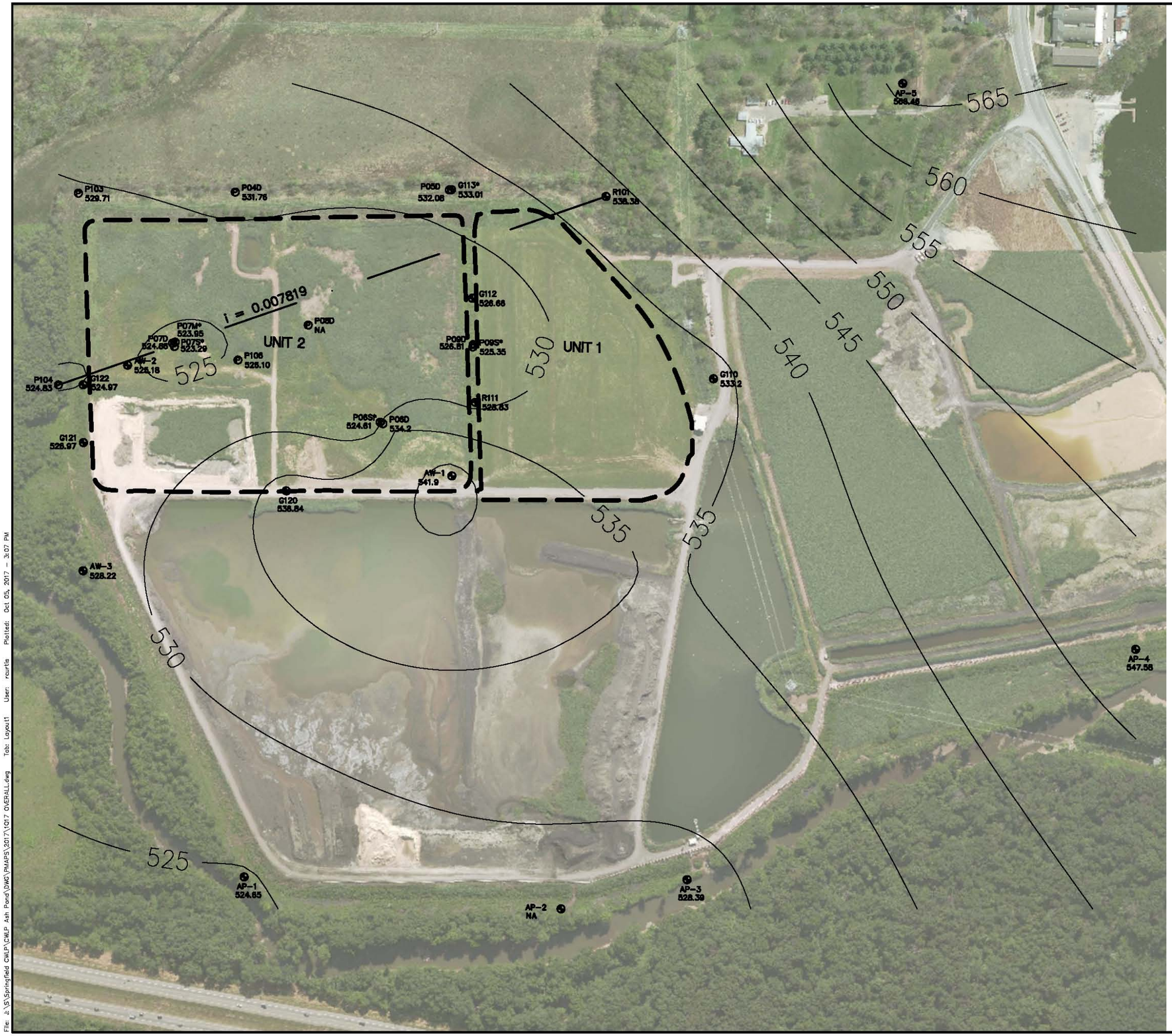
DATE: JUNE 2016

PROJECT ID: 160285/0001

SHEET NUMBER: 1Q16

Response to 1st RTP
CWLP - 008667

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LEGEND:

- LANDFILL MONITORING WELL LOCATION
- PIEZOMETER

NOTES:

1. SAMPLING DATE: FEBRUARY 16, 2017.
2. CONTOUR INTERVAL = 5 FEET.
3. i = HYDRAULIC GRADIENT
4. NA = GROUNDWATER ELEVATION NOT AVAILABLE.
5. * IN THE CASE OF NESTED WELLS, THE GROUNDWATER ELEVATIONS FROM DEEPER WELLS (BASAL SAND) WERE USED IN THE COMPILATION OF POTENTIOMETRIC CONTOURS.

N

300 0 300 600

SCALE: IN FEET

ANDREWS ENGINEERING, INC.
3300 Ginger Creek Drive, Springfield, IL 62711-7233
Tel (217) 787-2334 Fax (217) 787-9495
Pontiac, IL • Naperville, IL • Indianapolis, IN • Warrenton, MO

APPROVED BY: CRM | DESIGNED BY: CRM | DRAWN BY: RMC

POTENTIOMETRIC SURFACE MAP
1ST QUARTER 2017

PLANS PREPARED FOR
CITY, WATER, LIGHT, AND POWER
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: OCOTBER 2017

PROJECT ID: 160285/0001

SHEET NUMBER: 1Q17

Response to 1st RTP
CWLP - 008668

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APPENDIX B
WELL CONSTRUCTION DETAILS

Electronic Filing: Received, Clerk's Office 02/13/2020

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Sangamon Well #: AP-1R

Site Name: City Water, Light, & Power Borehole #: AP-1R

Coordinates: X 831.70 Y 5132.40 (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___"

Surveyed by: _____ IL Registration #: _____

Drilling Contractor: Terra Drill, Inc. Consulting Firm: Andrews Engineering, Inc.

Driller: J. Brown Geologist: M. Hewitt

Drilling Method: 4¼" HSA w/ 5' Continuous Barrel Logged by: M. Hewitt

Drilling Fluids (type): _____ Report Form Completed by: J. Rhoades

Date Well Started: 1/30/2012 Date Well Finished: 1/30/2012 Date Form Completed: 2/27/2012

ANNULAR SPACE DETAILS

Type of surface seal: Concrete

Type of annular sealant: Bentonite Grout

Installation method: Tremie

Setting time: 2 Hours

Type of bentonite seal – Bentonite Chips (circle one)

Installation method: Free drop

Setting time: 2 Hours

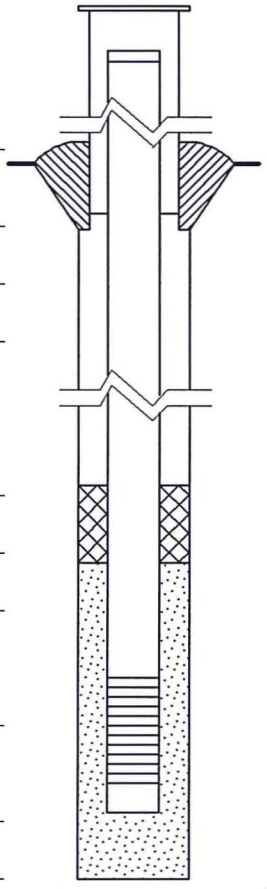
Type of sand pack: Unimin Sand

Grain size: 10/20 (sieve size)

Installation method: Free drop

Type of backfill material: _____ (if applicable)

Installation method: _____



ELEVATION (MSL)®	DEPTH (BGS)♦ (0.01 ft)	
535.60	-2.50	Top of Protective Casing
535.60	-2.50	Top of Riser Pipe
533.10	.00	Ground Surface
530.10	3.00	Top of Annular Sealant
n/a	n/a	Static Water Level Measured on (after completion)
517.00	16.10	Top of Seal
513.51	19.59	Top of Sandpack
514.01	19.09	Top of Screen
504.63	28.47	Bottom of Screen
504.10	29.00	Bottom of Well
500.60	32.50	Bottom of Borehole

® Referenced to a National Geodetic Vertical Datum
♦ positive (+) values below GS, negitive (-) values above GS

WELL CONSTRUCTION MATERIALS (circle one)

Protective Casing	SS304, SS316, PTFE, PVC or *Other:Steel*
Riser Pipe Above W.T.	SS304, SS316, PTFE, *PVC*, or Other:
Riser Pipe Below W.T.	SS304, SS316, PTFE, *PVC*, or Other:
Screen	SS304, SS316, PTFE, *PVC*, or Other:

(AE950315)

CASING MEASUREMENTS

Diameter of Borehole (in)	8.0
ID of Riser Pipe (in)	2.0
Protective Casing Length (ft)	5.0
Riser Pipe Length (ft)	21.59
Bottom of Screen to End Cap (ft)	.53
Screen Length [1st slot to last slot] (ft)	9.38
Total Length of Casing (ft)	31.50
Screen Slot Size*	0.01"

*Hand-slotted well screens are unacceptable.

Response to 1st RTP
CWLP - 008670

Electronic Filing: Received, Clerk's Office 02/13/2020

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Sangamon Well #: AP-2A

Site Name: Springfield City Water, Light, and Power Borehole #: _____

Coordinates: X 735.9 Y 4185.2 (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___"

Surveyed by: Springfield City Water, Light, and Power IL Registration #: _____

Drilling Contractor: Bulldog Drilling, Inc. Consulting Firm: Andrews Engineering, Inc.

Driller: J. Edwards Geologist: C. Myrvold

Drilling Method: AMS Powerprobe w/ 4.25" HSA and 5' MC Logged by: C. Myrvold

Drilling Fluids (type): na Report Form Completed by: C. Myrvold

Date Well Started: 2/16/2016 Date Well Finished: 2/16/2016 Date Form Completed: 3/06/2016

ANNULAR SPACE DETAILS

Type of surface seal: Concrete

Type of annular sealant: N/A

Installation method: _____

Setting time: _____

Type of bentonite seal: Bentonite chips

Installation method: Free drop

Setting time: 24+ hours

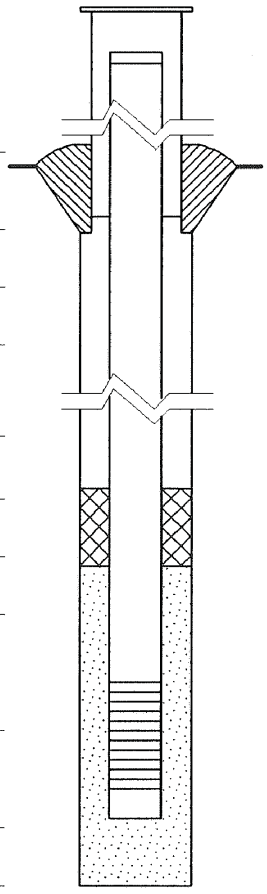
Type of sand pack: Silica sand

Grain size: 20/40 (sieve size)

Installation method: Free drop

Type of backfill material: N/A (if applicable)

Installation method: _____



ELEVATION (MSL)®	DEPTH (BGS)* (0.01 ft)	
536.50	-2.90	Top of Protective Casing
536.10	-2.50	Top of Riser Pipe
533.60	0.00	Ground Surface
	N/A	Top of Annular Sealant
		Static Water Level Measured on (after completion)
530.60	3.00	Top of Seal
527.19	6.41	Top of Sandpack
525.19	8.41	Top of Screen
515.54	18.06	Bottom of Screen
515.10	18.50	Bottom of Well
514.60	19.00	Bottom of Borehole

® Referenced to a National Geodetic Vertical Datum
* positive (+) values below GS, negitive (–) values above GS

Notes:

WELL CONSTRUCTION MATERIALS

Protective Casing	Anodized Aluminum
Riser Pipe Above W.T.	PVC
Riser Pipe Below W.T.	PVC
Screen	PVC

CASING MEASUREMENTS

Diameter of Borehole (in)	8.25
ID of Riser Pipe (in)	2
Protective Casing Length (ft)	5.0
Riser Pipe Length (ft)	10.91
Bottom of Screen to End Cap (ft)	0.44
Screen Length [1st slot to last slot] (ft)	9.65
Total Length of Casing (ft)	21.00
Screen Slot Size¥	#10 (0.01)

¥Hand-slotted well screens are unacceptable.

Professional Service Industries, Inc.
480 North Street
Springfield, Illinois 62704
Telephone: 217/544-6663
Fax: 217/544-6143

LOG OF BORING AP-3

Sheet 1 of 1

PSI Job No.: 0020522
Project: Piezometer Installation
Location: CWLP Ash Pond
East Lake Shore Drive
Springfield, Illinois

Drilling Method: Hollow Stem Auger
Sampling Method: Split Spoon
Hammer Type: CME Automatic; ETR = 86%
Boring Location: See attached boring location plan.

WATER LEVELS
While Drilling: None feet
Upon Completion: N/A
Delay: N/A

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			1	18	Dark brown silty CLAY, very stiff, slightly moist	CL	6-7-8 N_{60}=21		
	5			2	18	Gray/brown clayey SILT, soft to stiff, moist to saturated	ML	3-3-4 N_{60}=10		
				3	18			1-1-1 N_{60}=3		
	10			4	18	Gray clayey SILT, soft to very stiff, saturated		2-1-2 N_{60}=4		
				5	18			2-2-4 N_{60}=9		
	15			6	16		ML	2-2-4 N_{60}=9		
				7	18			4-4-6 N_{60}=14		
	20			8	10	Gray SHALE, hard, slightly moist Boring terminated at -19.5	CL	32-50/3"		

STANDARD PENETRATION TEST DATA
N in blows/ft
Moisture, PL, LL
0 25 50
STRENGTH, tsf
Qu, Qp
0 2.0 4.0

Well Diagram: J-Plug; Concrete Cap; 2" PVC Solid Riser; Bentonite Seal; Sand Filter Pack; 0.01" PVC Slotted Well Screen

Completion Depth: 20.0 ft
Date Boring Started: 4/21/10
Date Boring Completed: 4/21/10
Logged By: Rob Preuss
Drilling Contractor: PSI, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude:
Longitude:
Drill Rig: ATV D50
Remarks: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Moistures determined by visual methods

The stratification lines represent approximate boundaries. The transition may be gradual.

Professional Service Industries, Inc.
480 North Street
Springfield, Illinois 62704
Telephone: 217/544-6663
Fax: 217/544-6143

LOG OF BORING AP-4

Sheet 1 of 1

PSI Job No.: 0020522
Project: Piezometer Installation
Location: CWLP Ash Pond
East Lake Shore Drive
Springfield, Illinois

Drilling Method: Hollow Stem Auger
Sampling Method: Split Spoon
Hammer Type: CME Automatic; ETR = 86%
Boring Location: See attached boring location plan.

WATER LEVELS
While Drilling 11 feet
Upon Completion N/A
Delay N/A

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			1	17	Brown silty CLAY, some brown sand, firm to stiff, slightly moist (FILL)	CL	4-4-3 N_{60}=10		
	5			2	18	Brown silty CLAY, trace roots, firm to stiff, moist (FILL)	CL	4-3-2 N_{60}=7		
				3	10	Brown SILT, trace gray, firm to stiff, moist (FILL)	ML	6-3-2 N_{60}=7		
	10			4	12	5" Brown SAND transitioning to Black FLY ASH at 9.4', stiff to very stiff, slightly moist (FILL)		2-2-4 N_{60}=9		
				5	18		SAND/FLY ASH	2-2-2 N_{60}=6		
	15			6	16			2-1-1 N_{60}=3		
				7	16			6-6-5 N_{60}=16		
	20			8	18	Black FLY ASH, some fine sub-round gravel, stiff to very stiff, moist to saturated (FILL)	FLY ASH	3-3-3 N_{60}=9		
						Gray/green (organic?) CLAY, stiff, trace fine sand, moist to saturated				
	25			9	1		CL	3-3-4 N_{60}=10		
	30			10	18	Brown/gray silty CLAY, fiorm to stiff, saturated	CL	2-2-3 N_{60}=7		
				11	18	Gray SILT, stiff to very stiff, saturated		3-3-4 N_{60}=10		
	40			12	18		ML	4-4-4 N_{60}=11		
	45			13	18			4-4-6 N_{60}=14		
	50			14	18	Gray fine to coarse SAND, medium dense, saturated		4-5-7 N_{60}=17		
	55			15	18		SW	5-5-7 N_{60}=17		
				16	1	Gray SHALE, hard, moist	CL	50/1"		
	60					Boring terminated at -60'				

STANDARD PENETRATION TEST DATA
N in blows/ft
Moisture PL LL
0 25 50
STRENGTH, tsf
Qu Qp
0 2.0 4.0
>>

Well Diagram: J-Plug; Concrete Cap; 2" PVC Solid Riser; Bentonite Seal; Sand Filter Pack; 0.01" PVC Slotted Screen

Completion Depth: 60.0 ft
Date Boring Started: 4/20/10
Date Boring Completed: 4/20/10
Logged By: Rob Preuss
Drilling Contractor: PSI, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude:
Longitude:
Drill Rig: ATV D50
Remarks: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Moistures determined by visual methods.

The stratification lines represent approximate boundaries. The transition may be gradual.

Electronic Filing: Received, Clerk's Office 02/13/2020

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Sangamon Well #: AP-5

Site Name: City Water, Light, & Power Borehole #: AP-5

Coordinates: X 3203.10 Y 3164.10 (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___"

Surveyed by: _____ IL Registration #: _____

Drilling Contractor: Terra Drill, Inc. Consulting Firm: Andrews Engineering, Inc.

Driller: J. Brown Geologist: M. Hewitt

Drilling Method: 4¼" HSA w/ 5' CB & 2' SS Logged by: M. Hewitt

Drilling Fluids (type): _____ Report Form Completed by: J. Rhoades

Date Well Started: 2/1/2012 Date Well Finished: 2/1/2012 Date Form Completed: 2/27/2012

ANNULAR SPACE DETAILS

Type of surface seal: Concrete

Type of annular sealant: Bentonite Grout

Installation method: Tremie

Setting time: 2 Hours

Type of bentonite seal – Bentonite Chips (circle one)

Installation method: Free drop

Setting time: 2 Hours

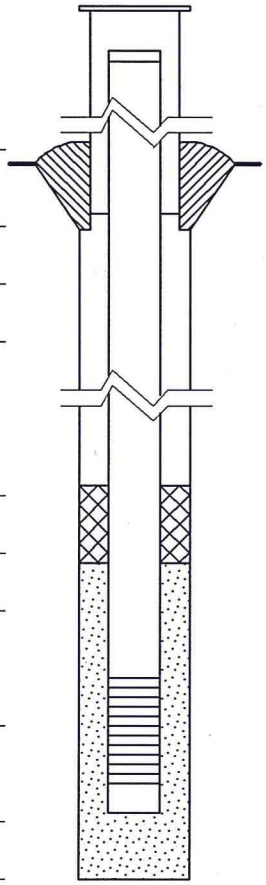
Type of sand pack: Unimin Sand

Grain size: 10/20 (sieve size)

Installation method: Free drop

Type of backfill material: Bentonite Chips (if applicable)

Installation method: Free drop



ELEVATION (MSL)*	DEPTH (BGS)* (0.01 ft)	
584.30	-2.70	Top of Protective Casing
583.90	-2.30	Top of Riser Pipe
581.60	.00	Ground Surface
578.60	3.00	Top of Annular Sealant
n/a	n/a	Static Water Level Measured on (after completion)
565.48	16.12	Top of Seal
563.48	18.12	Top of Sandpack
563.78	17.82	Top of Screen
554.44	27.16	Bottom of Screen
553.90	27.70	Bottom of Well
551.10	30.50	Bottom of Borehole

* Referenced to a National Geodetic Vertical Datum
♦ positive (+) values below GS, negitive (-) values above GS

NOTES:

•Borehole AP-5 sampled to 49.0 feet below ground surface (BGS) and backfilled with bentonite chips to 30.5 feet BGS

WELL CONSTRUCTION MATERIALS (circle one)

Protective Casing	SS304, SS316, PTFE, PVC or *Other:Steel*
Riser Pipe Above W.T.	SS304, SS316, PTFE, *PVC*, or Other:
Riser Pipe Below W.T.	SS304, SS316, PTFE, *PVC*, or Other:
Screen	SS304, SS316, PTFE, *PVC*, or Other:

CASING MEASUREMENTS

Diameter of Borehole (in)	8.0
ID of Riser Pipe (in)	2.0
Protective Casing Length (ft)	5.0
Riser Pipe Length (ft)	20.12
Bottom of Screen to End Cap (ft)	.54
Screen Length [1st slot to last slot] (ft)	9.34
Total Length of Casing (ft)	30.00
Screen Slot Size*	0.01"

*Hand-slotted well screens are unacceptable.

(AE950315)

Response to 1st RTP
CWLP - 008674

Electronic Filing: Received, Clerk's Office 02/13/2020

Illinois Environmental Protection Agency — **Well Completion Report**

Site Number: 1678250020 County: Sangamon

Site Name: FGDS Development Landfill Well #: AW-3

State Plane Coordinate: X ____ Y ____ (or) Latitude: ° ' " Longitude: ° ' " Borehole #: AW-3

Surveyed by: David Mihelsic IL Registration #: 3762

Drilling Contractor: Reynolds Drilling Corp. Driller: Andrew Rachford

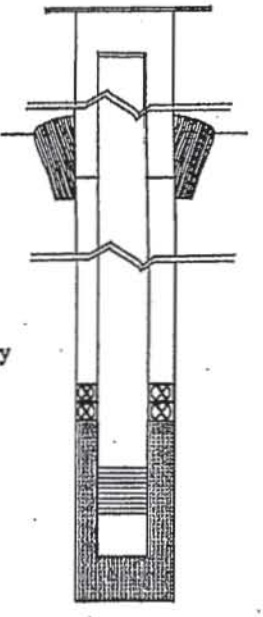
Consulting Firm: Rapps Engineering & Applied Science Geologist: Ken Miller

Drilling Method: HSA Drilling Fluid (Type): NA

Logged By: Ken Miller Date Started: 12/30/08 Date Finished: 12/31/08

Report Form Completed By: Ken Miller Date: 5/18/09

ANNULAR SPACE DETAILS



Type of Surface Seal: Cement

Type of Annular Sealant: Bentonite Chips

Installation Method: Poured

Setting Time: >24 hrs

Type of Bentonite Seal - - Granular, (Pellet), Slurry (Choose One)

Installation Method: Poured

Setting Time: 16 hrs

Type of Sand Pack: Quartz Sand

Grain Size: 50 (Sieve Size)

Installation Method: Poured

Type of Backfill Material: (If applicable)

Installation Method:

	Elevations (MSL)*	Depths (BGS)	(.01ft.)
	____	____	Top of Protective Casing
	540.33	-2.58	Top of Riser Pipe
	537.75	0	Ground Surface
	534.75	3.00	Top of Annular Sealant
	____	____	Static Water Level (After Completion)
	511.32	26.43	Top of Seal
	508.32	29.43	Top of Sand Pack
	506.32	31.43	Top of Screen
	496.32	41.43	Bottom of Screen
	495.92	41.83	Bottom of Well
	495.92	41.83	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or (Other)
Riser Pipe Above W.T.	SS304, SS316, PTFE, (PVC), or Other
Riser Pipe Below W.T.	SS304, SS316, PTFE, (PVC), or Other
Screen	SS304, SS316, PTFE, (PVC), or Other

CASING MEASURMENTS

Diameter of Borehole (inches)	8.25
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	34.01
Bottom of Screen to End Cap (feet)	0.4
Screen Length (1" slot to last slot) (feet)	10
Total Length of Casing (feet)	44.41
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

Well Completion Form (revised 02/06/02)

APPENDIX C

STATISTICAL METHOD FOR DETERMINATION OF BACKGROUNDS

Statistical Analyses Method

1.0 References

1. "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Unified Final Guidance." USEPA, March 2009.

2.0 Statistical Method

The statistical method includes the calculation of the 95% Upper Prediction Limit (upper and lower for pH) for each parameter utilizing the background data set. Prior to the calculation of the Prediction Limit, the data set is evaluated for normality, outliers and the percentage of non-detect values. Each of the steps for determining the Prediction Limit is outlined below in Sections 2.1 through 2.4.

2.1 Normality Testing

The distribution of the data is tested for normality using the Shapiro-Wilk normality test. If the data is not found to follow a normal distribution, a nonparametric statistical method shall be utilized. Generally, the highest detected concentration is utilized as the Upper Prediction Limit if the data set is found to be nonparametric. If the data is found to follow a normal distribution, the procedures outlined below are used to determine the Prediction Limit.

2.2 Handling of Outliers

Prior to statistical analyses, the data set is evaluated for outliers. Outliers are defined as data points that vary significantly from the mean value of the data set. Outliers may represent sampling error, contamination from surface run-off, analytical laboratory error, or anomalous site conditions. Outliers, if not removed from the data set, can erroneously increase the prediction limit which makes the prediction limit less likely to detect a statistically significant increase related to a release from a waste unit. Once a statistical outlier has been identified, the concentrations shall be evaluated to determine the cause. If the outlier is determined to be a result of sampling, laboratory or some other error, the outlier will be removed from the data set. If no specific reason can be documented the point will be considered representative of site conditions and will be included in the statistical analysis. Statistical analysis will then be conducted as described below. Evaluation for outliers will be completed utilizing Grubb's Test as well as Dixon's Test (both at 1% significance).

2.3 Handling of Non-Detects (NDs)

Non-detect values (NDs) are handled according to the percentage of Non-Detects (%ND) present in the data set. The data treatment is completed according to the following criteria:

a) For under 0% NDs, no adjustment is made to the values in the data set.
b) For under 15% NDs, the value of one-half (½) the reported Detection Limit (DL) is substituted for the ND value, and the mean and standard deviation are calculated using detected values with the substituted ND values.
c) For 15-50% NDs with a single censoring point, Cohen's Adjustment is used to adjust the mean and standard deviation. The adjusted mean and standard deviation are then used to calculate the Prediction Limit.
d) For 15-50% NDs with multiple censoring points:
    - For small data sets (<5): ½ the PQL can be substituted for ND values. The Prediction Limit is then calculated with the dataset containing the substituted values.
    - For larger data sets: Kaplan-Meier is used to adjust the mean and standard deviation. The adjusted mean and standard deviation are then used to calculate the Prediction Limit.
e) For over 50% but not 100% NDs, the highest recorded concentration is substituted for the prediction limit.
f) For 100% NDs, the Practical Quantitation Limit (PQL) will be utilized as the upper confidence limit.

2.4 Calculation of the Prediction Limit

After any outliers are removed and the data has been treated for non-detect values, the statistical procedure for calculation of the Prediction Limit will be conducted according to the following steps:

a) <u>Calculate arithmetic mean</u>

The arithmetic mean is calculated using the pooled data for each parameter. The arithmetic mean (X_b) is calculated using the following equation:

$$X_b = \frac{X_1 + X_2 + \ldots + X_n}{n}$$

where: X_b = Average background value
X_n = Individual background value for *n* sample
n = Number of background values

b) Calculate standard deviation

The standard deviation is calculated using the pooled data for each parameter.

The standard deviation is calculated using the following equation:

$$S_b = \sqrt{\frac{(X_1 - X_b) + (X_2 - X_b) + \ldots + (X_n - X_b)}{n - 1}}$$

where: S_b = Population standard deviation
X_n = Individual background value for *n* sample
X_b = Mean (1)
n = Number of background samples

c) Calculate the 95% Prediction Limit

The 95% Prediction Limit is calculated for each parameter using the mean (1), the standard deviation (2), the number of background samples, and the Student's t value given for α = 0.05 (95% Confidence). The Prediction Limit for pH is calculated as and upper and lower limit. All other Prediction Limits are calculated as an upper limit. The Student's t value varies upon the number of background samples. The 95% Prediction Limit is calculated using the following equation:

$$PL = X_b \pm S_b \bullet t \bullet \sqrt{1 + \frac{1}{n}}$$

where: PL = Upper Prediction Limit (Upper and Lower for pH)
X_b = Mean (1)
S_b = Standard Deviation (2)
t = Student's t value at 0.05 significance
n = Number of background samples

APPENDIX D
BACKGROUND CONCENTRATIONS AND CALCULATIONS

Electronic Filing: Received, Clerk's Office 02/13/2020

City Water, Light and Power

Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix III Parameters

Raw Data Summary

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	Distribution[1]	Proposed Background Value
AP-4	Boron, total	mg/l	0.119	0.123	0.787	< 2	< 0.687	0.75	0.665	< 2	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.787
AP-5	Boron, total	mg/l	< 1	< 0.625	0.782	< 3.2	< 0.687	0.22	0.0954	< 2		
AP-4	Chloride, total	mg/l	10.1	9.85	11	10.5	10.8	11	10.7	10.9	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	24.2
AP-5	Chloride, total	mg/l	24.2	7.23	3.32	3.76	3.71	2.61	1.95	2.07		
AP-4	Fluoride, total	mg/l	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.2	< 0.5	< 0.5	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.62
AP-5	Fluoride, total	mg/l	0.62	< 0.5	< 0.5	< 0.5	< 0.5	0.43	< 0.5	< 0.5		
AP-4	pH (field)	units	6.81	7.07	7.63	7.09	7.04	7.23	7.04	7.1	Normal - Calculate Interwell Prediction Limit	6.76-7.63
AP-5	pH (field)	units	7.33	7.19		7.29	7.23	7.46	7.15	7.32		
AP-4	Sulfate, total	mg/l	< 5	< 5	< 5	< 5	< 5	0.3	< 5	< 5	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	84.5
AP-5	Sulfate, total	mg/l	82.3	43.5	76.8	84.5	83.4	55.3	66.8	59.5		
AP-4	Total Dissolved Solids	mg/l	490	560	448	574	460	578	548	316	Normal - Calculate Interwell Prediction Limit	597.94
AP-5	Total Dissolved Solids	mg/l	414	404	316	404	370	410	428	384		

Well	Parameter	Units	5/28/15	8/20/15	11/13/15	2/26/16	5/13/16	8/4/16	11/18/16	2/16/17	Distribution*	Proposed Background Value
AP-4	Calcium, total	mg/l	121	117	125	125	118	118	117	136	Normal - Calculate Interwell Prediction Limit	176.63
AP-5	Calcium, total	mg/l	103	92.2	124	98.1	77.3	158	201	155		

Notes:

1. Shapiro-Wilk method utilized to determine if the data set follows a normal distribution. ProUCL 5.1 was used for the calculations. ProUCL 5.1 outputs are provided.

2. In accordance with Chapter 18.3 of the March 2009 Unified Guidance (Statistical Analysis of Groundwater at RCRA Facilities), the maximum detected concentration is utilized as the interwell prediction limit and proposed background when the dataset does not follow a normal distribution.

Response to 1st RTP
CWLP - 008681

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City Water, Light and Power

Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix III Parameters

Outlier Analysis

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	Number of Samples	Mean	Standard Deviation	Critical Values
AP-4	pH (field)	units	6.81	7.07	7.63	7.09	7.04	7.23	7.04	7.1	15	7.198666667	0.196136	2.705
AP-5	pH (field)	units	7.33	7.19		7.29	7.23	7.46	7.15	7.32				
AP-4	Total Dissolved Solids	mg/l	490	560	448	574	460	578	548	316	16	444	85.19468	2.747
AP-5	Total Dissolved Solids	mg/l	414	404	316	404	370	410	428	384				
Well	**Parameter**	**Units**	**5/28/15**	**8/20/15**	**11/13/15**	**2/26/16**	**5/13/16**	**8/4/16**	**11/18/16**	**2/16/17**	**Number of Samples**	**Mean**	**Standard Deviation**	**Critical Values**
AP-4	Calcium, total	mg/l	121	117	125	125	118	118	117	136	16	124.1	29.06863	2.747
AP-5	Calcium, total	mg/l	103	92.2	124	98.1	77.3	158	201	155				

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13
AP-4	pH (field)	units	-1.981613	-0.656006	2.1991488	-0.554036	-0.80896	0.1597527	-0.80896	-0.503051
AP-5	pH (field)	units	0.6696017	-0.044187		0.4656621	0.1597527	1.3324055	-0.248127	0.6186168
AP-4	Total Dissolved Solids	mg/l	0.5399398	1.3615874	0.0469513	1.5259169	0.1878052	1.5728682	1.2207335	-1.502441
AP-5	Total Dissolved Solids	mg/l	-0.352135	-0.469513	-1.502441	-0.469513	-0.868599	-0.399086	-0.187805	-0.704269
Well	**Parameter**	**Units**	**5/28/15**	**8/20/15**	**11/13/15**	**2/26/16**	**5/13/16**	**8/4/16**	**11/18/16**	**2/16/17**
AP-4	Calcium, total	mg/l	-0.106644	-0.24425	0.0309612	0.0309612	-0.209848	-0.209848	-0.24425	0.409376
AP-5	Calcium, total	mg/l	-0.725868	-1.097403	-0.00344	-0.894435	-1.609983	1.1662056	2.6454634	1.0630015

Notes:

1. Outlier method presented above outlined is in ASTM paper E178-75 (Grubb's Test).
2. Outliers were also evaluated utilizing Dixon's Test in ProUCL 5.1 at 1% Significance. ProUCL 5.1 output are provided.
3. Outliers that were identified by both methods are noted with a shaded value.

Response to 1st RTP
CWLP - 008682

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City Water, Light and Power

Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix III Parameters

Non-Detect Percentage Analysis

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	Number of Samples	Number of ND's	% ND	ND Treatment
AP-4	pH (field)	units	6.81	7.07	7.63	7.09	7.04	7.23	7.04	7.1	15	0	0%	No Adjustment
AP-5	pH (field)	units	7.33	7.19		7.29	7.23	7.46	7.15	7.32				
AP-4	Total Dissolved Solids	mg/l	490	560	448	574	460	578	548	316	16	0	0%	No Adjustment
AP-5	Total Dissolved Solids	mg/l	414	404	316	404	370	410	428	384				
Well	**Parameter**	**Units**	**5/28/15**	**8/20/15**	**11/13/15**	**2/26/16**	**5/13/16**	**8/4/16**	**11/18/16**	**2/16/17**	**Number of Samples**	**Number of ND's**	**% ND**	**ND Treatment**
AP-4	Calcium, total	mg/l	121	117	125	125	118	118	117	136	16	0	0%	No Adjustment
AP-5	Calcium, total	mg/l	103	92.2	124	98.1	77.3	158	201	155				

Notes:

1. For datasets with a fraction of non-detect values from 25% to 50%, adjustments to the mean and standard deviation (SD) are required.
2. For datasets with a single censoring point (RL), Cohen's Ajustment may be used to adjust the mean and SD or a substitution of 1/2 the RL may be used for small datasets (<5) in accordance with Section 15.2 of the March 2009 Unified Guidance (Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities).
3. Kaplan-Meier may be used to adjust the mean and SD for datasets with single or multiple censoring points (RL). The Kaplan-Meier adjusted mean and SD were calculated using ProUCL 5.1.
2. For datasets that do not include non-detect values, no adjustment to the mean and standard deviation are required prior to calculating the prediction limit.

Response to 1st RTP
CWLP - 008683

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City Water, Light and Power

Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix III Parameters

Prediction Limit Calculation

Prediction Limit = x + st[1+(1/n)]^*½

Confidence Level = 95%

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	ND Treatment	Mean [x]	Standard Deviation [s]	Number of Samples	T Value [t]	Prediction Limit	
AP-4	pH (field)	units	6.81	7.07	7.63	7.09	7.04	7.23	7.04	7.1	No Adjustment	7.1986667	0.20	15	2.145	6.7642	7.6332
AP-5	pH (field)	units	7.33	7.19		7.29	7.23	7.46	7.15	7.32							
AP-4	Total Dissolved Solids	mg/l	490	560	448	574	460	578	548	316	No Adjustment	444	85.19	16	1.753	597.9426139	
AP-5	Total Dissolved Solids	mg/l	414	404	316	404	370	410	428	384							
Well	**Parameter**	**Units**	**5/28/15**	**8/20/15**	**11/13/15**	**2/26/16**	**5/13/16**	**8/4/16**	**11/18/16**	**2/16/17**	**ND Treatment**	**Mean**	**Standard Deviation**	**Number of Samples**	**T Value**	**Prediction Limit**	
AP-4	Calcium, total	mg/l	121	117	125	125	118	118	117	136	No Adjustment	124.1	29.07	16	1.753	176.6255938	
AP-5	Calcium, total	mg/l	103	92.2	124	98.1	77.3	158	201	155							

Response to 1st RTP
CWLP - 008684

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City Water, Light and Power

Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix IV Parameters

Well	Parameter	Units	2/22/2012	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	Distribution[1]	Proposed Background Value
AP-4	Antimony, total	mg/l	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	0.0152	< 0.006	< 0.006	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.016
AP-5	Antimony, total	mg/l	< 0.006	< 0.006	0.0063	< 0.0096	< 0.006	0.016	< 0.006	< 0.006		
AP-4	Arsenic, total	mg/l	< 0.05	< 0.05	0.0294	0.00608	< 0.05	0.025	0.0193	< 0.05	Normal - Calculate Interwell Prediction Limit	0.0724
AP-5	Arsenic, total	mg/l	< 0.05	0.076	0.102	0.0243	< 0.05	0.0094	< 0.015	< 0.05		
AP-4	Barium, total	mg/l	< 2	< 2	0.366	< 2	< 2	0.37	0.385	< 2	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	5.24
AP-5	Barium, total	mg/l	5.24	< 2	2.76	< 3.2	< 2	0.13	0.228	< 2		
AP-4	Beryllium, total	mg/l	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.0164
AP-5	Beryllium, total	mg/l	0.0142	0.0128	0.0092	0.0164	< 0.004	< 0.004	< 0.004	< 0.004		
AP-4	Cadmium, total	mg/l	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.0025	< 0.005	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.0128
AP-5	Cadmium, total	mg/l	0.00776	0.0128	0.00575	< 0.008	< 0.005	< 0.005	< 0.0025	< 0.005		
AP-4	Chromium, total	mg/l	< 0.1	< 0.1	< 0.0175	< 0.1	< 0.1	0.0039	< 0.01	< 0.1	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.811
AP-5	Chromium, total	mg/l	0.811	0.328	0.449	0.42	< 0.1	0.016	0.0431	0.113		
AP-4	Cobalt, total	mg/l	< 1	< 1	< 0.0175	< 1	< 1	< 1	< 0.015	< 1	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.297
AP-5	Cobalt, total	mg/l	< 1	< 1	0.297	< 1.6	< 1	0.0086	0.0223	< 1		
AP-4	Lead, total	mg/l	< 0.0075	< 0.0075	< 0.005	< 0.0075	< 0.0075	0.0036	< 0.005	< 0.0075	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.638
AP-5	Lead, total	mg/l	0.638	0.236	0.312	0.277	0.0244	0.0104	0.0312	0.638		
AP-4	Mercury, total	mg/l	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.0008
AP-5	Mercury, total	mg/l	0.0008	< 0.0005	0.0007	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005		
AP-4	Selenium, total	mg/l	< 0.05	< 0.05	0.00497	< 0.05	< 0.05	0.0079	< 0.0025	< 0.05	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.0079
AP-5	Selenium, total	mg/l	< 0.05	< 0.05	0.00585	< 0.08	< 0.05	0.0046	0.00523	< 0.05		
AP-4	Thallium, total	mg/l	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.00556
AP-5	Thallium, total	mg/l	0.00556	0.00258	0.00302	< 0.0032	< 0.002	< 0.002	< 0.002	< 0.002		

Well	Parameter	Units	5/28/2015	8/20/15	11/13/15	2/26/16	5/13/16	8/4/16	11/18/16	2/16/17	Distribution[1]	Proposed Background Value
AP-4	Lithium	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	100% ND - Propose PQL as Prediction Limit	0.05
AP-5	Lithium	mg/l	< 0.05	< 0.05	< 0.25	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05		
AP-4	Molybdenum	mg/l	< 0.025	< 0.025	< 0.05	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	100% ND - Propose PQL as Prediction Limit	0.025
AP-5	Molybdenum	mg/l	< 0.025	< 0.025	< 0.05	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025		

Well	Parameter	Units	8/23/2012	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	2/26/14	5/20/14	Distribution[1]	Proposed Background Value
AP-4	Radium-226	pCi/l	< 0.97	0.41	< 0.57	0.84	< 0.57	0.46	0.91	1.2	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	7.1
AP-5	Radium-226	pCi/l	7.1	< 0.74	1.6	1.1	1	1.8	< -0.04	-0.03		
AP-4	Radium-228	pCi/l	< 0.71	2.3	< 0.83	0.69	< 1.4	< 0.52	0.56	0.53	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	5.1
AP-5	Radium-228	pCi/l	5.1	< 1.28	1.6	< 0.68	0.81	1.7	< 1.8	0.95		

Notes:

1. Shapiro-Wilk method utilized to determine if the data set follows a normal distribution. ProUCL 5.1 was used for the calculations. ProUCL 5.1 outputs are provided.

2. In accordance with Section 18.3 of the March 2009 Unified Guidance (Statistical Analysis of Groundwater at RCRA Facilities), the maximum detected concentration is utilized as the interwell prediction limit and proposed background when the dataset does not follow a normal distribution.

Response to 1st RTP
CWLP - 008685

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City Water, Light and Power

Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix IV Parameters

Outlier Analysis

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	Number of Samples	Mean	Standard Deviation	Critical Values
AP-4	Arsenic, total	mg/l	< 0.05	< 0.05	0.0294	0.00608	< 0.05	0.025	0.0193	< 0.05	16	0.04103	0.025229	2.747
AP-5	Arsenic, total	mg/l	< 0.05	0.076	0.102	0.0243	< 0.05	0.0094	< 0.015	< 0.05				

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13
AP-4	Arsenic, total	mg/l	0.355548	0.355548	-0.46098	-1.38533	0.355548	-0.63539	-0.86132	0.355548
AP-5	Arsenic, total	mg/l	0.355548	1.386121	2.416694	-0.66313	0.355548	-1.25373	-1.03176	0.355548

Notes:

1. Outlier method presented above outlined is in ASTM paper E178-75 (Grubb's Test).
2. Outliers were also evaluated utilizing Dixon's Test in ProUCL 5.1 at 1% Significance. ProUCL 5.1 output are provided.
3. Outliers that were identified by both methods are noted with a shaded value.

Response to 1st RTP
CWLP - 008686

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Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix IV Parameters

Non-Detect Percentage Analysis

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	Number of Samples	Number of ND's	% ND	ND Treatment
AP-4	Arsenic, total	mg/l	< 0.05	< 0.05	0.0294	0.00608	< 0.05	0.025	0.0193	< 0.05	16	8	50%	Kaplan-Meier
AP-5	Arsenic, total	mg/l	< 0.05	0.076	0.102	0.0243	< 0.05	0.0094	< 0.015	< 0.05				

Notes:

1. For datasets with a fraction of non-detect values from 25% to 50%, adjustments to the mean and standard deviation (SD) are required.
2. For datasets with a single censoring point (RL), Cohen's Ajustment may be used to adjust the mean and SD or a substitution of 1/2 the RL may be used for small datasets (<5) in accordance with Section 15.2 of the March 2009 Unified Guidance (Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities).
3. Kaplan-Meier may be used to adjust the mean and SD for datasets with single or multiple censoring points (RL). The Kaplan-Meier adjusted mean and SD were calculated using ProUCL 5.1.
2. For datasets that do not include non-detect values, no adjustment to the mean and standard deviation are required prior to calculating the prediction limit.

Response to 1st RTP
CWLP - 008687

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City Water, Light and Power

Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix IV Parameters

Prediction Limit Calculation

Prediction Limit = x + st[1+(1/n)]^*½

Confidence Level = 95%

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	ND Treatment	Mean [x]	Standard Deviation [s]	Number of Samples	T Value [t]	Prediction Limit Limit
AP-4	Arsenic, total	mg/l	< 0.05	< 0.05	0.0294	0.00608	< 0.05	0.025	0.0193	< 0.05	No Adjustment	0.0263	0.0255	16	1.753	0.072377252
AP-5	Arsenic, total	mg/l	< 0.05	0.076	0.102	0.0243	< 0.05	0.0094	< 0.015	< 0.05						

Note:

1. Multiple censoring points (RL's) were observed. Therefore, Kaplan-Meier was utilized to adjust the mean and SD.

Response to 1st RTP
CWLP - 008688

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/25/2017 3:46:43 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Arsenic

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	8	8	50.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	8	0.015	0.05	0.0456	0.05	0.0124
Statistics (Non-Detects Only)	8	0.00608	0.102	0.0364	0.0247	0.0341
Statistics (All: NDs treated as DL value)	16	0.00608	0.102	0.041	0.05	0.0252
Statistics (All: NDs treated as DL/2 value)	16	0.00608	0.102	0.0296	0.025	0.0247
Statistics (Normal ROS Imputed Data)	16	-0.0127	0.102	0.0268	0.0227	0.0292
Statistics (Gamma ROS Imputed Data)	16	0.00608	0.102	0.0278	0.021	0.0264
Statistics (Lognormal ROS Imputed Data)	16	0.00559	0.102	0.0266	0.0199	0.0265

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	1.472	1.004	0.0247	-3.689	0.946	-0.256
Statistics (NDs = DL)	2.385	1.98	0.0172	-3.418	0.762	-0.223
Statistics (NDs = DL/2)	2.194	1.824	0.0135	-3.764	0.713	-0.189
Statistics (Gamma ROS Estimates)	1.701	1.424	0.0163	-3.905	0.795	-0.204
Statistics (Lognormal ROS Estimates)	--	--	--	-3.982	0.84	-0.211

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.897	0.945	0.795	0.941

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.805	0.818	Data Not Normal
Shapiro-Wilk (NDs = DL)	0.899	0.887	Data Appear Normal
Shapiro-Wilk (NDs = DL/2)	0.653	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.895	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.332	0.283	Data Not Normal
Lilliefors (NDs = DL)	0.236	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.387	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.209	0.213	Data Appear Normal

User Selected Options

Date/Time of Computation	ProUCL 5.19/25/2017 4:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Boron

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	8	8	50.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	8	0.625	3.2	1.525	1.5	0.924
Statistics (Non-Detects Only)	8	0.0954	0.787	0.443	0.443	0.328
Statistics (All: NDs treated as DL value)	16	0.0954	3.2	0.984	0.719	0.872
Statistics (All: NDs treated as DL/2 value)	16	0.0954	1.6	0.603	0.583	0.421
Statistics (Normal ROS Imputed Data)	16	0.0954	0.787	0.383	0.37	0.255
Statistics (Gamma ROS Imputed Data)	16	0.0954	0.787	0.367	0.313	0.253
Statistics (Lognormal ROS Imputed Data)	16	0.0954	0.787	0.343	0.254	0.26

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	1.601	1.084	0.276	-1.159	0.953	-0.823
Statistics (NDs = DL)	1.286	1.087	0.765	-0.453	1.068	-2.358
Statistics (NDs = DL/2)	1.856	1.55	0.325	-0.8	0.865	-1.081
Statistics (Gamma ROS Estimates)	2.291	1.903	0.16	-1.237	0.718	-0.58
Statistics (Lognormal ROS Estimates)	--	--	--	-1.332	0.742	-0.557

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.898	0.911	0.96	0.943

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.771	0.818	Data Not Normal
Shapiro-Wilk (NDs = DL)	0.831	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.919	0.887	Data Appear Normal
Shapiro-Wilk (Normal ROS Estimates)	0.867	0.887	Data Not Normal
Lilliefors (Detects Only)	0.251	0.283	Data Appear Normal
Lilliefors (NDs = DL)	0.277	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.168	0.213	Data Appear Normal
Lilliefors (Normal ROS Estimates)	0.198	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/25/2017 3:58:26 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Barium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	7	9	56.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	9	2	3.2	2.133	2	0.4
Statistics (Non-Detects Only)	7	0.13	5.24	1.354	0.37	1.946
Statistics (All: NDs treated as DL value)	16	0.13	5.24	1.792	2	1.327
Statistics (All: NDs treated as DL/2 value)	16	0.13	5.24	1.192	1	1.248
Statistics (Normal ROS Imputed Data)	16	-1.289	5.24	0.89	0.378	1.513
Statistics (Gamma ROS Imputed Data)	16	0.01	5.24	0.837	0.344	1.375
Statistics (Lognormal ROS Imputed Data)	16	0.0763	5.24	0.818	0.368	1.342

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	0.712	0.502	1.901	-0.543	1.352	-2.49
Statistics (NDs = DL)	1.387	1.169	1.292	0.182	1.086	5.978
Statistics (NDs = DL/2)	1.445	1.216	0.825	-0.208	0.915	-4.395
Statistics (Gamma ROS Estimates)	0.516	0.461	1.621	-1.402	1.901	-1.356
Statistics (Lognormal ROS Estimates)	--	--	--	-0.9	1.09	-1.212

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.825	0.912	0.8	0.913

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.688	0.803	Data Not Normal
Shapiro-Wilk (NDs = DL)	0.842	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.664	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.855	0.887	Data Not Normal
Lilliefors (Detects Only)	0.405	0.304	Data Not Normal
Lilliefors (NDs = DL)	0.25	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.374	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.218	0.213	Data Not Normal

User Selected Options

Date/Time of Computation	ProUCL 5.19/25/2017 4:03:44 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Beryllium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	4	12	75.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	12	0.004	0.004	0.004	0.004	9.059E-19
Statistics (Non-Detects Only)	4	0.0092	0.0164	0.0132	0.0135	0.00302
Statistics (All: NDs treated as DL value)	16	0.004	0.0164	0.00629	0.004	0.00431
Statistics (All: NDs treated as DL/2 value)	16	0.002	0.0164	0.00479	0.002	0.00517
Statistics (Normal ROS Imputed Data)	16	-0.01	0.0164	0.0032	0.00292	0.00761
Statistics (Gamma ROS Imputed Data)	16	0.0092	0.0164	0.0108	0.01	0.00195
Statistics (Lognormal ROS Imputed Data)	16	0.00207	0.0164	0.00694	0.00575	0.00426

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	23.28	5.987	5.6479E-4	-4.353	0.246	-0.0564
Statistics (NDs = DL)	3.279	2.706	0.00192	-5.229	0.534	-0.102
Statistics (NDs = DL/2)	1.37	1.155	0.00349	-5.749	0.84	-0.146
Statistics (Gamma ROS Estimates)	39.38	32.04	2.7394E-4	-4.542	0.157	-0.0347
Statistics (Lognormal ROS Estimates)	--	--	--	-5.138	0.601	-0.117

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.987	0.77	0.772	0.997

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.981	0.748	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.593	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.593	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.984	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.204	0.375	Data Appear Normal
Lilliefors (NDs = DL)	0.452	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.455	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.084	0.213	Data Appear Normal

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 5:05:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Calcium

Raw Statistics

Number of Valid Observations	16
Number of Distinct Observations	13
Minimum	77.3
Maximum	201
Mean of Raw Data	124.1
Standard Deviation of Raw Data	29.07
Khat	20.96
Theta hat	5.92
Kstar	17.08
Theta star	7.268
Mean of Log Transformed Data	4.797
Standard Deviation of Log Transformed Data	0.224

Normal GOF Test Results

Correlation Coefficient R	0.944
Shapiro Wilk Test Statistic	0.909
Shapiro Wilk Critical (0.05) Value	0.887
Approximate Shapiro Wilk P Value	0.0906
Lilliefors Test Statistic	0.238
Lilliefors Critical (0.05) Value	0.213

Data appear Approximate Normal at (0.05) Significance Level

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 9:51:59 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Cadmium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	3	13	81.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	13	0.0025	0.008	0.00485	0.005	0.00133
Statistics (Non-Detects Only)	3	0.00575	0.0128	0.00877	0.00776	0.00363
Statistics (All: NDs treated as DL value)	16	0.0025	0.0128	0.00558	0.005	0.00238
Statistics (All: NDs treated as DL/2 value)	16	0.00125	0.0128	0.00361	0.0025	0.00294
Statistics (Normal ROS Imputed Data)	16	-0.015	0.0128	-0.00253	-0.00298	0.00727
Statistics (Gamma ROS Imputed Data)	16	0.00575	0.0128	0.00977	0.01	0.00142
Statistics (Lognormal ROS Imputed Data)	16	6.0454E-4	0.0128	0.00329	0.00227	0.00316

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (NDs = DL)	7.069	5.785	7.8965E-4	-5.261	0.388	-0.0737
Statistics (NDs = DL/2)	2.647	2.192	0.00136	-5.824	0.599	-0.103
Statistics (Gamma ROS Estimates)	42.99	34.97	2.2724E-4	-4.64	0.166	-0.0357
Statistics (Lognormal ROS Estimates)	--	--	--	-6.04	0.803	-0.133

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.971	0.835	0.784	0.992

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.942	0.767	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.726	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.636	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.984	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.276	0.425	Data Appear Normal
Lilliefors (NDs = DL)	0.346	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.397	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.103	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 1:58:45 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Chloride

Raw Statistics

Number of Valid Observations	16
Number of Distinct Observations	15
Minimum	1.95
Maximum	24.2
Mean of Raw Data	8.356
Standard Deviation of Raw Data	5.632
Khat	2.299
Theta hat	3.635
Kstar	1.91
Theta star	4.376
Mean of Log Transformed Data	1.89
Standard Deviation of Log Transformed Data	0.745

Normal GOF Test Results

Correlation Coefficient R	0.896
Shapiro Wilk Test Statistic	0.815
Shapiro Wilk Critical (0.05) Value	0.887
Approximate Shapiro Wilk P Value	0.00346
Lilliefors Test Statistic	0.257
Lilliefors Critical (0.05) Value	0.213

Data not Normal at (0.05) Significance Level

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 2:30:51 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Cobalt

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	3	13	81.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	13	0.015	1.6	0.895	1	0.423
Statistics (Non-Detects Only)	3	0.0086	0.297	0.109	0.0223	0.163
Statistics (All: NDs treated as DL value)	16	0.0086	1.6	0.748	1	0.497
Statistics (All: NDs treated as DL/2 value)	16	0.0075	0.8	0.384	0.5	0.241
Statistics (Normal ROS Imputed Data)	16	-0.146	0.297	0.0515	0.0278	0.118
Statistics (Gamma ROS Imputed Data)	16	0.0086	0.323	0.0699	0.0104	0.106
Statistics (Lognormal ROS Imputed Data)	16	0.00135	0.297	0.0524	0.0159	0.0874

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (NDs = DL)	0.744	0.646	1.005	-1.097	1.889	-1.722
Statistics (NDs = DL/2)	0.839	0.723	0.458	-1.66	1.746	-1.052
Statistics (Gamma ROS Estimates)	0.636	0.558	0.11	-3.625	1.353	-0.373
Statistics (Lognormal ROS Estimates)	--	--	--	-4.015	1.498	-0.373

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.886	0.868	0.867	0.98

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.786	0.767	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.75	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.751	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.961	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.37	0.425	Data Appear Normal
Lilliefors (NDs = DL)	0.382	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.373	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.136	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 2:15:26 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Chromium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	8	8	50.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	8	0.01	0.1	0.0784	0.1	0.04
Statistics (Non-Detects Only)	8	0.0039	0.811	0.273	0.221	0.283
Statistics (All: NDs treated as DL value)	16	0.0039	0.811	0.176	0.1	0.22
Statistics (All: NDs treated as DL/2 value)	16	0.0039	0.811	0.156	0.05	0.229
Statistics (Normal ROS Imputed Data)	16	-0.299	0.811	0.103	0.0296	0.281
Statistics (Gamma ROS Imputed Data)	16	0.0039	0.811	0.147	0.0202	0.234
Statistics (Lognormal ROS Imputed Data)	16	0.00144	0.811	0.144	0.0212	0.236

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	0.643	0.485	0.425	-2.25	1.878	-0.835
Statistics (NDs = DL)	0.757	0.656	0.232	-2.529	1.466	-0.58
Statistics (NDs = DL/2)	0.606	0.534	0.258	-2.876	1.576	-0.548
Statistics (Gamma ROS Estimates)	0.483	0.434	0.304	-3.239	1.723	-0.532
Statistics (Lognormal ROS Estimates)	--	--	--	-3.525	1.996	-0.566

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.942	0.845	0.817	0.957

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.88	0.818	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.725	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.677	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.924	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.214	0.283	Data Appear Normal
Lilliefors (NDs = DL)	0.362	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.366	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.174	0.213	Data Appear Normal

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 2:43:21 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Fluoride

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	3	13	81.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	13	0.5	0.5	0.5	0.5	0
Statistics (Non-Detects Only)	3	0.2	0.62	0.417	0.43	0.21
Statistics (All: NDs treated as DL value)	16	0.2	0.62	0.484	0.5	0.0838
Statistics (All: NDs treated as DL/2 value)	16	0.2	0.62	0.281	0.25	0.102
Statistics (Normal ROS Imputed Data)	16	0.0634	0.62	0.323	0.321	0.15
Statistics (Gamma ROS Imputed Data)	16	0.155	0.62	0.33	0.314	0.126
Statistics (Lognormal ROS Imputed Data)	16	0.149	0.62	0.317	0.293	0.128

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (NDs = DL)	23.42	19.07	0.0207	-0.746	0.24	-0.321
Statistics (NDs = DL/2)	12.34	10.07	0.0228	-1.31	0.268	-0.204
Statistics (Gamma ROS Estimates)	7.453	6.097	0.0443	-1.177	0.385	-0.327
Statistics (Lognormal ROS Estimates)	--	--	--	-1.222	0.397	-0.325

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.998	0.692	0.665	0.997

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.997	0.767	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.526	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.472	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.991	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.192	0.425	Data Appear Normal
Lilliefors (NDs = DL)	0.449	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.495	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.0794	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 2:58:10 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Mercury

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	2	14	87.50%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	14	5.0000E-4	5.0000E-4	5.0000E-4	5.0000E-4	2.250E-19
Statistics (Non-Detects Only)	2	7.0000E-4	8.0000E-4	7.5000E-4	7.5000E-4	7.0711E-5
Statistics (All: NDs treated as DL value)	16	5.0000E-4	8.0000E-4	5.3125E-4	5.0000E-4	8.7321E-5
Statistics (All: NDs treated as DL/2 value)	16	2.5000E-4	8.0000E-4	3.1250E-4	2.5000E-4	1.7176E-4
Statistics (Normal ROS Imputed Data)	16	-1.466E-4	8.0000E-4	3.0705E-4	3.0035E-4	2.6145E-4
Statistics (Gamma ROS Imputed Data)	16	N/A	N/A	N/A	N/A	N/A
Statistics (Lognormal ROS Imputed Data)	16	2.2601E-4	8.0000E-4	4.3882E-4	4.1068E-4	1.5791E-4

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (NDs = DL)	49.09	39.93	1.0822E-5	-7.55	0.14	-0.0185
Statistics (NDs = DL/2)	5.969	4.892	5.2352E-5	-8.157	0.375	-0.046
Statistics (Gamma ROS Estimates)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (Lognormal ROS Estimates)	--	--	--	-7.789	0.349	-0.0448

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	1	0.628	0.628	0.998

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (NDs = DL)	0.414	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.41	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.992	0.887	Data Appear Normal
Lilliefors (Detects Only)	N/A	N/A	
Lilliefors (NDs = DL)	0.515	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.517	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.0586	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 5:07:40 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Lithium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	0	16	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!

Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Lithium was not processed!

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 5:08:42 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Molybdenum

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	0	16	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!

Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Molybdenum was not processed!

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 2:53:27 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Lead

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	9	7	43.75%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	7	0.005	0.0075	0.00679	0.0075	0.00122
Statistics (Non-Detects Only)	9	0.0036	0.638	0.241	0.236	0.255
Statistics (All: NDs treated as DL value)	16	0.0036	0.638	0.139	0.00895	0.222
Statistics (All: NDs treated as DL/2 value)	16	0.0025	0.638	0.137	0.00708	0.223
Statistics (Normal ROS Imputed Data)	16	-0.428	0.638	0.0464	0.007	0.307
Statistics (Gamma ROS Imputed Data)	16	0.0036	0.638	0.14	0.0102	0.221
Statistics (Lognormal ROS Imputed Data)	16	4.0641E-4	0.638	0.137	0.0101	0.223

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	0.595	0.47	0.406	-2.463	1.911	-0.776
Statistics (NDs = DL)	0.41	0.374	0.338	-3.577	1.915	-0.535
Statistics (NDs = DL/2)	0.354	0.33	0.387	-3.88	2.172	-0.56
Statistics (Gamma ROS Estimates)	0.45	0.407	0.311	-3.4	1.776	-0.522
Statistics (Lognormal ROS Estimates)	--	--	--	-4.02	2.4	-0.597

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.923	0.812	0.813	0.969

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.827	0.829	Data Not Normal
Shapiro-Wilk (NDs = DL)	0.654	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.656	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.934	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.239	0.274	Data Appear Normal
Lilliefors (NDs = DL)	0.373	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.37	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.207	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.110/3/2017 9:00:31 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

pH

Raw Statistics

Number of Valid Observations	15
Number of Distinct Observations	13
Minimum	6.81
Maximum	7.63
Mean of Raw Data	7.199
Standard Deviation of Raw Data	0.196
Khat	1450
Theta hat	0.00497
Kstar	1160
Theta star	0.00621
Mean of Log Transformed Data	1.974
Standard Deviation of Log Transformed Data	0.0272

Normal GOF Test Results

Correlation Coefficient R	0.977
Shapiro Wilk Test Statistic	0.969
Shapiro Wilk Critical (0.05) Value	0.881
Approximate Shapiro Wilk P Value	0.725
Lilliefors Test Statistic	0.143
Lilliefors Critical (0.05) Value	0.22

Data appear Normal at (0.05) Significance Level

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/28/2017 11:48:02 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Ra226

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	11	5	31.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	5	-0.04	0.97	0.562	0.57	0.374
Statistics (Non-Detects Only)	11	-0.03	7.1	1.49	1	1.933
Statistics (All: NDs treated as DL value)	16	-0.04	7.1	1.2	0.875	1.651
Statistics (All: NDs treated as DL/2 value)	16	N/A	N/A	N/A	N/A	N/A
Statistics (Normal ROS Imputed Data)	16	-2.249	7.1	0.749	0.65	1.995

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.76	0.728	0.733	0.869

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.611	0.85	Data Not Normal
Shapiro-Wilk (NDs = DL)	0.561	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.567	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.789	0.887	Data Not Normal
Lilliefors (Detects Only)	0.345	0.251	Data Not Normal
Lilliefors (NDs = DL)	0.313	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.292	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.237	0.213	Data Not Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/28/2017 11:49:12 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Ra228

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	9	7	43.75%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	7	0.52	1.8	1.027	0.83	0.466
Statistics (Non-Detects Only)	9	0.53	5.1	1.582	0.95	1.451
Statistics (All: NDs treated as DL value)	16	0.52	5.1	1.339	0.89	1.136
Statistics (All: NDs treated as DL/2 value)	16	0.26	5.1	1.115	0.695	1.202
Statistics (Normal ROS Imputed Data)	16	-1.431	5.1	0.846	0.553	1.428
Statistics (Gamma ROS Imputed Data)	16	0.01	5.1	0.963	0.545	1.289
Statistics (Lognormal ROS Imputed Data)	16	0.202	5.1	1.095	0.604	1.207

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	1.94	1.367	0.816	0.179	0.749	4.172
Statistics (NDs = DL)	2.452	2.034	0.546	0.0746	0.628	8.42
Statistics (NDs = DL/2)	1.63	1.366	0.684	-0.229	0.78	-3.411
Statistics (Gamma ROS Estimates)	0.608	0.536	1.583	-1.052	1.865	-1.773
Statistics (Lognormal ROS Estimates)	--	--	--	-0.255	0.787	-3.079

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.851	0.814	0.795	0.904

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.739	0.829	Data Not Normal
Shapiro-Wilk (NDs = DL)	0.683	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.655	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.846	0.887	Data Not Normal
Lilliefors (Detects Only)	0.245	0.274	Data Appear Normal
Lilliefors (NDs = DL)	0.235	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.304	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.221	0.213	Data Not Normal

User Selected Options

Date/Time of Computation	ProUCL 5.19/25/2017 3:43:44 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Antimony

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	3	13	81.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	13	0.006	0.0096	0.00628	0.006	9.9846E-4
Statistics (Non-Detects Only)	3	0.0063	0.016	0.0125	0.0152	0.00538
Statistics (All: NDs treated as DL value)	16	0.006	0.016	0.00744	0.006	0.00331
Statistics (All: NDs treated as DL/2 value)	16	0.003	0.016	0.00489	0.003	0.00428
Statistics (Normal ROS Imputed Data)	16	-0.0265	0.016	-0.00565	-0.00701	0.0121
Statistics (Gamma ROS Imputed Data)	16	0.0063	0.016	0.0105	0.01	0.00221
Statistics (Lognormal ROS Imputed Data)	16	2.7001E-4	0.016	0.00379	0.00177	0.00489

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (NDs = DL)	8.001	6.542	9.3037E-4	-4.964	0.335	-0.0674
Statistics (NDs = DL/2)	2.563	2.124	0.00191	-5.527	0.574	-0.104
Statistics (Gamma ROS Estimates)	26.29	21.4	3.9826E-4	-4.579	0.2	-0.0436
Statistics (Lognormal ROS Estimates)	--	--	--	-6.209	1.159	-0.187

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.901	0.7	0.704	0.992

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.811	0.767	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.498	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.504	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.978	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.359	0.425	Data Appear Normal
Lilliefors (NDs = DL)	0.448	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.421	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.0832	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 3:03:58 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Selenium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	5	11	68.75%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	11	0.0025	0.08	0.0484	0.05	0.0177
Statistics (Non-Detects Only)	5	0.0046	0.0079	0.00571	0.00523	0.00131
Statistics (All: NDs treated as DL value)	16	0.0025	0.08	0.0351	0.05	0.025
Statistics (All: NDs treated as DL/2 value)	16	0.00125	0.04	0.0184	0.025	0.0114
Statistics (Normal ROS Imputed Data)	16	0.00251	0.0079	0.00521	0.00522	0.00155
Statistics (Gamma ROS Imputed Data)	16	0.0046	0.01	0.00866	0.01	0.00216
Statistics (Lognormal ROS Imputed Data)	16	0.0033	0.0079	0.00532	0.00517	0.00136

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	26.79	10.85	2.1315E-4	-5.184	0.211	-0.0407
Statistics (NDs = DL)	1.165	0.988	0.0301	-3.838	1.211	-0.315
Statistics (NDs = DL/2)	1.71	1.431	0.0108	-4.314	0.976	-0.226
Statistics (Gamma ROS Estimates)	13.66	11.14	6.3377E-4	-4.786	0.298	-0.0622
Statistics (Lognormal ROS Estimates)	--	--	--	-5.268	0.255	-0.0485

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.916	0.878	0.896	0.987

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.848	0.762	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.764	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.801	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.967	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.257	0.343	Data Appear Normal
Lilliefors (NDs = DL)	0.35	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.342	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.119	0.213	Data Appear Normal

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 4:56:42 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Sulfate

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	9	7	43.75%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	7	5	5	5	5	0
Statistics (Non-Detects Only)	9	0.3	84.5	61.38	66.8	26.96
Statistics (All: NDs treated as DL value)	16	0.3	84.5	36.71	24.25	34.96
Statistics (All: NDs treated as DL/2 value)	16	0.3	84.5	35.62	23	36.02
Statistics (Normal ROS Imputed Data)	16	-20.67	84.5	38.83	38	35
Statistics (Gamma ROS Imputed Data)	16	0.3	84.5	46.67	39.94	26.42
Statistics (Lognormal ROS Imputed Data)	16	0.3	84.5	35.84	25.4	35.84

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	1.122	0.822	54.73	3.609	1.819	0.504
Statistics (NDs = DL)	0.696	0.607	52.74	2.734	1.677	0.613
Statistics (NDs = DL/2)	0.548	0.487	64.95	2.431	1.915	0.788
Statistics (Gamma ROS Estimates)	1.506	1.265	31	3.476	1.344	0.387
Statistics (Lognormal ROS Estimates)	--	--	--	2.343	2.098	0.896

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.907	0.901	0.895	0.977

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.83	0.829	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.785	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.773	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.935	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.196	0.274	Data Appear Normal
Lilliefors (NDs = DL)	0.318	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.321	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.119	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 5:02:40 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

TDS

Raw Statistics

Number of Valid Observations	16
Number of Distinct Observations	14
Minimum	316
Maximum	578
Mean of Raw Data	444
Standard Deviation of Raw Data	85.19
Khat	29.07
Theta hat	15.27
Kstar	23.66
Theta star	18.76
Mean of Log Transformed Data	6.079
Standard Deviation of Log Transformed Data	0.193

Normal GOF Test Results

Correlation Coefficient R	0.971
Shapiro Wilk Test Statistic	0.927
Shapiro Wilk Critical (0.05) Value	0.887
Approximate Shapiro Wilk P Value	0.271
Lilliefors Test Statistic	0.139
Lilliefors Critical (0.05) Value	0.213

Data appear Normal at (0.05) Significance Level

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 4:59:14 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Thallium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	3	13	81.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	13	0.002	0.0032	0.00209	0.002	3.3282E-4
Statistics (Non-Detects Only)	3	0.00258	0.00556	0.00372	0.00302	0.00161
Statistics (All: NDs treated as DL value)	16	0.002	0.00556	0.0024	0.002	9.2960E-4
Statistics (All: NDs treated as DL/2 value)	16	0.001	0.00556	0.00155	0.001	0.00124
Statistics (Normal ROS Imputed Data)	16	-0.00705	0.00556	-0.00129	-0.00153	0.00333
Statistics (Gamma ROS Imputed Data)	16	0.00258	0.01	0.00882	0.01	0.0026
Statistics (Lognormal ROS Imputed Data)	16	2.2972E-4	0.00556	0.00139	9.2841E-4	0.00136

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (NDs = DL)	10.96	8.944	2.1882E-4	-6.08	0.284	-0.0467
Statistics (NDs = DL/2)	3.068	2.535	5.0437E-4	-6.643	0.527	-0.0793
Statistics (Gamma ROS Estimates)	7.213	5.902	0.00122	-4.801	0.447	-0.0931
Statistics (Lognormal ROS Estimates)	--	--	--	-6.92	0.842	-0.122

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.926	0.696	0.714	0.995

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.858	0.767	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.507	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.529	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.991	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.335	0.425	Data Appear Normal
Lilliefors (NDs = DL)	0.416	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.421	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.0776	0.213	Data Appear Normal

User Selected Options

Date/Time of Computation ProUCL 5.19/27/2017 3:54:50 PM

From File WorkSheet.xls

Full Precision OFF

Dixon's Outlier Test for Arsenic

Total N = 16

Number NDs = 8

Number Detects = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

Note: NDs excluded from Outlier Test

1. Data Value 0.102 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.281

For 10% significance level, 0.102 is not an outlier.

For 5% significance level, 0.102 is not an outlier.

For 1% significance level, 0.102 is not an outlier.

2. Data Value 0.00608 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.047

For 10% significance level, 0.00608 is not an outlier.

For 5% significance level, 0.00608 is not an outlier.

For 1% significance level, 0.00608 is not an outlier.

User Selected Options

Date/Time of Computation ProUCL 5.19/28/2017 11:52:22 AM

From File WorkSheet.xls

Full Precision OFF

Dixon's Outlier Test for Calcium

Total N = 16

Number NDs = 0

Number Detects = 16

10% critical value: 0.454

5% critical value: 0.507

1% critical value: 0.595

Note: NDs excluded from Outlier Test

1. Data Value 201 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.447

For 10% significance level, 201 is not an outlier.

For 5% significance level, 201 is not an outlier.

For 1% significance level, 201 is not an outlier.

2. Data Value 77.3 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.268

For 10% significance level, 77.3 is not an outlier.

For 5% significance level, 77.3 is not an outlier.

For 1% significance level, 77.3 is not an outlier.

User Selected Options

Date/Time of Computation	ProUCL 5.19/27/2017 3:39:01 PM
From File	WorkSheet.xls
Full Precision	OFF

Dixon's Outlier Test for pH

Total N = 15

Number NDs = 0

Number Detects = 15

10% critical value: 0.472

5% critical value: 0.525

1% critical value: 0.616

Note: NDs excluded from Outlier Test

1. Data Value 7.63 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.508

For 10% significance level, 7.63 is an outlier.

For 5% significance level, 7.63 is not an outlier.

For 1% significance level, 7.63 is not an outlier.

2. Data Value 6.81 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.442

For 10% significance level, 6.81 is not an outlier.

For 5% significance level, 6.81 is not an outlier.

For 1% significance level, 6.81 is not an outlier.

User Selected Options

Date/Time of Computation ProUCL 5.19/27/2017 3:36:41 PM

From File WorkSheet.xls

Full Precision OFF

Dixon's Outlier Test for TDS

Total N = 16

Number NDs = 0

Number Detects = 16

10% critical value: 0.454

5% critical value: 0.507

1% critical value: 0.595

Note: NDs excluded from Outlier Test

1. Data Value 578 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.087

For 10% significance level, 578 is not an outlier.

For 5% significance level, 578 is not an outlier.

For 1% significance level, 578 is not an outlier.

2. Data Value 316 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.221

For 10% significance level, 316 is not an outlier.

For 5% significance level, 316 is not an outlier.

For 1% significance level, 316 is not an outlier.

Background Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.110/3/2017 10:23:39 AM
From File	Data Sept28.xls
Full Precision	OFF
Confidence Coefficient	95%
Coverage	95%
Different or Future K Observations	1
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	16	Number of Missing Observations	0
Number of Distinct Observations	10		
Number of Detects	8	Number of Non-Detects	8
Number of Distinct Detects	8	Number of Distinct Non-Detects	2
Minimum Detect	0.00608	Minimum Non-Detect	0.015
Maximum Detect	0.102	Maximum Non-Detect	0.05
Variance Detected	0.00116	Percent Non-Detects	50%
Mean Detected	0.0364	SD Detected	0.0341
Mean of Detected Logged Data	-3.689	SD of Detected Logged Data	0.946

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.524	d2max (for USL)	2.443

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	**0.0263**	**KM SD**	**0.0255**
95% UTL95% Coverage	0.0907	95% KM UPL (t)	0.0724
90% KM Percentile (z)	0.059	95% KM Percentile (z)	0.0682
99% KM Percentile (z)	0.0856	95% KM USL	0.0886

10.18

10.18	10/17/2017 - CCR Landfill Groundwater Monitoring System Certification	Groundwater Monitoring System Certification, April 2018	CWLP	26647	26648

Electronic Filing: Received, Clerk's Office 02/13/2020

City Water, Light & Power
CCR Surface Impoundments

Groundwater Monitoring System Certification

40 CFR Section §257.91(f)

October 2017 (Revised April 2018)

Prepared for:
City Water, Light & Power
3100 Stevenson Drive
Springfield, Illinois 62703

Prepared by:

ANDREWS ENGINEERING INC
3300 Ginger Creek Drive
Springfield, IL 62711
Tel: (217) 787-2334; Fax: (217) 787-9495

Suppl. Resp. to Ltr. dtd. 6/1/20
CWLP 2664

GROUNDWATER MONITORING SYSTEM CERTIFICATION – CCR SURFACE IMPOUNDMENTS

City Water, Light and Power (CWLP) owns and operates two (2) existing coal combustion residual (CCR) surface impoundments located north and east of the former Lakeside Power Generating Station and Dallman Power Generating Station. The rules promulgated by the U.S. Environmental Protection Agency (EPA) pertaining to Disposal of CCR from Electric Utilities published in 40 CFR Part 257 on April 17, 2015 in Federal Register are applicable to the two surface impoundments; the Lakeside Ash Pond and the Dallman Ash Pond.

The CCR Rule, 40 CFR Subpart D – Standards for the Disposal of CCRs, Section §257.91 requires groundwater monitoring system that consists of sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that:

1) accurately represent the quality of background groundwater that has not been affected by leakage from a CCR unit;

2) accurately represent the quality of groundwater passing the waste boundary of the CCR unit consisting of a downgradient monitoring system installed at the waste boundary that ensures detection of groundwater contamination in the uppermost aquifer and the ability to monitor all potential contaminant pathways;

3) consists of a sufficient number of monitoring wells, appropriately spaced and screened based upon site-specific technical information including aquifer thickness, groundwater flow rate, groundwater flow direction including seasonal and temporal fluctuations in groundwater flow and saturated and unsaturated geologic units and fill materials overlying the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer, including, but not limited to, thicknesses, stratigraphy, lithology, hydraulic conductivities, porosities and effective porosities;

4) consists of a minimum of one upgradient and three downgradient monitoring wells (note: the existing monitoring system exceeds the minimum requirement, consisting of two upgradient and four downgradient monitoring wells); and

5) monitoring wells constructed in a manner that maintains the integrity of the monitoring well borehole, consisting of a screened interval packed with appropriately sized sand/gravel that enables the collection of groundwater samples, and has an annular space sealed to prevent the contamination of samples and groundwater.

The Groundwater Monitoring Program has been revised (April 2018) for the replacement of well AW-3. It was determined that the specific parameter concentrations in well AW-3 were not consistent with the adjacent wells, including wells contained in the monitor well network for the permitted CCR landfill. AW-3 was further evaluated to ensure samples could be collected that would represent groundwater moving beneath the unit and provide data determining whether the groundwater was affected by the CCR impoundment. The integrity of the well may be suspect and replacement of the well was warranted. The replacement well (RW-3) was installed within 10 feet of the original well, containing nearly identical depths and well screen intervals.

The above information is contained in the Groundwater Monitoring Program maintained in the facility operating record. The groundwater monitoring system at the Lakeside and Dallman Ash Ponds meets the requirements of 40 CFR Section §257.91.

Paul M. Van Metre, P.E.

6-7-18
Date

10.19

10.19	7/11/2018 – CWLP established Groundwater Protection Standards	GWPS2018	CWLP	27435	27435

City Water, Light and Power Establishment of Groundwater Protection Standards per 40 CFR 257.95(h)				
Constituents	**Units**	**Maximum Contaminant Level (MCL) 40 CFR 141.62 and 141.66**	**Background Concentration AP-4 & AP-5**	**Groundwater Protection Standards**
Antimony, total	mg/l	0.006	0.016	0.016
Arsenic, total	mg/l	0.01	0.0724	0.0724
Barium, total	mg/l	2.0	5.24	5.24
Beryllium, total	mg/l	0.004	0.0164	0.0164
Cadmium, total	mg/l	0.005	0.0128	0.0128
Chromium, total	mg/l	0.1	0.811	0.811
Cobalt, total	mg/l	0.006	0.297	0.297
Fluoride, total	mg/l	4.0	0.595	4.0
Lead, total	mg/l	0.015	0.638	0.638
Lithium, total	mg/l	0.04	0.05	0.05
Mercury, total	mg/l	0.002	0.0008	0.002
Molybdenum, total	mg/l	0.1	0.025	0.1
Selenium, total	mg/l	0.05	0.0079	0.05
Thallium, total	mg/l	0.002	0.00556	0.00556
Radium 226 and 228 combined	pCi/l	5	12.2	12.2
				July 11, 2018

Notes:

1. The higher of the two values is used for determination of the Groundwater Protection Standard.

2. The 40 CFR 257 list requires Radium-226 and Radium-228 combined. The established MCL is for the combined parameters. However, these parameters require two separate analysis and have been reported separately by the analytical laboratory. The sum of the values has been provided and compared to the MCL.

3. Background concentrations are those presented in the Groundwater Monitoring Program (October 2017).

NA Not available.

10.20

10.20	2/28/2018 – CWLP uploaded Assessment Monitoring Program notification	CWLP CCR Assessment Monitoring Notification 2018	CWLP	27436	27436

City Water, Light and Power
Coal Combustion Residuals Surface Impoundments

Notification that an Assessment Monitoring Program has been Established in Accordance with 40 CFR 257.95(a)

February 2018

10.21

10.21	7/11/18 - CCR Surface Impoundments Notification of Statistically Significant Increase	July 2018 SSI Notification FINAL	CWLP	27437	27437

City Water, Light & Power
Coal Combustion Residuals Surface Impoundments

Notification of Statistically Significant Increases in Accordance with 40 CFR 257.95(g)

City Water, Light and Power (CWLP) owns and operates two (2) existing coal combustion residual (CCR) surface impoundments. The CWLP CCR surface impoundments are located north and east of the former Lakeside Power Generating Station and Dallman Power Generating Station in the Eastern ½ of Section 12, Township 15 North, Range 5 West, in Springfield, Illinois. These CCR surface impoundments are identified as the Lakeside Ash Pond and the Dallman Ash Pond.

Due to statistically significant increases over background concentrations for specific Appendix III parameters at certain wells, assessment monitoring was initiated pursuant to 40 CFR 257.95(b). The initial assessment monitoring sampling event occurred May 4, 2018, with resampling occurring July 9, 2018. Groundwater Protection Standards were subsequently established pursuant to 40 CFR 257.95(d)(2). In accordance with 40 CFR 257.95(g), provided herein is notification of a statistically significant increase above the Groundwater Protection Standard for one parameter, total arsenic at well RW-3.

An investigation has been initiated to evaluate the geochemical properties in the vicinity of RW-3 and is currently ongoing.

10.22

10.22	11/16/2018 - CCR Surface Impoundment Location Restrictions Demonstration	Location Requirements 10-2018	CWLP	27438	27440

CITY WATER, LIGHT AND POWER
CCR SURFACE IMPOUNDMENT LOCATION RESTRICTIONS

The following information provides an evaluation of the CCR locations standards with respect to closure or retrofitting the CCR surface impoundments.

The locations restrictions consist of:

1. Placement Above the Uppermost Aquifer (§257.60)
2. Wetlands (§257.61)
3. Fault Areas (§257.62)
4. Seismic Impact Zones (§257.63)
5. Unstable Areas (§257.64)

Documentation showing compliance with the location standards must be placed in the operational record by October 17, 2018. If compliance cannot be certified, closure requirements of §257.101(b)(1) will apply. Each restriction is discussed separately below. The Lakeside and Dallman ash ponds are both considered CCR impoundments.

Placement Above the Uppermost Aquifer

The impoundments must be constructed with a base that is located no less than 5 feet above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to fluctuations in the groundwater elevations. If the demonstration cannot be made by the aforementioned date, the facility must cease accepting the CCR and begin closure activities pursuant to §257.101(b)(1).

Definitions of relevant terms in the paragraph above include (from §257.53):

> "*Aquifer* means a geologic formation, group of formations, or portion of a formation capable of yielding usable quantities of groundwater to wells or springs."
>
> "*Uppermost Aquifer* means the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary. Upper limit is measured at a point nearest to the natural ground surface to which the aquifer rises during the wet season."

It is debatable whether the deposits beneath the ash ponds are capable of yielding "usable" quantities of groundwater as the term is vague. Therefore, since the term "aquifer" is part of "uppermost aquifer," it can also be debatable if the unconsolidated deposits overlying the bedrock but beneath the ash ponds constitute an uppermost aquifer.

There are fine-grained sediments (silty clay/clayey silt) present beneath the ponds that do have confining hydraulic properties. However, there are also sand/sandy deposits that are water-bearing with potentiometric surfaces within 5 feet of the bottom of the ponds.

Documents from Hanson Engineers (1987) indicate the base of the Lakeside ash pond is approximately 535 feet above mean sea level (msl). Design drawings from Burns & McDonnell (1976) show the base of the Dallman ash pond to be approximately 533 feet above msl, with some variability. The potentiometric surfaces along the perimeter of the impoundments are largely above those elevations with the exception of the wells adjacent to (north and west) the Dallman ash pond. However, because the water level in the pond is approximately 548 feet above msl, an outward hydraulic gradient is present which fully saturates the soils beneath the impoundment. There is a direct hydraulic connection with the water table.

The term “uppermost aquifer” is contained in the RCRA Subtitle D regulations that were used when creating the CCR regulations. Additionally, the “uppermost aquifer” was incorporated into the 35 Illinois Administrative Code (IAC) Part 814, Subpart C regulations, which apply to the FGDS onsite landfill. The uppermost aquifer at the landfill site does include the water-bearing deposits beneath the landfill, which also extend beneath and adjacent to the ash ponds.

Based on the potentiometric surfaces and the bottom elevations of the Dallman and Lakeside ash ponds, it is likely the ponds would be found not to meet the location standard of §257.60. Therefore, either retrofit or closure must be implemented pursuant to §257.101(b)(1).

Wetlands

The applicable units must not be located in wetlands. The existing and potential applicable units are listed on the wetland inventory map as a wetland. Clarification with the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers (USACE) should adequately address any issues. It is Andrews’ experience that no USACE permit will be necessary for any of the operational ponds (CCR or process) and that the wetlands can be disturbed or removed.

Fault Areas

The applicable surface impoundments must not be located within 200 feet of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates that an alternative setback distance of less than 200 feet will prevent damage to the structural integrity of the CCR unit.

The fault areas for the FGDS landfill were identified as part of the initial Significant Modification Application (Log No. 1995-243-LFM). The study area incorporates that of the surface impoundments. There are no fault areas in the vicinity of the surface impoundments.

Seismic Impact Zones

The applicable units must not be located in seismic impact zones unless the owner or operator demonstrates that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

The seismic impact zones were evaluated as part of the initial Significant Modification Application (Log No. 1995-243-LFM) to Unit 2 of the FGDS landfill, including evaluation of the slope and mass stability. The study area includes the location of the impoundments. The ponds are not located within a seismic impact zone that would pose a threat to the structural integrity of the impoundments.

Unstable Areas

The applicable units must not be located in an unstable area unless it can be demonstrated that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR units to ensure that the integrity of the structural components of the CCR unit will not be disrupted.

Unstable area means a location that is susceptible to natural or human-induced events or forces capable of impairing the integrity of some or all of the structural components responsible for preventing releases from the CCR unit. The preamble implies these issues will specifically relate to foundation conditions resulting in mass movement of soils, or karst terrains where bedrock is involved.

The hazard potential classification assessment with oversight from the Illinois Department of Natural Resources, and structural integrity assessments, did not indicate any unstable areas in the immediate surface impoundment area. Geotechnical analyses were conducted for both the Lakeside and Dallman ponds, and for the FGDS landfill as part of the permitting process. As provided in the differing reports, the soil characteristics were adequate to support the structures designed for the Lakeside and Dallman ash ponds.

COMPLIANCE

Of the five location requirements, four appear to comply with the specific rules. However, unlined ponds are placed directly above and within 5 feet of the high water table for the uppermost aquifer. Either it must be demonstrated that there will not be intermittent, reoccurring or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer, or cessation of disposal and closure must begin.

Hydraulic separation can be shown by retrofitting the ponds. A composite liner consisting of a two-foot (minimum) low hydraulic conductivity ($< 1.0 \times 10^{-7}$ cm/sec) clayey material overlain by a minimum 30 mil geomembrane (or equivalent) will be adequate to demonstrate hydraulic separation. Part or all of the impoundments can be retrofitted to meet the location requirement.

10.28

10.28	5/6/2019 - Assessment of Corrective Measures Extension	CWLP Assessment of Corrective Measures Extension May 2019	CWLP	29236	29237

Electronic Filing: Received, Clerk's Office 02/13/2020

City Water, Light and Power
Coal Combustion Residuals Surface Impoundments

Assessment of Corrective Measures Extension in Accordance with 40 CFR 257.96(a)

May 2019

Resp. to 1st RTP, 4th Supp
CWLP - 29236

City Water, Light and Power (CWLP) owns and operates two existing coal combustion residual (CCR) surface impoundments. These CCR surface impoundments are identified as the Lakeside Ash Pond and the Dallman Ash Pond and are located northeast of the power plant complex in Springfield, Illinois. CWLP is currently characterizing the nature and extent of the release in accordance with 40 CFR 257.95(g), however due to poor weather conditions much of the site has been inaccessible, therefore we have been unable to install additional monitoring wells and sample in accordance with 257.95(d)(1). The additional monitoring wells are scheduled to be installed and sampled in May 2019. Therefore CWLP is extending the deadline for assessment of corrective measure by 60 days in accordance with 40 CFR 257.96(a).

Certified in accordance with 257.96(a)by: William E. Antonacci

William Antonacci, P.E.

Date: 4-29-19



10.29

10.29	8/5/2019 – CWLP uploaded Completion of Corrective Measures	CWLP CCR Completion of Corrective Measures 2019	CWLP	29238	29239

Electronic Filing: Received, Clerk's Office 02/13/2020

City Water, Light and Power
Coal Combustion Residuals Surface Impoundments

Completion of Corrective Measures in Accordance with 40 CFR 257.96(a)

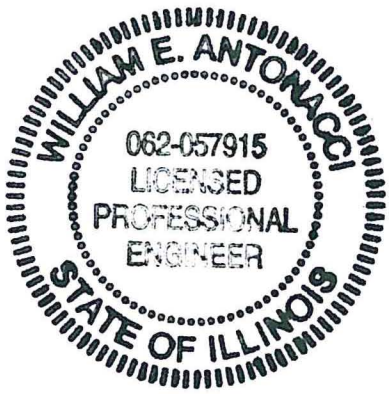
July 2019

City Water, Light and Power (CWLP) owns and operates two existing coal combustion residual (CCR) surface impoundments. These CCR surface impoundments are identified as the Lakeside Ash Pond and the Dallman Ash Pond and are located northeast of the power plant complex in Springfield, Illinois. CWLP has begun to characterize the nature and extent of the release in accordance with 40 CFR 257.95(g)(1), however due to poor weather conditions much of the site has been inaccessible and in May 2019 CWLP utilized the 60 day extension in accordance with 40 CFR 257.96(a). Finally, due to 40 CFR 257.95(g)(5) the surface impoundments must either retrofit and/or close, which are the long term corrective measures. CWLP has not made a decision on either retrofitting and/or closing the impoundments at this point in time due to the complexities of our system (all CCR and non-CCR material going to these impoundments are wet-generated, not dry). CWLP has initiated the alternative closure requirements in accordance with 40 CFR 257.103(a)(1) and will be submitting an annual progress report in May of 2020 updating the status of the impoundments.

Certified in accordance with 257.96(a) by: William E. Antonacci

William Antonacci, P.E.

Date: 6/26/19



10.30

10.30	4/5/2019 – CWLP uploaded Initiation of Assessment of Corrective Measures	CWLP CCR Initiation of Assessment of Corrective Measures	CWLP	29240	29240

City Water, Light and Power
Coal Combustion Residuals Surface Impoundments

Initiation of Assessment of Corrective Measures in Accordance with 40 CFR 257.95(g)(5)

April 2019

10.31

10.31	5/6/2019 - Notification of Intent to Comply with Alternative Closure Requirements	CWLP Notification of Intent to Comply with 257.103(a)(1)	CWLP	29241	29243

City Water, Light and Power
Coal Combustion Residuals Surface Impoundments

Notification of Intent to Comply with Alternative Closure Requirements in Accordance with 40 CFR 257.103(a)(1)

April 2019

City Water, Light and Power (CWLP) owns and operates two existing coal combustion residual (CCR) surface impoundments. These CCR surface impoundments are identified as the Lakeside Ash Pond and the Dallman Ash Pond and are located northeast of the power plant complex in Springfield, Illinois. The ponds are operated under National Pollutant Discharge Elimination System (NPDES) Permit Number IL0024767. All material going to these ponds are wet-generated, not dry.

The Lakeside Ash Pond was placed in service prior to 1958 and ceased receiving ash in 2009. It has been divided into four separate ponds, three limesludge ponds and the settling pond consisting of approximately 35.0 acres. The Lakeside Ash Pond currently receives limesludge from the CWLP Drinking Water Purification Plant, scrubber wastewater treatment plant clarifier blowdown and water from miscellaneous floor drains. The Dallman Ash Pond was placed into service in 1976 and is approximately 34.5 acres. The Dallman Ash Pond currently receives fly ash and bottom ash, which are sluiced with raw lake water, industrial wastewater treatment plant clarifier blowdown and landfill leachate. Settled water from both the Lakeside Ash Pond and Dallman Ash Pond flow into opposite sides of a Clarification Pond for final polishing before being discharged to Sugar Creek at Outfall 004.

CWLP became subject to 257.101(a) and (b)(1) retrofit or closure requirements in October 2018. CWLP qualifies for the Alternative Closure Requirements 257.103(a) since no alternative disposal capacity is currently available. As mentioned, all the materials currently being sent to the Lakeside Ash Pond and Dallman Ash Pond are wet-generated, not dry. As written in the Federal Register / Vol. 80, No. 74 / Friday, April 17, 2015 / Rules and Regulations page 21423;

> *1. No alternative CCR disposal capacity (§ 257.103(a)).* The Agency recognizes that the circumstance may arise where a facility's only disposal capacity, both on-site and off-site, is in a CCR unit that has triggered the closure requirements in § 257.101(a), (b)(1), or (d). As a result, the facility may be faced with either violating the closure requirements in § 257.101 by continuing to place CCR in a unit that is required to close, or having to cease generating power at that facility because there is no place in which to dispose of the resulting waste. For example, while it is possible to transport dry ash off-site to alternate disposal facility that simply is not feasible for wet-generated CCR. Nor can facilities immediately convert to dry handling systems. As noted previously, the law cannot compel actions that are physically impossible, and it is incumbent on EPA to develop a regulation that does not in essence establish such a standard. Should a facility choose to comply with the regulation and stop generating power, there would be significant risks to human health that would arise if a community would be left without power for an extended period of time. As information in the record demonstrates, obtaining alternative capacity can sometimes require a substantial amount of time (*e.g.*, if the facility needs to construct alternative capacity, including potentially the need to locate an alternative site or purchase additional property).

Prior to becoming subject to the retrofit or closure requirements of 257.101 (a) and (b)(1), CWLP commissioned Burns & McDonnell in 2012 and again in 2016 to perform an environmental compliance study with the following goals:

1. Identify current and future environmental regulations that impact the Dallman units
2. Evaluate control options for compliance and the associated costs of compliance
3. Analyze the financial impacts on CWLP of the various compliance options
4. Recommendation of compliance options and unit operations

The 2016 commissioned environmental compliance study was completed in April 2018. Due to on-going litigation and a reconsideration of the Effluent Limitations Guidelines (ELG) rule it has been difficult to finalize a compliance option for the Lakeside and Dallman Ash Ponds (either retrofit and/or close).

Additionally, CWLP is currently performing an economic evaluation in the form of an Integrated Resource Plan, of each Dallman coal-fired unit (31, 32, 33 and 4), considering the information in the environmental compliance study and energy markets as they exist, this evaluation will be complete by May 2019. Once the economic evaluation is complete, CWLP will be in a better position to determine if Dallman units 31, 32, 33 and 4 are cost-effective to continue to operate. After this evaluation is complete CWLP will decide on a compliance plan for the impoundments, either retrofitting and/or closing the Lakeside Ash Pond and Dallman Ash Pond.

CWLP is in compliance with all other requirements of the CCR rule. Finally, CWLP will submit a progress report concerning the Lakeside and Dallman Ash Ponds in accordance with 257.103 (c)(2)(i) no later than May 2020.

Certified in accordance with 257.103(a)(1) by: _____

Douglas A. Brown, P.E.
Chief Utility Engineer

Date: 4/4/19

11.1

11.1	10/17/2016 - Liner Status Report for Coal Combustion Residuals Surface Impoundments	03 - CWLP 2016 Surface Impoundment Liner Rpt	CWLP	09379	09382

Electronic Filing: Received, Clerk's Office 02/13/2020

City Water, Light & Power
Ash Impoundments
Springfield, Sangamon County, Illinois

Liner Status Report for Coal Combustion Residuals Surface Impoundments

October 2016

Prepared for:
City Water, Light & Power
3100 Stevenson Drive
Springfield, Illinois 62703

Prepared by:

ANDREWS ENGINEERING INC
3300 Ginger Creek Drive
Springfield, IL 62711
Tel: (217) 787-2334; Fax: (217) 787-9495

Response to 1st RTP
CWLP - 009379

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1. INTRODUCTION

City Water, Light and Power (CWLP) ash ponds are coal combustion residuals (CCR) surface impoundments, which include both the Lakeside and Dallman ash ponds. A review of the construction history for the CCR surface impoundments was conducted as required by 40 CFR Part 257.71:

> *257.71 (a)(1) No later than October 17, 2016, the owner or operator of an existing CCR surface impoundment must document whether or not such unit was constructed with any one of the following:*
> *(i) A liner consisting of a minimum of two feet of compacted soil with a hydraulic conductivity of no more than 1×10^{-7} cm/sec;*
> *(ii) A composite liner that meets the requirements of § 257.70(b); or*
> *(iii) An alternative composite liner that meets the requirements of § 257.70(c)*

Andrews Engineering, Inc. (AEI) performed the review of information, which included the following documents:

- Coal Ash Impoundment Site Assessment Final Report (May 2011)
- Historical Aerial Photographs (April 1995 – March 2014)
- Engineering Report: Proposed Embankment Modification; CWLP Ash Disposal Area (July 1987)
- Construction Grading Plan for the Dallman Ash Pond (August 1976)

2. CCR UNIT INFORMATION

Both the Lakeside Ash Pond and the Dallman Ash Pond are owned and operated by CWLP. The ponds are operated under National Pollutant Discharge Elimination System (NPDES) Permit Number IL0024767.

The Lakeside Ash Pond is primarily a diked embankment with some incising along the east perimeter and was placed into service prior to 1958. The Lakeside Ash Pond ceased receiving ash in 2009. It has been divided into four separate ponds, three lime softening ponds and the settling pond consisting of approximately 35.0 acres in total.

The second impoundment, the Dallman Ash Pond, which is a diked embankment, was placed into service in approximately 1976 and is approximately 34.5 acres. Fly ash and bottom ash are sluiced to the Dallman Ash Pond with raw lake water.

Pursuant to the aforementioned NPDES permit, settled water from both the Dallman Ash Pond and Lakeside Ash Pond flow into opposite sides of a Clarification Pond before being discharged to Sugar Creek at Outfall 004.

3. CONSTRUCTION

The Sugar Creek historically meandered across the site, generally from the south to the north. During the construction of the ash ponds, the creek was abandoned and relocated to the west of the site. The old creek bed was filled with different types of soil, ranging from cohesive soils

characterized as silty clays, to granular fill characterized as poorly graded silty to clayey sands. Most of the soil analysis was performed during hydrogeological investigations performed for the east adjacent CCR landfill.

The cohesive soils of the creek fill were tested and exhibited a range of hydraulic conductivity from 7.6 x 10^{-8} cm/sec to 2.1 x 10^{-5} cm/sec. The upper layer of soil at the site consists of mainly brown, light brown, and brownish-gray silty clays and clayey silts having soft to stiff consistency. This includes all eolian soils (loess) deposited near the surface, isolated pockets and lenses of fine grained silty to clayey sand at some locations and alluvial silts and silty clays. Recompacted silty clay samples from the native soils have exhibited permeability values between 1 x 10^{-7} to 1 x 10^{-9} cm/sec. The in-place creek sediment's soils permeability typically range from 1 x 10^{-6} to 1 x 10^{-8} cm/sec.

4. LINER STATUS

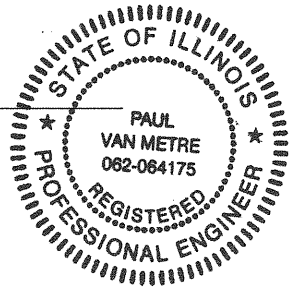
Both the Lakeside Ash Pond and the Dallman Ash pond were built on top of in-place clayey soils. While the vertical hydraulic conductivity is generally low, soils were not compacted beneath the impoundments except for sections where the dikes of the Dallman Ash Pond were built atop the existing creek bed. No composite liner or alternate composite liner as specified in 40 CFR Part 257.70 (b) or 40 CFR Part 257.70 (c)(1), was used to line the bottom of either ash pond.

5. STATEMENT

This Liner Status Report for Coal Combustion Residuals Surface Impoundments was completed for CWLP by Andrews Engineering, Inc. in accordance with the requirements under 40 CFR Part 257.71.

Paul M. Van Metre, P.E.

10-13-2016
Date



11.2

11.2	10/17/2016 - History of Construction Report for CCR Surface Impoundments	04 - CWLP 2016 History of Const Rpt	CWLP	09383	09403

Electronic Filing: Received, Clerk's Office 02/13/2020

City Water, Light & Power
Ash Impoundments
Springfield, Sangamon County, Illinois

History of Construction Report for Coal Combustion Residuals Surface Impoundments

October 2016

Prepared for:
City Water, Light & Power
3100 Stevenson Drive
Springfield, Illinois 62703

Prepared by:

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Response to 1st RTP
CWLP - 009383

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APPENDICES

APPENDIX A – FIGURES

APPENDIX B – AREA-CAPACITY CURVES

1. INTRODUCTION

City Water, Light and Power (CWLP) Lakeside Ash Pond and Dallman Ash Pond are coal combustion residuals (CCR) surface impoundments. A review of the construction history for the CCR surface impoundments was conducted as required by 40 CFR Part 257.73:

> *257.73 (c)(1) No later than October 17, 2016, the owner or operator of the CCR unit must compile a history of construction, which shall contain, to the extent feasible, the information specified in paragraphs (c)(1)(i) through (xi) of this section.*

Andrews Engineering, Inc. (AEI) performed the review of information, which included the following documents:

- Coal Ash Impoundment Site Assessment Final Report (May 2011)
- Historical Aerial Photographs (April 1995 – March 2014)
- Engineering Report: Proposed Embankment Modification; CWLP Ash Disposal Area (July 1987).
- Construction Grading Plan for the Dallman Ash Pond (August 1976)

2. CCR UNIT INFORMATION

Both the Lakeside Ash Pond and the Dallman Ash Pond are owned and operated by CWLP. The CWLP main office is located at 4th Floor, Municipal Center East, 800 E. Monroe Street, Springfield, IL 62757. The ponds are operated under National Pollutant Discharge Elimination System (NPDES) Permit Number IL0024767.

3. LOCATION

The Lakeside Ash Pond and the Dallman Ash Pond are located north of East Lake Shore Drive, just east of Interstate 55. The CCR units are located in the eastern half of Range 5 West, Township 15 North, Section 12 in Sangamon County, Illinois (Springfield East Quadrangle, Illinois, USGS). The locations of the CCR units are shown in Figure 1 of this report.

4. PURPOSE

The Lakeside Ash Pond is primarily a diked embankment with some incising along the east perimeter and was placed into service prior to 1958. The original Lakeside Ash Pond was been divided into four separate ponds since it was expanded vertically in 1988: three lime softening ponds and the settling pond. The current Lakeside Ash Pond is approximately 27.6 acres and ceased receiving ash in 2009.

The Dallman Ash Pond was placed into service in approximately 1976 and is approximately 34.5 acres. Fly ash and bottom ash from the CWLP power plant are sluiced to the Dallman Ash Pond with raw lake water.

Settled water from both the Dallman Ash Pond and Lakeside Ash Pond flow into opposite sides of a Clarification Pond before being discharged to Sugar Creek at Outfall 004.

5. WATERSHED AREA

The site is located within the South Fork Sangamon Watershed (USGS 07130007). However, since both ash ponds were built from diked embankments, virtually no surface water flows into the surface impoundments. Therefore, the watershed area for both of the ash ponds would be roughly equal to their surface area. The Dallman Ash Pond is approximately 34.5 acres. The Lakeside Ash Pond is approximately 27.6 acres.

6. FOUNDATION

The Sugar Creek historically meandered across the site, generally from the west to east with an overall flow direction to the north. During the construction of the ash ponds, the creek was abandoned and relocated to the west of the site. The old creek bed was filled with different types of soil, ranging from cohesive soils characterized as silty clays, to granular fill characterized as poorly graded silty to clayey sands. Most of the soil analysis was performed during hydrogeological investigations performed for the east adjacent CCR landfill.

The cohesive soils of the creek fill were tested as part of the CCR landfill permitting process. The landfill location is shown in Figure 1. The soils exhibited the following range of index and engineering properties:

- Liquid limit = 34 to 46
- Plasticity index = 9 to 26
- Gravel content = 0 percent
- Sand content = 2 to 48 percent
- Silt/Clay content = 52 to 98 percent
- Dry density = 80 to 104 pcf
- Hydraulic conductivity 7.6×10^{-8} to 2.1×10^{-5} cm/sec

Sieve analysis on the granular fill yielded the following results:

- Gravel content = 0 to 2 percent
- Sand content = 55 to 65 percent
- Silt/Clay content = 33 to 45 percent

Prior to the area development, the upper layer of soil at the site consisted of mainly brown, light brown, and brownish-gray silty clays and clayey silts having soft to stiff consistency. This includes all eolian soils (loess) deposited near the surface, isolated pockets and lenses of fine grained silty to clayey sand at some locations and alluvial silts and silty clays. Recompacted silty clay samples from the native soils have exhibited hydraulic conductivity values between 1×10^{-7} to 1×10^{-9} cm/sec. The in-place creek sediment's soils permeability typically range from 1×10^{-6} to 1×10^{-8} cm/sec. Much of the shallow soils were displaced during area development.

7. CONSTRUCTION

7.1 Lakeside Ash Pond

The Lakeside Ash Pond is a diked pond. The pond was built prior to 1958 and was bounded by the Lake Springfield Spaulding Dam to the south. The original pond was approximately 44 acres. The soil berms comprising the east, north, and west boundaries were built approximately 18 to 20 feet above the inside bottom elevation, with side slopes ranging between 2.5 to 3.0H:1.0V.

The Lakeside Ash Pond system was expanded vertically in 1988. The vertical expansion consists of berms built on top and inside of the existing embankments in such a way that the toe of the outer slope of the expansion berms matches up with the top of the inner slope of the existing embankments. The berms were built on top of a stable base comprised of bottom ash on the inside of the existing berms. The vertical expansion berms are approximately ten feet in height. The berms were constructed with compacted cohesive materials. The top and outer slopes are covered with a 6-inch topsoil layer. The top of the berms are 10 feet wide. The outer slope of the berms was built at a 2H:1V slope. The inner slope of the berms was built at a 1H:1V slopes. During the vertical expansion in 1988, the Lakeside Ash Pond was separated to create lime softening ponds on the south section of the pond.

7.2 Dallman Ash Pond

The Dallman Ash Pond was built 1976; it has not been expanded. The berms for the Dallman Ash Pond were built to a height of approximately 27 feet, using slopes of 2.5H:1V for both the inner and outer slopes. Riprap was placed at the bottom section of the outer slopes for the west and north berms. The south berm for the Dallman Ash Pond is shared by the Clarification Pond located to the south.

8. DRAWINGS

The following drawings are included in Appendix A of this report:

- Figure 1 – Site Map identifying the location of the CCR units.
- Figure 2 – Plan View of the surface impoundments and the locations of outlets, normal operating pool elevations, maximum pool elevations, and maximum depths of each CCR unit.
- Construction Drawings – Plan Views and Cross Sections of each CCR unit.

Plan Drawings and Cross Sections of the Lakeside Ash Pond are taken from the construction design drawings included in the 1987 Proposed Embankment Modifications report by Hanson Engineers, Inc. No as-built drawings are available for either the original pond construction prior to 1958 or the expansion in 1988. No construction design drawings are available for the original pond construction. The Plan Drawing shows the proposed expansion with two lime softening ponds. The third lime softening pond was constructed from the southern portion of the expanded settling pond at a later time.

The Plan Drawing of the Dallman Ash Pond is taken from the 1976 Construction Grading Plan. Cross Sections for the Dallman Ash Pond have been created based on this Plan Drawing. No as-built drawings are available for the construction of the Dallman Ash Pond.

Neither CCR unit contains foundation improvements, drainage provisions, diversion ditches, or instrumentation. No identifiable natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or misoperation are known to CWLP personnel.

9. INSTRUMENTATION

According to CWLP personnel, none of the CCR units contains any such unit instrumentation, which would include dedicated piezometers, pool elevation and freeboard instrumentation or more sophisticated measuring devices for measuring pressure, seepage, internal movement, slope movement, and/or vibration. Due to the limited extent of the impoundments, such instrumentation was deemed unnecessary.

10. AREA-CAPACITY CURVES

Area-capacity curves for the CCR units are included in Appendix B of this report. Area-capacity curves for the CCR units are calculated based on information from the construction drawings discussed in Section 8 of this report.

11. SPILLWAYS

Neither ash pond has constructed or natural spillways.

12. SURVEILLANCE, MAINTENANCE, AND REPAIR

Visual inspections of the CCR units are performed on a weekly basis in accordance with 40 CFR 257.83(a)(1)(i) for the purpose of identifying appearances of actual or potential structural weaknesses and other conditions that are disrupting or have the potential to disrupt the operation or safety of the CCR units or appurtenant structures. Erosional features, such as ruts or gullies, are promptly filled with soil and seeded. Any repairs completed as part of maintenance are specifically monitored during the weekly inspections for future occurrences. Because of the limited extent of the impoundments, only minimal maintenance is necessary.

13. STRUCTURAL CONDITION OF CCR UNITS

Signs of erosion have been periodically observed on the north and west outer berms of the Dallman Ash Pond in the forms of ruts and gullies that typically range from 6 to 24 inches deep. The erosion appears to be caused by stormwater flow collecting at points along the top of the berm before flowing down the outer slope in concentrated streams. Ruts and gullies are routinely filled with soil and monitored in the observed locations. Erosion of similar severity was discussed in the 2011 Site Assessment Final Report, which recommended that the erosion be repaired on an as-needed basis.

Indications of seepage have been observed on outer berms of the Lakeside Ash Pond and lime softening ponds, between the top of the original pond berms and the vertical expansion berms. These range from staining or dampness to areas with noticeable drainage. Signs of seepage have been observed along the west berm, as well as isolated portions on the east and west portions of the north berm of the Lakeside Ash Pond. This seepage is discussed in the 2011 Site Assessment Final Report.

No other visual indications of actual or potential structural weaknesses and other conditions that are disrupting or have the potential to disrupt the operation or safety of the CCR unit or appurtenant structures have been observed for the CCR units during any of the weekly inspections since the initiation of this weekly inspection program on October 16, 2015. Based on the review of historical aerial photographs, there were no observed indications of mass movement on any of the constructed berms for the active cells of the CCR units.

14. STATEMENT

This History of Construction Report for Coal Combustion Residuals Surface Impoundments was completed for CWLP by Andrews Engineering, Inc. in accordance with the requirements under 40 CFR Part 257.73.

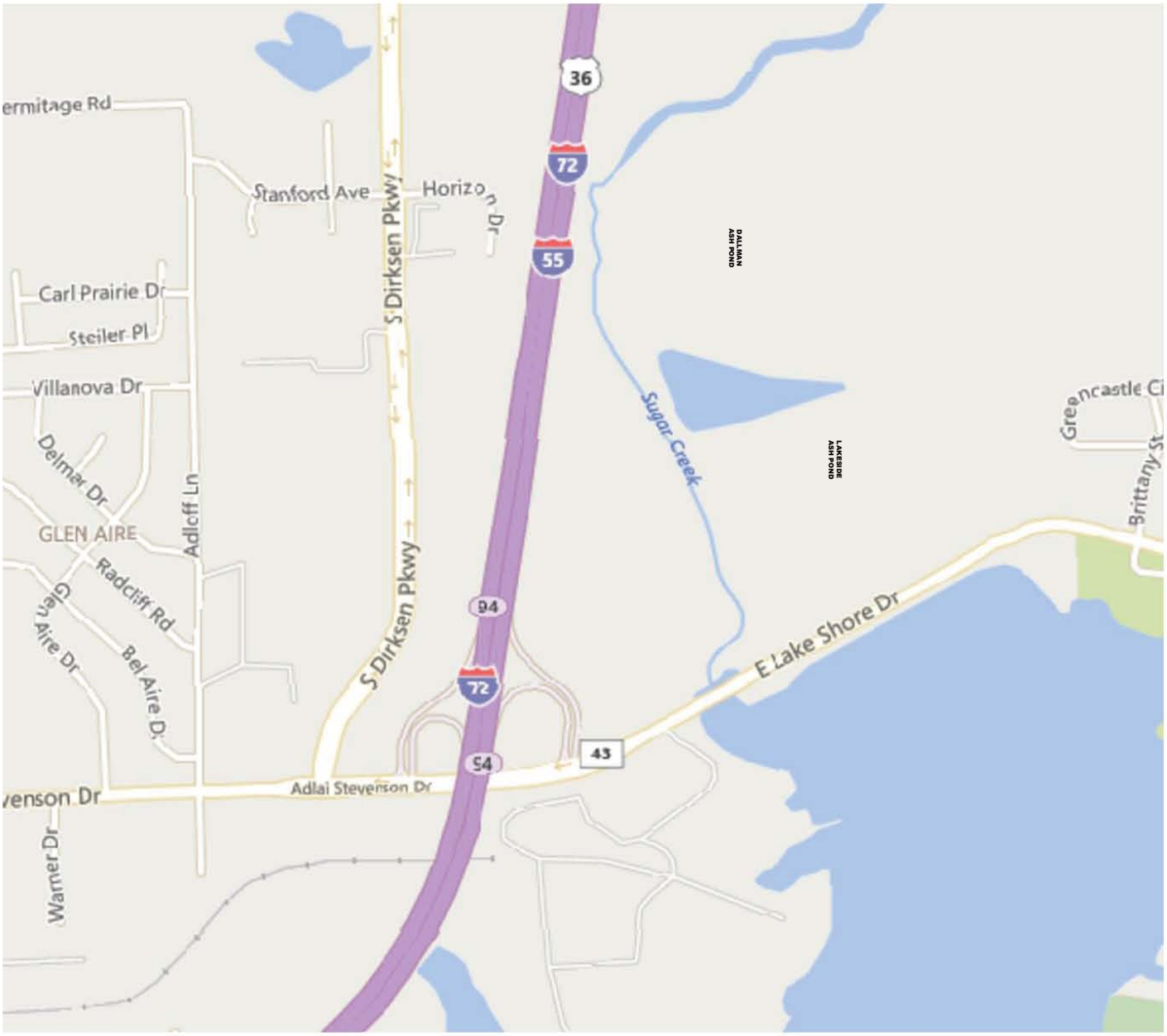
Paul M. Van Metre, P.E.

10-14-2016
Date



APPENDIX A

Figures



ILLINOIS

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Pontiac, IL ● Naperville, IL ● Indianapolis, IN ● Warrenton, MO
Professional Design Engineering and Land Surveying Firm #184-001541

J:\S\Springfield CWLP\CWLP\dwg\SURFACE IMPOUNDMENTS.dwg Tab: FIGURE 2 Last Saved: October 13, 2016, by Ryan Curtis Plotted: Thursday, October 13, 2016 10:08:03 AM



FIG. 2

SHEET NUMBER:

PROJECT ID: 150077/0011

DATE: OCTOBER 2016

CWLP COAL COMBUSTION RESIDUALS SURFACE IMPOUNDMENTS

PLANS PREPARED FOR

CITY, WATER, LIGHT & POWER

SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

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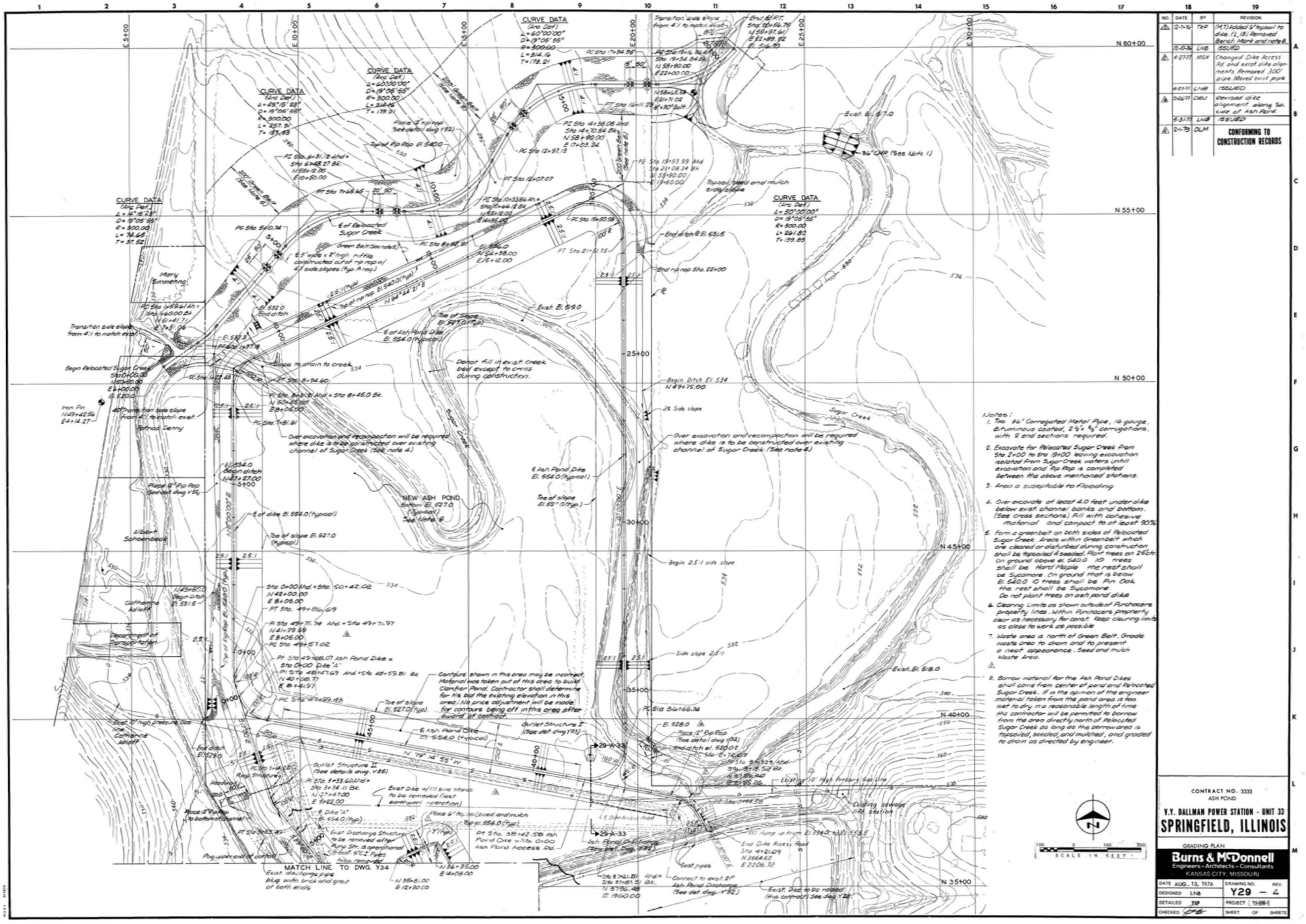
APPROVED BY: PMV | DESIGNED BY: PMV | DRAWN BY: MPN

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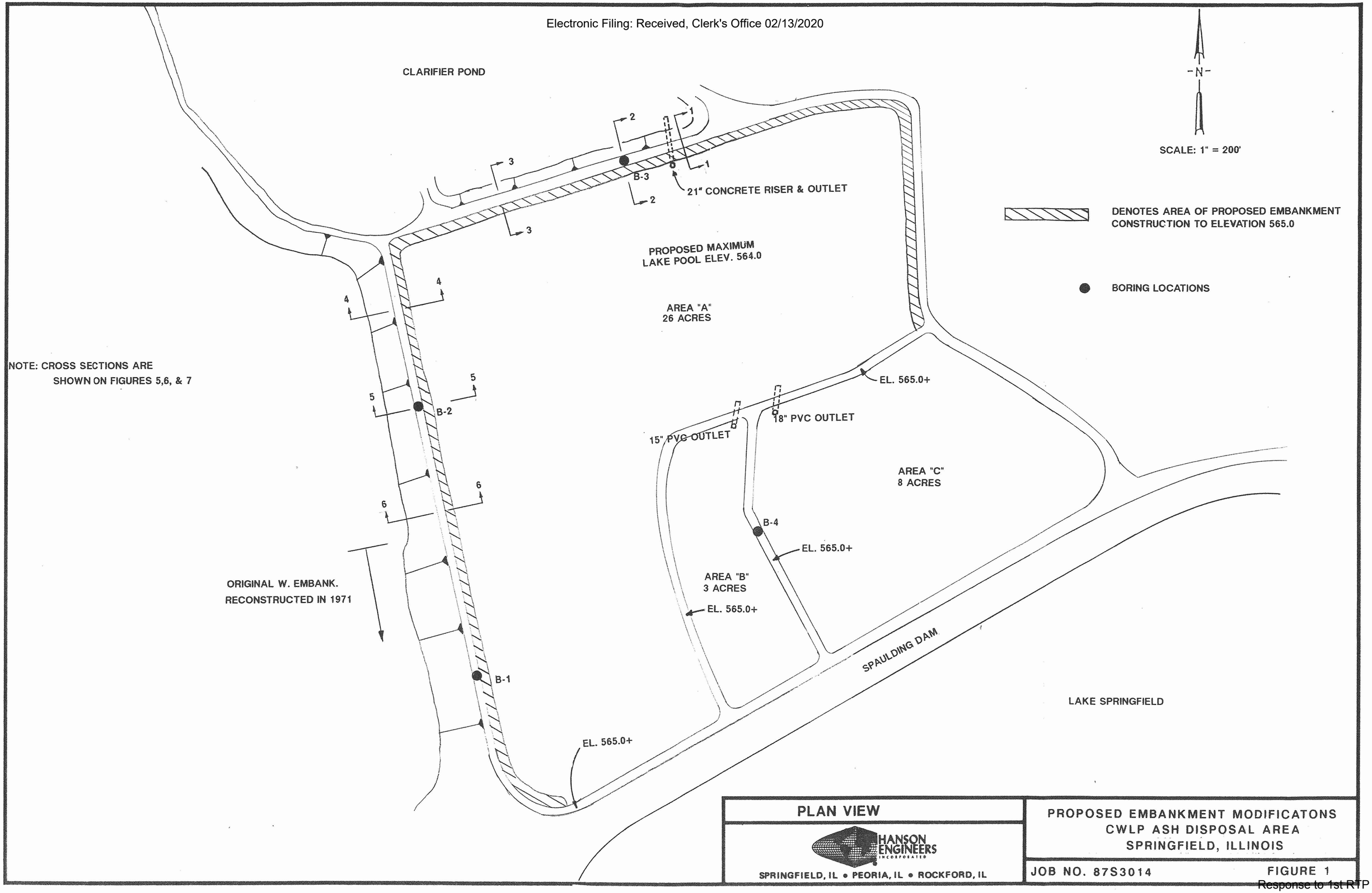
NO.	DATE	DESCRIPTION	BY

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Response to 1st RTP


Notes:
1. Two 84" Corrugated Metal Pipe, 16 gauge, Bituminous coated, 2 2/3" x 1/2" corrugations, with 2 end sections required.
2. Excavate for Relocated Sugar Creek from Sta 2+00 to Sta 19+00 leaving excavation isolated from Sugar Creek waters until excavation and Rip Rap is completed between the above mentioned stations.
3. Area is susceptible to Flooding
4. Over excavate at least 4.0 feet under dike below exist. channel banks and bottom. (See cross sections.) Fill with cohesive material and compact to at least 90%
5. Form a greenbelt on both sides of Relocated Sugar Creek. Areas within Greenbelt which are cleared or disturbed during construction shall be topsoiled & seeded. Plant trees on 25ft. On ground above el. 540.0 10 trees shall be Hard Maple the rest shall be Sycamore. On ground that is below El 540.0 10 trees shall be Pin Oak, the rest shall be Sycamore. Do not plant trees on ash pond dike
6. Clearing Limits as shown outside of Purchasers property lines. Within Purchasers property clear as necessary for const. Keep clearing limits as close to work as possible
7. Waste area is north of Green Belt. Grade waste area to drain and to present a neat appearance. Seed and mulch Waste Area.
9. Borrow material for the Ash Pond Dikes shall come from center of pond and Relocated Sugar Creek. If in the opinion of the engineer material taken from the pond area is too wet to dry in a reasonable length of time the contractor will be permitted to borrow from the area directly north of Relocated Sugar Creek as long as the borrow area is topsoiled, seeded, and mulched, and graded to drain as directed by engineer.
CONTRACT NO.. 3333
ASH POND
V.Y. DALLMAN POWER STATION - UNIT 33
SPRINGFIELD, ILLINOIS
GRADING PLAN
Burns & McDonnell
Engineers – Architects – Consultants
KANSAS CITY, MISSOURI
DATE AUG. 13, 1976
DESIGNED LNB
DETAILED TRP
CHECKED
DRAWING NO. Y29 – 4
PROJECT 73-009-1
SHEET OF SHEETS
NO. DATE BY REVISION
1 2-1-76 TRP (MT) Added 6" topsoil to dike. (L, (B) Removed Bench Mark and note 8. ISSUED
2 2-10-76 LNB
3 4-27-77 MGH Changed Dike Access Rd. and exist. dike alignments. Removed 300' pipe. Moved exist. pipe.
4-27-77 LNB ISSUED
4 5-26-77 DBJ Revised dike alignment along So. side of Ash Pond.
5-31-77 LNB ISSUED
5 2-1-79 DLM CONFORMING TO CONSTRUCTION RECORDS

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PLAN VIEW

HANSON ENGINEERS INCORPORATED

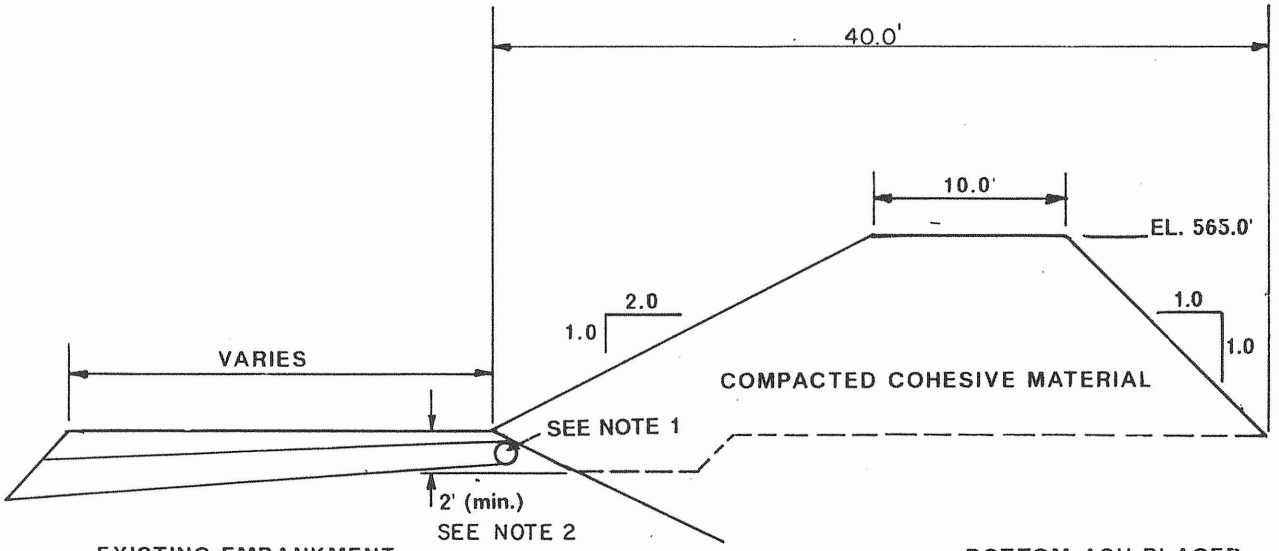
SPRINGFIELD, IL • PEORIA, IL • ROCKFORD, IL

PROPOSED EMBANKMENT MODIFICATONS
CWLP ASH DISPOSAL AREA
SPRINGFIELD, ILLINOIS

JOB NO. 87S3014

FIGURE 1

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CWLP - 009394



TYPICAL SECTION

NOTE: 1 - FILTER FABRIC WRAPPED PERFORATED CORRUGATED DRAINAGE PIPE WITH NON-PERFORATED OUTLETS INTO CLARIFIER POND. PIPE IS SURROUNDED WITH BED OF BOTTOM ASH

NOTE: 2 - COMPACTED COHESIVE MATERIAL "KEYED" INTO STABLE WORKING SURFACE A MINIMUM DEPTH OF 2 ft. FOR SEEPAGE CONTROL

EMBANKMENT CONFIGURATION

HANSON ENGINEERS INCORPORATED

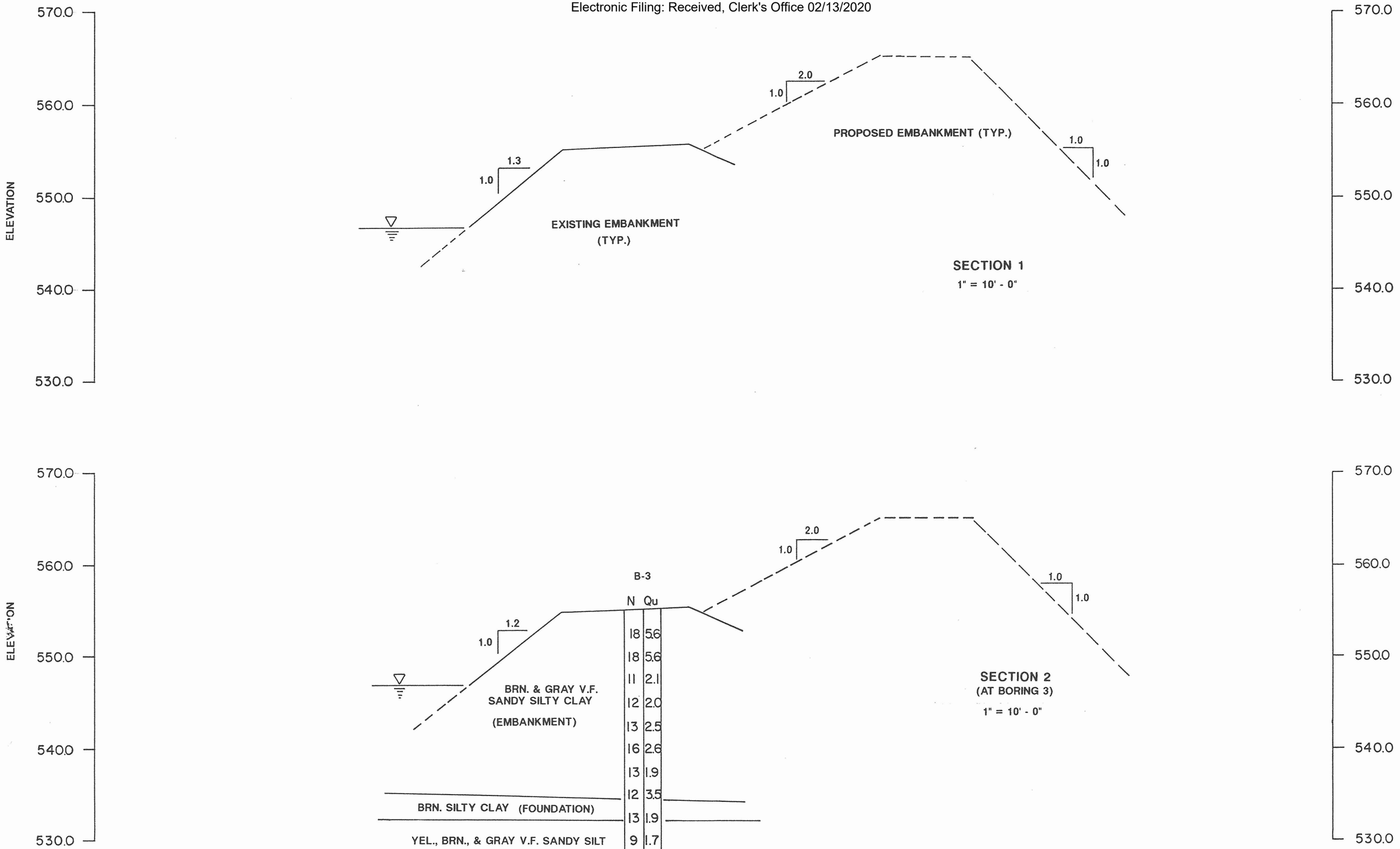
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PROPOSED EMBANKMENT MODIFICATONS
CWLP ASH DISPOSAL AREA
SPRINGFIELD, ILLINOIS

JOB NO. 87S3014

FIGURE 2

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CROSS SECTIONS

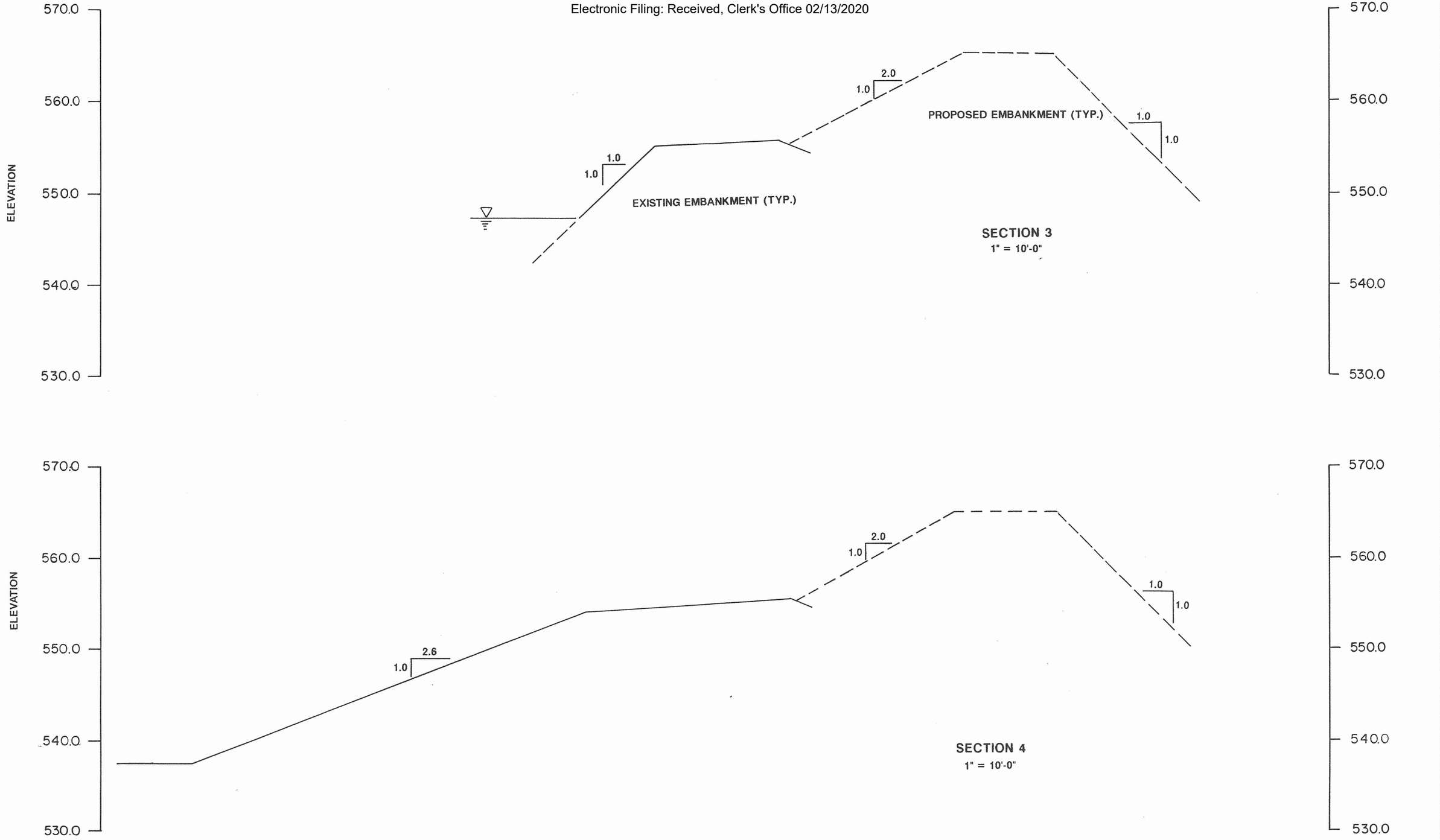
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PROPOSED EMBANKMENT MODIFICATONS
CWLP ASH DISPOSAL AREA
SPRINGFIELD, ILLINOIS

JOB NO. 87S3014 FIGURE 5

Response to 1st RTP
CWLP - 009396



CROSS SECTIONS

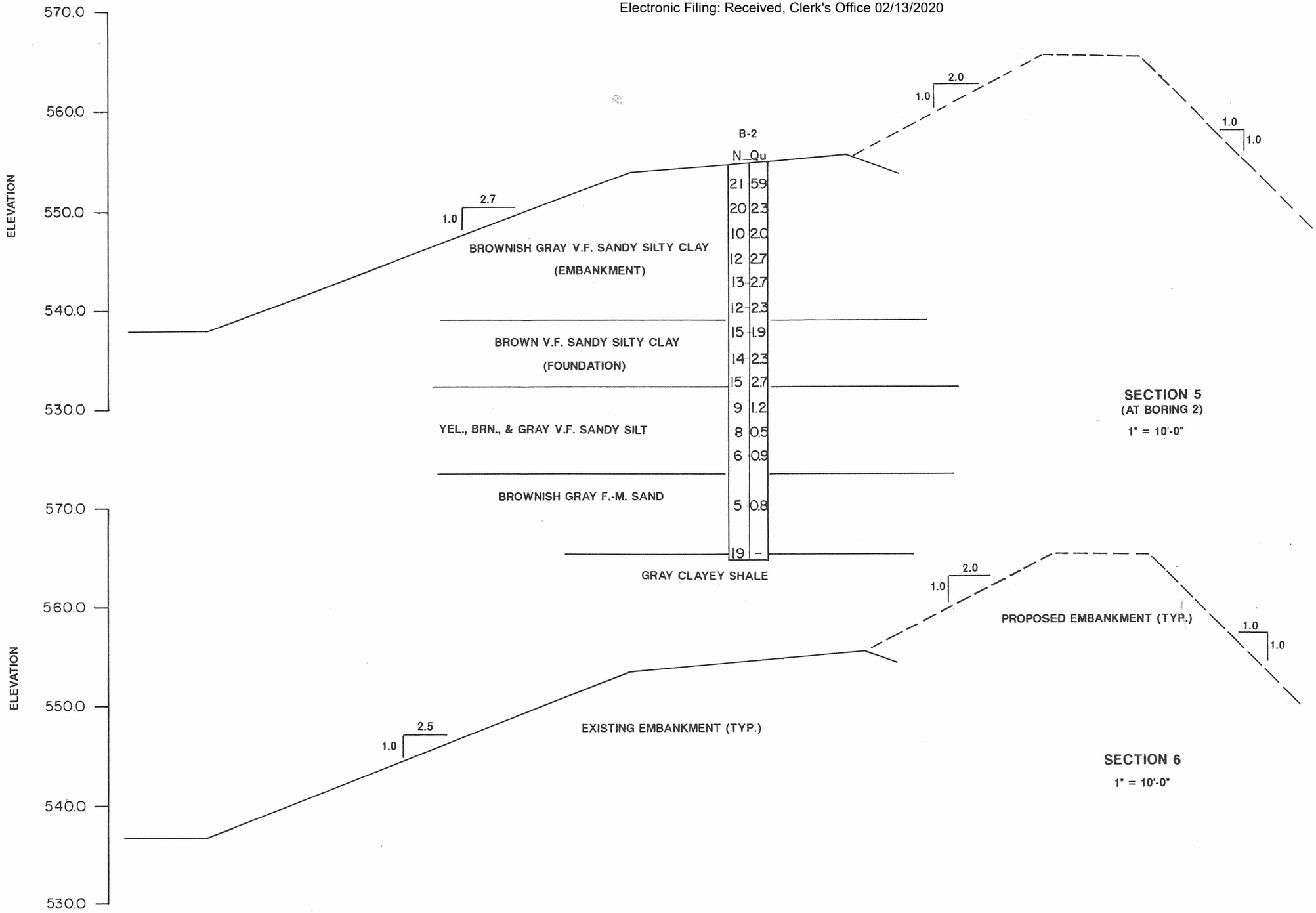
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PROPOSED EMBANKMENT MODIFICATONS
CWLP ASH DISPOSAL AREA
SPRINGFIELD, ILLINOIS

JOB NO. 87S3014 FIGURE 6

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CROSS SECTIONS

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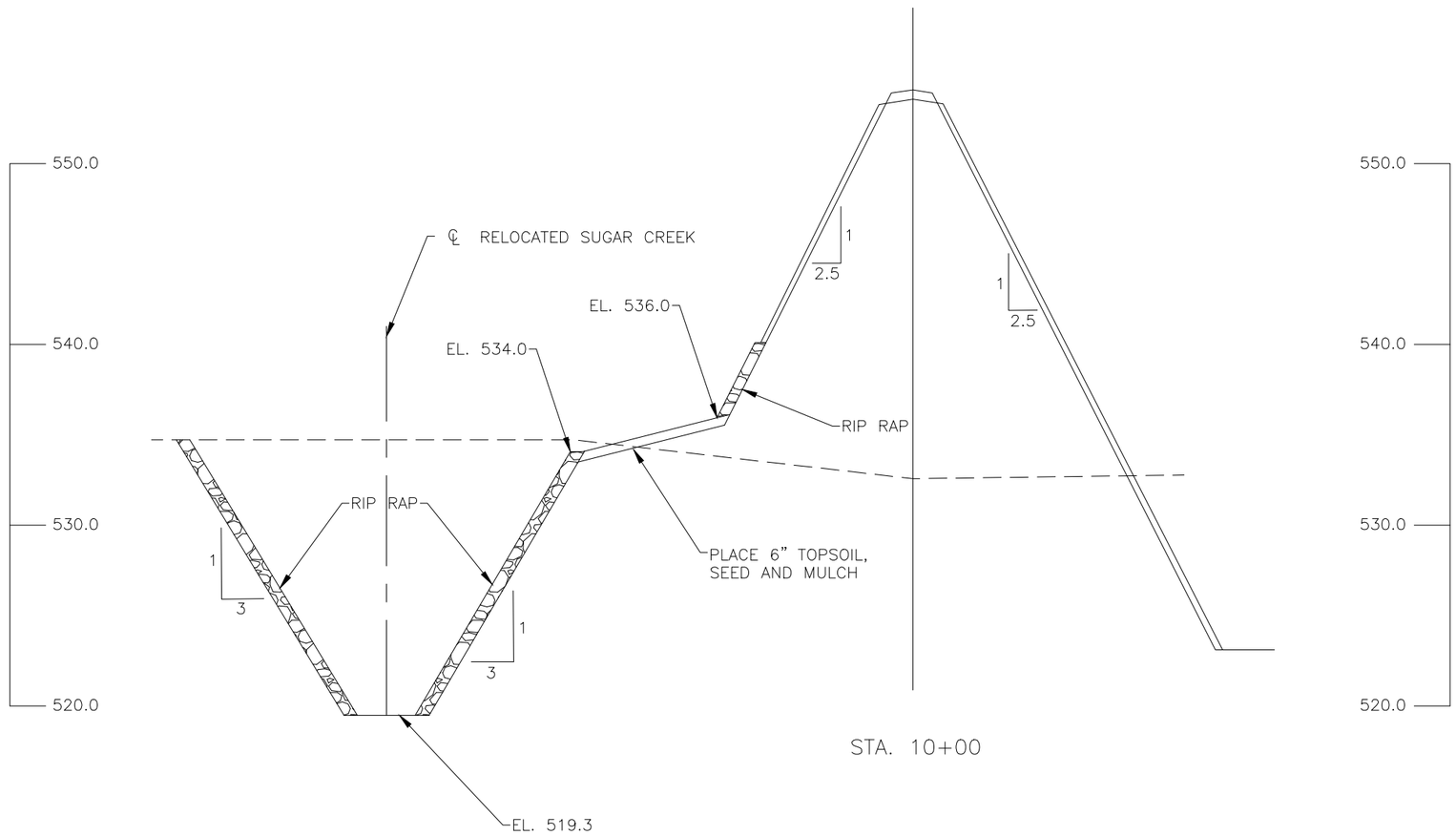
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PROPOSED EMBANKMENT MODIFICATONS
CWLP ASH DISPOSAL AREA
SPRINGFIELD, ILLINOIS

JOB NO. 87S3014 FIGURE 7

Response to 1st RTP
CWLP - 009398

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STA. 10+00

HORIZ. 0 20 40 80
VERT. 0 4 8 16
SCALE: IN FEET

NOTES:
CROSS-SECTION BASED ON CONSTRUCTION PLAN DRAWINGS
PREPARED BY BURNS & McDONNEL IN AUGUST 1976

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PROFESSIONAL DESIGN ENGINEERING AND LAND SURVEYING FIRM #184001541

DESIGNED BY: PMV | DRAWN BY: RMC | APPROVED BY: PMV

DALLMAN ASH POND CROSS-SECTION AT STA. 10+00

PLANS PREPARED FOR
CITY, WATER, LIGHT & POWER
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: OCTOBER 2016

PROJECT ID: 150077/0011

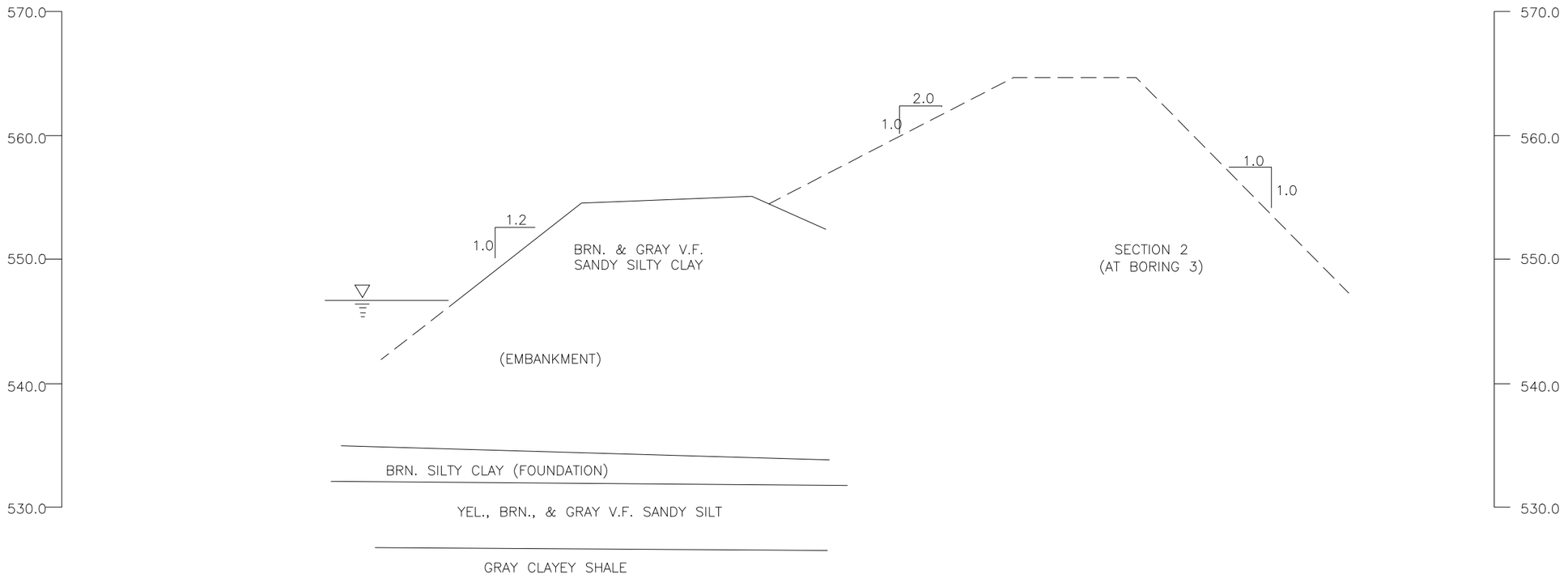
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NOTES:
CROSS-SECTION BASED ON CONSTRUCTION PLAN DRAWINGS INCLUDED IN ENGINEERING REPORT PROPOSED EMBANKMENT MODIFICATIONS, HANSON ENGINEERS, INC., JULY 1987

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LAKESIDE ASH POND CROSS-SECTION 2

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DATE: OCTOBER 2016

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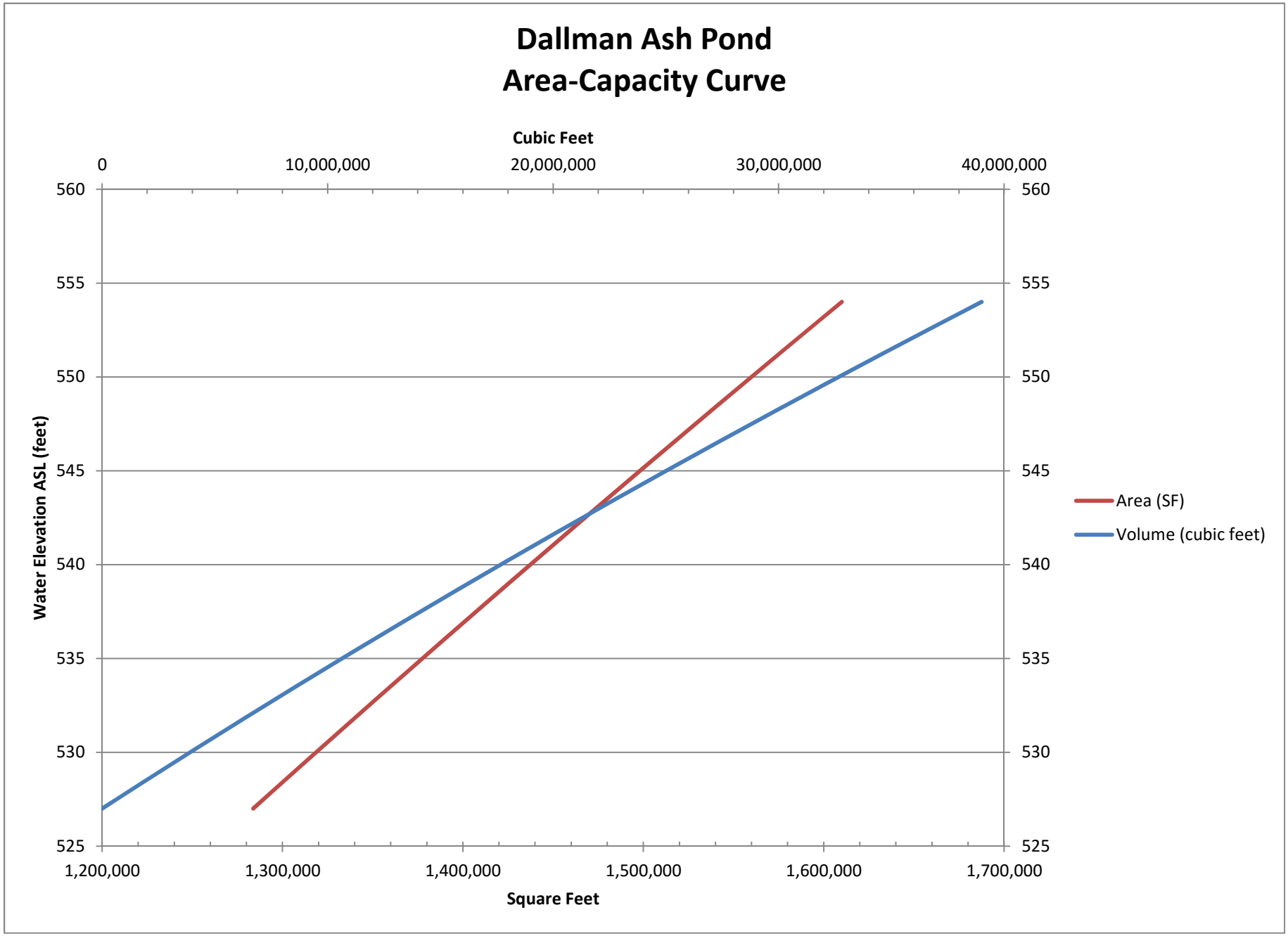
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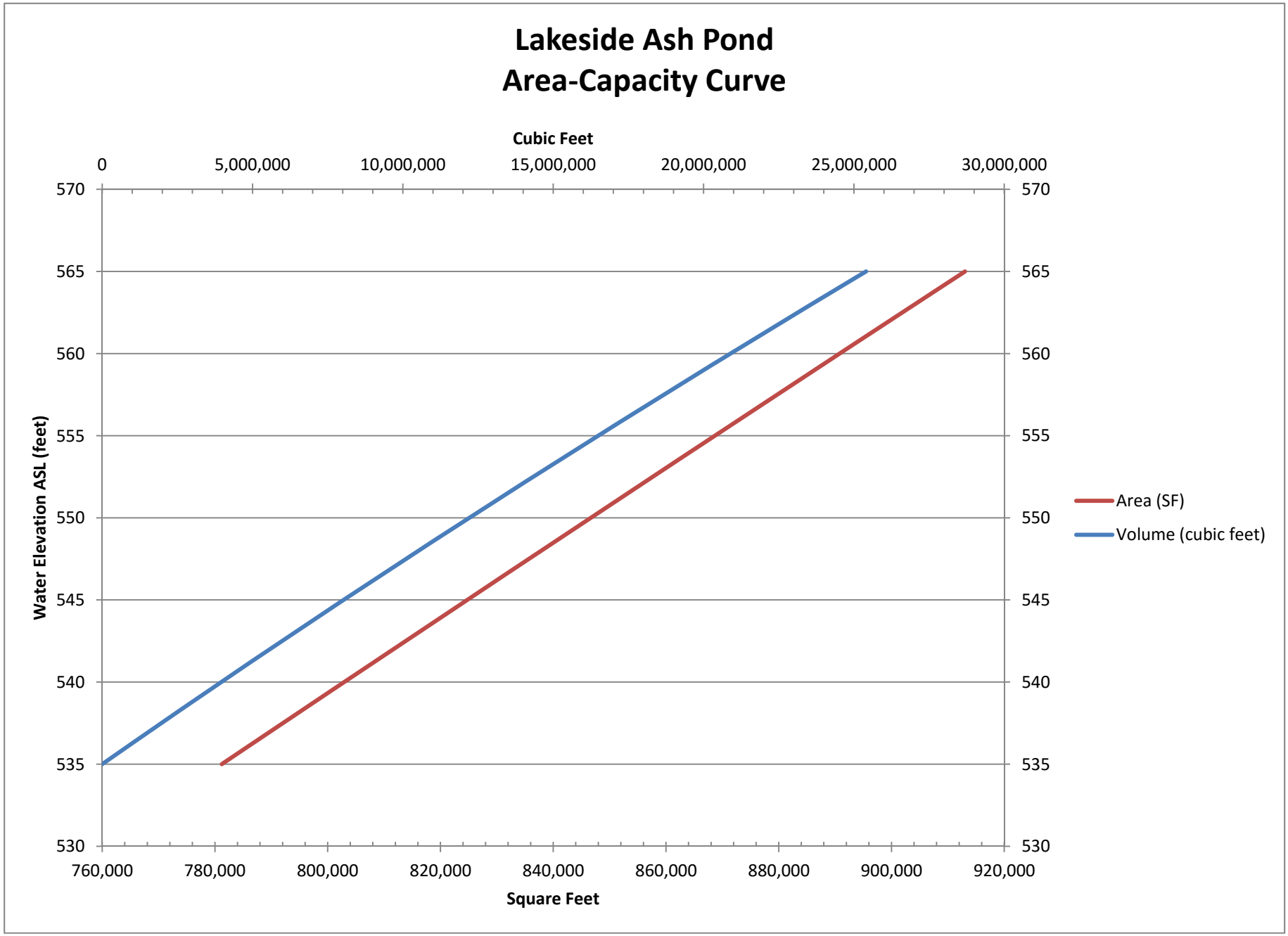
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APPENDIX B

Area-Capacity Curves



Response to 1st RTP
CWLP - 009402


Lakeside Ash Pond
Area-Capacity Curve
Cubic Feet
0
5,000,000
10,000,000
15,000,000
20,000,000
25,000,000
30,000,000
Water Elevation ASL (feet)
570
565
560
555
550
545
540
535
530
760,000
780,000
800,000
820,000
840,000
860,000
880,000
900,000
920,000
Square Feet
Area (SF)
Volume (cubic feet)

16.15

16.15	10/17/2017 - CCR Surface Impoundments Groundwater Statistical Method Certification	CCR Surface Impoundments Groundwater Monitoring Program	CWLP	12911	12983

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City Water, Light & Power
Coal Combustion Residuals Surface Impoundments

Groundwater Monitoring Program

Prepared for:
City Water, Light & Power
201 E. Lake Shore Drive
Springfield, Illinois

Prepared by:

ANDREWS ENGINEERING INC
3300 Ginger Creek Drive
Springfield, IL 62711
Tel: (217) 787-2334
Fax: (217) 787-9495

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TABLES

Table 1: Well Construction Summary

FIGURES

Figure 1: Site Location
Figure 2: Site Features
Figure 3: Groundwater Monitoring System

APPENDICES

Appendix A – Potentiometric Surface Maps
Appendix B – Well Construction Details
Appendix C – Statistical Method for Determination of Backgrounds
Appendix D – Background Concentrations and Calculations

1. INTRODUCTION

City Water, Light and Power (CWLP) owns and operates two (2) existing coal combustion residual (CCR) surface impoundments and intends to comply with the rules promulgated by the U.S. Environmental Protection Agency (EPA) pertaining to Disposal of CCR from Electric Utilities published in 40 CFR Part 257 on April 17, 2015 in Federal Register, Volume 80, No. 74; and with the Technical Amendments published on July 2, 2015 in Federal Register, Volume 80, No. 127.

The CWLP CCR surface impoundments are located north and east of the former Lakeside Power Generating Station and Dallman Power Generating Station in the Eastern ½ of Section 12, Township 15 North, Range 5 West, in Springfield, Illinois (see Figure 1). These CCR surface impoundments are identified as the Lakeside Ash Pond and the Dallman Ash Pond (see Figure 2).

The former Lakeside Power Generating Station and Dallman Power Generating Station are situated on the northwestern bank of Lake Springfield in Springfield, Illinois. The Lakeside Ash Pond is immediately south of Spaulding Dam at the northern end of Lake Springfield. The Dallman Ash Pond is immediately northwest of the Lakeside Ash Pond.

Placed into service prior to 1958, the Lakeside Ash Pond is primarily a diked embankment. The Lakeside Ash Pond consists of four separate ponds (i.e., three lime softening ponds and a settling pond) totaling approximately 35.0 acres. The Lakeside Ash Pond ceased receiving ash in 2009.

The Dallman Ash Pond was placed into service in approximately 1976 and is also a diked embankment. The Dallman Ash Pond is approximately 34.5 acres. Fly ash and bottom ash are sluiced to the Dallman Ash Pond with raw lake water.

This Groundwater Monitoring Program (GMP) was prepared to meet the groundwater monitoring and corrective action requirements of the Federal CCR Rule Part 257.90-98. The federal rules are specifically addressed in Section 3 and referenced throughout this document.

1.1 REGULATIONS

The two (2) CCR surface impoundments are regulated by Federal CCR Rule 40 CFR Part 257 Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities (EPA, 2015). As indicated above, the groundwater monitoring and corrective action requirements of the Federal CCR Rule Part 257.90-98 apply to both impoundments.

1.2 SITE DEVELOPMENT

The Lakeside Ash Pond was placed into service prior to 1958 and ceased receiving ash in 2009. The Dallman Ash Pond was placed into service in approximately 1976 and continues to receive ash. The most recent change made to the CCR surface impoundments was a vertical expansion to the Lakeside Ash Pond system in 1988. The vertical expansion consists of berms built on top and inside of the existing embankments in such a way that the toe of the outer slope of the expansion berms matches up with the top of the inner slope of the existing embankments. The vertical expansion berms are approximately ten feet in height.

2. SUBSURFACE CONDITIONS AT THE CCR SURFACE IMPOUNDMENTS

The subsurface conditions of the area in and surrounding the CCR surface impoundments have been characterized through multiple subsurface investigations, including those prior to the impoundment development, along the perimeter of the impoundments and including the hydrogeologic investigation at the permitted Subtitle D CCR landfill located north of the Lakeside Ash Pond and east of the Dallman Ash Pond. These investigations were as follows:

- Professional Service Industries (PSI), June 1989. This investigation consisted of five soil borings within the east section of the south cell (Cell 1).
- Andrews Environmental Engineering, Inc. (AEEI), February 1990. This investigation was performed for Cell 2 and consisted of 13 soil borings. The drilling and testing were completed by PSI.
- Andrews Environmental Engineering, Inc. (AEEI), March 1990. This investigation was performed to install six wells at the Facility. The drilling and testing were completed by PSI.
- Patrick Engineering, Inc. (PEI), July 1992. This investigation was performed to further characterize the hydrogeology of the landfill setting. Approximately 44 soil borings and piezometers were installed by PEI.
- Stabilize, Inc. (SI), December 2008. This investigation installed three new monitoring wells as part of an assessment program for the landfill. The drilling, soil testing, and well construction were performed by Reynolds Well Drilling.
- City Water, Light and Power (CWLP), April 2010. This investigation was performed to install four piezometers on the west side of the CCR surface impoundments along Sugar Creek. The drilling and testing were completed by PSI.
- Stabilize, Inc. (SI), May 2011. This investigation installed four new monitoring wells to further the characterization of the CCR surface impoundments. The drilling, soil testing, and well construction were performed by PSI.
- Andrews Engineering, Inc. (AEI), January 2012. This investigation was performed to replace CCR surface impoundment wells and install an additional background well. The drilling and well installation were completed by TerraDrill.
- Andrews Engineering, Inc. (AEI), July 2017. This project included drilling peripheral to the Dallman Ash Pond.

The summary discussion below of the subsurface conditions is presented in context of the 2015 Federal CCR Rule requirements for groundwater monitoring systems. Emphasis is placed on characterizing the existing wells and hydrogeologic conditions of the uppermost aquifer and underlying confining aquitard. The uppermost aquifer is the required unit for groundwater quality monitoring under the Federal CCR rule.

The occurrence of the deposits discussed below is highly variable due to the meandering nature of Sugar Creek prior to the development of Lake Springfield and Spaulding Dam. The meandering creek has resulted in sequential erosion and deposition (scour and fill) throughout much of the creek drainage system, both laterally and vertically.

2.1 SURFICIAL DEPOSITS

The shallow stratigraphy and lithology at the CCR surface impoundments include approximately 20 to 50 feet of Pleistocene sediments, dependent upon location. In ascending order these materials are identified as basal sand, lower cohesive deposit, shallow sand, upper cohesive deposit and fill material.

The overall tendency is for the finer-grained materials (clays, silty clays and silts) to overlie the coarser-grained materials (sands and gravels). This coarsening downward is present throughout much of the site. At the majority of the borehole locations, the coarser materials rest directly on top of the weathered bedrock surface. It is this coarser material, the basal sand, which is characterized as the uppermost aquifer.

Basal Sand

In most locations, the basal sand is the lower-most surficial deposit. The basal sand is a gray colored, poorly graded, silty to clayey fine sand to well graded sand with minor amounts of fine gravel. This unit was encountered in a medium dense to dense condition. The top elevation of the basal sand varies from 491 to 513 feet mean sea level (MSL) and the thickness ranges from about 0 to 12.3 feet. The unit was not encountered consistently, likely due to excessive erosion of the creek bottom.

The basal sand generally overlies the bedrock surface and underlies the lower cohesive deposit. There are some pockets of very hard, fine grained silty clay to clay overlying bedrock in a few areas. The basal sand is present above these pockets of clayey deposits, thought to be weathered bedrock.

The basal sand generally consists of 0% to 34% gravel, 50% to 91% sand, and 6% to 44% silt/clay; and exhibits a mean field hydraulic conductivity of 1.73×10^{-2} cm/sec. The basal sand was saturated in all locations where it was encountered.

Lower Cohesive Deposit

The lower cohesive deposit consists of brown, gray, and brownish gray silty clays, clayey silts, and clays, having very soft to stiff consistency. The lower cohesive deposit ranges in thickness from 0 to 22 feet with an average thickness of about 15 feet. The deposit was not encountered in isolated areas along the abandoned creek, possibly due to excessive erosion of creek bottom in these areas.

The lower cohesive deposit is generally overlain by the shallow sand and underlain by the basal sand. However, within the abandoned creek area, the lower cohesive deposit was encountered directly below the creek fill. In some areas the basal sand is not present and the lower cohesive deposit directly overlies the bedrock.

The soils in the lower cohesive deposit can be similar in color and texture to the soils in the upper cohesive deposit. The distinction between the two deposits was based on the presence or changes in soil consistency (as measured with a calibrated hand held penetrometer) and a marked difference in moisture content. The lower cohesive deposit is not exposed at the ground surface in the investigated area.

The lower cohesive deposit consists of 0% gravel, 8% to 48% sand, and 52% to 95% silt/clay; and has a relatively low hydraulic conductivity. The vertical hydraulic conductivity ranges from

1.3 x 10^{-8} to 1.8 x 10^{-6} cm/sec (triaxial permeameter). The horizontal hydraulic conductivity ranges from 4.6 x 10^{-5} to 7.6 x 10^{-5} cm/sec (field slug tests).

Shallow Sand

The shallow sand overlies the lower cohesive deposit and underlies the upper cohesive deposit. The unit consists of a brown to gray silty to clayey fine sand. It contains small lenses of silty clay and clayey silt. This unit is not continuous over the entire site. Its thickness ranges from one to three feet over most of the investigated area.

Laboratory tests performed on representative samples collected from the shallow sand unit during this and previous investigations indicate the shallow sand contains 0% gravel, 50% to 52% sand, and 48% to 50% silt/clay. Two landfill piezometers were screened in the shallow sand unit to obtain potentiometric surface information and conduct field hydraulic conductivity tests. The hydraulic conductivity of this unit based on the slug test results ranges from 3.6 x 10^{-3} to 2.9 x 10^{-2} cm/sec.

Upper Cohesive Deposit

The upper cohesive deposit has a relatively low hydraulic conductivity in the vertical direction as determined by laboratory triaxial hydraulic conductivity tests from borings taken from the landfill investigation. The hydraulic conductivity values determined from the laboratory tests ranged from 1.6 x 10^{-5} cm/sec to 5.2 x 10^{-7} cm/sec. However, the upper cohesive deposit is an alluvial deposit and it is expected that the horizontal coefficient of hydraulic conductivity will be greater than the vertical coefficient. Based on test results for the lower cohesive deposit, it is anticipated that the horizontal hydraulic conductivity for the upper cohesive deposit is in the range of 10^{-6} to 10^{-5} cm/sec.

Creek Fill Material

The· borings made along the abandoned creek locations indicate that the creek fill materials consist of variable soils ranging from silty clays to silty sands. Cohesive soils characterized as silty clays to organic silty clay were typically encountered. In some areas, the cohesive fill materials extended down to the top of bedrock. The granular fill materials are typically poorly graded silty to clayey sands and contain organics or wood fragments. In some areas, the granular fill materials also extended down to the top of bedrock.

The cohesive fill material contains 0% gravel, 2% to 48% sand, and 52% to 98% silt/clay. The vertical hydraulic conductivity ranges from 7.6 x 10^{-8} cm/sec to.2.1x10^{-5} cm/sec. The granular fill materials contain 0 to 2% gravel, 55% to 65% sand and 33% to 45% silt/clay. Based on one laboratory hydraulic conductivity test performed on a Shelby tube sample obtained from berm fill, the hydraulic conductivity of the granular fill material is 3.3 x 10^{-8} cm/sec.

The creek fill materials identified during the previous landfill investigations have a significant effect on the site hydrogeologic conditions. In some areas the till materials, consisting of either granular soils or organic silty clays, extend from existing grade to the bedrock surface and locally interconnect all three water bearing units. The upper and lower cohesive deposits are considered to act as aquitards (where present) which restrict vertical flow into the water bearing units. For all practical purposes, the bedrock is considered to be an aquiclude.

Fill materials encountered in the landfill borings range from silty clays and organic silty clays to silty sands and clayey sands. These water level measurements indicate that groundwater

movement within the creek fill materials is complicated because of the highly variable hydraulic characteristics of the fill materials and their random placement. In some areas, there appears to be direct hydraulic communication between fill materials, shallow sand, and basal sand.

Four landfill piezometers are screened into the fill materials. Of these, one piezometer was installed into cohesive fill material and the other piezometers were installed in granular till materials. Hydraulic conductivity of the granular fill materials is based on one field test resulting in a value of 6.1×10^{-2} cm/sec. The hydraulic conductivity of the cohesive fill material ranged from 7.1×10^{-5} cm/sec to 1.1×10^{-4} cm/sec. These values represent the hydraulic conductivity in the horizontal direction.

Laboratory hydraulic conductivity test performed on landfill cohesive fill materials ranged from 2.1×10^{-3} cm/sec to 3.3×10^{-8} cm/sec. The higher hydraulic conductivity values are believed to be typical of soils which contain organic matter (e.g. wood fragments). The hydraulic conductivity values based on laboratory tests are generally considered to be representative of the coefficient of hydraulic conductivity in the vertical direction because of the sample configuration during testing. However, because of the randomness of the fill, it is more likely that the hydraulic conductivity is within the range of 10^{-5} to 10^{-4} cm/sec.

2.2 UPPERMOST BEDROCK

The bedrock at the project site consists of Pennsylvanian shales which are gray in color. The bedrock surface elevation varies from approximately 492 feet MSL near the center of the existing landfill, to approximately 554 feet MSL located on a bedrock outcrop near the landfill area (southeast corner of Cell 1). In general, the bedrock surface slopes from the east and west towards the center of the landfill area.

Rock Quality Designation (RQD) measurements were performed on all core samples taken from the landfill area. RQDs measured from core samples collected during this investigation ranges from 80% to 100%. The RQD values indicate that the bedrock is not highly fractured. Two in situ hydraulic conductivity tests were performed to determine the hydraulic conductivity of the upper portions of the bedrock. Test results indicate hydraulic conductivity values of 1.8×10^{-7} cm/sec and 1.3×10^{-6} cm/sec. This shows that the bedrock encountered at the project site is relatively impermeable. There is good correlation between the lithology of the rocks tested and the hydraulic conductivity values obtained. The upper bedrock beneath the impoundments is expected to exhibit the same characteristics as encountered at the landfill.

2.3 HYDROGEOLOGIC UNITS

The uppermost aquifer and underlying confining unit control groundwater movement and the potential for CCR impacted groundwater migration at the site. A description of the uppermost aquifer and the underlying confining unit follows:

<u>Uppermost Aquifer</u>

The uppermost aquifer is characterized as the basal sand overlying the shale bedrock. In some locations the creek fill materials, ranging from silty clays and organic silty clays to silty sands and clayey sands, were found to be in direct hydraulic communication with the basal sand that directly overlies the bedrock surface. Due to the highly variable hydraulic characteristics and random placement of the creek fill materials, further characterization is difficult.

As indicated above, the hydraulic conductivity of the basal sand ranges from 5.6 x 10^{-4} to 3.6 x 10^{-2} cm/sec. The groundwater in the basal sand appears to be under confined, semi-confined, or unconfined conditions dependent upon location. The upper limit of the uppermost aquifer is dependent upon the seasonally fluctuating groundwater table. The potentiometric surface of the basal sand varies from 565 feet MSL at upgradient locations, south of the Lakeside Ash Pond, to 525 feet MSL at downgradient locations near Sugar Creek, north of the Dallman Ash Pond. As a result, the saturated thickness is variably dependent upon the location and the seasonal variation in the groundwater table.

Lower Confining Unit

The uppermost bedrock at the project site is primarily Pennsylvanian age shale with isolated thin coal layers. The Pennsylvanian shale functions as a lower confining unit due to its low permeability and effective porosity. The lower confining unit represents a natural hydrogeologic barrier (i.e., aquitard) to the vertical movement of groundwater.

In situ hydraulic conductivity test (slug tests) indicate that the hydraulic conductivity for the upper portions of the bedrock range from 1.8 x 10^{-7} to 1.3 x 10^{-6} cm/sec. There appears to be good correlation between the rock lithology and the measured values of hydraulic conductivity. The bedrock over most of the site will act as an aquiclude and prevent the downward movement of groundwater.

2.4 GROUNDWATER MOVEMENT

Groundwater movement is controlled by recharge along topographic highs and discharge along the original stream valley. The pre-surface impoundment flow direction in the uppermost aquifer was dominantly horizontal from the adjacent banks toward the natural convergence along Sugar Creek, which formerly drained the site. This was overall from south to north with local deviations. This dominant flow pattern persists under present day conditions but with localized variation introduced by the hydrologic discontinuity created upon construction of the CCR surface impoundments.

Existing wells at the site, including wells from the Flue Gas Desulfurization Systems (FGDS) Landfill, were used to derive potentiometric surface maps for 2016 and 2017. As shown, overall groundwater movement is from south to north (see Appendix A). The east perimeter of the Lakeside Pond is largely upgradient, and the west side is largely sidegradient where groundwater movement is parallel to the perimeter. Excavated areas within the landfill boundary act as a groundwater sink along the east side of the Dallman Ash Pond. Groundwater generally moves northward from the Dallman Ash Pond but also moves easterly towards the FGDS Landfill and westerly towards Sugar Creek.

3. GROUNDWATER MONITORING AND CORRECTIVE ACTION – 40 CFR §257.90 THROUGH §257.98

The following sections specifically address the sub rules pertaining to Groundwater Monitoring and Corrective Action under sections Applicability (§257.90), Groundwater Monitoring Systems (§257.91), Groundwater Sampling and Analysis Requirements (§257.93), Detection Monitoring Program (§257.94), Assessment Monitoring Program (§257.95), Assessment of Corrective Measures (§257.96), Selection of Remedy (§257.97), and Implementation of the Corrective Action Program (§257.98).

3.1 APPLICABILITY – §257.90

Owners of existing CCR surface impoundments are required to install groundwater monitoring systems, develop a sampling and analysis program to include statistical procedures to be used for evaluating monitoring data, and initiate detection monitoring and evaluation of data for "statistically significant increases (SSI)" over background levels for selected constituents. If detected constituents are measured at a "statistically significant level (SSL)" over the established background level, the facility must conduct assessment monitoring, and if necessary, initiate corrective action responses to control the release.

The facility must make available an annual groundwater monitoring and corrective action report, the first of which is due no later than January 31, 2018. The report must document the status the groundwater monitoring and corrective action program, summarize actions completed, describe problems encountered, and identify activities for the upcoming year. The content of the report is prescribed in §257.90(e). The report must be placed in the facility's operating record and comply with the recordkeeping requirements in §257.105(h), notification requirements in §257.106(h), and internet requirements in §257.107(h).

3.2 GROUNDWATER MONITORING SYSTEM – §257.91

The rule for Groundwater Monitoring Systems (GMS) is a performance standard (§257.91(a)), where the system must consist of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that: (1) accurately represent the quality of background groundwater that has not been affected by leakage from a CCR unit, and (2) accurately represent the quality of groundwater passing the impoundment boundary of the CCR unit to monitor potential contaminant pathways in the uppermost aquifer.

Under §257.91(b-c) the number, spacing, and depths of the groundwater monitoring wells have been determined based upon site-specific technical information to meet the rule's performance standard, including the subsurface conditions observed at the site as summarized in Section 2 of this document. This includes a characterization of the uppermost aquifer.

The monitoring well locations take into consideration the natural (pre-surface impoundment) and current convergence of groundwater flow paths. The wells are located as close as feasible to the downgradient CCR surface impoundments based on topography, surface impoundment construction, and operations. The existing monitor well network (number of wells, locations, and screen interval) was installed pursuant to recommendations of the Illinois EPA Bureau of Water. The network consists of six monitor wells screening the silt, sand, and gravel at the bedrock interface. The direction of groundwater movement, as described above, is to the west-northwest; therefore, the northern and western boundaries of the impoundments will be downgradient, and the southern and eastern boundaries will be upgradient. The monitoring network includes two upgradient wells (wells AP-4 and AP-5) and four downgradient wells (AP-1, AP-2, AP-3, and AW-3). The well locations are depicted in Figure 2 and Figure 3. Table 1 provides a summary of well construction and the approximate screened intervals. Appendix B contains the well completion reports.

Pursuant to §257.91(e), the monitoring wells are constructed in a manner that maintains the integrity of the monitoring well and borehole. All wells were installed pursuant to the Illinois Department of Public Health Water Well Construction Code (77 IAC 920) for monitoring well construction standards. All monitoring well installations were documented in the respective reports. Well construction details are provided in Appendix B. All drilling and groundwater

monitoring well construction was completed under the direct supervision of an Illinois Licensed Professional Geologist.

Background Quality – §257.91(1)

Two (2) groundwater monitoring wells are representative of background (ambient) groundwater quality conditions of the uppermost aquifer. These wells are identified as AP-4 and AP-5. Background concentrations are chemical concentrations or parameter values that represent naturally-occurring groundwater that has not been impacted by the surface impoundment or other facility activities.

Monitoring well AP-4 is located in an upgradient position, southwest of the CCR surface impoundments and along the eastern bank of Sugar Creek, immediately north of Lake Springfield dam. The well screen elevation is approximately 494.9 to 504.9 feet MSL at the surface of the Pennsylvanian shale, screening the basal sand. This well is not upgradient of the subject CCR surface impoundments in a hydrologic sense but it is located on available CWLP property where it provides representative background groundwater quality, as allowed under §257.91(a)(1)ii.

Monitoring well AP-5 is located in an upgradient position, southeast of the CCR surface impoundments and in a topographically slightly higher position. The well screen elevation is approximately 554.44 to 563.78 feet MSL. The screened section of AP-5 is also located at the top of Pennsylvanian shale and screened across the basal sand at this location. This well monitors the upgradient groundwater quality of the uppermost aquifer at this location.

Background concentrations for AP-4 and AP-5 were developed from samples collected for eight consecutive quarters, allowing the statistical method employed to account for seasonal/temporal variability. The chemical constituents include only those parameters Contained in Appendices III and IV of Part 257 (Tables III-2 and III-3, respectively).

The background concentrations are statistically analyzed to establish site-specific upper confidence limits for each chemical or parameter. The statistical methodology utilized for derivation of the background concentrations is provided in Appendix C. The data, calculations and resulting background concentrations are provided in Appendix D.

Results from the background wells (AP-4 and AP-5) will be continually evaluated. If the groundwater quality significantly changes, it will become necessary to revise the background concentrations. In such an event, the statistical method contained in Appendix C will be utilized for such revision. Details for any revision will be placed in the facility record.

Downgradient Quality - §257.91(2)

Four (4) groundwater wells allow monitoring of the downgradient groundwater quality conditions in the uppermost aquifer. These wells are identified as AP-1, AP-2, AP-3 and AW-3. The locations and depths of these wells accurately represent the quality of groundwater passing the impoundment boundaries of the CCR units and reasonably make possible the detection of geochemical changes in the uppermost aquifer. These groundwater monitoring wells are all screened at the top of the weathered bedrock surface. Monitoring wells AP-1, AP-2, AP-3 and AW-3 are located along the toe of the CCR surface impoundments and adjacent to Sugar Creek. Further details are listed below:

Monitoring well AP-1 is screened from approximately 504.63 to 514.01 feet MSL. The screened zone consists of a sand at the surface of the Pennsylvanian shale.

Monitoring well AP-2 is screened from approximately 515.54 to 525.19 feet MSL. The screened zone consists of a clayey sand to sand at the surface of the Pennsylvanian shale.

Monitoring well AP-3 is screened from approximately 514.7 to 524.7 feet MSL. The screened zone consists of a clayey silt at the surface of the Pennsylvanian shale.

Monitoring well AW-3 is screened from approximately 496.32 to 506.32 feet MSL. The screened zone consists of a silt and silty sand at the surface of the Pennsylvanian shale.

3.3 GROUNDWATER SAMPLING AND ANALYSIS REQUIREMENTS – §257.93

The Groundwater Monitoring Program (GMP) includes consistent sampling and analysis procedures to provide accurate representation of groundwater quality (§257.93(a)). The activities include sample collection, preservation and shipment, analytical procedures, chain of custody, and quality assurance and quality control.

Groundwater is sampled for the constituents listed in Appendices III and IV of Part 257 (§257.93(b)). For detection monitoring, these constituents include boron, calcium, chloride, fluoride, pH, sulfate, and total dissolved solids from Appendix III Part 257 (Table III-2); and for assessment monitoring (if necessary) these constituents include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, selenium, thallium, and radium 226 & 228 combined from Appendix IV Part 257 (Table III-3). All constituents are analyzed as total recoverable, where samples are not field filtered.

Pursuant to §257.93(c), groundwater levels will be measured in each groundwater monitoring well immediately prior to purging, and each time groundwater is sampled. Other wells may be retained as water level measurement points. Levels will be measured to the nearest 0.01 feet (1/100 hundredth) and used to determine rate and direction of groundwater movement each time groundwater is sampled. In addition, a water table map/potentiometric surface map for the uppermost aquifer will be generated using the measured water levels obtained from each sampling event. The contours on these maps will allow for a quantitative assessment of flow rate and direction. Measurements of well depths will also be obtained during each sampling event to verify that the wells are physically intact and not filling with sediment, except where such measurements are not possible due to the presence of dedicated sampling equipment in the well.

Pursuant to §257.93(d), the background groundwater quality has been established for each of the constituents listed in Appendices III and IV of Part 257 (see Tables III-2 and III-3) by using the upgradient and background wells described under §257.91(a)(1), as applicable for detection (§257.94(a)) or assessment (§257.95(a)) monitoring requirements. The upgradient and background wells include AP-4 and AP-5.

The number of samples collected under detection and assessment monitoring, if necessary (for both downgradient and background wells), will be consistent with the statistical procedures selected under §257.93(f) and the performance standard under §257.93(g). The sampling procedures are consistent with that specified under §257.94(b-d) for detection monitoring and §257.95(b-d) for assessment monitoring, and §257.96(b) for corrective action.

Pursuant to §257.93(f), the selected statistical method to be used during detection monitoring in evaluating groundwater monitoring data for each constituent is the Prediction Interval Procedure under §257.93(f)(3). For this procedure, an interval for each constituent is established from the distribution of the background data and then the level of each constituent in each compliance well (i.e., well/constituent) is compared to the upper prediction limit to assess if a statistically significant increase (SSI) over background has occurred.

The selected method to evaluate concentrations obtained as part of the detection monitoring program is appropriate to determine the occurrence of statistically significant changes in the groundwater quality data and complies with the performance standards under §257.93(g), including:

(1) §257.93(g)(1) addressing the distribution of constituents where normal distributions will use parametric methods and non-normal distributions will use non-parametric methods.

(2) §257.93(g)(4) addressing the effectiveness of this approach by considering the number of samples in the background database, the data distribution, and the range of concentrations values for each constituent of concern.

(3) §257.93(g)(5) establishing the practical quantitation limit as the lowest concentration level that can be reliably achieved during routine laboratory operating conditions.

(4) §257.93(g)(6) allowing for the correction of seasonal and spatial variability as well as temporal correlation in the data.

The methodology to screen background data and establish background constituent levels is provided in Appendix A. This selected statistical approach will be effective in detecting changes in groundwater quality based on the use of interwell prediction limits (EPA, Unified Guidance, 2009). The statistically calculated interwell prediction limits (Appendix D) will be used during detection monitoring to statistically analyze detected inorganic constituents at each monitoring well (i.e., well/constituents) to determine under §257.93(h) whether or not there is a statistically significant increase (SSI) over background values. The SSI determination(s) will be completed within 90 days of completing sampling and analysis, where under §257.93(h)(2)(i), analysis is for total recoverable metals of non-field filtered samples. Volatile organic compounds and synthetic compounds are not applicable to this CCR site. Inorganic well/constituent pairs with confirmed SSI (i.e., interwell prediction limit exceedances) will then be placed into the Assessment Monitoring Program under §257.95.

3.4 DETECTION MONITORING PROGRAM – §257.94

Pursuant to §257.94(a), the Detection Monitoring Program includes, at a minimum, groundwater monitoring for all constituents listed in Appendix III to Part 257, including boron, calcium, chloride, fluoride, pH, sulfate, and total dissolved solids (TDS). The long-term monitoring frequency for the Appendix III constituents under §257.94(b) will be semiannual during the active life of the CCR unit and the post closure period.

Pursuant to §257.94(b), eight (8) independent samples were collected from each background and downgradient well and analyzed for the constituents listed in Appendix III to Part 257 including boron, calcium, chloride, fluoride, pH, sulfate, and total dissolved solids (TDS); and for the constituents listed in Appendix IV to Part 257 including antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, selenium, thallium, and radium 226 & 228 combined. The initial eight (8) independent sampling events were

completed over the second quarter 2015 through first quarter 2017 (§257.94(b)). This schedule allowed the capture of seasonal variability in quality and groundwater flow conditions. Details for derivation of the background concentrations were discussed in Section 3.2 above.

The number of samples collected and analyzed are consistent with the sampling and statistical procedures referenced in §257.93(e) and account for any unique characteristics of the site (§257.94(c)). Sampling for detection monitoring will occur on a semi-annual basis.

Alternative monitoring frequency for repeated sampling and analyses for constituents listed in Appendix III of Part 257 during the active life and the post-closure period based on the availability of groundwater may be implemented pursuant to §257.94(d). However, as stated above, detection monitoring will occur on a semi-annual basis, beginning in October/November 2017 such that the first Groundwater Monitoring and Corrective Action Report can be completed by January 31, 2018.

Pursuant to §257.94(e), if the facility determines pursuant to §257.93(h) that there is a statistically significant increase (SSI) over background levels for one or more of the constituents listed in Appendix III to Part 257 at any monitoring well, within 90 days of this determination the facility will establish an assessment monitoring program meeting the requirements of §257.95 and prepare a notification for the facility's operating record stating that an assessment monitoring program has been established. Such a determination for SSI will occur under the Detection Monitoring Program after completion of the initial 8 independent sampling events and the initial statistical evaluation. As applicable, the facility may also demonstrate that a source other than the CCR unit(s) caused the SSI, or that the SSI was the result of error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The demonstration must be in writing and completed within 90 days of detecting the SSI. If the demonstration is successful, then detection monitoring may continue.

Given the variability of the groundwater chemistry within the facility area, confirmation sampling may be conducted within 90 days of the observation of the SSI. This aids in preventing false positives and prematurely implementing an assessment monitoring program. If resampling occurs due to a SSI, then the SSI will be recorded in the facility record noting that resampling will occur. Within 90 days of the initial observed SSI, the results of the resample event must be placed in the facility record. If the SSI is not confirmed, detection monitoring will continue. If the SSI is confirmed, assessment monitoring pursuant to §257.95 must be initiated.

3.5 ASSESSMENT MONITORING PROGRAM – §257.95

Except as stated above, assessment monitoring is required pursuant to §257.95(a) whenever a SSI has been detected during detection monitoring for one or more of the constituents in Appendix III of Part 257. Under §257.95(b), within 90 days of triggering an assessment monitoring program, and annually thereafter, the facility must sample and analyze the groundwater for all constituents listed in Appendix IV to Part 257 until detection monitoring resumes. An alternative monitoring frequency may be considered if documented under the requirements of §257.95(c).

After obtaining the results from the initial and subsequent sampling events required under §257.95(b), the facility must within 90 days of obtaining the results, and on at least a semiannual basis thereafter, resample all wells that were installed pursuant to §257.91 and conduct analyses for all constituents in Appendix III and for those constituents in Appendix IV to Part 257 that are detected. The results must then be placed in the operating record.

Groundwater Protection Standards (GWPS) will be established for all constituents detected pursuant to §257.95(b or d) and in accordance with the requirements of §257.95(h). These activities and results will be summarized in the annual groundwater monitoring and corrective action report required under §257.90(e).

Pursuant to §257.95(e), if the concentration of all constituents listed in Appendix III and Appendix IV of Part 257 are shown to be at or below background values, using the statistical procedures in §257.93(g), for two consecutive sampling events, the facility may return to the detection monitoring and place notification in the operating record. If the concentrations of any constituent in Appendix III and Appendix IV to Part 257 are above background values, but all concentrations are below the GWPS, assessment monitoring must continue (§257.95(f)).

If one or more constituents in Appendix IV to Part 257 are detected at statistically significant levels (SSL) above the GWPS, the facility must place notification in the operating record and proceed to characterize the nature and extent of the release and any relevant site conditions that may affect the remedy ultimately selected (§257.95(g)). The characterization must meet the requirements of §257.95(g)(1) and the public notification the requirements of §257.95(g)(2). Under §257.95(g)(3), within 90 days of finding that any of the constituents listed in Appendix IV to Part 257 have been detected at a SSL exceeding the GWPS, the facility must either initiate an assessment of corrective measures under §257.96, or demonstrate an error in any such determination.

A GWPS must be established for each constituent in Appendix IV to Part 257 detected in the groundwater. The GWPS shall be: (1) for constituents for which a maximum contaminant level (MCL) has been established, the MCL for that constituent, or (2) for constituents for which an MCL has not been established, the background concentration for the constituent established from wells in accordance with §257.91, or (3) for constituents for which the background level is higher than the MCL identified under §257.95(h)(1), the background concentration shall be the GWPS.

3.6 ASSESSMENT OF CORRECTIVE MEASURES – §257.96

Within 90 days of determining that any constituent listed in Appendix IV of Part 257 has been detected at a SSL exceeding the GWPS, or immediately upon detection of a release, the facility must initiate an assessment of corrective measures to prevent further releases, to remediate releases, and to restore the affected area to original conditions (§257.96(a)). The assessment must be completed within 90 days unless a time extension of not more than 60 days is needed to complete the assessment, as demonstrated by the facility. The facility will include any such demonstration in the annual groundwater monitoring and corrective action report required under §257.90(e). The CCR unit will continue to monitor groundwater in accordance with the Assessment Monitoring Program during the assessment of corrective measures.

The assessment of corrective measures will evaluate the effectiveness of potential corrective measures in meeting the requirements and objectives of the remedy as described under §257.97, including performance, reliability, ease of implementation, impacts, exposure, time required, permitting, etc. (§257.96(c)).

The completed assessment of corrective measures will be placed in the operating record; discussed at a public meeting at least 30 days prior to the selection of a remedy under §257.97; and recordkeeping, notification, and internet requirements will be met.

3.7 SELECTION OF REMEDY – §257.97

Based on the results of the assessment of corrective measures, a remedy will be selected as soon as feasible that meets the standards listed in §257.97(b), including being protective of human health and environment, attain the GWPS, control the source(s) of release so as to reduce or eliminate, to the extent feasible, further releases on constituents in Appendix IV of Part 257, remove from the environment as much of the contaminated material as feasible, and comply with standards for management of wastes under §257.98(d). In selecting the remedy, the facility will consider the requirements of §257.97(c) and establish a schedule for implementing and completing remedial activities under §257.97(d).

3.8 IMPLEMENTATION OF THE CORRECTIVE ACTION PROGRAM – §257.98

Pursuant to §257.98(a), within 90 days of selecting the remedy, the facility will initiate remedial activities. Based on the schedule provided under §257.97(d) for implementation of remedial activities, the facility must establish and implement a corrective action groundwater monitoring program that meets the requirements of an assessment monitoring program under §257.95, implement the corrective action remedy selected under §257.97, and address any interim measures that might be needed to reduce the contaminants leaching from the CCR unit. If at any time the facility determines that compliance with the requirements of §257.97(b) is not being achieved through the remedy selected, other methods or techniques that could feasibly achieve compliance should be evaluated and implemented (§257.98(b)).

Pursuant to §257.98(c), the remedy will be considered complete when compliance with the GWPS has been achieved at all points within the plume of contamination that lie beyond the groundwater monitoring well system and concentrations of constituents listed in Appendix IV of Part 257 have not exceeded the GWPS for a period of three consecutive years. Table III-7 depicts the methodology for corrective action, where the effectiveness of the remedial actions will be evaluated based on the confidence intervals constructed for applicable well/constituent pairs as compared to a specified clean-up standard which is the GWPS. When the entire interval is determined to be below the standard under §257.98(c) for three consecutive years, that well/constituent pair will be declared to be in compliance, and inorganic well/constituent pairs will be moved back into detection monitoring and appropriate limit-based statistics will resume.

All CCR units that are managed pursuant to a remedy required under §257.97 will be managed in a manner that complies with applicable RCRA requirements (§257.98(d)). Pursuant to §257.98(e), upon completion of the remedy the facility will prepare a notification stating that the remedy has been completed and obtain a certification from a qualified professional engineer.

4. RECORDKEEPING, NOTIFICATION, AND POSTING OF INFORMATION – FEDERAL RULE §257.105 THROUGH §257.107

4.1 RECORDKEEPING REQUIREMENTS – §257.105

CWLP, as owner of an existing CCR unit, will maintain files in its operating record as required under §257.105(h) – groundwater monitoring and corrective action – for a period of no less than five years. This includes:

1. annual groundwater monitoring report,
2. documentation pertaining to monitoring wells,

3. groundwater monitoring certification,
4. selection of statistical method certification,
5. notification within 30 days of establishing an assessment monitoring program,
6. analytical results of Appendices III and IV to Part 257,
7. notification within 30 days of returning to a detection monitoring program,
8. notification within 30 days of detecting of constituents in Appendix IV of Part 257 at statistically significant levels above the groundwater protection standard,
9. notification within 30 days of initiating the assessment of corrective measures,
10. the completed assessment of corrective measures,
11. documentation recording the public meeting for the corrective measures assessment,
12. the semiannual report describing the progress in selecting and designing the remedy and the selection of remedy report, and
13. notification within 30 days of completing the remedy.

4.2 NOTIFICATION REQUIREMENTS – §257.106

Notifications required under §257.106(h) – groundwater monitoring and corrective action – will be sent to the relevant regulatory authority, including for (1) availability of:

1. the annual groundwater report,
2. availability of the groundwater monitoring system certification,
3. selection of a statistical method certification,
4. that an assessment monitoring program has been established,
5. that the CCR unit is returning to a detection monitoring program,
6. that constituent(s) in Appendix IV to Part 257 have been detected at statistically significant levels above the groundwater protection standard and notifications to landowners,
7. that an assessment of corrective measures has been initiated,
8. availability of assessment of corrective measures,
9. the availability of the semiannual report describing the progress in selecting and designing the remedy and the selection of remedy report, and
10. completion of the remedy.

4.3 PUBLICALY ACCESSIBLE INTERNET SITE REQUIREMENTS – §257.107

CWLP will maintain a publicly accessible Internet site (CCR website) containing the information specified in §257.107(h) – groundwater monitoring and corrective action.

http://ehs.cwlp.com/

V. REFERENCES CITED

U.S. Environmental Protection Agency (EPA), March 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance. Office of Resource Conservation and Recovery Program Implementation and Information Division, U.S. Environmental Protection Agency, Washington, DC.

U.S. Environmental Protection Agency (EPA), 2015. Published in Federal Register Volume 80, No. 74 published on April 17, 2015, *Final Rule 40 CFR Part 257 Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities*; and *Technical Amendments* (correcting the effective date) published in Federal Register Volume 80, No. 127 on July 2, 2015.

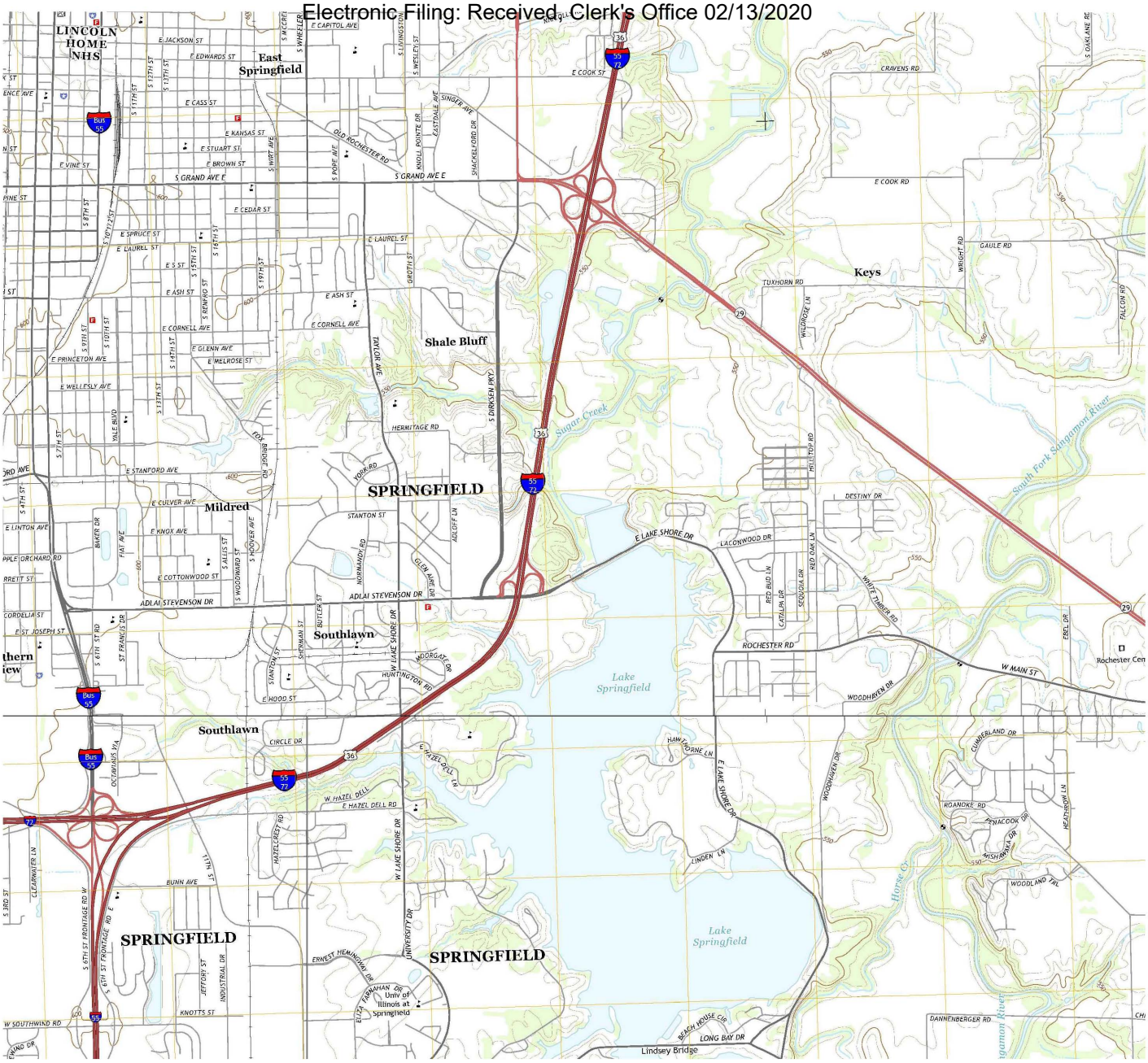
TABLES

Table 1 Well Construction Summary

Well ID	Monitoring Position	Material Screened	Top of Casing (feet MSL)	Ground Surface (feet MSL)	Top of Screen (feet MSL)	Bottom of Screen (feet MSL)
AP-1	Downgradient	Bedrock/Unconsolidated Interface	535.60	533.10	514.01	504.63
AP-2	Downgradient	Bedrock/Unconsolidated Interface	536.10	533.60	525.19	515.54
AP-3	Downgradient	Bedrock/Unconsolidated Interface	535.40	533.70	524.7	514.7
AP-4	Upgradient	Bedrock/Unconsolidated Interface	559.20	553.90	504.9	494.9
AP-5	Upgradient	Bedrock/Unconsolidated Interface	583.90	581.60	563.78	554.44
AW-3	Downgradient	Bedrock/Unconsolidated Interface	540.33	537.75	506.32	496.32

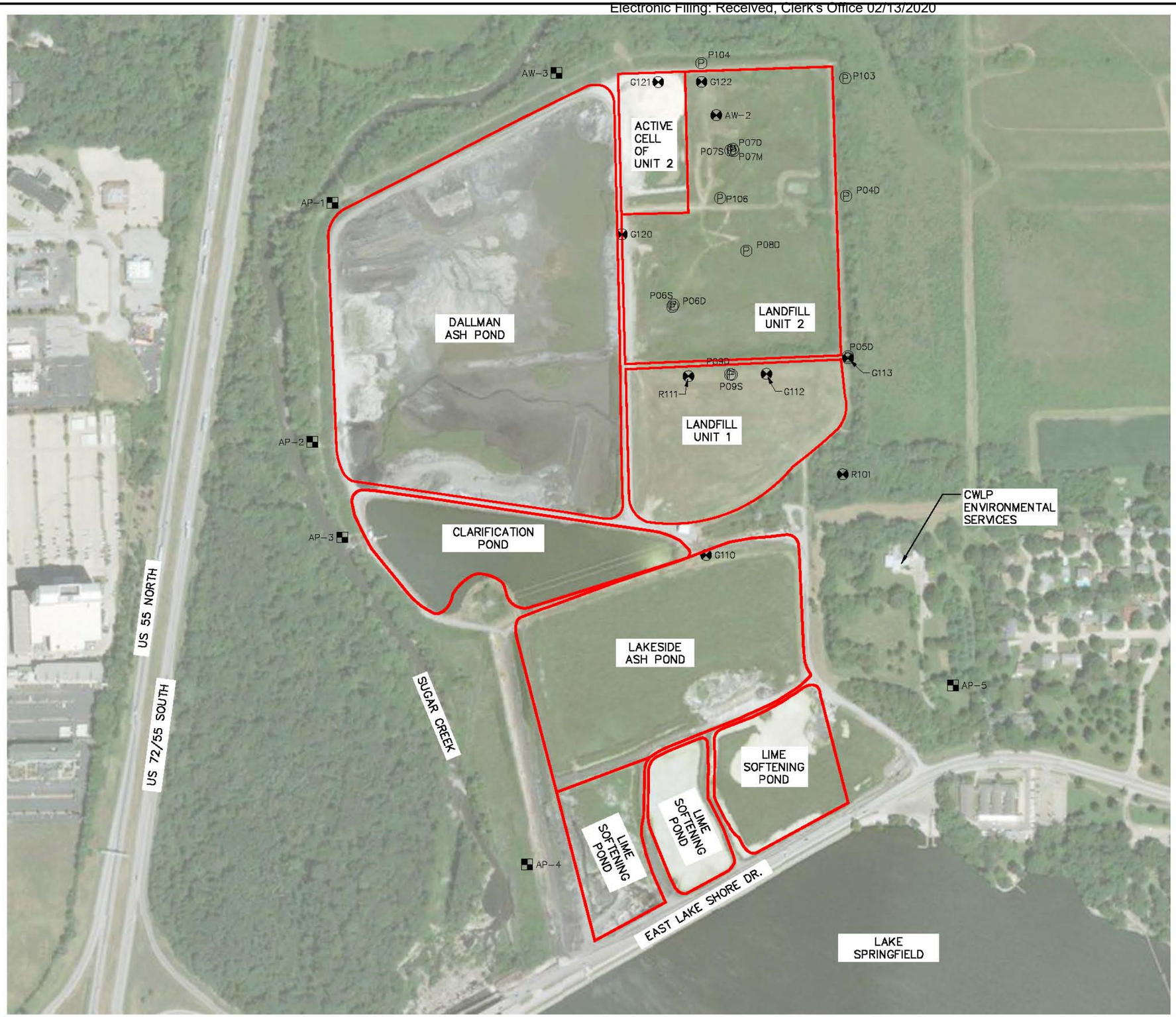
Response to 1st RTP
CWLP - 012929

FIGURES


LINCOLN HOME NHS
East Springfield
Shale Bluff
SPRINGFIELD
Mildred
Southlawn
Keys
Lake Springfield
Sugar Creek
South Fork Sangamon River
Horse Cr
SPRINGFIELD
SPRINGFIELD
Univ of Illinois at Springfield
Lindsey Bridge
E LAKE SHORE DR
ADLAI STEVENSON DR
ROCHESTER RD
W MAIN ST
E COOK ST
CRAVENS RD
E COOK RD
TUXHORN RD
GAULE RD
DESTINY DR
LACONWOOD DR
WHITE TIMBER RD
WOODHAVEN DR
CUMBERLAND DR
ROANOKE RD
WOODLAND TRL
DANNENBERGER RD
LONG BAY DR
BEACH HOUSE CIR
LINDEN LN
HAWTHORNE LN
E HAZEL DELL LN
W HAZEL DELL
CIRCLE DR
HERMITAGE RD
STANTON ST
YORK RD
E STANFORD AVE
E CULVER AVE
E KNOX AVE
E COTTONWOOD ST
E HOOD ST
HUNTINGTON RD
E CORNELL AVE
E GLENN AVE
E MELROSE ST
E LAUREL ST
E ASH ST
E CEDAR ST
E BROWN ST
E STUART ST
E KANSAS ST
E CASS ST
E EDWARDS ST
E JACKSON ST
E CAPITOL AVE
S GRAND AVE E
OLD ROCHESTER RD
S 6TH ST FRONTAGE RD W
S 6TH ST FRONTAGE RD E
W SOUTHWIND RD
KNOTTS ST
BUNN AVE
11TH ST
W LAKE SHORE DR
E LAKE SHORE DR
UNIVERSITY DR
ERNEST HEMINGWAY DR
TAMARAHAN DR
BEACH HOUSE CIR
Bus 55
55
72
36
29
72

ILLINOIS

Electronic Filing: Received, Clerk's Office 02/13/2020



LEGEND

- ASH IMPOUNDMENT MONITORING WELL LOCATION
- PIEZOMETER LOCATION
- LANDFILL MONITORING WELL LOCATION

N

0 200 400 800

SCALE: IN FEET

NOTE:
BACKGROUND IMAGE DERIVED FROM BING.

NO.	DATE	REVISIONS DESCRIPTION	BY

ANDREWS ENGINEERING, INC.
3300 GINGER CREEK DRIVE
SPRINGFIELD, ILLINOIS 62711-7233
PH (217) 787-2334 FAX (217) 787-9495
PONTIAC, IL • LOMBARD, IL • INDIANAPOLIS, IN • WARRENTON, MO
PROFESSIONAL DESIGN ENGINEERING AND LAND SURVEYING FIRM #184-001541

DESIGNED BY: MTH | DRAWN BY: RMC | APPROVED BY: MTH

SITE FACILITIES

PLANS PREPARED FOR
CITY, WATER, LIGHT & POWER
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: OCTOBER 2017

PROJECT ID: 170306/0001

SHEET NUMBER:
FIGURE 2

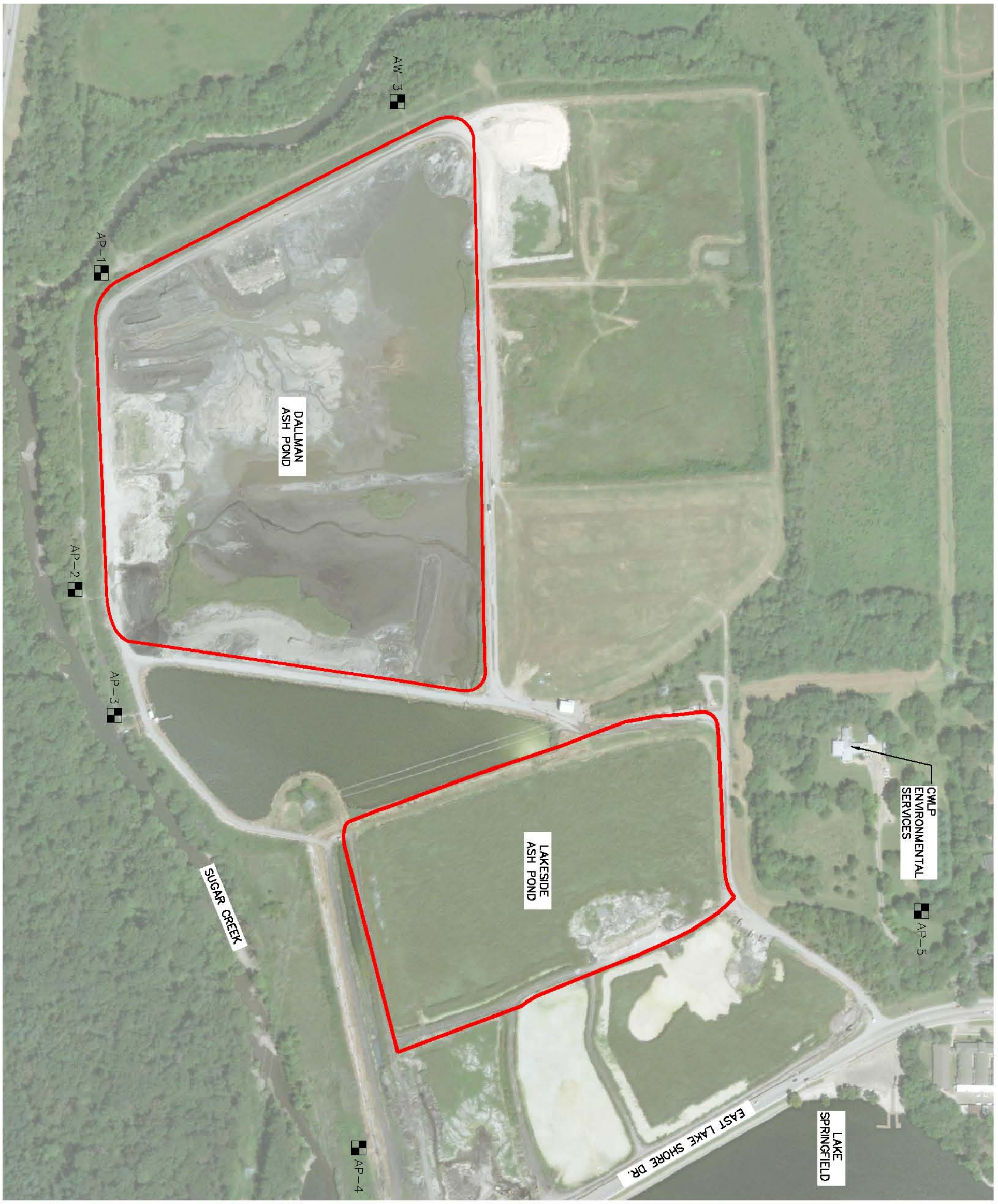
© 2017 Andrews Engineering, Inc.

J:\S\Springfield CWLP\CWLP\dwg\2017\Existing Groundwater Monitoring Network.dwg Tab: FIGURE 2 Last Saved: October 4, 2017, by Ryan Curtis Plotted: Thursday, October 05, 2017 1:10:23 PM

Response to 1st RTP
CWLP - 012932

Electronic Filing: Received, Clerk's Office 02/13/2020

J:\S\Springfield CWLP\CWLP\dwg\2017\Existing Groundwater Monitoring Network.dwg Tab: FIGURE 3 Last Saved: October 4, 2017, by Ryan Curtis Plotted: Thursday, October 05, 2017 1:09:35 PM



NOTE: BACKGROUND IMAGE DERIVED FROM BING.

0 150 300 600
SCALE: IN FEET

N

LEGEND

ASH IMPOUNDMENT MONITORING WELL LOCATION

FIGURE 3

SHEET NUMBER:

PROJECT ID: 170306/0001

DATE: OCTOBER 2017

GROUNDWATER MONITORING SYSTEM

PLANS PREPARED FOR

CITY, WATER, LIGHT & POWER

SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

ANDREWS ENGINEERING, INC.
3300 GINGER CREEK DRIVE
SPRINGFIELD, ILLINOIS 62711-7233
PH (217) 787-2334 FAX (217) 787-9495
PONTIAC, IL • LOMBARD, IL • INDIANAPOLIS, IN • WARRENTON, MO
PROFESSIONAL DESIGN ENGINEERING AND LAND SURVEYING FIRM #184-001541

APPROVED BY: MTH | DESIGNED BY: MTH | DRAWN BY: RMC

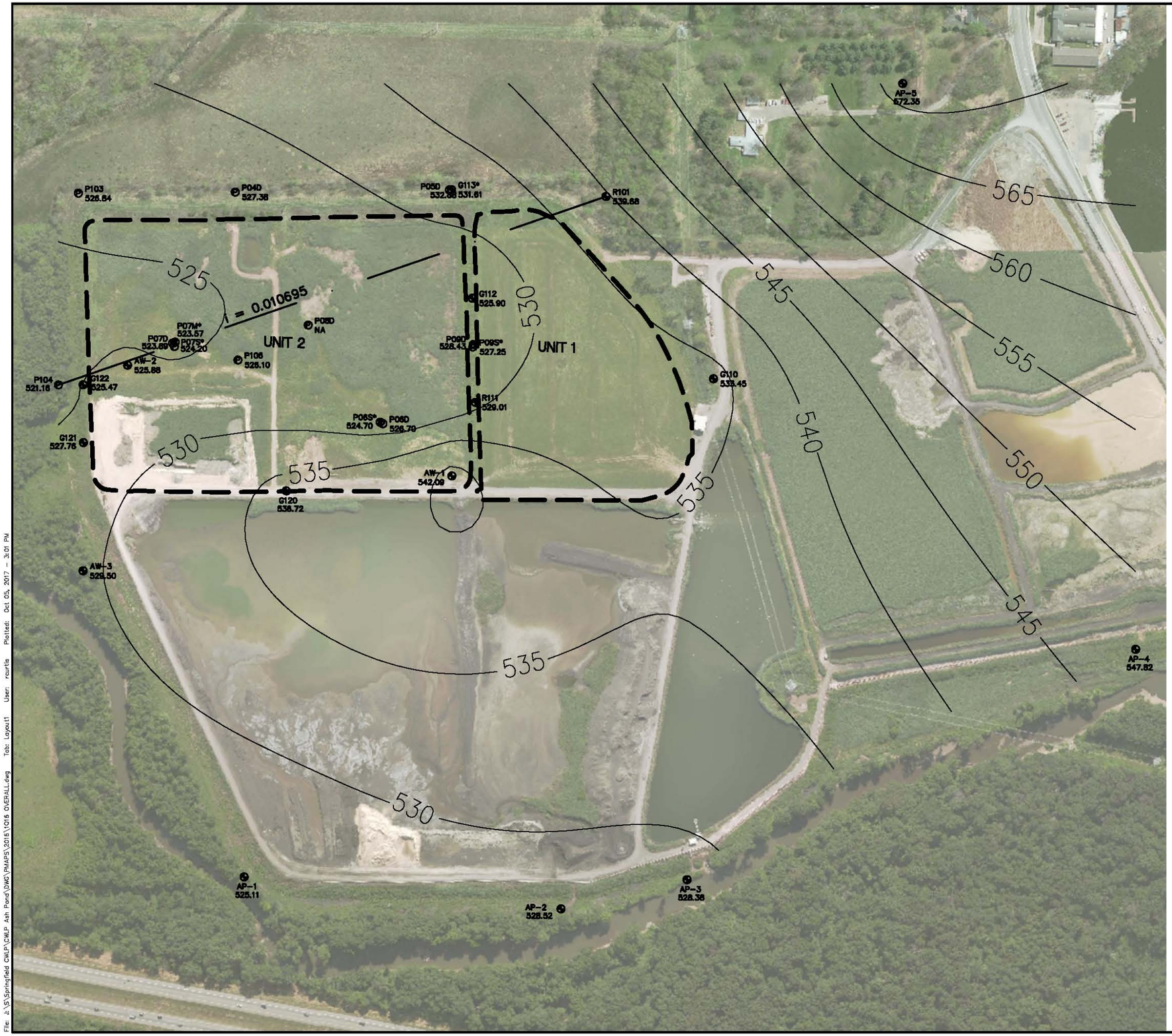
REVISIONS

NO.	DATE	DESCRIPTION	BY

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Response to 1st RTP
CWLP - 012933

APPENDIX A
POTENTIOMETRIC SURFACE MAPS



LEGEND:

- LANDFILL MONITORING WELL LOCATION
- PIEZOMETER

NOTES:

1. SAMPLING DATE: FEBRUARY 25, 2016.
2. CONTOUR INTERVAL = 5 FEET.
3. i = HYDRAULIC GRADIENT
4. NA = GROUNDWATER ELEVATION NOT AVAILABLE.
5. * IN THE CASE OF NESTED WELLS, THE GROUNDWATER ELEVATIONS FROM DEEPER WELLS (BASAL SAND) WERE USED IN THE COMPILATION OF POTENTIOMETRIC CONTOURS.

N

300 0 300 600

SCALE: IN FEET

ANDREWS ENGINEERING, INC.
3300 Ginger Creek Drive, Springfield, IL 62711-7233
Tel (217) 787-2334 Fax (217) 787-9495
Pontiac, IL • Naperville, IL • Indianapolis, IN • Warrenton, MO

APPROVED BY: CRM | DESIGNED BY: CRM | DRAWN BY: MPN

POTENTIOMETRIC SURFACE MAP
1ST QUARTER 2016

PLANS PREPARED FOR
CITY, WATER, LIGHT, AND POWER
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: JUNE 2016

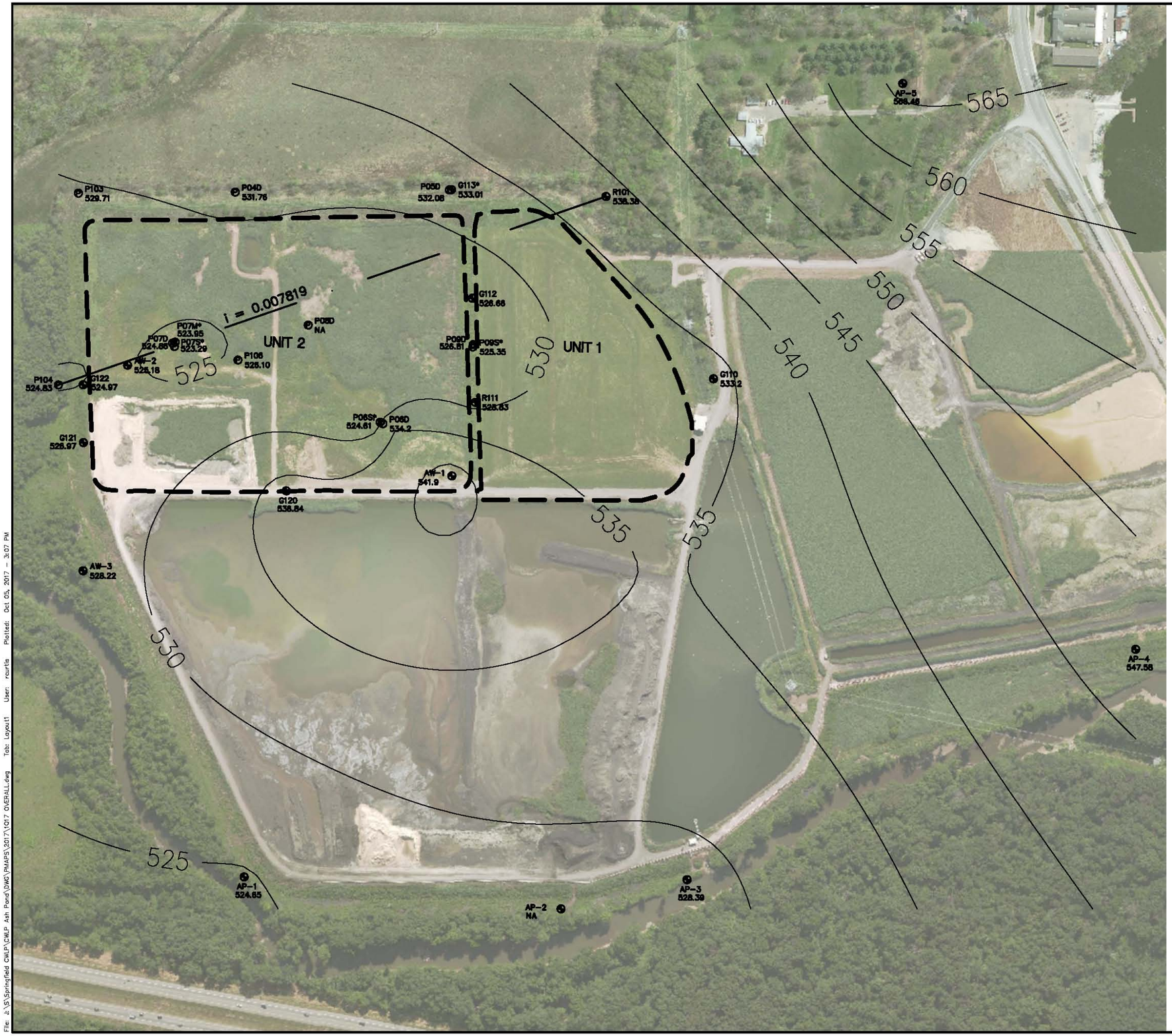
PROJECT ID: 160285/0001

SHEET NUMBER: 1Q16

Response to 1st RTP
CWLP - 012936

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LEGEND:

- LANDFILL MONITORING WELL LOCATION
- PIEZOMETER

NOTES:

1. SAMPLING DATE: FEBRUARY 16, 2017.
2. CONTOUR INTERVAL = 5 FEET.
3. i = HYDRAULIC GRADIENT
4. NA = GROUNDWATER ELEVATION NOT AVAILABLE.
5. * IN THE CASE OF NESTED WELLS, THE GROUNDWATER ELEVATIONS FROM DEEPER WELLS (BASAL SAND) WERE USED IN THE COMPILATION OF POTENTIOMETRIC CONTOURS.

N

300 0 300 600

SCALE: IN FEET

ANDREWS ENGINEERING, INC.
3300 Ginger Creek Drive, Springfield, IL 62711-7233
Tel (217) 787-2334 Fax (217) 787-9495
Pontiac, IL • Naperville, IL • Indianapolis, IN • Warrenton, MO

APPROVED BY: CRM | DESIGNED BY: CRM | DRAWN BY: RMC

POTENTIOMETRIC SURFACE MAP
1ST QUARTER 2017

PLANS PREPARED FOR
CITY, WATER, LIGHT, AND POWER
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: OCOTBER 2017

PROJECT ID: 160285/0001

SHEET NUMBER: 1Q17

Response to 1st RTP
CWLP - 012930

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APPENDIX B
WELL CONSTRUCTION DETAILS

Electronic Filing: Received, Clerk's Office 02/13/2020

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Sangamon Well #: AP-1R

Site Name: City Water, Light, & Power Borehole #: AP-1R

Coordinates: X 831.70 Y 5132.40 (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___"

Surveyed by: _____ IL Registration #: _____

Drilling Contractor: Terra Drill, Inc. Consulting Firm: Andrews Engineering, Inc.

Driller: J. Brown Geologist: M. Hewitt

Drilling Method: 4¼" HSA w/ 5' Continuous Barrel Logged by: M. Hewitt

Drilling Fluids (type): _____ Report Form Completed by: J. Rhoades

Date Well Started: 1/30/2012 Date Well Finished: 1/30/2012 Date Form Completed: 2/27/2012

ANNULAR SPACE DETAILS

Type of surface seal: Concrete

Type of annular sealant: Bentonite Grout

Installation method: Tremie

Setting time: 2 Hours

Type of bentonite seal – Bentonite Chips (circle one)

Installation method: Free drop

Setting time: 2 Hours

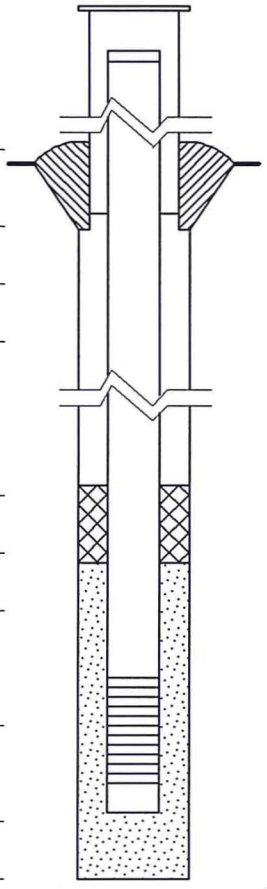
Type of sand pack: Unimin Sand

Grain size: 10/20 (sieve size)

Installation method: Free drop

Type of backfill material: _____ (if applicable)

Installation method: _____



ELEVATION (MSL)*	DEPTH (BGS)♦ (0.01 ft)	
535.60	-2.50	Top of Protective Casing
535.60	-2.50	Top of Riser Pipe
533.10	.00	Ground Surface
530.10	3.00	Top of Annular Sealant
n/a	n/a	Static Water Level Measured on (after completion)
517.00	16.10	Top of Seal
513.51	19.59	Top of Sandpack
514.01	19.09	Top of Screen
504.63	28.47	Bottom of Screen
504.10	29.00	Bottom of Well
500.60	32.50	Bottom of Borehole

* Referenced to a National Geodetic Vertical Datum
♦ positive (+) values below GS, negitive (-) values above GS

WELL CONSTRUCTION MATERIALS (circle one)

Protective Casing	SS304, SS316, PTFE, PVC or *Other:Steel*
Riser Pipe Above W.T.	SS304, SS316, PTFE, *PVC*, or Other:
Riser Pipe Below W.T.	SS304, SS316, PTFE, *PVC*, or Other:
Screen	SS304, SS316, PTFE, *PVC*, or Other:

(AE950315)

CASING MEASUREMENTS

Diameter of Borehole (in)	8.0
ID of Riser Pipe (in)	2.0
Protective Casing Length (ft)	5.0
Riser Pipe Length (ft)	21.59
Bottom of Screen to End Cap (ft)	.53
Screen Length [1st slot to last slot] (ft)	9.38
Total Length of Casing (ft)	31.50
Screen Slot Size*	0.01"

*Hand-slotted well screens are unacceptable.

Response to 1st RTP
CWLP - 012938

Electronic Filing: Received, Clerk's Office 02/13/2020

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Sangamon Well #: AP-2A

Site Name: Springfield City Water, Light, and Power Borehole #: _____

Coordinates: X 735.9 Y 4185.2 (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___"

Surveyed by: Springfield City Water, Light, and Power IL Registration #: _____

Drilling Contractor: Bulldog Drilling, Inc. Consulting Firm: Andrews Engineering, Inc.

Driller: J. Edwards Geologist: C. Myrvold

Drilling Method: AMS Powerprobe w/ 4.25" HSA and 5' MC Logged by: C. Myrvold

Drilling Fluids (type): na Report Form Completed by: C. Myrvold

Date Well Started: 2/16/2016 Date Well Finished: 2/16/2016 Date Form Completed: 3/06/2016

ANNULAR SPACE DETAILS

Type of surface seal: Concrete

Type of annular sealant: N/A

Installation method: _____

Setting time: _____

Type of bentonite seal: Bentonite chips

Installation method: Free drop

Setting time: 24+ hours

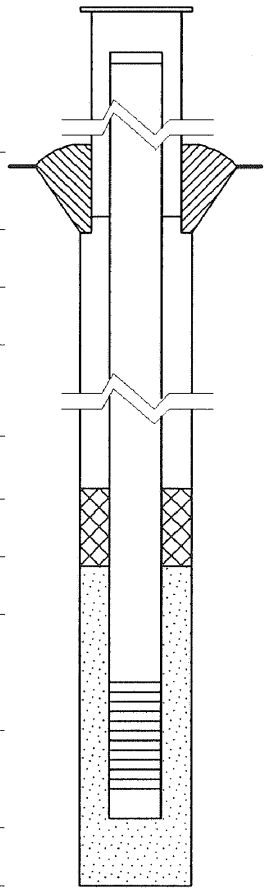
Type of sand pack: Silica sand

Grain size: 20/40 (sieve size)

Installation method: Free drop

Type of backfill material: N/A (if applicable)

Installation method: _____



ELEVATION (MSL)®	DEPTH (BGS)* (0.01 ft)	
536.50	-2.90	Top of Protective Casing
536.10	-2.50	Top of Riser Pipe
533.60	0.00	Ground Surface
	N/A	Top of Annular Sealant
		Static Water Level Measured on (after completion)
530.60	3.00	Top of Seal
527.19	6.41	Top of Sandpack
525.19	8.41	Top of Screen
515.54	18.06	Bottom of Screen
515.10	18.50	Bottom of Well
514.60	19.00	Bottom of Borehole

® Referenced to a National Geodetic Vertical Datum
* positive (+) values below GS, negitive (-) values above GS

Notes:

WELL CONSTRUCTION MATERIALS

Protective Casing	Anodized Aluminum
Riser Pipe Above W.T.	PVC
Riser Pipe Below W.T.	PVC
Screen	PVC

CASING MEASUREMENTS

Diameter of Borehole (in)	8.25
ID of Riser Pipe (in)	2
Protective Casing Length (ft)	5.0
Riser Pipe Length (ft)	10.91
Bottom of Screen to End Cap (ft)	0.44
Screen Length [1st slot to last slot] (ft)	9.65
Total Length of Casing (ft)	21.00
Screen Slot Size*	#10 (0.01)

*Hand-slotted well screens are unacceptable.

Professional Service Industries, Inc.
480 North Street
Springfield, Illinois 62704
Telephone: 217/544-6663
Fax: 217/544-6143

LOG OF BORING AP-3

Sheet 1 of 1

PSI Job No.: 0020522
Project: Piezometer Installation
Location: CWLP Ash Pond
East Lake Shore Drive
Springfield, Illinois

Drilling Method: Hollow Stem Auger
Sampling Method: Split Spoon
Hammer Type: CME Automatic; ETR = 86%
Boring Location: See attached boring location plan.

WATER LEVELS
While Drilling: None feet
Upon Completion: N/A
Delay: N/A

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			1	18	Dark brown silty CLAY, very stiff, slightly moist	CL	6-7-8 N_{60}=21		
	5			2	18	Gray/brown clayey SILT, soft to stiff, moist to saturated	ML	3-3-4 N_{60}=10		
				3	18			1-1-1 N_{60}=3		
	10			4	18	Gray clayey SILT, soft to very stiff, saturated		2-1-2 N_{60}=4		
				5	18			2-2-4 N_{60}=9		
	15			6	16		ML	2-2-4 N_{60}=9		
				7	18			4-4-6 N_{60}=14		
	20			8	10	Gray SHALE, hard, slightly moist Boring terminated at -19.5	CL	32-50/3"		

STANDARD PENETRATION TEST DATA
N in blows/ft
Moisture, PL, LL
0 25 50
STRENGTH, tsf
Qu, Qp
0 2.0 4.0

Well Diagram: J-Plug; Concrete Cap; 2" PVC Solid Riser; Bentonite Seal; Sand Filter Pack; 0.01" PVC Slotted Well Screen

Completion Depth: 20.0 ft
Date Boring Started: 4/21/10
Date Boring Completed: 4/21/10
Logged By: Rob Preuss
Drilling Contractor: PSI, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude:
Longitude:
Drill Rig: ATV D50
Remarks: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Moistures determined by visual methods

The stratification lines represent approximate boundaries. The transition may be gradual.

Professional Service Industries, Inc.
480 North Street
Springfield, Illinois 62704
Telephone: 217/544-6663
Fax: 217/544-6143

LOG OF BORING AP-4

Sheet 1 of 1

PSI Job No.: 0020522
Project: Piezometer Installation
Location: CWLP Ash Pond
East Lake Shore Drive
Springfield, Illinois

Drilling Method: Hollow Stem Auger
Sampling Method: Split Spoon
Hammer Type: CME Automatic; ETR = 86%
Boring Location: See attached boring location plan.

WATER LEVELS
While Drilling 11 feet
Upon Completion N/A
Delay N/A

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			1	17	Brown silty CLAY, some brown sand, firm to stiff, slightly moist (FILL)	CL	4-4-3 N_{60}=10		
	5			2	18	Brown silty CLAY, trace roots, firm to stiff, moist (FILL)	CL	4-3-2 N_{60}=7		
				3	10	Brown SILT, trace gray, firm to stiff, moist (FILL)	ML	6-3-2 N_{60}=7		
	10			4	12	5" Brown SAND transitioning to Black FLY ASH at 9.4', stiff to very stiff, slightly moist (FILL)		2-2-4 N_{60}=9		
				5	18		SAND/FLY ASH	2-2-2 N_{60}=6		
	15			6	16			2-1-1 N_{60}=3		
				7	16			6-6-5 N_{60}=16		
	20			8	18	Black FLY ASH, some fine sub-round gravel, stiff to very stiff, moist to saturated (FILL)	FLY ASH	3-3-3 N_{60}=9		
						Gray/green (organic?) CLAY, stiff, trace fine sand, moist to saturated				
	25			9	1		CL	3-3-4 N_{60}=10		
				10	18	Brown/gray silty CLAY, fiorm to stiff, saturated	CL	2-2-3 N_{60}=7		
	30			11	18	Gray SILT, stiff to very stiff, saturated		3-3-4 N_{60}=10		
				12	18		ML	4-4-4 N_{60}=11		
	40			13	18			4-4-6 N_{60}=14		
	45			14	18			4-5-7 N_{60}=17		
	50			15	18	Gray fine to coarse SAND, medium dense, saturated	SW	5-5-7 N_{60}=17		
	55			16	1	Gray SHALE, hard, moist	CL	50/1"		
	60					Boring terminated at -60'				

STANDARD PENETRATION TEST DATA
N in blows/ft
Moisture PL LL
0 25 50
STRENGTH, tsf
Qu Qp
0 2.0 4.0
>>

Well Diagram: J-Plug; Concrete Cap; 2" PVC Solid Riser; Bentonite Seal; Sand Filter Pack; 0.01" PVC Slotted Screen

Completion Depth: 60.0 ft
Date Boring Started: 4/20/10
Date Boring Completed: 4/20/10
Logged By: Rob Preuss
Drilling Contractor: PSI, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude:
Longitude:
Drill Rig: ATV D50
Remarks: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Moistures determined by visual methods.

The stratification lines represent approximate boundaries. The transition may be gradual.

Electronic Filing: Received, Clerk's Office 02/13/2020

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Sangamon Well #: AP-5

Site Name: City Water, Light, & Power Borehole #: AP-5

Coordinates: X 3203.10 Y 3164.10 (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___"

Surveyed by: _____ IL Registration #: _____

Drilling Contractor: Terra Drill, Inc. Consulting Firm: Andrews Engineering, Inc.

Driller: J. Brown Geologist: M. Hewitt

Drilling Method: 4¼" HSA w/ 5' CB & 2' SS Logged by: M. Hewitt

Drilling Fluids (type): _____ Report Form Completed by: J. Rhoades

Date Well Started: 2/1/2012 Date Well Finished: 2/1/2012 Date Form Completed: 2/27/2012

ANNULAR SPACE DETAILS

Type of surface seal: Concrete

Type of annular sealant: Bentonite Grout

Installation method: Tremie

Setting time: 2 Hours

Type of bentonite seal – Bentonite Chips (circle one)

Installation method: Free drop

Setting time: 2 Hours

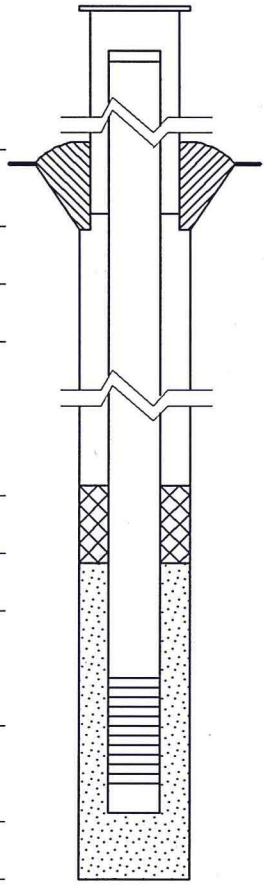
Type of sand pack: Unimin Sand

Grain size: 10/20 (sieve size)

Installation method: Free drop

Type of backfill material: Bentonite Chips (if applicable)

Installation method: Free drop



ELEVATION (MSL)®	DEPTH (BGS)♦ (0.01 ft)	
584.30	-2.70	Top of Protective Casing
583.90	-2.30	Top of Riser Pipe
581.60	.00	Ground Surface
578.60	3.00	Top of Annular Sealant
n/a	n/a	Static Water Level Measured on (after completion)
565.48	16.12	Top of Seal
563.48	18.12	Top of Sandpack
563.78	17.82	Top of Screen
554.44	27.16	Bottom of Screen
553.90	27.70	Bottom of Well
551.10	30.50	Bottom of Borehole

® Referenced to a National Geodetic Vertical Datum
♦ positive (+) values below GS, negitive (-) values above GS

NOTES:

•Borehole AP-5 sampled to 49.0 feet below ground surface (BGS) and backfilled with bentonite chips to 30.5 feet BGS

WELL CONSTRUCTION MATERIALS (circle one)

Protective Casing	SS304, SS316, PTFE, PVC or *Other:Steel*
Riser Pipe Above W.T.	SS304, SS316, PTFE, *PVC*, or Other:
Riser Pipe Below W.T.	SS304, SS316, PTFE, *PVC*, or Other:
Screen	SS304, SS316, PTFE, *PVC*, or Other:

CASING MEASUREMENTS

Diameter of Borehole (in)	8.0
ID of Riser Pipe (in)	2.0
Protective Casing Length (ft)	5.0
Riser Pipe Length (ft)	20.12
Bottom of Screen to End Cap (ft)	.54
Screen Length [1st slot to last slot] (ft)	9.34
Total Length of Casing (ft)	30.00
Screen Slot Size*	0.01"

*Hand-slotted well screens are unacceptable.

(AE950315)

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Illinois Environmental Protection Agency — Well Completion Report

Site Number: 1678250020 County: Sangamon

Site Name: FGDS Development Landfill Well #: AW-3

State Plane Coordinate: X ____ Y ____ (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____ Borehole #: AW-3

Surveyed by: David Mihelsic IL Registration #: 3762

Drilling Contractor: Reynolds Drilling Corp. Driller: Andrew Rachford

Consulting Firm: Rapps Engineering & Applied Science Geologist: Ken Miller

Drilling Method: HSA Drilling Fluid (Type): NA

Logged By: Ken Miller Date Started: 12/30/08 Date Finished: 12/31/08

Report Form Completed By: Ken Miller Date: 5/18/09

ANNULAR SPACE DETAILS

Type of Surface Seal: Cement

Type of Annular Sealant: Bentonite Chips

Installation Method: Poured

Setting Time: >24 hrs

Type of Bentonite Seal - - Granular, Pellet, Slurry (Choose One)

Installation Method: Poured

Setting Time: 16 hrs

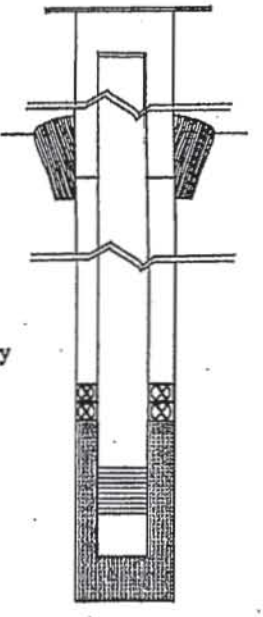
Type of Sand Pack: Quartz Sand

Grain Size: 50 (Sieve Size)

Installation Method: Poured

Type of Backfill Material: (If applicable)

Installation Method:



Elevations (MSL)*	Depths (BGS)	(.01ft.)
____	____	Top of Protective Casing
540.33	-2.58	Top of Riser Pipe
537.75	0	Ground Surface
534.75	3.00	Top of Annular Sealant
____	____	Static Water Level (After Completion)
511.32	26.43	Top of Seal
508.32	29.43	Top of Sand Pack
506.32	31.43	Top of Screen
496.32	41.43	Bottom of Screen
495.92	41.83	Bottom of Well
495.92	41.83	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or Other
Riser Pipe Above W.T.	SS304, SS316, PTFE, PVC, or Other
Riser Pipe Below W.T.	SS304, SS316, PTFE, PVC, or Other
Screen	SS304, SS316, PTFE, PVC, or Other

CASING MEASURMENTS

Diameter of Borehole (inches)	8.25
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	34.01
Bottom of Screen to End Cap (feet)	0.4
Screen Length (1" slot to last slot) (feet)	10
Total Length of Casing (feet)	44.41
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

Well Completion Form (revised 02/06/02)

APPENDIX C

STATISTICAL METHOD FOR DETERMINATION OF BACKGROUNDS

Statistical Analyses Method

1.0 References

1. "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Unified Final Guidance." USEPA, March 2009.

2.0 Statistical Method

The statistical method includes the calculation of the 95% Upper Prediction Limit (upper and lower for pH) for each parameter utilizing the background data set. Prior to the calculation of the Prediction Limit, the data set is evaluated for normality, outliers and the percentage of non-detect values. Each of the steps for determining the Prediction Limit is outlined below in Sections 2.1 through 2.4.

2.1 Normality Testing

The distribution of the data is tested for normality using the Shapiro-Wilk normality test. If the data is not found to follow a normal distribution, a nonparametric statistical method shall be utilized. Generally, the highest detected concentration is utilized as the Upper Prediction Limit if the data set is found to be nonparametric. If the data is found to follow a normal distribution, the procedures outlined below are used to determine the Prediction Limit.

2.2 Handling of Outliers

Prior to statistical analyses, the data set is evaluated for outliers. Outliers are defined as data points that vary significantly from the mean value of the data set. Outliers may represent sampling error, contamination from surface run-off, analytical laboratory error, or anomalous site conditions. Outliers, if not removed from the data set, can erroneously increase the prediction limit which makes the prediction limit less likely to detect a statistically significant increase related to a release from a waste unit. Once a statistical outlier has been identified, the concentrations shall be evaluated to determine the cause. If the outlier is determined to be a result of sampling, laboratory or some other error, the outlier will be removed from the data set. If no specific reason can be documented the point will be considered representative of site conditions and will be included in the statistical analysis. Statistical analysis will then be conducted as described below. Evaluation for outliers will be completed utilizing Grubb's Test as well as Dixon's Test (both at 1% significance).

2.3 Handling of Non-Detects (NDs)

Non-detect values (NDs) are handled according to the percentage of Non-Detects (%ND) present in the data set. The data treatment is completed according to the following criteria:

a) For under 0% NDs, no adjustment is made to the values in the data set.
b) For under 15% NDs, the value of one-half (½) the reported Detection Limit (DL) is substituted for the ND value, and the mean and standard deviation are calculated using detected values with the substituted ND values.
c) For 15-50% NDs with a single censoring point, Cohen's Adjustment is used to adjust the mean and standard deviation. The adjusted mean and standard deviation are then used to calculate the Prediction Limit.
d) For 15-50% NDs with multiple censoring points:
    - For small data sets (<5): ½ the PQL can be substituted for ND values. The Prediction Limit is then calculated with the dataset containing the substituted values.
    - For larger data sets: Kaplan-Meier is used to adjust the mean and standard deviation. The adjusted mean and standard deviation are then used to calculate the Prediction Limit.
e) For over 50% but not 100% NDs, the highest recorded concentration is substituted for the prediction limit.
f) For 100% NDs, the Practical Quantitation Limit (PQL) will be utilized as the upper confidence limit.

2.4 Calculation of the Prediction Limit

After any outliers are removed and the data has been treated for non-detect values, the statistical procedure for calculation of the Prediction Limit will be conducted according to the following steps:

a) <u>Calculate arithmetic mean</u>

The arithmetic mean is calculated using the pooled data for each parameter. The arithmetic mean (X_b) is calculated using the following equation:

$$X_b = \frac{X_1 + X_2 + \ldots + X_n}{n}$$

where: X_b = Average background value
X_n = Individual background value for *n* sample
n = Number of background values

b) Calculate standard deviation

The standard deviation is calculated using the pooled data for each parameter.

The standard deviation is calculated using the following equation:

$$S_b = \sqrt{\frac{(X_1 - X_b) + (X_2 - X_b) + \ldots + (X_n - X_b)}{n - 1}}$$

where: S_b = Population standard deviation
X_n = Individual background value for *n* sample
X_b = Mean (1)
n = Number of background samples

c) Calculate the 95% Prediction Limit

The 95% Prediction Limit is calculated for each parameter using the mean (1), the standard deviation (2), the number of background samples, and the Student's t value given for α = 0.05 (95% Confidence). The Prediction Limit for pH is calculated as and upper and lower limit. All other Prediction Limits are calculated as an upper limit. The Student's t value varies upon the number of background samples. The 95% Prediction Limit is calculated using the following equation:

$$PL = X_b \pm S_b \bullet t \bullet \sqrt{1 + \frac{1}{n}}$$

where: PL = Upper Prediction Limit (Upper and Lower for pH)
X_b = Mean (1)
S_b = Standard Deviation (2)
t = Student's t value at 0.05 significance
n = Number of background samples

APPENDIX D
BACKGROUND CONCENTRATIONS AND CALCULATIONS

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City Water, Light and Power

Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix III Parameters

Raw Data Summary

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	Distribution[1]	Proposed Background Value
AP-4	Boron, total	mg/l	0.119	0.123	0.787	< 2	< 0.687	0.75	0.665	< 2	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.787
AP-5	Boron, total	mg/l	< 1	< 0.625	0.782	< 3.2	< 0.687	0.22	0.0954	< 2		
AP-4	Chloride, total	mg/l	10.1	9.85	11	10.5	10.8	11	10.7	10.9	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	24.2
AP-5	Chloride, total	mg/l	24.2	7.23	3.32	3.76	3.71	2.61	1.95	2.07		
AP-4	Fluoride, total	mg/l	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.2	< 0.5	< 0.5	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.62
AP-5	Fluoride, total	mg/l	0.62	< 0.5	< 0.5	< 0.5	< 0.5	0.43	< 0.5	< 0.5		
AP-4	pH (field)	units	6.81	7.07	7.63	7.09	7.04	7.23	7.04	7.1	Normal - Calculate Interwell Prediction Limit	6.76-7.63
AP-5	pH (field)	units	7.33	7.19		7.29	7.23	7.46	7.15	7.32		
AP-4	Sulfate, total	mg/l	< 5	< 5	< 5	< 5	< 5	0.3	< 5	< 5	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	84.5
AP-5	Sulfate, total	mg/l	82.3	43.5	76.8	84.5	83.4	55.3	66.8	59.5		
AP-4	Total Dissolved Solids	mg/l	490	560	448	574	460	578	548	316	Normal - Calculate Interwell Prediction Limit	597.94
AP-5	Total Dissolved Solids	mg/l	414	404	316	404	370	410	428	384		

Well	Parameter	Units	5/28/15	8/20/15	11/13/15	2/26/16	5/13/16	8/4/16	11/18/16	2/16/17	Distribution*	Proposed Background Value
AP-4	Calcium, total	mg/l	121	117	125	125	118	118	117	136	Normal - Calculate Interwell Prediction Limit	176.63
AP-5	Calcium, total	mg/l	103	92.2	124	98.1	77.3	158	201	155		

Notes:

1. Shapiro-Wilk method utilized to determine if the data set follows a normal distribution. ProUCL 5.1 was used for the calculations. ProUCL 5.1 outputs are provided.
2. In accordance with Chapter 18.3 of the March 2009 Unified Guidance (Statistical Analysis of Groundwater at RCRA Facilities), the maximum detected concentration is utilized as the interwell prediction limit and proposed background when the dataset does not follow a normal distribution.

Response to 1st RTP
CWLP - 012949

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City Water, Light and Power

Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix III Parameters

Outlier Analysis

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	Number of Samples	Mean	Standard Deviation	Critical Values
AP-4	pH (field)	units	6.81	7.07	7.63	7.09	7.04	7.23	7.04	7.1	15	7.198666667	0.196136	2.705
AP-5	pH (field)	units	7.33	7.19		7.29	7.23	7.46	7.15	7.32				
AP-4	Total Dissolved Solids	mg/l	490	560	448	574	460	578	548	316	16	444	85.19468	2.747
AP-5	Total Dissolved Solids	mg/l	414	404	316	404	370	410	428	384				
Well	**Parameter**	**Units**	**5/28/15**	**8/20/15**	**11/13/15**	**2/26/16**	**5/13/16**	**8/4/16**	**11/18/16**	**2/16/17**	**Number of Samples**	**Mean**	**Standard Deviation**	**Critical Values**
AP-4	Calcium, total	mg/l	121	117	125	125	118	118	117	136	16	124.1	29.06863	2.747
AP-5	Calcium, total	mg/l	103	92.2	124	98.1	77.3	158	201	155				

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13
AP-4	pH (field)	units	-1.981613	-0.656006	2.1991488	-0.554036	-0.80896	0.1597527	-0.80896	-0.503051
AP-5	pH (field)	units	0.6696017	-0.044187		0.4656621	0.1597527	1.3324055	-0.248127	0.6186168
AP-4	Total Dissolved Solids	mg/l	0.5399398	1.3615874	0.0469513	1.5259169	0.1878052	1.5728682	1.2207335	-1.502441
AP-5	Total Dissolved Solids	mg/l	-0.352135	-0.469513	-1.502441	-0.469513	-0.868599	-0.399086	-0.187805	-0.704269
Well	**Parameter**	**Units**	**5/28/15**	**8/20/15**	**11/13/15**	**2/26/16**	**5/13/16**	**8/4/16**	**11/18/16**	**2/16/17**
AP-4	Calcium, total	mg/l	-0.106644	-0.24425	0.0309612	0.0309612	-0.209848	-0.209848	-0.24425	0.409376
AP-5	Calcium, total	mg/l	-0.725868	-1.097403	-0.00344	-0.894435	-1.609983	1.1662056	2.6454634	1.0630015

Notes:

1. Outlier method presented above outlined is in ASTM paper E178-75 (Grubb's Test).
2. Outliers were also evaluated utilizing Dixon's Test in ProUCL 5.1 at 1% Significance. ProUCL 5.1 output are provided.
3. Outliers that were identified by both methods are noted with a shaded value.

Response to 1st RTP
CWLP - 012950

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City Water, Light and Power

Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix III Parameters

Non-Detect Percentage Analysis

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	Number of Samples	Number of ND's	% ND	ND Treatment
AP-4	pH (field)	units	6.81	7.07	7.63	7.09	7.04	7.23	7.04	7.1	15	0	0%	No Adjustment
AP-5	pH (field)	units	7.33	7.19		7.29	7.23	7.46	7.15	7.32				
AP-4	Total Dissolved Solids	mg/l	490	560	448	574	460	578	548	316	16	0	0%	No Adjustment
AP-5	Total Dissolved Solids	mg/l	414	404	316	404	370	410	428	384				
Well	**Parameter**	**Units**	**5/28/15**	**8/20/15**	**11/13/15**	**2/26/16**	**5/13/16**	**8/4/16**	**11/18/16**	**2/16/17**	**Number of Samples**	**Number of ND's**	**% ND**	**ND Treatment**
AP-4	Calcium, total	mg/l	121	117	125	125	118	118	117	136	16	0	0%	No Adjustment
AP-5	Calcium, total	mg/l	103	92.2	124	98.1	77.3	158	201	155				

Notes:

1. For datasets with a fraction of non-detect values from 25% to 50%, adjustments to the mean and standard deviation (SD) are required.
2. For datasets with a single censoring point (RL), Cohen's Ajustment may be used to adjust the mean and SD or a substitution of 1/2 the RL may be used for small datasets (<5) in accordance with Section 15.2 of the March 2009 Unified Guidance (Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities).
3. Kaplan-Meier may be used to adjust the mean and SD for datasets with single or multiple censoring points (RL). The Kaplan-Meier adjusted mean and SD were calculated using ProUCL 5.1.
2. For datasets that do not include non-detect values, no adjustment to the mean and standard deviation are required prior to calculating the prediction limit.

Response to 1st RTP
CWLP - 012951

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City Water, Light and Power

Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix III Parameters

Prediction Limit Calculation

Prediction Limit = x + st[1+(1/n)]^*½

Confidence Level = 95%

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	ND Treatment	Mean [x]	Standard Deviation [s]	Number of Samples	T Value [t]	Prediction Limit Limit	
AP-4	pH (field)	units	6.81	7.07	7.63	7.09	7.04	7.23	7.04	7.1	No Adjustment	7.1986667	0.20	15	2.145	6.7642	7.6332
AP-5	pH (field)	units	7.33	7.19		7.29	7.23	7.46	7.15	7.32							
AP-4	Total Dissolved Solids	mg/l	490	560	448	574	460	578	548	316	No Adjustment	444	85.19	16	1.753	597.9426139	
AP-5	Total Dissolved Solids	mg/l	414	404	316	404	370	410	428	384							
Well	**Parameter**	**Units**	**5/28/15**	**8/20/15**	**11/13/15**	**2/26/16**	**5/13/16**	**8/4/16**	**11/18/16**	**2/16/17**	**ND Treatment**	**Mean**	**Standard Deviation**	**Number of Samples**	**T Value**	**Prediction Limit Limit**	
AP-4	Calcium, total	mg/l	121	117	125	125	118	118	117	136	No Adjustment	124.1	29.07	16	1.753	176.6255938	
AP-5	Calcium, total	mg/l	103	92.2	124	98.1	77.3	158	201	155							

Response to 1st RTP
CWLP - 012952

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City Water, Light and Power

Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix IV Parameters

Well	Parameter	Units	2/22/2012	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	Distribution[1]	Proposed Background Value
AP-4	Antimony, total	mg/l	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	0.0152	< 0.006	< 0.006	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.016
AP-5	Antimony, total	mg/l	< 0.006	< 0.006	0.0063	< 0.0096	< 0.006	0.016	< 0.006	< 0.006		
AP-4	Arsenic, total	mg/l	< 0.05	< 0.05	0.0294	0.00608	< 0.05	0.025	0.0193	< 0.05	Normal - Calculate Interwell Prediction Limit	0.0724
AP-5	Arsenic, total	mg/l	< 0.05	0.076	0.102	0.0243	< 0.05	0.0094	< 0.015	< 0.05		
AP-4	Barium, total	mg/l	< 2	< 2	0.366	< 2	< 2	0.37	0.385	< 2	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	5.24
AP-5	Barium, total	mg/l	5.24	< 2	2.76	< 3.2	< 2	0.13	0.228	< 2		
AP-4	Beryllium, total	mg/l	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.0164
AP-5	Beryllium, total	mg/l	0.0142	0.0128	0.0092	0.0164	< 0.004	< 0.004	< 0.004	< 0.004		
AP-4	Cadmium, total	mg/l	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.0025	< 0.005	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.0128
AP-5	Cadmium, total	mg/l	0.00776	0.0128	0.00575	< 0.008	< 0.005	< 0.005	< 0.0025	< 0.005		
AP-4	Chromium, total	mg/l	< 0.1	< 0.1	< 0.0175	< 0.1	< 0.1	0.0039	< 0.01	< 0.1	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.811
AP-5	Chromium, total	mg/l	0.811	0.328	0.449	0.42	< 0.1	0.016	0.0431	0.113		
AP-4	Cobalt, total	mg/l	< 1	< 1	< 0.0175	< 1	< 1	< 1	< 0.015	< 1	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.297
AP-5	Cobalt, total	mg/l	< 1	< 1	0.297	< 1.6	< 1	0.0086	0.0223	< 1		
AP-4	Lead, total	mg/l	< 0.0075	< 0.0075	< 0.005	< 0.0075	< 0.0075	0.0036	< 0.005	< 0.0075	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.638
AP-5	Lead, total	mg/l	0.638	0.236	0.312	0.277	0.0244	0.0104	0.0312	0.638		
AP-4	Mercury, total	mg/l	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.0008
AP-5	Mercury, total	mg/l	0.0008	< 0.0005	0.0007	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005		
AP-4	Selenium, total	mg/l	< 0.05	< 0.05	0.00497	< 0.05	< 0.05	0.0079	< 0.0025	< 0.05	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.0079
AP-5	Selenium, total	mg/l	< 0.05	< 0.05	0.00585	< 0.08	< 0.05	0.0046	0.00523	< 0.05		
AP-4	Thallium, total	mg/l	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.00556
AP-5	Thallium, total	mg/l	0.00556	0.00258	0.00302	< 0.0032	< 0.002	< 0.002	< 0.002	< 0.002		

Well	Parameter	Units	5/28/2015	8/20/15	11/13/15	2/26/16	5/13/16	8/4/16	11/18/16	2/16/17	Distribution[1]	Proposed Background Value
AP-4	Lithium	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	100% ND - Propose PQL as Prediction Limit	0.05
AP-5	Lithium	mg/l	< 0.05	< 0.05	< 0.25	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05		
AP-4	Molybdenum	mg/l	< 0.025	< 0.025	< 0.05	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	100% ND - Propose PQL as Prediction Limit	0.025
AP-5	Molybdenum	mg/l	< 0.025	< 0.025	< 0.05	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025		

Well	Parameter	Units	8/23/2012	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	2/26/14	5/20/14	Distribution[1]	Proposed Background Value
AP-4	Radium-226	pCi/l	< 0.97	0.41	< 0.57	0.84	< 0.57	0.46	0.91	1.2	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	7.1
AP-5	Radium-226	pCi/l	7.1	< 0.74	1.6	1.1	1	1.8	< -0.04	-0.03		
AP-4	Radium-228	pCi/l	< 0.71	2.3	< 0.83	0.69	< 1.4	< 0.52	0.56	0.53	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	5.1
AP-5	Radium-228	pCi/l	5.1	< 1.28	1.6	< 0.68	0.81	1.7	< 1.8	0.95		

Notes:

1. Shapiro-Wilk method utilized to determine if the data set follows a normal distribution. ProUCL 5.1 was used for the calculations. ProUCL 5.1 outputs are provided.

2. In accordance with Section 18.3 of the March 2009 Unified Guidance (Statistical Analysis of Groundwater at RCRA Facilities), the maximum detected concentration is utilized as the interwell prediction limit and proposed background when the dataset does not follow a normal distribution.

Response to 1st RTP
CWLP - 012953

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City Water, Light and Power

Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix IV Parameters

Outlier Analysis

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	Number of Samples	Mean	Standard Deviation	Critical Values
AP-4	Arsenic, total	mg/l	< 0.05	< 0.05	0.0294	0.00608	< 0.05	0.025	0.0193	< 0.05	16	0.04103	0.025229	2.747
AP-5	Arsenic, total	mg/l	< 0.05	0.076	0.102	0.0243	< 0.05	0.0094	< 0.015	< 0.05				

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13
AP-4	Arsenic, total	mg/l	0.355548	0.355548	-0.46098	-1.38533	0.355548	-0.63539	-0.86132	0.355548
AP-5	Arsenic, total	mg/l	0.355548	1.386121	2.416694	-0.66313	0.355548	-1.25373	-1.03176	0.355548

Notes:

1. Outlier method presented above outlined is in ASTM paper E178-75 (Grubb's Test).
2. Outliers were also evaluated utilizing Dixon's Test in ProUCL 5.1 at 1% Significance. ProUCL 5.1 output are provided.
3. Outliers that were identified by both methods are noted with a shaded value.

Response to 1st RTP
CWLP - 012954

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City Water, Light and Power

Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix IV Parameters

Non-Detect Percentage Analysis

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	Number of Samples	Number of ND's	% ND	ND Treatment
AP-4	Arsenic, total	mg/l	< 0.05	< 0.05	0.0294	0.00608	< 0.05	0.025	0.0193	< 0.05	16	8	50%	Kaplan-Meier
AP-5	Arsenic, total	mg/l	< 0.05	0.076	0.102	0.0243	< 0.05	0.0094	< 0.015	< 0.05				

Notes:

1. For datasets with a fraction of non-detect values from 25% to 50%, adjustments to the mean and standard deviation (SD) are required.
2. For datasets with a single censoring point (RL), Cohen's Ajustment may be used to adjust the mean and SD or a substitution of 1/2 the RL may be used for small datasets (<5) in accordance with Section 15.2 of the March 2009 Unified Guidance (Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities).
3. Kaplan-Meier may be used to adjust the mean and SD for datasets with single or multiple censoring points (RL). The Kaplan-Meier adjusted mean and SD were calculated using ProUCL 5.1.
2. For datasets that do not include non-detect values, no adjustment to the mean and standard deviation are required prior to calculating the prediction limit.

Response to 1st RTP
CWLP - 012955

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City Water, Light and Power

Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

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Prediction Limit Calculation

Prediction Limit = x + st[1+(1/n)]^*½

Confidence Level = 95%

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	ND Treatment	Mean [x]	Standard Deviation [s]	Number of Samples	T Value [t]	Prediction Limit Limit
AP-4	Arsenic, total	mg/l	< 0.05	< 0.05	0.0294	0.00608	< 0.05	0.025	0.0193	< 0.05	No Adjustment	0.0263	0.0255	16	1.753	0.072377252
AP-5	Arsenic, total	mg/l	< 0.05	0.076	0.102	0.0243	< 0.05	0.0094	< 0.015	< 0.05						

Note:

1. Multiple censoring points (RL's) were observed. Therefore, Kaplan-Meier was utilized to adjust the mean and SD.

Response to 1st RTP
CWLP - 012956

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/25/2017 3:46:43 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Arsenic

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	8	8	50.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	8	0.015	0.05	0.0456	0.05	0.0124
Statistics (Non-Detects Only)	8	0.00608	0.102	0.0364	0.0247	0.0341
Statistics (All: NDs treated as DL value)	16	0.00608	0.102	0.041	0.05	0.0252
Statistics (All: NDs treated as DL/2 value)	16	0.00608	0.102	0.0296	0.025	0.0247
Statistics (Normal ROS Imputed Data)	16	-0.0127	0.102	0.0268	0.0227	0.0292
Statistics (Gamma ROS Imputed Data)	16	0.00608	0.102	0.0278	0.021	0.0264
Statistics (Lognormal ROS Imputed Data)	16	0.00559	0.102	0.0266	0.0199	0.0265

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	1.472	1.004	0.0247	-3.689	0.946	-0.256
Statistics (NDs = DL)	2.385	1.98	0.0172	-3.418	0.762	-0.223
Statistics (NDs = DL/2)	2.194	1.824	0.0135	-3.764	0.713	-0.189
Statistics (Gamma ROS Estimates)	1.701	1.424	0.0163	-3.905	0.795	-0.204
Statistics (Lognormal ROS Estimates)	--	--	--	-3.982	0.84	-0.211

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.897	0.945	0.795	0.941

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.805	0.818	Data Not Normal
Shapiro-Wilk (NDs = DL)	0.899	0.887	Data Appear Normal
Shapiro-Wilk (NDs = DL/2)	0.653	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.895	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.332	0.283	Data Not Normal
Lilliefors (NDs = DL)	0.236	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.387	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.209	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/25/2017 4:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Boron

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	8	8	50.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	8	0.625	3.2	1.525	1.5	0.924
Statistics (Non-Detects Only)	8	0.0954	0.787	0.443	0.443	0.328
Statistics (All: NDs treated as DL value)	16	0.0954	3.2	0.984	0.719	0.872
Statistics (All: NDs treated as DL/2 value)	16	0.0954	1.6	0.603	0.583	0.421
Statistics (Normal ROS Imputed Data)	16	0.0954	0.787	0.383	0.37	0.255
Statistics (Gamma ROS Imputed Data)	16	0.0954	0.787	0.367	0.313	0.253
Statistics (Lognormal ROS Imputed Data)	16	0.0954	0.787	0.343	0.254	0.26

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	1.601	1.084	0.276	-1.159	0.953	-0.823
Statistics (NDs = DL)	1.286	1.087	0.765	-0.453	1.068	-2.358
Statistics (NDs = DL/2)	1.856	1.55	0.325	-0.8	0.865	-1.081
Statistics (Gamma ROS Estimates)	2.291	1.903	0.16	-1.237	0.718	-0.58
Statistics (Lognormal ROS Estimates)	--	--	--	-1.332	0.742	-0.557

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.898	0.911	0.96	0.943

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.771	0.818	Data Not Normal
Shapiro-Wilk (NDs = DL)	0.831	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.919	0.887	Data Appear Normal
Shapiro-Wilk (Normal ROS Estimates)	0.867	0.887	Data Not Normal
Lilliefors (Detects Only)	0.251	0.283	Data Appear Normal
Lilliefors (NDs = DL)	0.277	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.168	0.213	Data Appear Normal
Lilliefors (Normal ROS Estimates)	0.198	0.213	Data Appear Normal

User Selected Options

Date/Time of Computation	ProUCL 5.19/25/2017 3:58:26 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Barium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	7	9	56.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	9	2	3.2	2.133	2	0.4
Statistics (Non-Detects Only)	7	0.13	5.24	1.354	0.37	1.946
Statistics (All: NDs treated as DL value)	16	0.13	5.24	1.792	2	1.327
Statistics (All: NDs treated as DL/2 value)	16	0.13	5.24	1.192	1	1.248
Statistics (Normal ROS Imputed Data)	16	-1.289	5.24	0.89	0.378	1.513
Statistics (Gamma ROS Imputed Data)	16	0.01	5.24	0.837	0.344	1.375
Statistics (Lognormal ROS Imputed Data)	16	0.0763	5.24	0.818	0.368	1.342

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	0.712	0.502	1.901	-0.543	1.352	-2.49
Statistics (NDs = DL)	1.387	1.169	1.292	0.182	1.086	5.978
Statistics (NDs = DL/2)	1.445	1.216	0.825	-0.208	0.915	-4.395
Statistics (Gamma ROS Estimates)	0.516	0.461	1.621	-1.402	1.901	-1.356
Statistics (Lognormal ROS Estimates)	--	--	--	-0.9	1.09	-1.212

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.825	0.912	0.8	0.913

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.688	0.803	Data Not Normal
Shapiro-Wilk (NDs = DL)	0.842	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.664	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.855	0.887	Data Not Normal
Lilliefors (Detects Only)	0.405	0.304	Data Not Normal
Lilliefors (NDs = DL)	0.25	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.374	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.218	0.213	Data Not Normal

User Selected Options

Date/Time of Computation	ProUCL 5.19/25/2017 4:03:44 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Beryllium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	4	12	75.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	12	0.004	0.004	0.004	0.004	9.059E-19
Statistics (Non-Detects Only)	4	0.0092	0.0164	0.0132	0.0135	0.00302
Statistics (All: NDs treated as DL value)	16	0.004	0.0164	0.00629	0.004	0.00431
Statistics (All: NDs treated as DL/2 value)	16	0.002	0.0164	0.00479	0.002	0.00517
Statistics (Normal ROS Imputed Data)	16	-0.01	0.0164	0.0032	0.00292	0.00761
Statistics (Gamma ROS Imputed Data)	16	0.0092	0.0164	0.0108	0.01	0.00195
Statistics (Lognormal ROS Imputed Data)	16	0.00207	0.0164	0.00694	0.00575	0.00426

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	23.28	5.987	5.6479E-4	-4.353	0.246	-0.0564
Statistics (NDs = DL)	3.279	2.706	0.00192	-5.229	0.534	-0.102
Statistics (NDs = DL/2)	1.37	1.155	0.00349	-5.749	0.84	-0.146
Statistics (Gamma ROS Estimates)	39.38	32.04	2.7394E-4	-4.542	0.157	-0.0347
Statistics (Lognormal ROS Estimates)	--	--	--	-5.138	0.601	-0.117

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.987	0.77	0.772	0.997

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.981	0.748	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.593	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.593	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.984	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.204	0.375	Data Appear Normal
Lilliefors (NDs = DL)	0.452	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.455	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.084	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 5:05:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Calcium

Raw Statistics

Number of Valid Observations	16
Number of Distinct Observations	13
Minimum	77.3
Maximum	201
Mean of Raw Data	124.1
Standard Deviation of Raw Data	29.07
Khat	20.96
Theta hat	5.92
Kstar	17.08
Theta star	7.268
Mean of Log Transformed Data	4.797
Standard Deviation of Log Transformed Data	0.224

Normal GOF Test Results

Correlation Coefficient R	0.944
Shapiro Wilk Test Statistic	0.909
Shapiro Wilk Critical (0.05) Value	0.887
Approximate Shapiro Wilk P Value	0.0906
Lilliefors Test Statistic	0.238
Lilliefors Critical (0.05) Value	0.213

Data appear Approximate Normal at (0.05) Significance Level

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 9:51:59 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Cadmium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	3	13	81.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	13	0.0025	0.008	0.00485	0.005	0.00133
Statistics (Non-Detects Only)	3	0.00575	0.0128	0.00877	0.00776	0.00363
Statistics (All: NDs treated as DL value)	16	0.0025	0.0128	0.00558	0.005	0.00238
Statistics (All: NDs treated as DL/2 value)	16	0.00125	0.0128	0.00361	0.0025	0.00294
Statistics (Normal ROS Imputed Data)	16	-0.015	0.0128	-0.00253	-0.00298	0.00727
Statistics (Gamma ROS Imputed Data)	16	0.00575	0.0128	0.00977	0.01	0.00142
Statistics (Lognormal ROS Imputed Data)	16	6.0454E-4	0.0128	0.00329	0.00227	0.00316

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (NDs = DL)	7.069	5.785	7.8965E-4	-5.261	0.388	-0.0737
Statistics (NDs = DL/2)	2.647	2.192	0.00136	-5.824	0.599	-0.103
Statistics (Gamma ROS Estimates)	42.99	34.97	2.2724E-4	-4.64	0.166	-0.0357
Statistics (Lognormal ROS Estimates)	--	--	--	-6.04	0.803	-0.133

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.971	0.835	0.784	0.992

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.942	0.767	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.726	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.636	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.984	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.276	0.425	Data Appear Normal
Lilliefors (NDs = DL)	0.346	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.397	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.103	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 1:58:45 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Chloride

Raw Statistics

Number of Valid Observations	16
Number of Distinct Observations	15
Minimum	1.95
Maximum	24.2
Mean of Raw Data	8.356
Standard Deviation of Raw Data	5.632
Khat	2.299
Theta hat	3.635
Kstar	1.91
Theta star	4.376
Mean of Log Transformed Data	1.89
Standard Deviation of Log Transformed Data	0.745

Normal GOF Test Results

Correlation Coefficient R	0.896
Shapiro Wilk Test Statistic	0.815
Shapiro Wilk Critical (0.05) Value	0.887
Approximate Shapiro Wilk P Value	0.00346
Lilliefors Test Statistic	0.257
Lilliefors Critical (0.05) Value	0.213

Data not Normal at (0.05) Significance Level

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 2:30:51 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Cobalt

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	3	13	81.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	13	0.015	1.6	0.895	1	0.423
Statistics (Non-Detects Only)	3	0.0086	0.297	0.109	0.0223	0.163
Statistics (All: NDs treated as DL value)	16	0.0086	1.6	0.748	1	0.497
Statistics (All: NDs treated as DL/2 value)	16	0.0075	0.8	0.384	0.5	0.241
Statistics (Normal ROS Imputed Data)	16	-0.146	0.297	0.0515	0.0278	0.118
Statistics (Gamma ROS Imputed Data)	16	0.0086	0.323	0.0699	0.0104	0.106
Statistics (Lognormal ROS Imputed Data)	16	0.00135	0.297	0.0524	0.0159	0.0874

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (NDs = DL)	0.744	0.646	1.005	-1.097	1.889	-1.722
Statistics (NDs = DL/2)	0.839	0.723	0.458	-1.66	1.746	-1.052
Statistics (Gamma ROS Estimates)	0.636	0.558	0.11	-3.625	1.353	-0.373
Statistics (Lognormal ROS Estimates)	--	--	--	-4.015	1.498	-0.373

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.886	0.868	0.867	0.98

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.786	0.767	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.75	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.751	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.961	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.37	0.425	Data Appear Normal
Lilliefors (NDs = DL)	0.382	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.373	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.136	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 2:15:26 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Chromium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	8	8	50.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	8	0.01	0.1	0.0784	0.1	0.04
Statistics (Non-Detects Only)	8	0.0039	0.811	0.273	0.221	0.283
Statistics (All: NDs treated as DL value)	16	0.0039	0.811	0.176	0.1	0.22
Statistics (All: NDs treated as DL/2 value)	16	0.0039	0.811	0.156	0.05	0.229
Statistics (Normal ROS Imputed Data)	16	-0.299	0.811	0.103	0.0296	0.281
Statistics (Gamma ROS Imputed Data)	16	0.0039	0.811	0.147	0.0202	0.234
Statistics (Lognormal ROS Imputed Data)	16	0.00144	0.811	0.144	0.0212	0.236

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	0.643	0.485	0.425	-2.25	1.878	-0.835
Statistics (NDs = DL)	0.757	0.656	0.232	-2.529	1.466	-0.58
Statistics (NDs = DL/2)	0.606	0.534	0.258	-2.876	1.576	-0.548
Statistics (Gamma ROS Estimates)	0.483	0.434	0.304	-3.239	1.723	-0.532
Statistics (Lognormal ROS Estimates)	--	--	--	-3.525	1.996	-0.566

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.942	0.845	0.817	0.957

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.88	0.818	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.725	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.677	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.924	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.214	0.283	Data Appear Normal
Lilliefors (NDs = DL)	0.362	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.366	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.174	0.213	Data Appear Normal

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 2:43:21 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Fluoride

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	3	13	81.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	13	0.5	0.5	0.5	0.5	0
Statistics (Non-Detects Only)	3	0.2	0.62	0.417	0.43	0.21
Statistics (All: NDs treated as DL value)	16	0.2	0.62	0.484	0.5	0.0838
Statistics (All: NDs treated as DL/2 value)	16	0.2	0.62	0.281	0.25	0.102
Statistics (Normal ROS Imputed Data)	16	0.0634	0.62	0.323	0.321	0.15
Statistics (Gamma ROS Imputed Data)	16	0.155	0.62	0.33	0.314	0.126
Statistics (Lognormal ROS Imputed Data)	16	0.149	0.62	0.317	0.293	0.128

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (NDs = DL)	23.42	19.07	0.0207	-0.746	0.24	-0.321
Statistics (NDs = DL/2)	12.34	10.07	0.0228	-1.31	0.268	-0.204
Statistics (Gamma ROS Estimates)	7.453	6.097	0.0443	-1.177	0.385	-0.327
Statistics (Lognormal ROS Estimates)	--	--	--	-1.222	0.397	-0.325

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.998	0.692	0.665	0.997

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.997	0.767	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.526	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.472	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.991	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.192	0.425	Data Appear Normal
Lilliefors (NDs = DL)	0.449	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.495	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.0794	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 2:58:10 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Mercury

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	2	14	87.50%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	14	5.0000E-4	5.0000E-4	5.0000E-4	5.0000E-4	2.250E-19
Statistics (Non-Detects Only)	2	7.0000E-4	8.0000E-4	7.5000E-4	7.5000E-4	7.0711E-5
Statistics (All: NDs treated as DL value)	16	5.0000E-4	8.0000E-4	5.3125E-4	5.0000E-4	8.7321E-5
Statistics (All: NDs treated as DL/2 value)	16	2.5000E-4	8.0000E-4	3.1250E-4	2.5000E-4	1.7176E-4
Statistics (Normal ROS Imputed Data)	16	-1.466E-4	8.0000E-4	3.0705E-4	3.0035E-4	2.6145E-4
Statistics (Gamma ROS Imputed Data)	16	N/A	N/A	N/A	N/A	N/A
Statistics (Lognormal ROS Imputed Data)	16	2.2601E-4	8.0000E-4	4.3882E-4	4.1068E-4	1.5791E-4

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (NDs = DL)	49.09	39.93	1.0822E-5	-7.55	0.14	-0.0185
Statistics (NDs = DL/2)	5.969	4.892	5.2352E-5	-8.157	0.375	-0.046
Statistics (Gamma ROS Estimates)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (Lognormal ROS Estimates)	--	--	--	-7.789	0.349	-0.0448

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	1	0.628	0.628	0.998

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (NDs = DL)	0.414	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.41	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.992	0.887	Data Appear Normal
Lilliefors (Detects Only)	N/A	N/A	
Lilliefors (NDs = DL)	0.515	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.517	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.0586	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 5:07:40 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Lithium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	0	16	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!

Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Lithium was not processed!

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 5:08:42 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Molybdenum

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	0	16	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!

Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Molybdenum was not processed!

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 2:53:27 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Lead

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	9	7	43.75%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	7	0.005	0.0075	0.00679	0.0075	0.00122
Statistics (Non-Detects Only)	9	0.0036	0.638	0.241	0.236	0.255
Statistics (All: NDs treated as DL value)	16	0.0036	0.638	0.139	0.00895	0.222
Statistics (All: NDs treated as DL/2 value)	16	0.0025	0.638	0.137	0.00708	0.223
Statistics (Normal ROS Imputed Data)	16	-0.428	0.638	0.0464	0.007	0.307
Statistics (Gamma ROS Imputed Data)	16	0.0036	0.638	0.14	0.0102	0.221
Statistics (Lognormal ROS Imputed Data)	16	4.0641E-4	0.638	0.137	0.0101	0.223

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	0.595	0.47	0.406	-2.463	1.911	-0.776
Statistics (NDs = DL)	0.41	0.374	0.338	-3.577	1.915	-0.535
Statistics (NDs = DL/2)	0.354	0.33	0.387	-3.88	2.172	-0.56
Statistics (Gamma ROS Estimates)	0.45	0.407	0.311	-3.4	1.776	-0.522
Statistics (Lognormal ROS Estimates)	--	--	--	-4.02	2.4	-0.597

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.923	0.812	0.813	0.969

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.827	0.829	Data Not Normal
Shapiro-Wilk (NDs = DL)	0.654	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.656	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.934	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.239	0.274	Data Appear Normal
Lilliefors (NDs = DL)	0.373	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.37	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.207	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.110/3/2017 9:00:31 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

pH

Raw Statistics

Number of Valid Observations	15
Number of Distinct Observations	13
Minimum	6.81
Maximum	7.63
Mean of Raw Data	7.199
Standard Deviation of Raw Data	0.196
Khat	1450
Theta hat	0.00497
Kstar	1160
Theta star	0.00621
Mean of Log Transformed Data	1.974
Standard Deviation of Log Transformed Data	0.0272

Normal GOF Test Results

Correlation Coefficient R	0.977
Shapiro Wilk Test Statistic	0.969
Shapiro Wilk Critical (0.05) Value	0.881
Approximate Shapiro Wilk P Value	0.725
Lilliefors Test Statistic	0.143
Lilliefors Critical (0.05) Value	0.22

Data appear Normal at (0.05) Significance Level

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/28/2017 11:48:02 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Ra226

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	11	5	31.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	5	-0.04	0.97	0.562	0.57	0.374
Statistics (Non-Detects Only)	11	-0.03	7.1	1.49	1	1.933
Statistics (All: NDs treated as DL value)	16	-0.04	7.1	1.2	0.875	1.651
Statistics (All: NDs treated as DL/2 value)	16	N/A	N/A	N/A	N/A	N/A
Statistics (Normal ROS Imputed Data)	16	-2.249	7.1	0.749	0.65	1.995

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.76	0.728	0.733	0.869

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.611	0.85	Data Not Normal
Shapiro-Wilk (NDs = DL)	0.561	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.567	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.789	0.887	Data Not Normal
Lilliefors (Detects Only)	0.345	0.251	Data Not Normal
Lilliefors (NDs = DL)	0.313	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.292	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.237	0.213	Data Not Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/28/2017 11:49:12 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Ra228

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	9	7	43.75%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	7	0.52	1.8	1.027	0.83	0.466
Statistics (Non-Detects Only)	9	0.53	5.1	1.582	0.95	1.451
Statistics (All: NDs treated as DL value)	16	0.52	5.1	1.339	0.89	1.136
Statistics (All: NDs treated as DL/2 value)	16	0.26	5.1	1.115	0.695	1.202
Statistics (Normal ROS Imputed Data)	16	-1.431	5.1	0.846	0.553	1.428
Statistics (Gamma ROS Imputed Data)	16	0.01	5.1	0.963	0.545	1.289
Statistics (Lognormal ROS Imputed Data)	16	0.202	5.1	1.095	0.604	1.207

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	1.94	1.367	0.816	0.179	0.749	4.172
Statistics (NDs = DL)	2.452	2.034	0.546	0.0746	0.628	8.42
Statistics (NDs = DL/2)	1.63	1.366	0.684	-0.229	0.78	-3.411
Statistics (Gamma ROS Estimates)	0.608	0.536	1.583	-1.052	1.865	-1.773
Statistics (Lognormal ROS Estimates)	--	--	--	-0.255	0.787	-3.079

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.851	0.814	0.795	0.904

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.739	0.829	Data Not Normal
Shapiro-Wilk (NDs = DL)	0.683	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.655	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.846	0.887	Data Not Normal
Lilliefors (Detects Only)	0.245	0.274	Data Appear Normal
Lilliefors (NDs = DL)	0.235	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.304	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.221	0.213	Data Not Normal

User Selected Options

Date/Time of Computation	ProUCL 5.19/25/2017 3:43:44 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Antimony

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	3	13	81.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	13	0.006	0.0096	0.00628	0.006	9.9846E-4
Statistics (Non-Detects Only)	3	0.0063	0.016	0.0125	0.0152	0.00538
Statistics (All: NDs treated as DL value)	16	0.006	0.016	0.00744	0.006	0.00331
Statistics (All: NDs treated as DL/2 value)	16	0.003	0.016	0.00489	0.003	0.00428
Statistics (Normal ROS Imputed Data)	16	-0.0265	0.016	-0.00565	-0.00701	0.0121
Statistics (Gamma ROS Imputed Data)	16	0.0063	0.016	0.0105	0.01	0.00221
Statistics (Lognormal ROS Imputed Data)	16	2.7001E-4	0.016	0.00379	0.00177	0.00489

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (NDs = DL)	8.001	6.542	9.3037E-4	-4.964	0.335	-0.0674
Statistics (NDs = DL/2)	2.563	2.124	0.00191	-5.527	0.574	-0.104
Statistics (Gamma ROS Estimates)	26.29	21.4	3.9826E-4	-4.579	0.2	-0.0436
Statistics (Lognormal ROS Estimates)	--	--	--	-6.209	1.159	-0.187

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.901	0.7	0.704	0.992

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.811	0.767	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.498	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.504	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.978	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.359	0.425	Data Appear Normal
Lilliefors (NDs = DL)	0.448	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.421	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.0832	0.213	Data Appear Normal

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 3:03:58 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Selenium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	5	11	68.75%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	11	0.0025	0.08	0.0484	0.05	0.0177
Statistics (Non-Detects Only)	5	0.0046	0.0079	0.00571	0.00523	0.00131
Statistics (All: NDs treated as DL value)	16	0.0025	0.08	0.0351	0.05	0.025
Statistics (All: NDs treated as DL/2 value)	16	0.00125	0.04	0.0184	0.025	0.0114
Statistics (Normal ROS Imputed Data)	16	0.00251	0.0079	0.00521	0.00522	0.00155
Statistics (Gamma ROS Imputed Data)	16	0.0046	0.01	0.00866	0.01	0.00216
Statistics (Lognormal ROS Imputed Data)	16	0.0033	0.0079	0.00532	0.00517	0.00136

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	26.79	10.85	2.1315E-4	-5.184	0.211	-0.0407
Statistics (NDs = DL)	1.165	0.988	0.0301	-3.838	1.211	-0.315
Statistics (NDs = DL/2)	1.71	1.431	0.0108	-4.314	0.976	-0.226
Statistics (Gamma ROS Estimates)	13.66	11.14	6.3377E-4	-4.786	0.298	-0.0622
Statistics (Lognormal ROS Estimates)	--	--	--	-5.268	0.255	-0.0485

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.916	0.878	0.896	0.987

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.848	0.762	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.764	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.801	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.967	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.257	0.343	Data Appear Normal
Lilliefors (NDs = DL)	0.35	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.342	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.119	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 4:56:42 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Sulfate

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	9	7	43.75%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	7	5	5	5	5	0
Statistics (Non-Detects Only)	9	0.3	84.5	61.38	66.8	26.96
Statistics (All: NDs treated as DL value)	16	0.3	84.5	36.71	24.25	34.96
Statistics (All: NDs treated as DL/2 value)	16	0.3	84.5	35.62	23	36.02
Statistics (Normal ROS Imputed Data)	16	-20.67	84.5	38.83	38	35
Statistics (Gamma ROS Imputed Data)	16	0.3	84.5	46.67	39.94	26.42
Statistics (Lognormal ROS Imputed Data)	16	0.3	84.5	35.84	25.4	35.84

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	1.122	0.822	54.73	3.609	1.819	0.504
Statistics (NDs = DL)	0.696	0.607	52.74	2.734	1.677	0.613
Statistics (NDs = DL/2)	0.548	0.487	64.95	2.431	1.915	0.788
Statistics (Gamma ROS Estimates)	1.506	1.265	31	3.476	1.344	0.387
Statistics (Lognormal ROS Estimates)	--	--	--	2.343	2.098	0.896

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.907	0.901	0.895	0.977

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.83	0.829	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.785	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.773	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.935	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.196	0.274	Data Appear Normal
Lilliefors (NDs = DL)	0.318	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.321	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.119	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 5:02:40 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

TDS

Raw Statistics

Number of Valid Observations	16
Number of Distinct Observations	14
Minimum	316
Maximum	578
Mean of Raw Data	444
Standard Deviation of Raw Data	85.19
Khat	29.07
Theta hat	15.27
Kstar	23.66
Theta star	18.76
Mean of Log Transformed Data	6.079
Standard Deviation of Log Transformed Data	0.193

Normal GOF Test Results

Correlation Coefficient R	0.971
Shapiro Wilk Test Statistic	0.927
Shapiro Wilk Critical (0.05) Value	0.887
Approximate Shapiro Wilk P Value	0.271
Lilliefors Test Statistic	0.139
Lilliefors Critical (0.05) Value	0.213

Data appear Normal at (0.05) Significance Level

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 4:59:14 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Thallium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	3	13	81.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	13	0.002	0.0032	0.00209	0.002	3.3282E-4
Statistics (Non-Detects Only)	3	0.00258	0.00556	0.00372	0.00302	0.00161
Statistics (All: NDs treated as DL value)	16	0.002	0.00556	0.0024	0.002	9.2960E-4
Statistics (All: NDs treated as DL/2 value)	16	0.001	0.00556	0.00155	0.001	0.00124
Statistics (Normal ROS Imputed Data)	16	-0.00705	0.00556	-0.00129	-0.00153	0.00333
Statistics (Gamma ROS Imputed Data)	16	0.00258	0.01	0.00882	0.01	0.0026
Statistics (Lognormal ROS Imputed Data)	16	2.2972E-4	0.00556	0.00139	9.2841E-4	0.00136

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (NDs = DL)	10.96	8.944	2.1882E-4	-6.08	0.284	-0.0467
Statistics (NDs = DL/2)	3.068	2.535	5.0437E-4	-6.643	0.527	-0.0793
Statistics (Gamma ROS Estimates)	7.213	5.902	0.00122	-4.801	0.447	-0.0931
Statistics (Lognormal ROS Estimates)	--	--	--	-6.92	0.842	-0.122

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.926	0.696	0.714	0.995

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.858	0.767	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.507	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.529	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.991	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.335	0.425	Data Appear Normal
Lilliefors (NDs = DL)	0.416	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.421	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.0776	0.213	Data Appear Normal

User Selected Options

Date/Time of Computation ProUCL 5.19/27/2017 3:54:50 PM

From File WorkSheet.xls

Full Precision OFF

Dixon's Outlier Test for Arsenic

Total N = 16

Number NDs = 8

Number Detects = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

Note: NDs excluded from Outlier Test

1. Data Value 0.102 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.281

For 10% significance level, 0.102 is not an outlier.

For 5% significance level, 0.102 is not an outlier.

For 1% significance level, 0.102 is not an outlier.

2. Data Value 0.00608 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.047

For 10% significance level, 0.00608 is not an outlier.

For 5% significance level, 0.00608 is not an outlier.

For 1% significance level, 0.00608 is not an outlier.

User Selected Options

Date/Time of Computation ProUCL 5.19/28/2017 11:52:22 AM

From File WorkSheet.xls

Full Precision OFF

Dixon's Outlier Test for Calcium

Total N = 16

Number NDs = 0

Number Detects = 16

10% critical value: 0.454

5% critical value: 0.507

1% critical value: 0.595

Note: NDs excluded from Outlier Test

1. Data Value 201 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.447

For 10% significance level, 201 is not an outlier.

For 5% significance level, 201 is not an outlier.

For 1% significance level, 201 is not an outlier.

2. Data Value 77.3 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.268

For 10% significance level, 77.3 is not an outlier.

For 5% significance level, 77.3 is not an outlier.

For 1% significance level, 77.3 is not an outlier.

User Selected Options

Date/Time of Computation	ProUCL 5.19/27/2017 3:39:01 PM
From File	WorkSheet.xls
Full Precision	OFF

Dixon's Outlier Test for pH

Total N = 15
Number NDs = 0
Number Detects = 15
10% critical value: 0.472
5% critical value: 0.525
1% critical value: 0.616
Note: NDs excluded from Outlier Test

1. Data Value 7.63 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.508

For 10% significance level, 7.63 is an outlier.
For 5% significance level, 7.63 is not an outlier.
For 1% significance level, 7.63 is not an outlier.

2. Data Value 6.81 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.442

For 10% significance level, 6.81 is not an outlier.
For 5% significance level, 6.81 is not an outlier.
For 1% significance level, 6.81 is not an outlier.

User Selected Options

Date/Time of Computation	ProUCL 5.19/27/2017 3:36:41 PM
From File	WorkSheet.xls
Full Precision	OFF

Dixon's Outlier Test for TDS

Total N = 16

Number NDs = 0

Number Detects = 16

10% critical value: 0.454

5% critical value: 0.507

1% critical value: 0.595

Note: NDs excluded from Outlier Test

1. Data Value 578 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.087

For 10% significance level, 578 is not an outlier.

For 5% significance level, 578 is not an outlier.

For 1% significance level, 578 is not an outlier.

2. Data Value 316 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.221

For 10% significance level, 316 is not an outlier.

For 5% significance level, 316 is not an outlier.

For 1% significance level, 316 is not an outlier.

Background Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.110/3/2017 10:23:39 AM
From File	Data Sept28.xls
Full Precision	OFF
Confidence Coefficient	95%
Coverage	95%
Different or Future K Observations	1
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	16	Number of Missing Observations	0
Number of Distinct Observations	10		
Number of Detects	8	Number of Non-Detects	8
Number of Distinct Detects	8	Number of Distinct Non-Detects	2
Minimum Detect	0.00608	Minimum Non-Detect	0.015
Maximum Detect	0.102	Maximum Non-Detect	0.05
Variance Detected	0.00116	Percent Non-Detects	50%
Mean Detected	0.0364	SD Detected	0.0341
Mean of Detected Logged Data	-3.689	SD of Detected Logged Data	0.946

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.524	d2max (for USL)	2.443

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	**0.0263**	**KM SD**	**0.0255**
95% UTL95% Coverage	0.0907	95% KM UPL (t)	0.0724
90% KM Percentile (z)	0.059	95% KM Percentile (z)	0.0682
99% KM Percentile (z)	0.0856	95% KM USL	0.0886

24.9

24.9	10/17/2017 - CCR Surface Impoundments Groundwater Monitoring System Certification	CCR Surface Impoundments Groundwater Monitoring Program	CWLP	26331	26403

Electronic Filing: Received, Clerk's Office 02/13/2020

City Water, Light & Power
Coal Combustion Residuals Surface Impoundments

Groundwater Monitoring Program

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APPENDICES

Appendix A – Potentiometric Surface Maps
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1. INTRODUCTION

City Water, Light and Power (CWLP) owns and operates two (2) existing coal combustion residual (CCR) surface impoundments and intends to comply with the rules promulgated by the U.S. Environmental Protection Agency (EPA) pertaining to Disposal of CCR from Electric Utilities published in 40 CFR Part 257 on April 17, 2015 in Federal Register, Volume 80, No. 74; and with the Technical Amendments published on July 2, 2015 in Federal Register, Volume 80, No. 127.

The CWLP CCR surface impoundments are located north and east of the former Lakeside Power Generating Station and Dallman Power Generating Station in the Eastern ½ of Section 12, Township 15 North, Range 5 West, in Springfield, Illinois (see Figure 1). These CCR surface impoundments are identified as the Lakeside Ash Pond and the Dallman Ash Pond (see Figure 2).

The former Lakeside Power Generating Station and Dallman Power Generating Station are situated on the northwestern bank of Lake Springfield in Springfield, Illinois. The Lakeside Ash Pond is immediately south of Spaulding Dam at the northern end of Lake Springfield. The Dallman Ash Pond is immediately northwest of the Lakeside Ash Pond.

Placed into service prior to 1958, the Lakeside Ash Pond is primarily a diked embankment. The Lakeside Ash Pond consists of four separate ponds (i.e., three lime softening ponds and a settling pond) totaling approximately 35.0 acres. The Lakeside Ash Pond ceased receiving ash in 2009.

The Dallman Ash Pond was placed into service in approximately 1976 and is also a diked embankment. The Dallman Ash Pond is approximately 34.5 acres. Fly ash and bottom ash are sluiced to the Dallman Ash Pond with raw lake water.

This Groundwater Monitoring Program (GMP) was prepared to meet the groundwater monitoring and corrective action requirements of the Federal CCR Rule Part 257.90-98. The federal rules are specifically addressed in Section 3 and referenced throughout this document.

1.1 REGULATIONS

The two (2) CCR surface impoundments are regulated by Federal CCR Rule 40 CFR Part 257 Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities (EPA, 2015). As indicated above, the groundwater monitoring and corrective action requirements of the Federal CCR Rule Part 257.90-98 apply to both impoundments.

1.2 SITE DEVELOPMENT

The Lakeside Ash Pond was placed into service prior to 1958 and ceased receiving ash in 2009. The Dallman Ash Pond was placed into service in approximately 1976 and continues to receive ash. The most recent change made to the CCR surface impoundments was a vertical expansion to the Lakeside Ash Pond system in 1988. The vertical expansion consists of berms built on top and inside of the existing embankments in such a way that the toe of the outer slope of the expansion berms matches up with the top of the inner slope of the existing embankments. The vertical expansion berms are approximately ten feet in height.

2. SUBSURFACE CONDITIONS AT THE CCR SURFACE IMPOUNDMENTS

The subsurface conditions of the area in and surrounding the CCR surface impoundments have been characterized through multiple subsurface investigations, including those prior to the impoundment development, along the perimeter of the impoundments and including the hydrogeologic investigation at the permitted Subtitle D CCR landfill located north of the Lakeside Ash Pond and east of the Dallman Ash Pond. These investigations were as follows:

- Professional Service Industries (PSI), June 1989. This investigation consisted of five soil borings within the east section of the south cell (Cell 1).
- Andrews Environmental Engineering, Inc. (AEEI), February 1990. This investigation was performed for Cell 2 and consisted of 13 soil borings. The drilling and testing were completed by PSI.
- Andrews Environmental Engineering, Inc. (AEEI), March 1990. This investigation was performed to install six wells at the Facility. The drilling and testing were completed by PSI.
- Patrick Engineering, Inc. (PEI), July 1992. This investigation was performed to further characterize the hydrogeology of the landfill setting. Approximately 44 soil borings and piezometers were installed by PEI.
- Stabilize, Inc. (SI), December 2008. This investigation installed three new monitoring wells as part of an assessment program for the landfill. The drilling, soil testing, and well construction were performed by Reynolds Well Drilling.
- City Water, Light and Power (CWLP), April 2010. This investigation was performed to install four piezometers on the west side of the CCR surface impoundments along Sugar Creek. The drilling and testing were completed by PSI.
- Stabilize, Inc. (SI), May 2011. This investigation installed four new monitoring wells to further the characterization of the CCR surface impoundments. The drilling, soil testing, and well construction were performed by PSI.
- Andrews Engineering, Inc. (AEI), January 2012. This investigation was performed to replace CCR surface impoundment wells and install an additional background well. The drilling and well installation were completed by TerraDrill.
- Andrews Engineering, Inc. (AEI), July 2017. This project included drilling peripheral to the Dallman Ash Pond.

The summary discussion below of the subsurface conditions is presented in context of the 2015 Federal CCR Rule requirements for groundwater monitoring systems. Emphasis is placed on characterizing the existing wells and hydrogeologic conditions of the uppermost aquifer and underlying confining aquitard. The uppermost aquifer is the required unit for groundwater quality monitoring under the Federal CCR rule.

The occurrence of the deposits discussed below is highly variable due to the meandering nature of Sugar Creek prior to the development of Lake Springfield and Spaulding Dam. The meandering creek has resulted in sequential erosion and deposition (scour and fill) throughout much of the creek drainage system, both laterally and vertically.

2.1 SURFICIAL DEPOSITS

The shallow stratigraphy and lithology at the CCR surface impoundments include approximately 20 to 50 feet of Pleistocene sediments, dependent upon location. In ascending order these materials are identified as basal sand, lower cohesive deposit, shallow sand, upper cohesive deposit and fill material.

The overall tendency is for the finer-grained materials (clays, silty clays and silts) to overlie the coarser-grained materials (sands and gravels). This coarsening downward is present throughout much of the site. At the majority of the borehole locations, the coarser materials rest directly on top of the weathered bedrock surface. It is this coarser material, the basal sand, which is characterized as the uppermost aquifer.

Basal Sand

In most locations, the basal sand is the lower-most surficial deposit. The basal sand is a gray colored, poorly graded, silty to clayey fine sand to well graded sand with minor amounts of fine gravel. This unit was encountered in a medium dense to dense condition. The top elevation of the basal sand varies from 491 to 513 feet mean sea level (MSL) and the thickness ranges from about 0 to 12.3 feet. The unit was not encountered consistently, likely due to excessive erosion of the creek bottom.

The basal sand generally overlies the bedrock surface and underlies the lower cohesive deposit. There are some pockets of very hard, fine grained silty clay to clay overlying bedrock in a few areas. The basal sand is present above these pockets of clayey deposits, thought to be weathered bedrock.

The basal sand generally consists of 0% to 34% gravel, 50% to 91% sand, and 6% to 44% silt/clay; and exhibits a mean field hydraulic conductivity of 1.73×10^{-2} cm/sec. The basal sand was saturated in all locations where it was encountered.

Lower Cohesive Deposit

The lower cohesive deposit consists of brown, gray, and brownish gray silty clays, clayey silts, and clays, having very soft to stiff consistency. The lower cohesive deposit ranges in thickness from 0 to 22 feet with an average thickness of about 15 feet. The deposit was not encountered in isolated areas along the abandoned creek, possibly due to excessive erosion of creek bottom in these areas.

The lower cohesive deposit is generally overlain by the shallow sand and underlain by the basal sand. However, within the abandoned creek area, the lower cohesive deposit was encountered directly below the creek fill. In some areas the basal sand is not present and the lower cohesive deposit directly overlies the bedrock.

The soils in the lower cohesive deposit can be similar in color and texture to the soils in the upper cohesive deposit. The distinction between the two deposits was based on the presence or changes in soil consistency (as measured with a calibrated hand held penetrometer) and a marked difference in moisture content. The lower cohesive deposit is not exposed at the ground surface in the investigated area.

The lower cohesive deposit consists of 0% gravel, 8% to 48% sand, and 52% to 95% silt/clay; and has a relatively low hydraulic conductivity. The vertical hydraulic conductivity ranges from

1.3 x 10^{-8} to 1.8 x 10^{-6} cm/sec (triaxial permeameter). The horizontal hydraulic conductivity ranges from 4.6 x 10^{-5} to 7.6 x 10^{-5} cm/sec (field slug tests).

Shallow Sand

The shallow sand overlies the lower cohesive deposit and underlies the upper cohesive deposit. The unit consists of a brown to gray silty to clayey fine sand. It contains small lenses of silty clay and clayey silt. This unit is not continuous over the entire site. Its thickness ranges from one to three feet over most of the investigated area.

Laboratory tests performed on representative samples collected from the shallow sand unit during this and previous investigations indicate the shallow sand contains 0% gravel, 50% to 52% sand, and 48% to 50% silt/clay. Two landfill piezometers were screened in the shallow sand unit to obtain potentiometric surface information and conduct field hydraulic conductivity tests. The hydraulic conductivity of this unit based on the slug test results ranges from 3.6 x 10^{-3} to 2.9 x 10^{-2} cm/sec.

Upper Cohesive Deposit

The upper cohesive deposit has a relatively low hydraulic conductivity in the vertical direction as determined by laboratory triaxial hydraulic conductivity tests from borings taken from the landfill investigation. The hydraulic conductivity values determined from the laboratory tests ranged from 1.6 x 10^{-5} cm/sec to 5.2 x 10^{-7} cm/sec. However, the upper cohesive deposit is an alluvial deposit and it is expected that the horizontal coefficient of hydraulic conductivity will be greater than the vertical coefficient. Based on test results for the lower cohesive deposit, it is anticipated that the horizontal hydraulic conductivity for the upper cohesive deposit is in the range of 10^{-6} to 10^{-5} cm/sec.

Creek Fill Material

The· borings made along the abandoned creek locations indicate that the creek fill materials consist of variable soils ranging from silty clays to silty sands. Cohesive soils characterized as silty clays to organic silty clay were typically encountered. In some areas, the cohesive fill materials extended down to the top of bedrock. The granular fill materials are typically poorly graded silty to clayey sands and contain organics or wood fragments. In some areas, the granular fill materials also extended down to the top of bedrock.

The cohesive fill material contains 0% gravel, 2% to 48% sand, and 52% to 98% silt/clay. The vertical hydraulic conductivity ranges from 7.6 x 10^{-8} cm/sec to.2.1x10^{-5} cm/sec. The granular fill materials contain 0 to 2% gravel, 55% to 65% sand and 33% to 45% silt/clay. Based on one laboratory hydraulic conductivity test performed on a Shelby tube sample obtained from berm fill, the hydraulic conductivity of the granular fill material is 3.3 x 10^{-8} cm/sec.

The creek fill materials identified during the previous landfill investigations have a significant effect on the site hydrogeologic conditions. In some areas the till materials, consisting of either granular soils or organic silty clays, extend from existing grade to the bedrock surface and locally interconnect all three water bearing units. The upper and lower cohesive deposits are considered to act as aquitards (where present) which restrict vertical flow into the water bearing units. For all practical purposes, the bedrock is considered to be an aquiclude.

Fill materials encountered in the landfill borings range from silty clays and organic silty clays to silty sands and clayey sands. These water level measurements indicate that groundwater

movement within the creek fill materials is complicated because of the highly variable hydraulic characteristics of the fill materials and their random placement. In some areas, there appears to be direct hydraulic communication between fill materials, shallow sand, and basal sand.

Four landfill piezometers are screened into the fill materials. Of these, one piezometer was installed into cohesive fill material and the other piezometers were installed in granular till materials. Hydraulic conductivity of the granular fill materials is based on one field test resulting in a value of 6.1×10^{-2} cm/sec. The hydraulic conductivity of the cohesive fill material ranged from 7.1×10^{-5} cm/sec to 1.1×10^{-4} cm/sec. These values represent the hydraulic conductivity in the horizontal direction.

Laboratory hydraulic conductivity test performed on landfill cohesive fill materials ranged from 2.1×10^{-3} cm/sec to 3.3×10^{-8} cm/sec. The higher hydraulic conductivity values are believed to be typical of soils which contain organic matter (e.g. wood fragments). The hydraulic conductivity values based on laboratory tests are generally considered to be representative of the coefficient of hydraulic conductivity in the vertical direction because of the sample configuration during testing. However, because of the randomness of the fill, it is more likely that the hydraulic conductivity is within the range of 10^{-5} to 10^{-4} cm/sec.

2.2 UPPERMOST BEDROCK

The bedrock at the project site consists of Pennsylvanian shales which are gray in color. The bedrock surface elevation varies from approximately 492 feet MSL near the center of the existing landfill, to approximately 554 feet MSL located on a bedrock outcrop near the landfill area (southeast corner of Cell 1). In general, the bedrock surface slopes from the east and west towards the center of the landfill area.

Rock Quality Designation (RQD) measurements were performed on all core samples taken from the landfill area. RQDs measured from core samples collected during this investigation ranges from 80% to 100%. The RQD values indicate that the bedrock is not highly fractured. Two in situ hydraulic conductivity tests were performed to determine the hydraulic conductivity of the upper portions of the bedrock. Test results indicate hydraulic conductivity values of 1.8×10^{-7} cm/sec and 1.3×10^{-6} cm/sec. This shows that the bedrock encountered at the project site is relatively impermeable. There is good correlation between the lithology of the rocks tested and the hydraulic conductivity values obtained. The upper bedrock beneath the impoundments is expected to exhibit the same characteristics as encountered at the landfill.

2.3 HYDROGEOLOGIC UNITS

The uppermost aquifer and underlying confining unit control groundwater movement and the potential for CCR impacted groundwater migration at the site. A description of the uppermost aquifer and the underlying confining unit follows:

Uppermost Aquifer

The uppermost aquifer is characterized as the basal sand overlying the shale bedrock. In some locations the creek fill materials, ranging from silty clays and organic silty clays to silty sands and clayey sands, were found to be in direct hydraulic communication with the basal sand that directly overlies the bedrock surface. Due to the highly variable hydraulic characteristics and random placement of the creek fill materials, further characterization is difficult.

As indicated above, the hydraulic conductivity of the basal sand ranges from 5.6 x 10^{-4} to 3.6 x 10^{-2} cm/sec. The groundwater in the basal sand appears to be under confined, semi-confined, or unconfined conditions dependent upon location. The upper limit of the uppermost aquifer is dependent upon the seasonally fluctuating groundwater table. The potentiometric surface of the basal sand varies from 565 feet MSL at upgradient locations, south of the Lakeside Ash Pond, to 525 feet MSL at downgradient locations near Sugar Creek, north of the Dallman Ash Pond. As a result, the saturated thickness is variably dependent upon the location and the seasonal variation in the groundwater table.

Lower Confining Unit

The uppermost bedrock at the project site is primarily Pennsylvanian age shale with isolated thin coal layers. The Pennsylvanian shale functions as a lower confining unit due to its low permeability and effective porosity. The lower confining unit represents a natural hydrogeologic barrier (i.e., aquitard) to the vertical movement of groundwater.

In situ hydraulic conductivity test (slug tests) indicate that the hydraulic conductivity for the upper portions of the bedrock range from 1.8 x 10^{-7} to 1.3 x 10^{-6} cm/sec. There appears to be good correlation between the rock lithology and the measured values of hydraulic conductivity. The bedrock over most of the site will act as an aquiclude and prevent the downward movement of groundwater.

2.4 GROUNDWATER MOVEMENT

Groundwater movement is controlled by recharge along topographic highs and discharge along the original stream valley. The pre-surface impoundment flow direction in the uppermost aquifer was dominantly horizontal from the adjacent banks toward the natural convergence along Sugar Creek, which formerly drained the site. This was overall from south to north with local deviations. This dominant flow pattern persists under present day conditions but with localized variation introduced by the hydrologic discontinuity created upon construction of the CCR surface impoundments.

Existing wells at the site, including wells from the Flue Gas Desulfurization Systems (FGDS) Landfill, were used to derive potentiometric surface maps for 2016 and 2017. As shown, overall groundwater movement is from south to north (see Appendix A). The east perimeter of the Lakeside Pond is largely upgradient, and the west side is largely sidegradient where groundwater movement is parallel to the perimeter. Excavated areas within the landfill boundary act as a groundwater sink along the east side of the Dallman Ash Pond. Groundwater generally moves northward from the Dallman Ash Pond but also moves easterly towards the FGDS Landfill and westerly towards Sugar Creek.

3. GROUNDWATER MONITORING AND CORRECTIVE ACTION – 40 CFR §257.90 THROUGH §257.98

The following sections specifically address the sub rules pertaining to Groundwater Monitoring and Corrective Action under sections Applicability (§257.90), Groundwater Monitoring Systems (§257.91), Groundwater Sampling and Analysis Requirements (§257.93), Detection Monitoring Program (§257.94), Assessment Monitoring Program (§257.95), Assessment of Corrective Measures (§257.96), Selection of Remedy (§257.97), and Implementation of the Corrective Action Program (§257.98).

3.1 APPLICABILITY – §257.90

Owners of existing CCR surface impoundments are required to install groundwater monitoring systems, develop a sampling and analysis program to include statistical procedures to be used for evaluating monitoring data, and initiate detection monitoring and evaluation of data for "statistically significant increases (SSI)" over background levels for selected constituents. If detected constituents are measured at a "statistically significant level (SSL)" over the established background level, the facility must conduct assessment monitoring, and if necessary, initiate corrective action responses to control the release.

The facility must make available an annual groundwater monitoring and corrective action report, the first of which is due no later than January 31, 2018. The report must document the status the groundwater monitoring and corrective action program, summarize actions completed, describe problems encountered, and identify activities for the upcoming year. The content of the report is prescribed in §257.90(e). The report must be placed in the facility's operating record and comply with the recordkeeping requirements in §257.105(h), notification requirements in §257.106(h), and internet requirements in §257.107(h).

3.2 GROUNDWATER MONITORING SYSTEM – §257.91

The rule for Groundwater Monitoring Systems (GMS) is a performance standard (§257.91(a)), where the system must consist of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that: (1) accurately represent the quality of background groundwater that has not been affected by leakage from a CCR unit, and (2) accurately represent the quality of groundwater passing the impoundment boundary of the CCR unit to monitor potential contaminant pathways in the uppermost aquifer.

Under §257.91(b-c) the number, spacing, and depths of the groundwater monitoring wells have been determined based upon site-specific technical information to meet the rule's performance standard, including the subsurface conditions observed at the site as summarized in Section 2 of this document. This includes a characterization of the uppermost aquifer.

The monitoring well locations take into consideration the natural (pre-surface impoundment) and current convergence of groundwater flow paths. The wells are located as close as feasible to the downgradient CCR surface impoundments based on topography, surface impoundment construction, and operations. The existing monitor well network (number of wells, locations, and screen interval) was installed pursuant to recommendations of the Illinois EPA Bureau of Water. The network consists of six monitor wells screening the silt, sand, and gravel at the bedrock interface. The direction of groundwater movement, as described above, is to the west-northwest; therefore, the northern and western boundaries of the impoundments will be downgradient, and the southern and eastern boundaries will be upgradient. The monitoring network includes two upgradient wells (wells AP-4 and AP-5) and four downgradient wells (AP-1, AP-2, AP-3, and AW-3). The well locations are depicted in Figure 2 and Figure 3. Table 1 provides a summary of well construction and the approximate screened intervals. Appendix B contains the well completion reports.

Pursuant to §257.91(e), the monitoring wells are constructed in a manner that maintains the integrity of the monitoring well and borehole. All wells were installed pursuant to the Illinois Department of Public Health Water Well Construction Code (77 IAC 920) for monitoring well construction standards. All monitoring well installations were documented in the respective reports. Well construction details are provided in Appendix B. All drilling and groundwater

monitoring well construction was completed under the direct supervision of an Illinois Licensed Professional Geologist.

Background Quality – §257.91(1)

Two (2) groundwater monitoring wells are representative of background (ambient) groundwater quality conditions of the uppermost aquifer. These wells are identified as AP-4 and AP-5. Background concentrations are chemical concentrations or parameter values that represent naturally-occurring groundwater that has not been impacted by the surface impoundment or other facility activities.

Monitoring well AP-4 is located in an upgradient position, southwest of the CCR surface impoundments and along the eastern bank of Sugar Creek, immediately north of Lake Springfield dam. The well screen elevation is approximately 494.9 to 504.9 feet MSL at the surface of the Pennsylvanian shale, screening the basal sand. This well is not upgradient of the subject CCR surface impoundments in a hydrologic sense but it is located on available CWLP property where it provides representative background groundwater quality, as allowed under §257.91(a)(1)ii.

Monitoring well AP-5 is located in an upgradient position, southeast of the CCR surface impoundments and in a topographically slightly higher position. The well screen elevation is approximately 554.44 to 563.78 feet MSL. The screened section of AP-5 is also located at the top of Pennsylvanian shale and screened across the basal sand at this location. This well monitors the upgradient groundwater quality of the uppermost aquifer at this location.

Background concentrations for AP-4 and AP-5 were developed from samples collected for eight consecutive quarters, allowing the statistical method employed to account for seasonal/temporal variability. The chemical constituents include only those parameters Contained in Appendices III and IV of Part 257 (Tables III-2 and III-3, respectively).

The background concentrations are statistically analyzed to establish site-specific upper confidence limits for each chemical or parameter. The statistical methodology utilized for derivation of the background concentrations is provided in Appendix C. The data, calculations and resulting background concentrations are provided in Appendix D.

Results from the background wells (AP-4 and AP-5) will be continually evaluated. If the groundwater quality significantly changes, it will become necessary to revise the background concentrations. In such an event, the statistical method contained in Appendix C will be utilized for such revision. Details for any revision will be placed in the facility record.

Downgradient Quality - §257.91(2)

Four (4) groundwater wells allow monitoring of the downgradient groundwater quality conditions in the uppermost aquifer. These wells are identified as AP-1, AP-2, AP-3 and AW-3. The locations and depths of these wells accurately represent the quality of groundwater passing the impoundment boundaries of the CCR units and reasonably make possible the detection of geochemical changes in the uppermost aquifer. These groundwater monitoring wells are all screened at the top of the weathered bedrock surface. Monitoring wells AP-1, AP-2, AP-3 and AW-3 are located along the toe of the CCR surface impoundments and adjacent to Sugar Creek. Further details are listed below:

Monitoring well AP-1 is screened from approximately 504.63 to 514.01 feet MSL. The screened zone consists of a sand at the surface of the Pennsylvanian shale.

Monitoring well AP-2 is screened from approximately 515.54 to 525.19 feet MSL. The screened zone consists of a clayey sand to sand at the surface of the Pennsylvanian shale.

Monitoring well AP-3 is screened from approximately 514.7 to 524.7 feet MSL. The screened zone consists of a clayey silt at the surface of the Pennsylvanian shale.

Monitoring well AW-3 is screened from approximately 496.32 to 506.32 feet MSL. The screened zone consists of a silt and silty sand at the surface of the Pennsylvanian shale.

3.3 GROUNDWATER SAMPLING AND ANALYSIS REQUIREMENTS – §257.93

The Groundwater Monitoring Program (GMP) includes consistent sampling and analysis procedures to provide accurate representation of groundwater quality (§257.93(a)). The activities include sample collection, preservation and shipment, analytical procedures, chain of custody, and quality assurance and quality control.

Groundwater is sampled for the constituents listed in Appendices III and IV of Part 257 (§257.93(b)). For detection monitoring, these constituents include boron, calcium, chloride, fluoride, pH, sulfate, and total dissolved solids from Appendix III Part 257 (Table III-2); and for assessment monitoring (if necessary) these constituents include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, selenium, thallium, and radium 226 & 228 combined from Appendix IV Part 257 (Table III-3). All constituents are analyzed as total recoverable, where samples are not field filtered.

Pursuant to §257.93(c), groundwater levels will be measured in each groundwater monitoring well immediately prior to purging, and each time groundwater is sampled. Other wells may be retained as water level measurement points. Levels will be measured to the nearest 0.01 feet (1/100 hundredth) and used to determine rate and direction of groundwater movement each time groundwater is sampled. In addition, a water table map/potentiometric surface map for the uppermost aquifer will be generated using the measured water levels obtained from each sampling event. The contours on these maps will allow for a quantitative assessment of flow rate and direction. Measurements of well depths will also be obtained during each sampling event to verify that the wells are physically intact and not filling with sediment, except where such measurements are not possible due to the presence of dedicated sampling equipment in the well.

Pursuant to §257.93(d), the background groundwater quality has been established for each of the constituents listed in Appendices III and IV of Part 257 (see Tables III-2 and III-3) by using the upgradient and background wells described under §257.91(a)(1), as applicable for detection (§257.94(a)) or assessment (§257.95(a)) monitoring requirements. The upgradient and background wells include AP-4 and AP-5.

The number of samples collected under detection and assessment monitoring, if necessary (for both downgradient and background wells), will be consistent with the statistical procedures selected under §257.93(f) and the performance standard under §257.93(g). The sampling procedures are consistent with that specified under §257.94(b-d) for detection monitoring and §257.95(b-d) for assessment monitoring, and §257.96(b) for corrective action.

Pursuant to §257.93(f), the selected statistical method to be used during detection monitoring in evaluating groundwater monitoring data for each constituent is the Prediction Interval Procedure under §257.93(f)(3). For this procedure, an interval for each constituent is established from the distribution of the background data and then the level of each constituent in each compliance well (i.e., well/constituent) is compared to the upper prediction limit to assess if a statistically significant increase (SSI) over background has occurred.

The selected method to evaluate concentrations obtained as part of the detection monitoring program is appropriate to determine the occurrence of statistically significant changes in the groundwater quality data and complies with the performance standards under §257.93(g), including:

(1) §257.93(g)(1) addressing the distribution of constituents where normal distributions will use parametric methods and non-normal distributions will use non-parametric methods.

(2) §257.93(g)(4) addressing the effectiveness of this approach by considering the number of samples in the background database, the data distribution, and the range of concentrations values for each constituent of concern.

(3) §257.93(g)(5) establishing the practical quantitation limit as the lowest concentration level that can be reliably achieved during routine laboratory operating conditions.

(4) §257.93(g)(6) allowing for the correction of seasonal and spatial variability as well as temporal correlation in the data.

The methodology to screen background data and establish background constituent levels is provided in Appendix A. This selected statistical approach will be effective in detecting changes in groundwater quality based on the use of interwell prediction limits (EPA, Unified Guidance, 2009). The statistically calculated interwell prediction limits (Appendix D) will be used during detection monitoring to statistically analyze detected inorganic constituents at each monitoring well (i.e., well/constituents) to determine under §257.93(h) whether or not there is a statistically significant increase (SSI) over background values. The SSI determination(s) will be completed within 90 days of completing sampling and analysis, where under §257.93(h)(2)(i), analysis is for total recoverable metals of non-field filtered samples. Volatile organic compounds and synthetic compounds are not applicable to this CCR site. Inorganic well/constituent pairs with confirmed SSI (i.e., interwell prediction limit exceedances) will then be placed into the Assessment Monitoring Program under §257.95.

3.4 DETECTION MONITORING PROGRAM – §257.94

Pursuant to §257.94(a), the Detection Monitoring Program includes, at a minimum, groundwater monitoring for all constituents listed in Appendix III to Part 257, including boron, calcium, chloride, fluoride, pH, sulfate, and total dissolved solids (TDS). The long-term monitoring frequency for the Appendix III constituents under §257.94(b) will be semiannual during the active life of the CCR unit and the post closure period.

Pursuant to §257.94(b), eight (8) independent samples were collected from each background and downgradient well and analyzed for the constituents listed in Appendix III to Part 257 including boron, calcium, chloride, fluoride, pH, sulfate, and total dissolved solids (TDS); and for the constituents listed in Appendix IV to Part 257 including antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, selenium, thallium, and radium 226 & 228 combined. The initial eight (8) independent sampling events were

completed over the second quarter 2015 through first quarter 2017 (§257.94(b)). This schedule allowed the capture of seasonal variability in quality and groundwater flow conditions. Details for derivation of the background concentrations were discussed in Section 3.2 above.

The number of samples collected and analyzed are consistent with the sampling and statistical procedures referenced in §257.93(e) and account for any unique characteristics of the site (§257.94(c)). Sampling for detection monitoring will occur on a semi-annual basis.

Alternative monitoring frequency for repeated sampling and analyses for constituents listed in Appendix III of Part 257 during the active life and the post-closure period based on the availability of groundwater may be implemented pursuant to §257.94(d). However, as stated above, detection monitoring will occur on a semi-annual basis, beginning in October/November 2017 such that the first Groundwater Monitoring and Corrective Action Report can be completed by January 31, 2018.

Pursuant to §257.94(e), if the facility determines pursuant to §257.93(h) that there is a statistically significant increase (SSI) over background levels for one or more of the constituents listed in Appendix III to Part 257 at any monitoring well, within 90 days of this determination the facility will establish an assessment monitoring program meeting the requirements of §257.95 and prepare a notification for the facility's operating record stating that an assessment monitoring program has been established. Such a determination for SSI will occur under the Detection Monitoring Program after completion of the initial 8 independent sampling events and the initial statistical evaluation. As applicable, the facility may also demonstrate that a source other than the CCR unit(s) caused the SSI, or that the SSI was the result of error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The demonstration must be in writing and completed within 90 days of detecting the SSI. If the demonstration is successful, then detection monitoring may continue.

Given the variability of the groundwater chemistry within the facility area, confirmation sampling may be conducted within 90 days of the observation of the SSI. This aids in preventing false positives and prematurely implementing an assessment monitoring program. If resampling occurs due to a SSI, then the SSI will be recorded in the facility record noting that resampling will occur. Within 90 days of the initial observed SSI, the results of the resample event must be placed in the facility record. If the SSI is not confirmed, detection monitoring will continue. If the SSI is confirmed, assessment monitoring pursuant to §257.95 must be initiated.

3.5 ASSESSMENT MONITORING PROGRAM – §257.95

Except as stated above, assessment monitoring is required pursuant to §257.95(a) whenever a SSI has been detected during detection monitoring for one or more of the constituents in Appendix III of Part 257. Under §257.95(b), within 90 days of triggering an assessment monitoring program, and annually thereafter, the facility must sample and analyze the groundwater for all constituents listed in Appendix IV to Part 257 until detection monitoring resumes. An alternative monitoring frequency may be considered if documented under the requirements of §257.95(c).

After obtaining the results from the initial and subsequent sampling events required under §257.95(b), the facility must within 90 days of obtaining the results, and on at least a semiannual basis thereafter, resample all wells that were installed pursuant to §257.91 and conduct analyses for all constituents in Appendix III and for those constituents in Appendix IV to Part 257 that are detected. The results must then be placed in the operating record.

Groundwater Protection Standards (GWPS) will be established for all constituents detected pursuant to §257.95(b or d) and in accordance with the requirements of §257.95(h). These activities and results will be summarized in the annual groundwater monitoring and corrective action report required under §257.90(e).

Pursuant to §257.95(e), if the concentration of all constituents listed in Appendix III and Appendix IV of Part 257 are shown to be at or below background values, using the statistical procedures in §257.93(g), for two consecutive sampling events, the facility may return to the detection monitoring and place notification in the operating record. If the concentrations of any constituent in Appendix III and Appendix IV to Part 257 are above background values, but all concentrations are below the GWPS, assessment monitoring must continue (§257.95(f)).

If one or more constituents in Appendix IV to Part 257 are detected at statistically significant levels (SSL) above the GWPS, the facility must place notification in the operating record and proceed to characterize the nature and extent of the release and any relevant site conditions that may affect the remedy ultimately selected (§257.95(g)). The characterization must meet the requirements of §257.95(g)(1) and the public notification the requirements of §257.95(g)(2). Under §257.95(g)(3), within 90 days of finding that any of the constituents listed in Appendix IV to Part 257 have been detected at a SSL exceeding the GWPS, the facility must either initiate an assessment of corrective measures under §257.96, or demonstrate an error in any such determination.

A GWPS must be established for each constituent in Appendix IV to Part 257 detected in the groundwater. The GWPS shall be: (1) for constituents for which a maximum contaminant level (MCL) has been established, the MCL for that constituent, or (2) for constituents for which an MCL has not been established, the background concentration for the constituent established from wells in accordance with §257.91, or (3) for constituents for which the background level is higher than the MCL identified under §257.95(h)(1), the background concentration shall be the GWPS.

3.6 ASSESSMENT OF CORRECTIVE MEASURES – §257.96

Within 90 days of determining that any constituent listed in Appendix IV of Part 257 has been detected at a SSL exceeding the GWPS, or immediately upon detection of a release, the facility must initiate an assessment of corrective measures to prevent further releases, to remediate releases, and to restore the affected area to original conditions (§257.96(a)). The assessment must be completed within 90 days unless a time extension of not more than 60 days is needed to complete the assessment, as demonstrated by the facility. The facility will include any such demonstration in the annual groundwater monitoring and corrective action report required under §257.90(e). The CCR unit will continue to monitor groundwater in accordance with the Assessment Monitoring Program during the assessment of corrective measures.

The assessment of corrective measures will evaluate the effectiveness of potential corrective measures in meeting the requirements and objectives of the remedy as described under §257.97, including performance, reliability, ease of implementation, impacts, exposure, time required, permitting, etc. (§257.96(c)).

The completed assessment of corrective measures will be placed in the operating record; discussed at a public meeting at least 30 days prior to the selection of a remedy under §257.97; and recordkeeping, notification, and internet requirements will be met.

3.7 SELECTION OF REMEDY – §257.97

Based on the results of the assessment of corrective measures, a remedy will be selected as soon as feasible that meets the standards listed in §257.97(b), including being protective of human health and environment, attain the GWPS, control the source(s) of release so as to reduce or eliminate, to the extent feasible, further releases on constituents in Appendix IV of Part 257, remove from the environment as much of the contaminated material as feasible, and comply with standards for management of wastes under §257.98(d). In selecting the remedy, the facility will consider the requirements of §257.97(c) and establish a schedule for implementing and completing remedial activities under §257.97(d).

3.8 IMPLEMENTATION OF THE CORRECTIVE ACTION PROGRAM – §257.98

Pursuant to §257.98(a), within 90 days of selecting the remedy, the facility will initiate remedial activities. Based on the schedule provided under §257.97(d) for implementation of remedial activities, the facility must establish and implement a corrective action groundwater monitoring program that meets the requirements of an assessment monitoring program under §257.95, implement the corrective action remedy selected under §257.97, and address any interim measures that might be needed to reduce the contaminants leaching from the CCR unit. If at any time the facility determines that compliance with the requirements of §257.97(b) is not being achieved through the remedy selected, other methods or techniques that could feasibly achieve compliance should be evaluated and implemented (§257.98(b)).

Pursuant to §257.98(c), the remedy will be considered complete when compliance with the GWPS has been achieved at all points within the plume of contamination that lie beyond the groundwater monitoring well system and concentrations of constituents listed in Appendix IV of Part 257 have not exceeded the GWPS for a period of three consecutive years. Table III-7 depicts the methodology for corrective action, where the effectiveness of the remedial actions will be evaluated based on the confidence intervals constructed for applicable well/constituent pairs as compared to a specified clean-up standard which is the GWPS. When the entire interval is determined to be below the standard under §257.98(c) for three consecutive years, that well/constituent pair will be declared to be in compliance, and inorganic well/constituent pairs will be moved back into detection monitoring and appropriate limit-based statistics will resume.

All CCR units that are managed pursuant to a remedy required under §257.97 will be managed in a manner that complies with applicable RCRA requirements (§257.98(d)). Pursuant to §257.98(e), upon completion of the remedy the facility will prepare a notification stating that the remedy has been completed and obtain a certification from a qualified professional engineer.

4. RECORDKEEPING, NOTIFICATION, AND POSTING OF INFORMATION – FEDERAL RULE §257.105 THROUGH §257.107

4.1 RECORDKEEPING REQUIREMENTS – §257.105

CWLP, as owner of an existing CCR unit, will maintain files in its operating record as required under §257.105(h) – groundwater monitoring and corrective action – for a period of no less than five years. This includes:

1. annual groundwater monitoring report,
2. documentation pertaining to monitoring wells,

3. groundwater monitoring certification,
4. selection of statistical method certification,
5. notification within 30 days of establishing an assessment monitoring program,
6. analytical results of Appendices III and IV to Part 257,
7. notification within 30 days of returning to a detection monitoring program,
8. notification within 30 days of detecting of constituents in Appendix IV of Part 257 at statistically significant levels above the groundwater protection standard,
9. notification within 30 days of initiating the assessment of corrective measures,
10. the completed assessment of corrective measures,
11. documentation recording the public meeting for the corrective measures assessment,
12. the semiannual report describing the progress in selecting and designing the remedy and the selection of remedy report, and
13. notification within 30 days of completing the remedy.

4.2 NOTIFICATION REQUIREMENTS – §257.106

Notifications required under §257.106(h) – groundwater monitoring and corrective action – will be sent to the relevant regulatory authority, including for (1) availability of:

1. the annual groundwater report,
2. availability of the groundwater monitoring system certification,
3. selection of a statistical method certification,
4. that an assessment monitoring program has been established,
5. that the CCR unit is returning to a detection monitoring program,
6. that constituent(s) in Appendix IV to Part 257 have been detected at statistically significant levels above the groundwater protection standard and notifications to landowners,
7. that an assessment of corrective measures has been initiated,
8. availability of assessment of corrective measures,
9. the availability of the semiannual report describing the progress in selecting and designing the remedy and the selection of remedy report, and
10. completion of the remedy.

4.3 PUBLICALY ACCESSIBLE INTERNET SITE REQUIREMENTS – §257.107

CWLP will maintain a publicly accessible Internet site (CCR website) containing the information specified in §257.107(h) – groundwater monitoring and corrective action.

http://ehs.cwlp.com/

V. REFERENCES CITED

U.S. Environmental Protection Agency (EPA), March 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance. Office of Resource Conservation and Recovery Program Implementation and Information Division, U.S. Environmental Protection Agency, Washington, DC.

U.S. Environmental Protection Agency (EPA), 2015. Published in Federal Register Volume 80, No. 74 published on April 17, 2015, *Final Rule 40 CFR Part 257 Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities*; and *Technical Amendments* (correcting the effective date) published in Federal Register Volume 80, No. 127 on July 2, 2015.

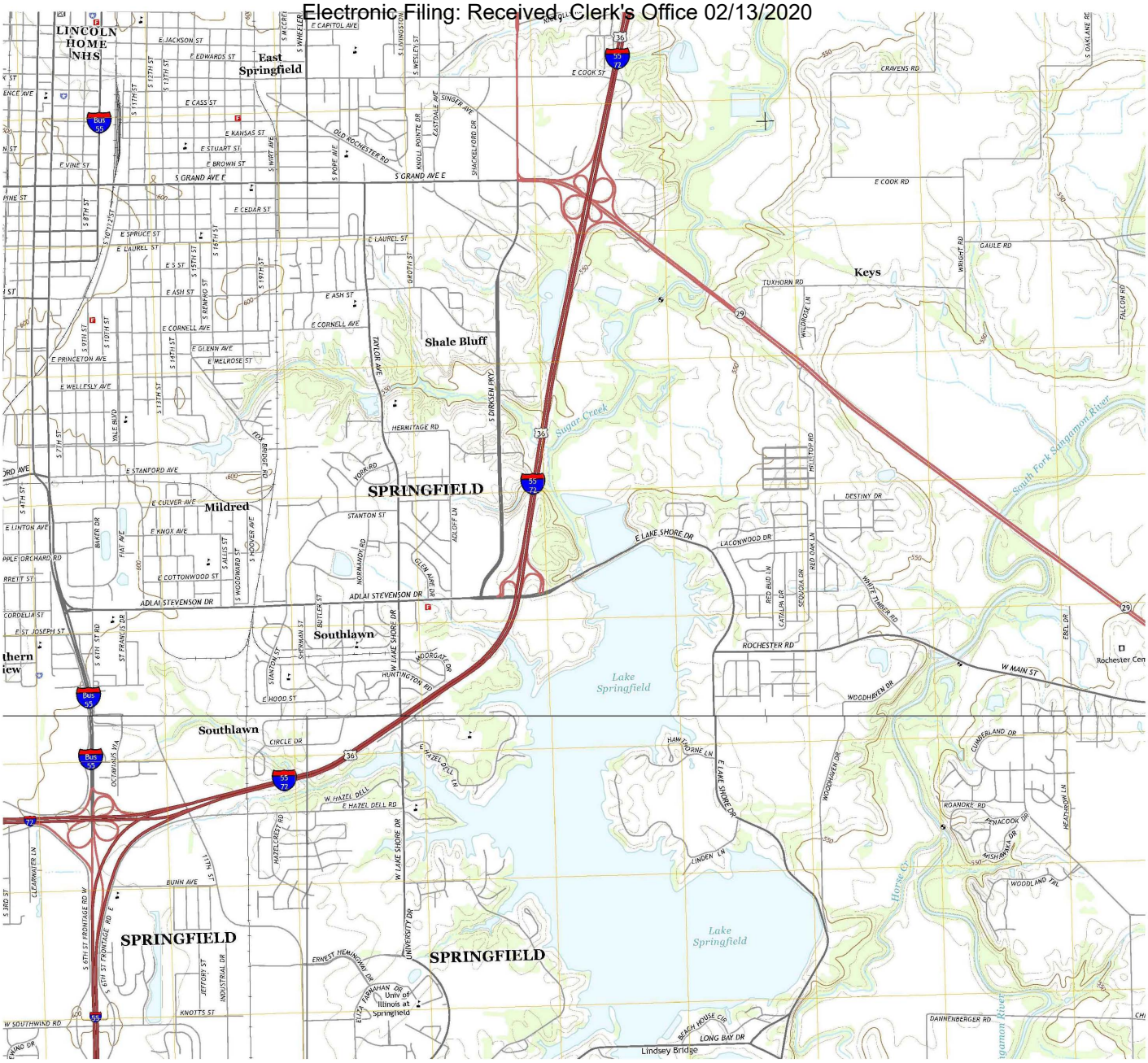
TABLES

Table 1 Well Construction Summary

Well ID	Monitoring Position	Material Screened	Top of Casing (feet MSL)	Ground Surface (feet MSL)	Top of Screen (feet MSL)	Bottom of Screen (feet MSL)
AP-1	Downgradient	Bedrock/Unconsolidated Interface	535.60	533.10	514.01	504.63
AP-2	Downgradient	Bedrock/Unconsolidated Interface	536.10	533.60	525.19	515.54
AP-3	Downgradient	Bedrock/Unconsolidated Interface	535.40	533.70	524.7	514.7
AP-4	Upgradient	Bedrock/Unconsolidated Interface	559.20	553.90	504.9	494.9
AP-5	Upgradient	Bedrock/Unconsolidated Interface	583.90	581.60	563.78	554.44
AW-3	Downgradient	Bedrock/Unconsolidated Interface	540.33	537.75	506.32	496.32

Response to 1st RTP
CWLP - 026349

FIGURES


LINCOLN HOME NHS
East Springfield
Shale Bluff
SPRINGFIELD
Mildred
Southlawn
Keys
Lake Springfield
Sugar Creek
South Fork Sangamon River
Horse Cr
SPRINGFIELD
SPRINGFIELD
Univ of Illinois at Springfield
Lindsey Bridge
E LAKE SHORE DR
ADLAI STEVENSON DR
ROCHESTER RD
W MAIN ST
E COOK ST
CRAVENS RD
E COOK RD
TUXHORN RD
GAULE RD
DESTINY DR
LACONWOOD DR
WOODHAVEN DR
CUMBERLAND DR
ROANOKE RD
WOODLAND TRL
DANNENBERGER RD
E HAZEL DELL RD
W HAZEL DELL
CIRCLE DR
HERMITAGE RD
STANTON ST
E HOOD ST
E CULVER AVE
E STANFORD AVE
E CORNELL AVE
E ASH ST
E LAUREL ST
E CEDAR ST
E CASS ST
E KANSAS ST
E STUART ST
E BROWN ST
S GRAND AVE E
E JACKSON ST
E EDWARDS ST
E CAPITOL AVE
E VINE ST
E PRINCETON AVE
E WELLESLY AVE
E GLENN AVE
E MELROSE ST
E KNOX AVE
E COTTONWOOD ST
E ST JOSEPH ST
BUNN AVE
KNOTTS ST
W SOUTHWIND RD
S 6TH ST FRONTAGE RD W
S 6TH ST FRONTAGE RD E
OLD ROCHESTER RD
YORK RD
HUNTINGTON RD
LINDEN LN
BEACH HOUSE CIR
LONG BAY DR
Bus 55
55
72
36
29
72

ILLINOIS

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LEGEND

- ASH IMPOUNDMENT MONITORING WELL LOCATION
- PIEZOMETER LOCATION
- LANDFILL MONITORING WELL LOCATION

N

0 200 400 800

SCALE: IN FEET

NOTE:
BACKGROUND IMAGE DERIVED FROM BING.

NO.	DATE	REVISIONS DESCRIPTION	BY

ANDREWS ENGINEERING, INC.
3300 GINGER CREEK DRIVE
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PROFESSIONAL DESIGN ENGINEERING AND LAND SURVEYING FIRM #184-001541

DESIGNED BY: MTH | DRAWN BY: RMC | APPROVED BY: MTH

SITE FACILITIES

PLANS PREPARED FOR
CITY, WATER, LIGHT & POWER
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: OCTOBER 2017

PROJECT ID: 170306/0001

SHEET NUMBER:

FIGURE 2

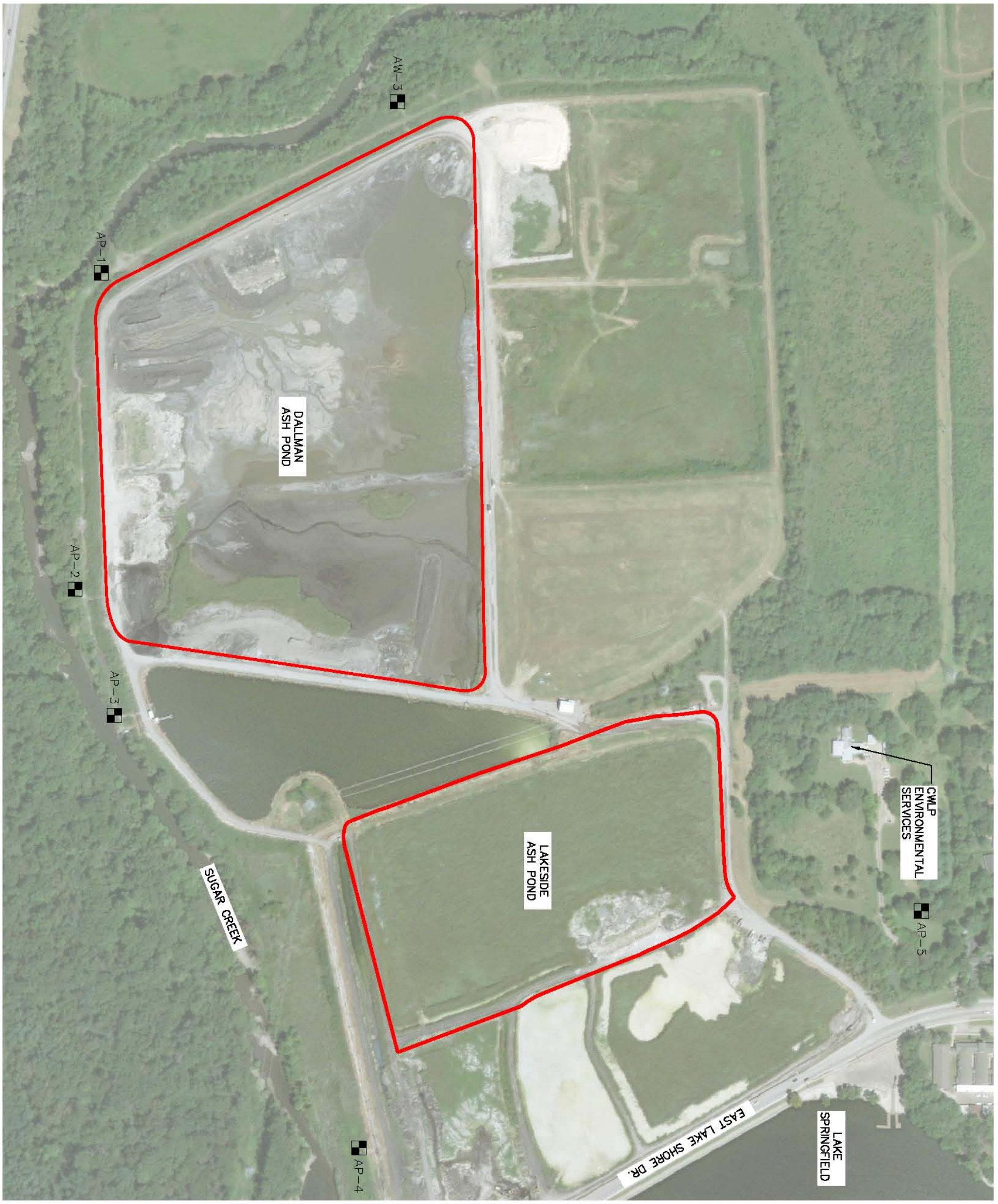
© 2017 Andrews Engineering, Inc.

J:\S\Springfield CWLP\CWLP\dwg\2017\Existing Groundwater Monitoring Network.dwg Tab: FIGURE 2 Last Saved: October 4, 2017, by Ryan Curtis Plotted: Thursday, October 05, 2017 1:10:23 PM

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CWLP - 026352

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J:\S\Springfield CWLP\CWLP\dwg\2017\Existing Groundwater Monitoring Network.dwg Tab: FIGURE 3 Last Saved: October 4, 2017, by Ryan Curtis Plotted: Thursday, October 05, 2017 1:09:35 PM



NOTE: BACKGROUND IMAGE DERIVED FROM BING.

0 150 300 600
SCALE: IN FEET

N

LEGEND

ASH IMPOUNDMENT MONITORING WELL LOCATION

FIGURE 3

SHEET NUMBER:

PROJECT ID: 170306/0001

DATE: OCTOBER 2017

GROUNDWATER MONITORING SYSTEM

PLANS PREPARED FOR

CITY, WATER, LIGHT & POWER

SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

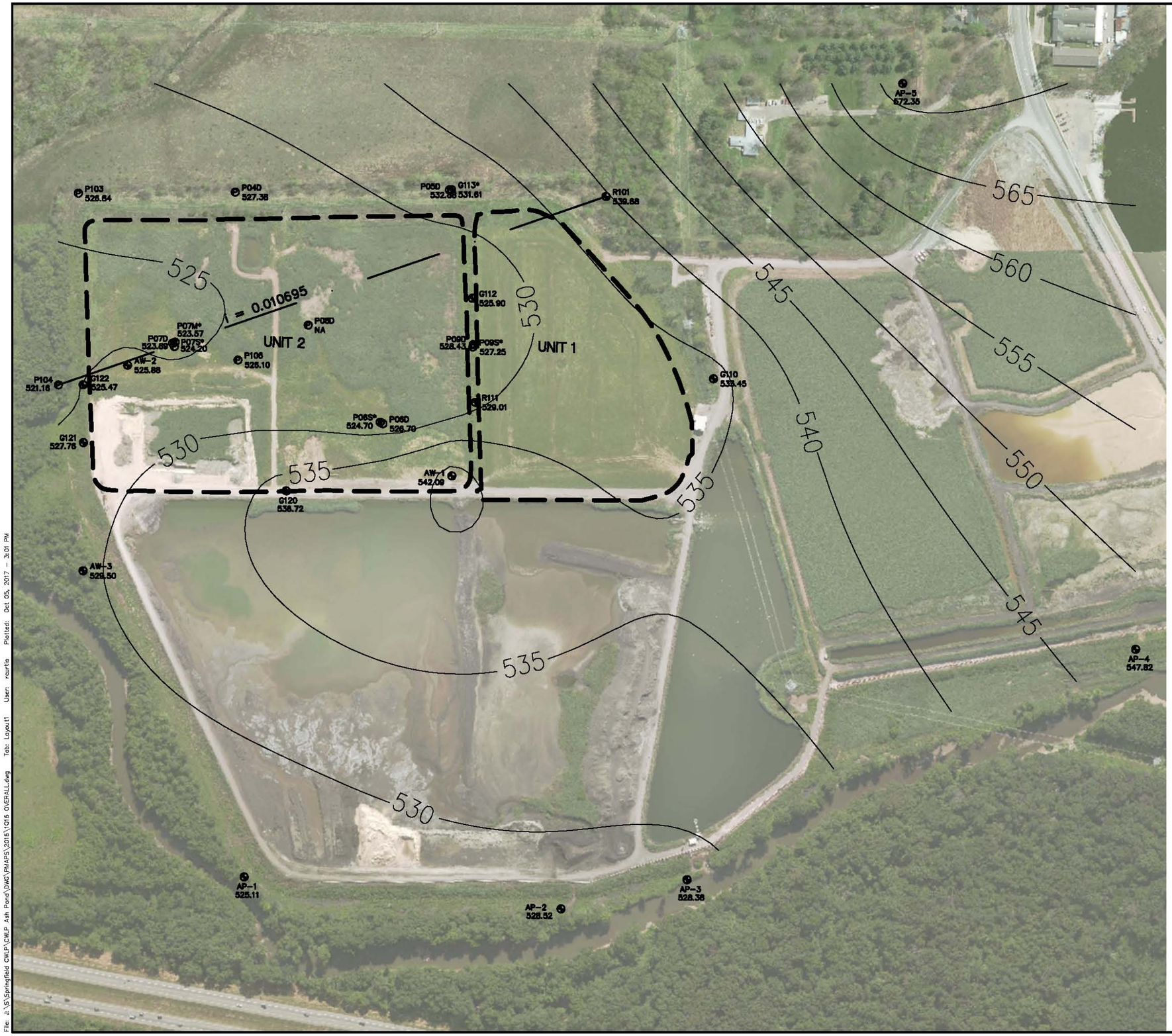
ANDREWS ENGINEERING, INC.
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PROFESSIONAL DESIGN ENGINEERING AND LAND SURVEYING FIRM #184-001541

APPROVED BY: MTH | DESIGNED BY: MTH | DRAWN BY: RMC

REVISIONS			
NO.	DATE	DESCRIPTION	BY

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APPENDIX A
POTENTIOMETRIC SURFACE MAPS



LEGEND:

- LANDFILL MONITORING WELL LOCATION
- PIEZOMETER

NOTES:

1. SAMPLING DATE: FEBRUARY 25, 2016.
2. CONTOUR INTERVAL = 5 FEET.
3. i = HYDRAULIC GRADIENT
4. NA = GROUNDWATER ELEVATION NOT AVAILABLE.
5. * IN THE CASE OF NESTED WELLS, THE GROUNDWATER ELEVATIONS FROM DEEPER WELLS (BASAL SAND) WERE USED IN THE COMPILATION OF POTENTIOMETRIC CONTOURS.

N

300 0 300 600

SCALE: IN FEET

ANDREWS ENGINEERING, INC.
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Tel (217) 787-2334 Fax (217) 787-9495
Pontiac, IL • Naperville, IL • Indianapolis, IN • Warrenton, MO

APPROVED BY: CRM | DESIGNED BY: CRM | DRAWN BY: MPN

POTENTIOMETRIC SURFACE MAP
1ST QUARTER 2016

PLANS PREPARED FOR
CITY, WATER, LIGHT, AND POWER
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: JUNE 2016

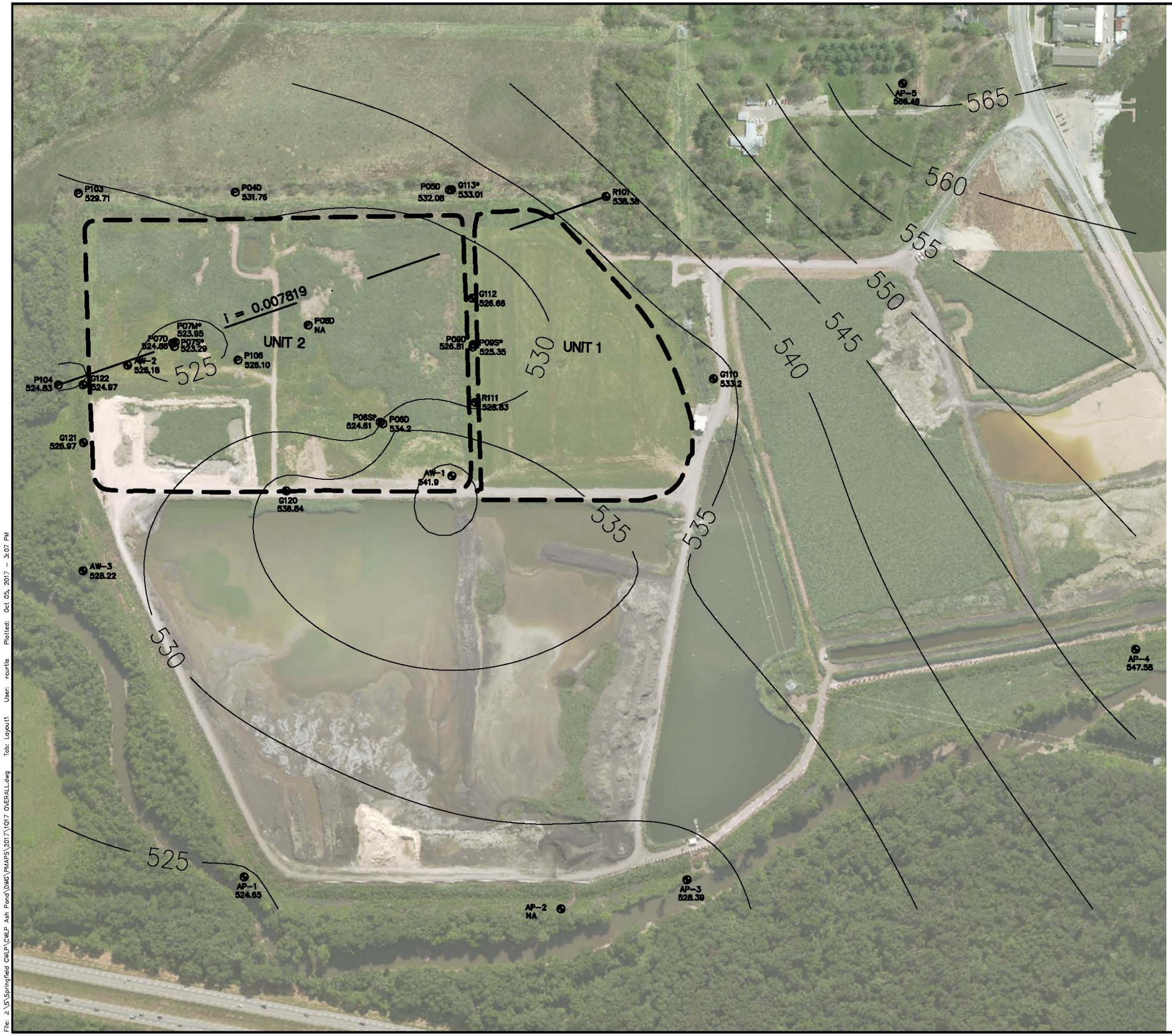
PROJECT ID: 160285/0001

SHEET NUMBER: 1Q16

Response to 1st RTP
CWLP - 026356

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LEGEND:

- LANDFILL MONITORING WELL LOCATION
- PIEZOMETER

NOTES:

1. SAMPLING DATE: FEBRUARY 16, 2017.
2. CONTOUR INTERVAL = 5 FEET.
3. i = HYDRAULIC GRADIENT
4. NA = GROUNDWATER ELEVATION NOT AVAILABLE.
5. * IN THE CASE OF NESTED WELLS, THE GROUNDWATER ELEVATIONS FROM DEEPER WELLS (BASAL SAND) WERE USED IN THE COMPILATION OF POTENTIOMETRIC CONTOURS.

N

300 0 300 600

SCALE: IN FEET

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APPROVED BY: CRM | DESIGNED BY: CRM | DRAWN BY: RMC

POTENTIOMETRIC SURFACE MAP
1ST QUARTER 2017

PLANS PREPARED FOR
CITY, WATER, LIGHT, AND POWER
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: OCOTBER 2017

PROJECT ID: 160285/0001

SHEET NUMBER: 1Q17

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APPENDIX B
WELL CONSTRUCTION DETAILS

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Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Sangamon Well #: AP-1R

Site Name: City Water, Light, & Power Borehole #: AP-1R

Coordinates: X 831.70 Y 5132.40 (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___"

Surveyed by: _____ IL Registration #: _____

Drilling Contractor: Terra Drill, Inc. Consulting Firm: Andrews Engineering, Inc.

Driller: J. Brown Geologist: M. Hewitt

Drilling Method: 4¼" HSA w/ 5' Continuous Barrel Logged by: M. Hewitt

Drilling Fluids (type): _____ Report Form Completed by: J. Rhoades

Date Well Started: 1/30/2012 Date Well Finished: 1/30/2012 Date Form Completed: 2/27/2012

ANNULAR SPACE DETAILS

Type of surface seal: Concrete

Type of annular sealant: Bentonite Grout

Installation method: Tremie

Setting time: 2 Hours

Type of bentonite seal – Bentonite Chips (circle one)

Installation method: Free drop

Setting time: 2 Hours

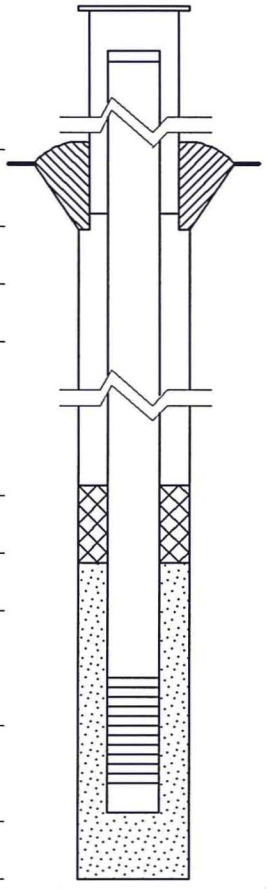
Type of sand pack: Unimin Sand

Grain size: 10/20 (sieve size)

Installation method: Free drop

Type of backfill material: _____ (if applicable)

Installation method: _____



ELEVATION (MSL)*	DEPTH (BGS)♦ (0.01 ft)	
535.60	-2.50	Top of Protective Casing
535.60	-2.50	Top of Riser Pipe
533.10	.00	Ground Surface
530.10	3.00	Top of Annular Sealant
n/a	n/a	Static Water Level Measured on (after completion)
517.00	16.10	Top of Seal
513.51	19.59	Top of Sandpack
514.01	19.09	Top of Screen
504.63	28.47	Bottom of Screen
504.10	29.00	Bottom of Well
500.60	32.50	Bottom of Borehole

* Referenced to a National Geodetic Vertical Datum
♦ positive (+) values below GS, negitive (-) values above GS

CASING MEASUREMENTS

Diameter of Borehole (in)	8.0
ID of Riser Pipe (in)	2.0
Protective Casing Length (ft)	5.0
Riser Pipe Length (ft)	21.59
Bottom of Screen to End Cap (ft)	.53
Screen Length [1st slot to last slot] (ft)	9.38
Total Length of Casing (ft)	31.50
Screen Slot Size*	0.01"

*Hand-slotted well screens are unacceptable.

WELL CONSTRUCTION MATERIALS (circle one)

Protective Casing	SS304, SS316, PTFE, PVC or *Other:Steel*
Riser Pipe Above W.T.	SS304, SS316, PTFE, *PVC*, or Other:
Riser Pipe Below W.T.	SS304, SS316, PTFE, *PVC*, or Other:
Screen	SS304, SS316, PTFE, *PVC*, or Other:

(AE950315)

Response to 1st RTP
CWLP - 026358

Electronic Filing: Received, Clerk's Office 02/13/2020

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Sangamon Well #: AP-2A

Site Name: Springfield City Water, Light, and Power Borehole #: _____

Coordinates: X 735.9 Y 4185.2 (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___"

Surveyed by: Springfield City Water, Light, and Power IL Registration #: _____

Drilling Contractor: Bulldog Drilling, Inc. Consulting Firm: Andrews Engineering, Inc.

Driller: J. Edwards Geologist: C. Myrvold

Drilling Method: AMS Powerprobe w/ 4.25" HSA and 5' MC Logged by: C. Myrvold

Drilling Fluids (type): na Report Form Completed by: C. Myrvold

Date Well Started: 2/16/2016 Date Well Finished: 2/16/2016 Date Form Completed: 3/06/2016

ANNULAR SPACE DETAILS

Type of surface seal: Concrete

Type of annular sealant: N/A

Installation method: _____

Setting time: _____

Type of bentonite seal: Bentonite chips

Installation method: Free drop

Setting time: 24+ hours

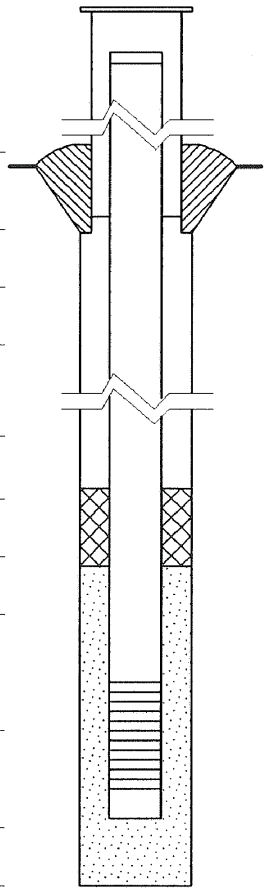
Type of sand pack: Silica sand

Grain size: 20/40 (sieve size)

Installation method: Free drop

Type of backfill material: N/A (if applicable)

Installation method: _____



ELEVATION (MSL)®	DEPTH (BGS)* (0.01 ft)	
536.50	-2.90	Top of Protective Casing
536.10	-2.50	Top of Riser Pipe
533.60	0.00	Ground Surface
	N/A	Top of Annular Sealant
		Static Water Level Measured on (after completion)
530.60	3.00	Top of Seal
527.19	6.41	Top of Sandpack
525.19	8.41	Top of Screen
515.54	18.06	Bottom of Screen
515.10	18.50	Bottom of Well
514.60	19.00	Bottom of Borehole

® Referenced to a National Geodetic Vertical Datum
* positive (+) values below GS, negitive (–) values above GS

Notes:

WELL CONSTRUCTION MATERIALS

Protective Casing	Anodized Aluminum
Riser Pipe Above W.T.	PVC
Riser Pipe Below W.T.	PVC
Screen	PVC

CASING MEASUREMENTS

Diameter of Borehole (in)	8.25
ID of Riser Pipe (in)	2
Protective Casing Length (ft)	5.0
Riser Pipe Length (ft)	10.91
Bottom of Screen to End Cap (ft)	0.44
Screen Length [1st slot to last slot] (ft)	9.65
Total Length of Casing (ft)	21.00
Screen Slot Size¥	#10 (0.01)

¥Hand-slotted well screens are unacceptable.

Professional Service Industries, Inc.
480 North Street
Springfield, Illinois 62704
Telephone: 217/544-6663
Fax: 217/544-6143

LOG OF BORING AP-3

Sheet 1 of 1

PSI Job No.: 0020522
Project: Piezometer Installation
Location: CWLP Ash Pond
East Lake Shore Drive
Springfield, Illinois

Drilling Method: Hollow Stem Auger
Sampling Method: Split Spoon
Hammer Type: CME Automatic; ETR = 86%
Boring Location: See attached boring location plan.

WATER LEVELS
While Drilling: None feet
Upon Completion: N/A
Delay: N/A

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			1	18	Dark brown silty CLAY, very stiff, slightly moist	CL	6-7-8 N_{60}=21		
	5			2	18	Gray/brown clayey SILT, soft to stiff, moist to saturated	ML	3-3-4 N_{60}=10		
				3	18			1-1-1 N_{60}=3		
	10			4	18	Gray clayey SILT, soft to very stiff, saturated		2-1-2 N_{60}=4		
				5	18			2-2-4 N_{60}=9		
	15			6	16		ML	2-2-4 N_{60}=9		
				7	18			4-4-6 N_{60}=14		
	20			8	10	Gray SHALE, hard, slightly moist Boring terminated at -19.5	CL	32-50/3"		

STANDARD PENETRATION TEST DATA
N in blows/ft
Moisture, PL, LL
0 25 50
STRENGTH, tsf
Qu, Qp
0 2.0 4.0

Well Diagram: J-Plug; Concrete Cap; 2" PVC Solid Riser; Bentonite Seal; Sand Filter Pack; 0.01" PVC Slotted Well Screen

Completion Depth: 20.0 ft
Date Boring Started: 4/21/10
Date Boring Completed: 4/21/10
Logged By: Rob Preuss
Drilling Contractor: PSI, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude:
Longitude:
Drill Rig: ATV D50
Remarks: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Moistures determined by visual methods

The stratification lines represent approximate boundaries. The transition may be gradual.

Professional Service Industries, Inc.
480 North Street
Springfield, Illinois 62704
Telephone: 217/544-6663
Fax: 217/544-6143

LOG OF BORING AP-4

Sheet 1 of 1

PSI Job No.: 0020522
Project: Piezometer Installation
Location: CWLP Ash Pond
East Lake Shore Drive
Springfield, Illinois

Drilling Method: Hollow Stem Auger
Sampling Method: Split Spoon
Hammer Type: CME Automatic; ETR = 86%
Boring Location: See attached boring location plan.

WATER LEVELS
While Drilling 11 feet
Upon Completion N/A
Delay N/A

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ● × Moisture ◪ PL ✚ LL (0, 25, 50) STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks	Well Diagram
	0			1	17	Brown silty CLAY, some brown sand, firm to stiff, slightly moist (FILL)	CL	4-4-3 N_{60}=10				J-Plug
				2	18	Brown silty CLAY, trace roots, firm to stiff, moist (FILL)	CL	4-3-2 N_{60}=7				
	5			3	10	Brown SILT, trace gray, firm to stiff, moist (FILL)	ML	6-3-2 N_{60}=7				
				4	12	5" Brown SAND transitioning to Black FLY ASH at 9.4', stiff to very stiff, slightly moist (FILL)		2-2-4 N_{60}=9				
	10			5	18		SAND/FLY ASH	2-2-2 N_{60}=6				
				6	16			2-1-1 N_{60}=3				
	15			7	16			6-6-5 N_{60}=16				
				8	18	Black FLY ASH, some fine sub-round gravel, stiff to very stiff, moist to saturated (FILL)	FLY ASH	3-3-3 N_{60}=9				Concrete Cap
	20					Gray/green (organic?) CLAY, stiff, trace fine sand, moist to saturated						2" PVC Solid Riser
				9	1		CL	3-3-4 N_{60}=10				
	25											Bentonite Seal
				10	18	Brown/gray silty CLAY, fiorm to stiff, saturated	CL	2-2-3 N_{60}=7				
	30											
				11	18	Gray SILT, stiff to very stiff, saturated		3-3-4 N_{60}=10				
	35											
				12	18		ML	4-4-4 N_{60}=11				
	40											
				13	18			4-4-6 N_{60}=14				
	45											
				14	18	Gray fine to coarse SAND, medium dense, saturated		4-5-7 N_{60}=17				
	50											
				15	18		SW	5-5-7 N_{60}=17				
	55											
				16	1	Gray SHALE, hard, moist	CL	50/1"		>>		0.01" PVC Slotted Screen
	60					Boring terminated at -60'						

Completion Depth: 60.0 ft
Date Boring Started: 4/20/10
Date Boring Completed: 4/20/10
Logged By: Rob Preuss
Drilling Contractor: PSI, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude:
Longitude:
Drill Rig: ATV D50
Remarks: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Moistures determined by visual methods.

The stratification lines represent approximate boundaries. The transition may be gradual.

Electronic Filing: Received, Clerk's Office 02/13/2020

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Sangamon Well #: AP-5

Site Name: City Water, Light, & Power Borehole #: AP-5

Coordinates: X 3203.10 Y 3164.10 (or) Latitude: ___° ___' ___" Longitude: ___° ___' ___"

Surveyed by: _____ IL Registration #: _____

Drilling Contractor: Terra Drill, Inc. Consulting Firm: Andrews Engineering, Inc.

Driller: J. Brown Geologist: M. Hewitt

Drilling Method: 4¼" HSA w/ 5' CB & 2' SS Logged by: M. Hewitt

Drilling Fluids (type): _____ Report Form Completed by: J. Rhoades

Date Well Started: 2/1/2012 Date Well Finished: 2/1/2012 Date Form Completed: 2/27/2012

ANNULAR SPACE DETAILS

Type of surface seal: Concrete

Type of annular sealant: Bentonite Grout

Installation method: Tremie

Setting time: 2 Hours

Type of bentonite seal – Bentonite Chips (circle one)

Installation method: Free drop

Setting time: 2 Hours

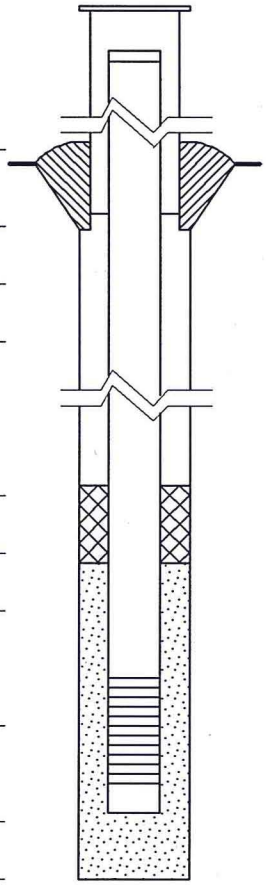
Type of sand pack: Unimin Sand

Grain size: 10/20 (sieve size)

Installation method: Free drop

Type of backfill material: Bentonite Chips (if applicable)

Installation method: Free drop



ELEVATION (MSL)®	DEPTH (BGS)◆ (0.01 ft)	
584.30	-2.70	Top of Protective Casing
583.90	-2.30	Top of Riser Pipe
581.60	.00	Ground Surface
578.60	3.00	Top of Annular Sealant
n/a	n/a	Static Water Level Measured on (after completion)
565.48	16.12	Top of Seal
563.48	18.12	Top of Sandpack
563.78	17.82	Top of Screen
554.44	27.16	Bottom of Screen
553.90	27.70	Bottom of Well
551.10	30.50	Bottom of Borehole

® Referenced to a National Geodetic Vertical Datum
◆ positive (+) values below GS, negitive (-) values above GS

NOTES:

•Borehole AP-5 sampled to 49.0 feet below ground surface (BGS) and backfilled with bentonite chips to 30.5 feet BGS

WELL CONSTRUCTION MATERIALS (circle one)

Protective Casing	SS304, SS316, PTFE, PVC or *Other:Steel*
Riser Pipe Above W.T.	SS304, SS316, PTFE, *PVC*, or Other:
Riser Pipe Below W.T.	SS304, SS316, PTFE, *PVC*, or Other:
Screen	SS304, SS316, PTFE, *PVC*, or Other:

CASING MEASUREMENTS

Diameter of Borehole (in)	8.0
ID of Riser Pipe (in)	2.0
Protective Casing Length (ft)	5.0
Riser Pipe Length (ft)	20.12
Bottom of Screen to End Cap (ft)	.54
Screen Length [1st slot to last slot] (ft)	9.34
Total Length of Casing (ft)	30.00
Screen Slot Size*	0.01"

*Hand-slotted well screens are unacceptable.

(AE950315)

Response to 1st RTP
CWLP - 026362

Electronic Filing: Received, Clerk's Office 02/13/2020

Illinois Environmental Protection Agency — Well Completion Report

Site Number: 1678250020 County: Sangamon

Site Name: FGDS Development Landfill Well #: AW-3

State Plane Coordinate: X ____ Y ____ (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____ Borehole #: AW-3

Surveyed by: David Mihelsic IL Registration #: 3762

Drilling Contractor: Reynolds Drilling Corp. Driller: Andrew Rachford

Consulting Firm: Rapps Engineering & Applied Science Geologist: Ken Miller

Drilling Method: HSA Drilling Fluid (Type): NA

Logged By: Ken Miller Date Started: 12/30/08 Date Finished: 12/31/08

Report Form Completed By: Ken Miller Date: 5/18/09

ANNULAR SPACE DETAILS

Type of Surface Seal: Cement

Type of Annular Sealant: Bentonite Chips

Installation Method: Poured

Setting Time: >24 hrs

Type of Bentonite Seal - - Granular, Pellet, Slurry (Choose One)

Installation Method: Poured

Setting Time: 16 hrs

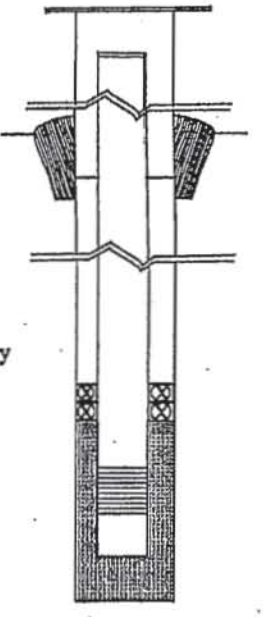
Type of Sand Pack: Quartz Sand

Grain Size: 50 (Sieve Size)

Installation Method: Poured

Type of Backfill Material: (If applicable)

Installation Method:



	Elevations (MSL)*	Depths (BGS)	(.01ft.)
	____	____	Top of Protective Casing
	540.33	-2.58	Top of Riser Pipe
	537.75	0	Ground Surface
	534.75	3.00	Top of Annular Sealant
	____	____	Static Water Level (After Completion)
	511.32	26.43	Top of Seal
	508.32	29.43	Top of Sand Pack
	506.32	31.43	Top of Screen
	496.32	41.43	Bottom of Screen
	495.92	41.83	Bottom of Well
	495.92	41.83	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or Other
Riser Pipe Above W.T.	SS304, SS316, PTFE, PVC, or Other
Riser Pipe Below W.T.	SS304, SS316, PTFE, PVC, or Other
Screen	SS304, SS316, PTFE, PVC, or Other

CASING MEASURMENTS

Diameter of Borehole (inches)	8.25
ID of Riser Pipe (inches)	2
Protective Casing Length (feet)	5
Riser Pipe Length (feet)	34.01
Bottom of Screen to End Cap (feet)	0.4
Screen Length (1" slot to last slot) (feet)	10
Total Length of Casing (feet)	44.41
Screen Slot Size **	0.010

**Hand-Slotted Well Screens are Unacceptable

Well Completion Form (revised 02/06/02)

Response to 1st RTP
CWLP - 026363

APPENDIX C

STATISTICAL METHOD FOR DETERMINATION OF BACKGROUNDS

Statistical Analyses Method

1.0 References

1. "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Unified Final Guidance." USEPA, March 2009.

2.0 Statistical Method

The statistical method includes the calculation of the 95% Upper Prediction Limit (upper and lower for pH) for each parameter utilizing the background data set. Prior to the calculation of the Prediction Limit, the data set is evaluated for normality, outliers and the percentage of non-detect values. Each of the steps for determining the Prediction Limit is outlined below in Sections 2.1 through 2.4.

2.1 Normality Testing

The distribution of the data is tested for normality using the Shapiro-Wilk normality test. If the data is not found to follow a normal distribution, a nonparametric statistical method shall be utilized. Generally, the highest detected concentration is utilized as the Upper Prediction Limit if the data set is found to be nonparametric. If the data is found to follow a normal distribution, the procedures outlined below are used to determine the Prediction Limit.

2.2 Handling of Outliers

Prior to statistical analyses, the data set is evaluated for outliers. Outliers are defined as data points that vary significantly from the mean value of the data set. Outliers may represent sampling error, contamination from surface run-off, analytical laboratory error, or anomalous site conditions. Outliers, if not removed from the data set, can erroneously increase the prediction limit which makes the prediction limit less likely to detect a statistically significant increase related to a release from a waste unit. Once a statistical outlier has been identified, the concentrations shall be evaluated to determine the cause. If the outlier is determined to be a result of sampling, laboratory or some other error, the outlier will be removed from the data set. If no specific reason can be documented the point will be considered representative of site conditions and will be included in the statistical analysis. Statistical analysis will then be conducted as described below. Evaluation for outliers will be completed utilizing Grubb's Test as well as Dixon's Test (both at 1% significance).

2.3 Handling of Non-Detects (NDs)

Non-detect values (NDs) are handled according to the percentage of Non-Detects (%ND) present in the data set. The data treatment is completed according to the following criteria:

a) For under 0% NDs, no adjustment is made to the values in the data set.
b) For under 15% NDs, the value of one-half (½) the reported Detection Limit (DL) is substituted for the ND value, and the mean and standard deviation are calculated using detected values with the substituted ND values.
c) For 15-50% NDs with a single censoring point, Cohen's Adjustment is used to adjust the mean and standard deviation. The adjusted mean and standard deviation are then used to calculate the Prediction Limit.
d) For 15-50% NDs with multiple censoring points:
    - For small data sets (<5): ½ the PQL can be substituted for ND values. The Prediction Limit is then calculated with the dataset containing the substituted values.
    - For larger data sets: Kaplan-Meier is used to adjust the mean and standard deviation. The adjusted mean and standard deviation are then used to calculate the Prediction Limit.
e) For over 50% but not 100% NDs, the highest recorded concentration is substituted for the prediction limit.
f) For 100% NDs, the Practical Quantitation Limit (PQL) will be utilized as the upper confidence limit.

2.4 Calculation of the Prediction Limit

After any outliers are removed and the data has been treated for non-detect values, the statistical procedure for calculation of the Prediction Limit will be conducted according to the following steps:

a) <u>Calculate arithmetic mean</u>

The arithmetic mean is calculated using the pooled data for each parameter. The arithmetic mean (X_b) is calculated using the following equation:

$$X_b = \frac{X_1 + X_2 + \ldots + X_n}{n}$$

where: X_b = Average background value
X_n = Individual background value for *n* sample
n = Number of background values

b) Calculate standard deviation

The standard deviation is calculated using the pooled data for each parameter.

The standard deviation is calculated using the following equation:

$$S_b = \sqrt{\frac{(X_1 - X_b) + (X_2 - X_b) + \ldots + (X_n - X_b)}{n - 1}}$$

where: S_b = Population standard deviation
X_n = Individual background value for *n* sample
X_b = Mean (1)
n = Number of background samples

c) Calculate the 95% Prediction Limit

The 95% Prediction Limit is calculated for each parameter using the mean (1), the standard deviation (2), the number of background samples, and the Student's t value given for α = 0.05 (95% Confidence). The Prediction Limit for pH is calculated as and upper and lower limit. All other Prediction Limits are calculated as an upper limit. The Student's t value varies upon the number of background samples. The 95% Prediction Limit is calculated using the following equation:

$$PL = X_b \pm S_b \bullet t \bullet \sqrt{1 + \frac{1}{n}}$$

where: PL = Upper Prediction Limit (Upper and Lower for pH)
X_b = Mean (1)
S_b = Standard Deviation (2)
t = Student's t value at 0.05 significance
n = Number of background samples

APPENDIX D
BACKGROUND CONCENTRATIONS AND CALCULATIONS

Electronic Filing: Received, Clerk's Office 02/13/2020

City Water, Light and Power

Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix III Parameters

Raw Data Summary

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	Distribution[1]	Proposed Background Value
AP-4	Boron, total	mg/l	0.119	0.123	0.787	< 2	< 0.687	0.75	0.665	< 2	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.787
AP-5	Boron, total	mg/l	< 1	< 0.625	0.782	< 3.2	< 0.687	0.22	0.0954	< 2		
AP-4	Chloride, total	mg/l	10.1	9.85	11	10.5	10.8	11	10.7	10.9	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	24.2
AP-5	Chloride, total	mg/l	24.2	7.23	3.32	3.76	3.71	2.61	1.95	2.07		
AP-4	Fluoride, total	mg/l	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.2	< 0.5	< 0.5	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.62
AP-5	Fluoride, total	mg/l	0.62	< 0.5	< 0.5	< 0.5	< 0.5	0.43	< 0.5	< 0.5		
AP-4	pH (field)	units	6.81	7.07	7.63	7.09	7.04	7.23	7.04	7.1	Normal - Calculate Interwell Prediction Limit	6.76-7.63
AP-5	pH (field)	units	7.33	7.19		7.29	7.23	7.46	7.15	7.32		
AP-4	Sulfate, total	mg/l	< 5	< 5	< 5	< 5	< 5	0.3	< 5	< 5	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	84.5
AP-5	Sulfate, total	mg/l	82.3	43.5	76.8	84.5	83.4	55.3	66.8	59.5		
AP-4	Total Dissolved Solids	mg/l	490	560	448	574	460	578	548	316	Normal - Calculate Interwell Prediction Limit	597.94
AP-5	Total Dissolved Solids	mg/l	414	404	316	404	370	410	428	384		
Well	**Parameter**	**Units**	**5/28/15**	**8/20/15**	**11/13/15**	**2/26/16**	**5/13/16**	**8/4/16**	**11/18/16**	**2/16/17**	**Distribution***	**Proposed Background Value**
AP-4	Calcium, total	mg/l	121	117	125	125	118	118	117	136	Normal - Calculate Interwell Prediction Limit	176.63
AP-5	Calcium, total	mg/l	103	92.2	124	98.1	77.3	158	201	155		

Notes:

1. Shapiro-Wilk method utilized to determine if the data set follows a normal distribution. ProUCL 5.1 was used for the calculations. ProUCL 5.1 outputs are provided.
2. In accordance with Chapter 18.3 of the March 2009 Unified Guidance (Statistical Analysis of Groundwater at RCRA Facilities), the maximum detected concentration is utilized as the interwell prediction limit and proposed background when the dataset does not follow a normal distribution.

Response to 1st RTP
CWLP - 026369

Electronic Filing: Received, Clerk's Office 02/13/2020

City Water, Light and Power

Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix III Parameters

Outlier Analysis

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	Number of Samples	Mean	Standard Deviation	Critical Values
AP-4	pH (field)	units	6.81	7.07	7.63	7.09	7.04	7.23	7.04	7.1	15	7.198666667	0.196136	2.705
AP-5	pH (field)	units	7.33	7.19		7.29	7.23	7.46	7.15	7.32				
AP-4	Total Dissolved Solids	mg/l	490	560	448	574	460	578	548	316	16	444	85.19468	2.747
AP-5	Total Dissolved Solids	mg/l	414	404	316	404	370	410	428	384				
Well	**Parameter**	**Units**	**5/28/15**	**8/20/15**	**11/13/15**	**2/26/16**	**5/13/16**	**8/4/16**	**11/18/16**	**2/16/17**	**Number of Samples**	**Mean**	**Standard Deviation**	**Critical Values**
AP-4	Calcium, total	mg/l	121	117	125	125	118	118	117	136	16	124.1	29.06863	2.747
AP-5	Calcium, total	mg/l	103	92.2	124	98.1	77.3	158	201	155				

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13
AP-4	pH (field)	units	-1.981613	-0.656006	2.1991488	-0.554036	-0.80896	0.1597527	-0.80896	-0.503051
AP-5	pH (field)	units	0.6696017	-0.044187		0.4656621	0.1597527	1.3324055	-0.248127	0.6186168
AP-4	Total Dissolved Solids	mg/l	0.5399398	1.3615874	0.0469513	1.5259169	0.1878052	1.5728682	1.2207335	-1.502441
AP-5	Total Dissolved Solids	mg/l	-0.352135	-0.469513	-1.502441	-0.469513	-0.868599	-0.399086	-0.187805	-0.704269
Well	**Parameter**	**Units**	**5/28/15**	**8/20/15**	**11/13/15**	**2/26/16**	**5/13/16**	**8/4/16**	**11/18/16**	**2/16/17**
AP-4	Calcium, total	mg/l	-0.106644	-0.24425	0.0309612	0.0309612	-0.209848	-0.209848	-0.24425	0.409376
AP-5	Calcium, total	mg/l	-0.725868	-1.097403	-0.00344	-0.894435	-1.609983	1.1662056	2.6454634	1.0630015

Notes:

1. Outlier method presented above outlined is in ASTM paper E178-75 (Grubb's Test).
2. Outliers were also evaluated utilizing Dixon's Test in ProUCL 5.1 at 1% Significance. ProUCL 5.1 output are provided.
3. Outliers that were identified by both methods are noted with a shaded value.

Response to 1st RTP
CWLP - 026370

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City Water, Light and Power

Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix III Parameters

Non-Detect Percentage Analysis

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	Number of Samples	Number of ND's	% ND	ND Treatment
AP-4	pH (field)	units	6.81	7.07	7.63	7.09	7.04	7.23	7.04	7.1	15	0	0%	No Adjustment
AP-5	pH (field)	units	7.33	7.19		7.29	7.23	7.46	7.15	7.32				
AP-4	Total Dissolved Solids	mg/l	490	560	448	574	460	578	548	316	16	0	0%	No Adjustment
AP-5	Total Dissolved Solids	mg/l	414	404	316	404	370	410	428	384				
Well	**Parameter**	**Units**	**5/28/15**	**8/20/15**	**11/13/15**	**2/26/16**	**5/13/16**	**8/4/16**	**11/18/16**	**2/16/17**	**Number of Samples**	**Number of ND's**	**% ND**	**ND Treatment**
AP-4	Calcium, total	mg/l	121	117	125	125	118	118	117	136	16	0	0%	No Adjustment
AP-5	Calcium, total	mg/l	103	92.2	124	98.1	77.3	158	201	155				

Notes:

1. For datasets with a fraction of non-detect values from 25% to 50%, adjustments to the mean and standard deviation (SD) are required.
2. For datasets with a single censoring point (RL), Cohen's Ajustment may be used to adjust the mean and SD or a substitution of 1/2 the RL may be used for small datasets (<5) in accordance with Section 15.2 of the March 2009 Unified Guidance (Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities).
3. Kaplan-Meier may be used to adjust the mean and SD for datasets with single or multiple censoring points (RL). The Kaplan-Meier adjusted mean and SD were calculated using ProUCL 5.1.
2. For datasets that do not include non-detect values, no adjustment to the mean and standard deviation are required prior to calculating the prediction limit.

Response to 1st RTP
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City Water, Light and Power

Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix III Parameters

Prediction Limit Calculation

Prediction Limit = x + st[1+(1/n)]^*½

Confidence Level = 95%

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	ND Treatment	Mean [x]	Standard Deviation [s]	Number of Samples	T Value [t]	Prediction Limit Limit	
AP-4	pH (field)	units	6.81	7.07	7.63	7.09	7.04	7.23	7.04	7.1	No Adjustment	7.1986667	0.20	15	2.145	6.7642	7.6332
AP-5	pH (field)	units	7.33	7.19		7.29	7.23	7.46	7.15	7.32							
AP-4	Total Dissolved Solids	mg/l	490	560	448	574	460	578	548	316	No Adjustment	444	85.19	16	1.753	597.9426139	
AP-5	Total Dissolved Solids	mg/l	414	404	316	404	370	410	428	384							
Well	**Parameter**	**Units**	**5/28/15**	**8/20/15**	**11/13/15**	**2/26/16**	**5/13/16**	**8/4/16**	**11/18/16**	**2/16/17**	**ND Treatment**	**Mean**	**Standard Deviation**	**Number of Samples**	**T Value**	**Prediction Limit Limit**	
AP-4	Calcium, total	mg/l	121	117	125	125	118	118	117	136	No Adjustment	124.1	29.07	16	1.753	176.6255938	
AP-5	Calcium, total	mg/l	103	92.2	124	98.1	77.3	158	201	155							

Response to 1st RTP
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City Water, Light and Power

Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix IV Parameters

Well	Parameter	Units	2/22/2012	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	Distribution[1]	Proposed Background Value
AP-4	Antimony, total	mg/l	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	0.0152	< 0.006	< 0.006	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.016
AP-5	Antimony, total	mg/l	< 0.006	< 0.006	0.0063	< 0.0096	< 0.006	0.016	< 0.006	< 0.006		
AP-4	Arsenic, total	mg/l	< 0.05	< 0.05	0.0294	0.00608	< 0.05	0.025	0.0193	< 0.05	Normal - Calculate Interwell Prediction Limit	0.0724
AP-5	Arsenic, total	mg/l	< 0.05	0.076	0.102	0.0243	< 0.05	0.0094	< 0.015	< 0.05		
AP-4	Barium, total	mg/l	< 2	< 2	0.366	< 2	< 2	0.37	0.385	< 2	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	5.24
AP-5	Barium, total	mg/l	5.24	< 2	2.76	< 3.2	< 2	0.13	0.228	< 2		
AP-4	Beryllium, total	mg/l	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.0164
AP-5	Beryllium, total	mg/l	0.0142	0.0128	0.0092	0.0164	< 0.004	< 0.004	< 0.004	< 0.004		
AP-4	Cadmium, total	mg/l	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.0025	< 0.005	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.0128
AP-5	Cadmium, total	mg/l	0.00776	0.0128	0.00575	< 0.008	< 0.005	< 0.005	< 0.0025	< 0.005		
AP-4	Chromium, total	mg/l	< 0.1	< 0.1	< 0.0175	< 0.1	< 0.1	0.0039	< 0.01	< 0.1	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.811
AP-5	Chromium, total	mg/l	0.811	0.328	0.449	0.42	< 0.1	0.016	0.0431	0.113		
AP-4	Cobalt, total	mg/l	< 1	< 1	< 0.0175	< 1	< 1	< 1	< 0.015	< 1	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.297
AP-5	Cobalt, total	mg/l	< 1	< 1	0.297	< 1.6	< 1	0.0086	0.0223	< 1		
AP-4	Lead, total	mg/l	< 0.0075	< 0.0075	< 0.005	< 0.0075	< 0.0075	0.0036	< 0.005	< 0.0075	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.638
AP-5	Lead, total	mg/l	0.638	0.236	0.312	0.277	0.0244	0.0104	0.0312	0.638		
AP-4	Mercury, total	mg/l	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.0008
AP-5	Mercury, total	mg/l	0.0008	< 0.0005	0.0007	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005		
AP-4	Selenium, total	mg/l	< 0.05	< 0.05	0.00497	< 0.05	< 0.05	0.0079	< 0.0025	< 0.05	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.0079
AP-5	Selenium, total	mg/l	< 0.05	< 0.05	0.00585	< 0.08	< 0.05	0.0046	0.00523	< 0.05		
AP-4	Thallium, total	mg/l	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	0.00556
AP-5	Thallium, total	mg/l	0.00556	0.00258	0.00302	< 0.0032	< 0.002	< 0.002	< 0.002	< 0.002		

Well	Parameter	Units	5/28/2015	8/20/15	11/13/15	2/26/16	5/13/16	8/4/16	11/18/16	2/16/17	Distribution[1]	Proposed Background Value
AP-4	Lithium	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	100% ND - Propose PQL as Prediction Limit	0.05
AP-5	Lithium	mg/l	< 0.05	< 0.05	< 0.25	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05		
AP-4	Molybdenum	mg/l	< 0.025	< 0.025	< 0.05	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	100% ND - Propose PQL as Prediction Limit	0.025
AP-5	Molybdenum	mg/l	< 0.025	< 0.025	< 0.05	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025		

Well	Parameter	Units	8/23/2012	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	2/26/14	5/20/14	Distribution[1]	Proposed Background Value
AP-4	Radium-226	pCi/l	< 0.97	0.41	< 0.57	0.84	< 0.57	0.46	0.91	1.2	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	7.1
AP-5	Radium-226	pCi/l	7.1	< 0.74	1.6	1.1	1	1.8	< -0.04	-0.03		
AP-4	Radium-228	pCi/l	< 0.71	2.3	< 0.83	0.69	< 1.4	< 0.52	0.56	0.53	Not Normal - Propose Highest Detected Concentration as Prediction Limit/Background	5.1
AP-5	Radium-228	pCi/l	5.1	< 1.28	1.6	< 0.68	0.81	1.7	< 1.8	0.95		

Notes:

1. Shapiro-Wilk method utilized to determine if the data set follows a normal distribution. ProUCL 5.1 was used for the calculations. ProUCL 5.1 outputs are provided.

2. In accordance with Section 18.3 of the March 2009 Unified Guidance (Statistical Analysis of Groundwater at RCRA Facilities), the maximum detected concentration is utilized as the interwell prediction limit and proposed background when the dataset does not follow a normal distribution.

Response to 1st RTP
CWLP - 026373

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Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix IV Parameters

Outlier Analysis

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	Number of Samples	Mean	Standard Deviation	Critical Values
AP-4	Arsenic, total	mg/l	< 0.05	< 0.05	0.0294	0.00608	< 0.05	0.025	0.0193	< 0.05	16	0.04103	0.025229	2.747
AP-5	Arsenic, total	mg/l	< 0.05	0.076	0.102	0.0243	< 0.05	0.0094	< 0.015	< 0.05				

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13
AP-4	Arsenic, total	mg/l	0.355548	0.355548	-0.46098	-1.38533	0.355548	-0.63539	-0.86132	0.355548
AP-5	Arsenic, total	mg/l	0.355548	1.386121	2.416694	-0.66313	0.355548	-1.25373	-1.03176	0.355548

Notes:

1. Outlier method presented above outlined is in ASTM paper E178-75 (Grubb's Test).
2. Outliers were also evaluated utilizing Dixon's Test in ProUCL 5.1 at 1% Significance. ProUCL 5.1 output are provided.
3. Outliers that were identified by both methods are noted with a shaded value.

Response to 1st RTP
CWLP - 026374

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Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix IV Parameters

Non-Detect Percentage Analysis

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	Number of Samples	Number of ND's	% ND	ND Treatment
AP-4	Arsenic, total	mg/l	< 0.05	< 0.05	0.0294	0.00608	< 0.05	0.025	0.0193	< 0.05	16	8	50%	Kaplan-Meier
AP-5	Arsenic, total	mg/l	< 0.05	0.076	0.102	0.0243	< 0.05	0.0094	< 0.015	< 0.05				

Notes:

1. For datasets with a fraction of non-detect values from 25% to 50%, adjustments to the mean and standard deviation (SD) are required.
2. For datasets with a single censoring point (RL), Cohen's Ajustment may be used to adjust the mean and SD or a substitution of 1/2 the RL may be used for small datasets (<5) in accordance with Section 15.2 of the March 2009 Unified Guidance (Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities).
3. Kaplan-Meier may be used to adjust the mean and SD for datasets with single or multiple censoring points (RL). The Kaplan-Meier adjusted mean and SD were calculated using ProUCL 5.1.
2. For datasets that do not include non-detect values, no adjustment to the mean and standard deviation are required prior to calculating the prediction limit.

Response to 1st RTP
CWLP - 026375

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Power Plant Ash Impoundment

Background Calculations - Interwell Prediction Limits

40 CFR 257 Appendix IV Parameters

Prediction Limit Calculation

Prediction Limit = x + st[1+(1/n)]^*½

Confidence Level = 95%

Well	Parameter	Units	2/22/12	4/25/12	8/23/12	11/28/12	2/21/13	5/22/13	8/28/13	11/20/13	ND Treatment	Mean [x]	Standard Deviation [s]	Number of Samples	T Value [t]	Prediction Limit Limit
AP-4	Arsenic, total	mg/l	< 0.05	< 0.05	0.0294	0.00608	< 0.05	0.025	0.0193	< 0.05	No Adjustment	0.0263	0.0255	16	1.753	0.072377252
AP-5	Arsenic, total	mg/l	< 0.05	0.076	0.102	0.0243	< 0.05	0.0094	< 0.015	< 0.05						

Note:

1. Multiple censoring points (RL's) were observed. Therefore, Kaplan-Meier was utilized to adjust the mean and SD.

Response to 1st RTP
CWLP - 026376

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/25/2017 3:46:43 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Arsenic

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	8	8	50.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	8	0.015	0.05	0.0456	0.05	0.0124
Statistics (Non-Detects Only)	8	0.00608	0.102	0.0364	0.0247	0.0341
Statistics (All: NDs treated as DL value)	16	0.00608	0.102	0.041	0.05	0.0252
Statistics (All: NDs treated as DL/2 value)	16	0.00608	0.102	0.0296	0.025	0.0247
Statistics (Normal ROS Imputed Data)	16	-0.0127	0.102	0.0268	0.0227	0.0292
Statistics (Gamma ROS Imputed Data)	16	0.00608	0.102	0.0278	0.021	0.0264
Statistics (Lognormal ROS Imputed Data)	16	0.00559	0.102	0.0266	0.0199	0.0265

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	1.472	1.004	0.0247	-3.689	0.946	-0.256
Statistics (NDs = DL)	2.385	1.98	0.0172	-3.418	0.762	-0.223
Statistics (NDs = DL/2)	2.194	1.824	0.0135	-3.764	0.713	-0.189
Statistics (Gamma ROS Estimates)	1.701	1.424	0.0163	-3.905	0.795	-0.204
Statistics (Lognormal ROS Estimates)	--	--	--	-3.982	0.84	-0.211

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.897	0.945	0.795	0.941

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.805	0.818	Data Not Normal
Shapiro-Wilk (NDs = DL)	0.899	0.887	Data Appear Normal
Shapiro-Wilk (NDs = DL/2)	0.653	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.895	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.332	0.283	Data Not Normal
Lilliefors (NDs = DL)	0.236	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.387	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.209	0.213	Data Appear Normal

User Selected Options

Date/Time of Computation	ProUCL 5.19/25/2017 4:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Boron

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	8	8	50.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	8	0.625	3.2	1.525	1.5	0.924
Statistics (Non-Detects Only)	8	0.0954	0.787	0.443	0.443	0.328
Statistics (All: NDs treated as DL value)	16	0.0954	3.2	0.984	0.719	0.872
Statistics (All: NDs treated as DL/2 value)	16	0.0954	1.6	0.603	0.583	0.421
Statistics (Normal ROS Imputed Data)	16	0.0954	0.787	0.383	0.37	0.255
Statistics (Gamma ROS Imputed Data)	16	0.0954	0.787	0.367	0.313	0.253
Statistics (Lognormal ROS Imputed Data)	16	0.0954	0.787	0.343	0.254	0.26

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	1.601	1.084	0.276	-1.159	0.953	-0.823
Statistics (NDs = DL)	1.286	1.087	0.765	-0.453	1.068	-2.358
Statistics (NDs = DL/2)	1.856	1.55	0.325	-0.8	0.865	-1.081
Statistics (Gamma ROS Estimates)	2.291	1.903	0.16	-1.237	0.718	-0.58
Statistics (Lognormal ROS Estimates)	--	--	--	-1.332	0.742	-0.557

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.898	0.911	0.96	0.943

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.771	0.818	Data Not Normal
Shapiro-Wilk (NDs = DL)	0.831	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.919	0.887	Data Appear Normal
Shapiro-Wilk (Normal ROS Estimates)	0.867	0.887	Data Not Normal
Lilliefors (Detects Only)	0.251	0.283	Data Appear Normal
Lilliefors (NDs = DL)	0.277	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.168	0.213	Data Appear Normal
Lilliefors (Normal ROS Estimates)	0.198	0.213	Data Appear Normal

User Selected Options

Date/Time of Computation	ProUCL 5.19/25/2017 3:58:26 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Barium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	7	9	56.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	9	2	3.2	2.133	2	0.4
Statistics (Non-Detects Only)	7	0.13	5.24	1.354	0.37	1.946
Statistics (All: NDs treated as DL value)	16	0.13	5.24	1.792	2	1.327
Statistics (All: NDs treated as DL/2 value)	16	0.13	5.24	1.192	1	1.248
Statistics (Normal ROS Imputed Data)	16	-1.289	5.24	0.89	0.378	1.513
Statistics (Gamma ROS Imputed Data)	16	0.01	5.24	0.837	0.344	1.375
Statistics (Lognormal ROS Imputed Data)	16	0.0763	5.24	0.818	0.368	1.342

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	0.712	0.502	1.901	-0.543	1.352	-2.49
Statistics (NDs = DL)	1.387	1.169	1.292	0.182	1.086	5.978
Statistics (NDs = DL/2)	1.445	1.216	0.825	-0.208	0.915	-4.395
Statistics (Gamma ROS Estimates)	0.516	0.461	1.621	-1.402	1.901	-1.356
Statistics (Lognormal ROS Estimates)	--	--	--	-0.9	1.09	-1.212

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.825	0.912	0.8	0.913

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.688	0.803	Data Not Normal
Shapiro-Wilk (NDs = DL)	0.842	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.664	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.855	0.887	Data Not Normal
Lilliefors (Detects Only)	0.405	0.304	Data Not Normal
Lilliefors (NDs = DL)	0.25	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.374	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.218	0.213	Data Not Normal

User Selected Options

Date/Time of Computation	ProUCL 5.19/25/2017 4:03:44 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Beryllium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	4	12	75.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	12	0.004	0.004	0.004	0.004	9.059E-19
Statistics (Non-Detects Only)	4	0.0092	0.0164	0.0132	0.0135	0.00302
Statistics (All: NDs treated as DL value)	16	0.004	0.0164	0.00629	0.004	0.00431
Statistics (All: NDs treated as DL/2 value)	16	0.002	0.0164	0.00479	0.002	0.00517
Statistics (Normal ROS Imputed Data)	16	-0.01	0.0164	0.0032	0.00292	0.00761
Statistics (Gamma ROS Imputed Data)	16	0.0092	0.0164	0.0108	0.01	0.00195
Statistics (Lognormal ROS Imputed Data)	16	0.00207	0.0164	0.00694	0.00575	0.00426

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	23.28	5.987	5.6479E-4	-4.353	0.246	-0.0564
Statistics (NDs = DL)	3.279	2.706	0.00192	-5.229	0.534	-0.102
Statistics (NDs = DL/2)	1.37	1.155	0.00349	-5.749	0.84	-0.146
Statistics (Gamma ROS Estimates)	39.38	32.04	2.7394E-4	-4.542	0.157	-0.0347
Statistics (Lognormal ROS Estimates)	--	--	--	-5.138	0.601	-0.117

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.987	0.77	0.772	0.997

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.981	0.748	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.593	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.593	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.984	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.204	0.375	Data Appear Normal
Lilliefors (NDs = DL)	0.452	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.455	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.084	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 5:05:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Calcium

Raw Statistics

Number of Valid Observations	16
Number of Distinct Observations	13
Minimum	77.3
Maximum	201
Mean of Raw Data	124.1
Standard Deviation of Raw Data	29.07
Khat	20.96
Theta hat	5.92
Kstar	17.08
Theta star	7.268
Mean of Log Transformed Data	4.797
Standard Deviation of Log Transformed Data	0.224

Normal GOF Test Results

Correlation Coefficient R	0.944
Shapiro Wilk Test Statistic	0.909
Shapiro Wilk Critical (0.05) Value	0.887
Approximate Shapiro Wilk P Value	0.0906
Lilliefors Test Statistic	0.238
Lilliefors Critical (0.05) Value	0.213

Data appear Approximate Normal at (0.05) Significance Level

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 9:51:59 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Cadmium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	3	13	81.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	13	0.0025	0.008	0.00485	0.005	0.00133
Statistics (Non-Detects Only)	3	0.00575	0.0128	0.00877	0.00776	0.00363
Statistics (All: NDs treated as DL value)	16	0.0025	0.0128	0.00558	0.005	0.00238
Statistics (All: NDs treated as DL/2 value)	16	0.00125	0.0128	0.00361	0.0025	0.00294
Statistics (Normal ROS Imputed Data)	16	-0.015	0.0128	-0.00253	-0.00298	0.00727
Statistics (Gamma ROS Imputed Data)	16	0.00575	0.0128	0.00977	0.01	0.00142
Statistics (Lognormal ROS Imputed Data)	16	6.0454E-4	0.0128	0.00329	0.00227	0.00316

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (NDs = DL)	7.069	5.785	7.8965E-4	-5.261	0.388	-0.0737
Statistics (NDs = DL/2)	2.647	2.192	0.00136	-5.824	0.599	-0.103
Statistics (Gamma ROS Estimates)	42.99	34.97	2.2724E-4	-4.64	0.166	-0.0357
Statistics (Lognormal ROS Estimates)	--	--	--	-6.04	0.803	-0.133

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.971	0.835	0.784	0.992

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.942	0.767	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.726	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.636	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.984	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.276	0.425	Data Appear Normal
Lilliefors (NDs = DL)	0.346	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.397	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.103	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 1:58:45 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Chloride

Raw Statistics

Number of Valid Observations	16
Number of Distinct Observations	15
Minimum	1.95
Maximum	24.2
Mean of Raw Data	8.356
Standard Deviation of Raw Data	5.632
Khat	2.299
Theta hat	3.635
Kstar	1.91
Theta star	4.376
Mean of Log Transformed Data	1.89
Standard Deviation of Log Transformed Data	0.745

Normal GOF Test Results

Correlation Coefficient R	0.896
Shapiro Wilk Test Statistic	0.815
Shapiro Wilk Critical (0.05) Value	0.887
Approximate Shapiro Wilk P Value	0.00346
Lilliefors Test Statistic	0.257
Lilliefors Critical (0.05) Value	0.213

Data not Normal at (0.05) Significance Level

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 2:30:51 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Cobalt

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	3	13	81.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	13	0.015	1.6	0.895	1	0.423
Statistics (Non-Detects Only)	3	0.0086	0.297	0.109	0.0223	0.163
Statistics (All: NDs treated as DL value)	16	0.0086	1.6	0.748	1	0.497
Statistics (All: NDs treated as DL/2 value)	16	0.0075	0.8	0.384	0.5	0.241
Statistics (Normal ROS Imputed Data)	16	-0.146	0.297	0.0515	0.0278	0.118
Statistics (Gamma ROS Imputed Data)	16	0.0086	0.323	0.0699	0.0104	0.106
Statistics (Lognormal ROS Imputed Data)	16	0.00135	0.297	0.0524	0.0159	0.0874

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (NDs = DL)	0.744	0.646	1.005	-1.097	1.889	-1.722
Statistics (NDs = DL/2)	0.839	0.723	0.458	-1.66	1.746	-1.052
Statistics (Gamma ROS Estimates)	0.636	0.558	0.11	-3.625	1.353	-0.373
Statistics (Lognormal ROS Estimates)	--	--	--	-4.015	1.498	-0.373

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.886	0.868	0.867	0.98

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.786	0.767	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.75	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.751	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.961	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.37	0.425	Data Appear Normal
Lilliefors (NDs = DL)	0.382	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.373	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.136	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 2:15:26 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Chromium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	8	8	50.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	8	0.01	0.1	0.0784	0.1	0.04
Statistics (Non-Detects Only)	8	0.0039	0.811	0.273	0.221	0.283
Statistics (All: NDs treated as DL value)	16	0.0039	0.811	0.176	0.1	0.22
Statistics (All: NDs treated as DL/2 value)	16	0.0039	0.811	0.156	0.05	0.229
Statistics (Normal ROS Imputed Data)	16	-0.299	0.811	0.103	0.0296	0.281
Statistics (Gamma ROS Imputed Data)	16	0.0039	0.811	0.147	0.0202	0.234
Statistics (Lognormal ROS Imputed Data)	16	0.00144	0.811	0.144	0.0212	0.236

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	0.643	0.485	0.425	-2.25	1.878	-0.835
Statistics (NDs = DL)	0.757	0.656	0.232	-2.529	1.466	-0.58
Statistics (NDs = DL/2)	0.606	0.534	0.258	-2.876	1.576	-0.548
Statistics (Gamma ROS Estimates)	0.483	0.434	0.304	-3.239	1.723	-0.532
Statistics (Lognormal ROS Estimates)	--	--	--	-3.525	1.996	-0.566

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.942	0.845	0.817	0.957

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.88	0.818	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.725	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.677	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.924	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.214	0.283	Data Appear Normal
Lilliefors (NDs = DL)	0.362	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.366	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.174	0.213	Data Appear Normal

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 2:43:21 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Fluoride

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	3	13	81.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	13	0.5	0.5	0.5	0.5	0
Statistics (Non-Detects Only)	3	0.2	0.62	0.417	0.43	0.21
Statistics (All: NDs treated as DL value)	16	0.2	0.62	0.484	0.5	0.0838
Statistics (All: NDs treated as DL/2 value)	16	0.2	0.62	0.281	0.25	0.102
Statistics (Normal ROS Imputed Data)	16	0.0634	0.62	0.323	0.321	0.15
Statistics (Gamma ROS Imputed Data)	16	0.155	0.62	0.33	0.314	0.126
Statistics (Lognormal ROS Imputed Data)	16	0.149	0.62	0.317	0.293	0.128

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (NDs = DL)	23.42	19.07	0.0207	-0.746	0.24	-0.321
Statistics (NDs = DL/2)	12.34	10.07	0.0228	-1.31	0.268	-0.204
Statistics (Gamma ROS Estimates)	7.453	6.097	0.0443	-1.177	0.385	-0.327
Statistics (Lognormal ROS Estimates)	--	--	--	-1.222	0.397	-0.325

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.998	0.692	0.665	0.997

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.997	0.767	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.526	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.472	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.991	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.192	0.425	Data Appear Normal
Lilliefors (NDs = DL)	0.449	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.495	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.0794	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 2:58:10 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Mercury

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	2	14	87.50%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	14	5.0000E-4	5.0000E-4	5.0000E-4	5.0000E-4	2.250E-19
Statistics (Non-Detects Only)	2	7.0000E-4	8.0000E-4	7.5000E-4	7.5000E-4	7.0711E-5
Statistics (All: NDs treated as DL value)	16	5.0000E-4	8.0000E-4	5.3125E-4	5.0000E-4	8.7321E-5
Statistics (All: NDs treated as DL/2 value)	16	2.5000E-4	8.0000E-4	3.1250E-4	2.5000E-4	1.7176E-4
Statistics (Normal ROS Imputed Data)	16	-1.466E-4	8.0000E-4	3.0705E-4	3.0035E-4	2.6145E-4
Statistics (Gamma ROS Imputed Data)	16	N/A	N/A	N/A	N/A	N/A
Statistics (Lognormal ROS Imputed Data)	16	2.2601E-4	8.0000E-4	4.3882E-4	4.1068E-4	1.5791E-4

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (NDs = DL)	49.09	39.93	1.0822E-5	-7.55	0.14	-0.0185
Statistics (NDs = DL/2)	5.969	4.892	5.2352E-5	-8.157	0.375	-0.046
Statistics (Gamma ROS Estimates)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (Lognormal ROS Estimates)	--	--	--	-7.789	0.349	-0.0448

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	1	0.628	0.628	0.998

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (NDs = DL)	0.414	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.41	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.992	0.887	Data Appear Normal
Lilliefors (Detects Only)	N/A	N/A	
Lilliefors (NDs = DL)	0.515	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.517	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.0586	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 5:07:40 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Lithium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	0	16	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!

Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Lithium was not processed!

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 5:08:42 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Molybdenum

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	0	16	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!

Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Molybdenum was not processed!

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 2:53:27 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Lead

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	9	7	43.75%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	7	0.005	0.0075	0.00679	0.0075	0.00122
Statistics (Non-Detects Only)	9	0.0036	0.638	0.241	0.236	0.255
Statistics (All: NDs treated as DL value)	16	0.0036	0.638	0.139	0.00895	0.222
Statistics (All: NDs treated as DL/2 value)	16	0.0025	0.638	0.137	0.00708	0.223
Statistics (Normal ROS Imputed Data)	16	-0.428	0.638	0.0464	0.007	0.307
Statistics (Gamma ROS Imputed Data)	16	0.0036	0.638	0.14	0.0102	0.221
Statistics (Lognormal ROS Imputed Data)	16	4.0641E-4	0.638	0.137	0.0101	0.223

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	0.595	0.47	0.406	-2.463	1.911	-0.776
Statistics (NDs = DL)	0.41	0.374	0.338	-3.577	1.915	-0.535
Statistics (NDs = DL/2)	0.354	0.33	0.387	-3.88	2.172	-0.56
Statistics (Gamma ROS Estimates)	0.45	0.407	0.311	-3.4	1.776	-0.522
Statistics (Lognormal ROS Estimates)	--	--	--	-4.02	2.4	-0.597

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.923	0.812	0.813	0.969

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.827	0.829	Data Not Normal
Shapiro-Wilk (NDs = DL)	0.654	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.656	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.934	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.239	0.274	Data Appear Normal
Lilliefors (NDs = DL)	0.373	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.37	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.207	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.110/3/2017 9:00:31 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

pH

Raw Statistics

Number of Valid Observations	15
Number of Distinct Observations	13
Minimum	6.81
Maximum	7.63
Mean of Raw Data	7.199
Standard Deviation of Raw Data	0.196
Khat	1450
Theta hat	0.00497
Kstar	1160
Theta star	0.00621
Mean of Log Transformed Data	1.974
Standard Deviation of Log Transformed Data	0.0272

Normal GOF Test Results

Correlation Coefficient R	0.977
Shapiro Wilk Test Statistic	0.969
Shapiro Wilk Critical (0.05) Value	0.881
Approximate Shapiro Wilk P Value	0.725
Lilliefors Test Statistic	0.143
Lilliefors Critical (0.05) Value	0.22

Data appear Normal at (0.05) Significance Level

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/28/2017 11:48:02 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Ra226

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	11	5	31.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	5	-0.04	0.97	0.562	0.57	0.374
Statistics (Non-Detects Only)	11	-0.03	7.1	1.49	1	1.933
Statistics (All: NDs treated as DL value)	16	-0.04	7.1	1.2	0.875	1.651
Statistics (All: NDs treated as DL/2 value)	16	N/A	N/A	N/A	N/A	N/A
Statistics (Normal ROS Imputed Data)	16	-2.249	7.1	0.749	0.65	1.995

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.76	0.728	0.733	0.869

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.611	0.85	Data Not Normal
Shapiro-Wilk (NDs = DL)	0.561	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.567	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.789	0.887	Data Not Normal
Lilliefors (Detects Only)	0.345	0.251	Data Not Normal
Lilliefors (NDs = DL)	0.313	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.292	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.237	0.213	Data Not Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/28/2017 11:49:12 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Ra228

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	9	7	43.75%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	7	0.52	1.8	1.027	0.83	0.466
Statistics (Non-Detects Only)	9	0.53	5.1	1.582	0.95	1.451
Statistics (All: NDs treated as DL value)	16	0.52	5.1	1.339	0.89	1.136
Statistics (All: NDs treated as DL/2 value)	16	0.26	5.1	1.115	0.695	1.202
Statistics (Normal ROS Imputed Data)	16	-1.431	5.1	0.846	0.553	1.428
Statistics (Gamma ROS Imputed Data)	16	0.01	5.1	0.963	0.545	1.289
Statistics (Lognormal ROS Imputed Data)	16	0.202	5.1	1.095	0.604	1.207

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	1.94	1.367	0.816	0.179	0.749	4.172
Statistics (NDs = DL)	2.452	2.034	0.546	0.0746	0.628	8.42
Statistics (NDs = DL/2)	1.63	1.366	0.684	-0.229	0.78	-3.411
Statistics (Gamma ROS Estimates)	0.608	0.536	1.583	-1.052	1.865	-1.773
Statistics (Lognormal ROS Estimates)	--	--	--	-0.255	0.787	-3.079

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.851	0.814	0.795	0.904

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.739	0.829	Data Not Normal
Shapiro-Wilk (NDs = DL)	0.683	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.655	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.846	0.887	Data Not Normal
Lilliefors (Detects Only)	0.245	0.274	Data Appear Normal
Lilliefors (NDs = DL)	0.235	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.304	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.221	0.213	Data Not Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/25/2017 3:43:44 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Antimony

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	3	13	81.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	13	0.006	0.0096	0.00628	0.006	9.9846E-4
Statistics (Non-Detects Only)	3	0.0063	0.016	0.0125	0.0152	0.00538
Statistics (All: NDs treated as DL value)	16	0.006	0.016	0.00744	0.006	0.00331
Statistics (All: NDs treated as DL/2 value)	16	0.003	0.016	0.00489	0.003	0.00428
Statistics (Normal ROS Imputed Data)	16	-0.0265	0.016	-0.00565	-0.00701	0.0121
Statistics (Gamma ROS Imputed Data)	16	0.0063	0.016	0.0105	0.01	0.00221
Statistics (Lognormal ROS Imputed Data)	16	2.7001E-4	0.016	0.00379	0.00177	0.00489

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (NDs = DL)	8.001	6.542	9.3037E-4	-4.964	0.335	-0.0674
Statistics (NDs = DL/2)	2.563	2.124	0.00191	-5.527	0.574	-0.104
Statistics (Gamma ROS Estimates)	26.29	21.4	3.9826E-4	-4.579	0.2	-0.0436
Statistics (Lognormal ROS Estimates)	--	--	--	-6.209	1.159	-0.187

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.901	0.7	0.704	0.992

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.811	0.767	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.498	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.504	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.978	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.359	0.425	Data Appear Normal
Lilliefors (NDs = DL)	0.448	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.421	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.0832	0.213	Data Appear Normal

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 3:03:58 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Selenium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	5	11	68.75%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	11	0.0025	0.08	0.0484	0.05	0.0177
Statistics (Non-Detects Only)	5	0.0046	0.0079	0.00571	0.00523	0.00131
Statistics (All: NDs treated as DL value)	16	0.0025	0.08	0.0351	0.05	0.025
Statistics (All: NDs treated as DL/2 value)	16	0.00125	0.04	0.0184	0.025	0.0114
Statistics (Normal ROS Imputed Data)	16	0.00251	0.0079	0.00521	0.00522	0.00155
Statistics (Gamma ROS Imputed Data)	16	0.0046	0.01	0.00866	0.01	0.00216
Statistics (Lognormal ROS Imputed Data)	16	0.0033	0.0079	0.00532	0.00517	0.00136

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	26.79	10.85	2.1315E-4	-5.184	0.211	-0.0407
Statistics (NDs = DL)	1.165	0.988	0.0301	-3.838	1.211	-0.315
Statistics (NDs = DL/2)	1.71	1.431	0.0108	-4.314	0.976	-0.226
Statistics (Gamma ROS Estimates)	13.66	11.14	6.3377E-4	-4.786	0.298	-0.0622
Statistics (Lognormal ROS Estimates)	--	--	--	-5.268	0.255	-0.0485

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.916	0.878	0.896	0.987

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.848	0.762	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.764	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.801	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.967	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.257	0.343	Data Appear Normal
Lilliefors (NDs = DL)	0.35	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.342	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.119	0.213	Data Appear Normal

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 4:56:42 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Sulfate

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	9	7	43.75%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	7	5	5	5	5	0
Statistics (Non-Detects Only)	9	0.3	84.5	61.38	66.8	26.96
Statistics (All: NDs treated as DL value)	16	0.3	84.5	36.71	24.25	34.96
Statistics (All: NDs treated as DL/2 value)	16	0.3	84.5	35.62	23	36.02
Statistics (Normal ROS Imputed Data)	16	-20.67	84.5	38.83	38	35
Statistics (Gamma ROS Imputed Data)	16	0.3	84.5	46.67	39.94	26.42
Statistics (Lognormal ROS Imputed Data)	16	0.3	84.5	35.84	25.4	35.84

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	1.122	0.822	54.73	3.609	1.819	0.504
Statistics (NDs = DL)	0.696	0.607	52.74	2.734	1.677	0.613
Statistics (NDs = DL/2)	0.548	0.487	64.95	2.431	1.915	0.788
Statistics (Gamma ROS Estimates)	1.506	1.265	31	3.476	1.344	0.387
Statistics (Lognormal ROS Estimates)	--	--	--	2.343	2.098	0.896

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.907	0.901	0.895	0.977

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.83	0.829	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.785	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.773	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.935	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.196	0.274	Data Appear Normal
Lilliefors (NDs = DL)	0.318	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.321	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.119	0.213	Data Appear Normal

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 5:02:40 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

TDS

Raw Statistics

Number of Valid Observations	16
Number of Distinct Observations	14
Minimum	316
Maximum	578
Mean of Raw Data	444
Standard Deviation of Raw Data	85.19
Khat	29.07
Theta hat	15.27
Kstar	23.66
Theta star	18.76
Mean of Log Transformed Data	6.079
Standard Deviation of Log Transformed Data	0.193

Normal GOF Test Results

Correlation Coefficient R	0.971
Shapiro Wilk Test Statistic	0.927
Shapiro Wilk Critical (0.05) Value	0.887
Approximate Shapiro Wilk P Value	0.271
Lilliefors Test Statistic	0.139
Lilliefors Critical (0.05) Value	0.213

Data appear Normal at (0.05) Significance Level

User Selected Options

Date/Time of Computation	ProUCL 5.19/26/2017 4:59:14 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	0.95

Thallium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	3	13	81.25%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	13	0.002	0.0032	0.00209	0.002	3.3282E-4
Statistics (Non-Detects Only)	3	0.00258	0.00556	0.00372	0.00302	0.00161
Statistics (All: NDs treated as DL value)	16	0.002	0.00556	0.0024	0.002	9.2960E-4
Statistics (All: NDs treated as DL/2 value)	16	0.001	0.00556	0.00155	0.001	0.00124
Statistics (Normal ROS Imputed Data)	16	-0.00705	0.00556	-0.00129	-0.00153	0.00333
Statistics (Gamma ROS Imputed Data)	16	0.00258	0.01	0.00882	0.01	0.0026
Statistics (Lognormal ROS Imputed Data)	16	2.2972E-4	0.00556	0.00139	9.2841E-4	0.00136

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (NDs = DL)	10.96	8.944	2.1882E-4	-6.08	0.284	-0.0467
Statistics (NDs = DL/2)	3.068	2.535	5.0437E-4	-6.643	0.527	-0.0793
Statistics (Gamma ROS Estimates)	7.213	5.902	0.00122	-4.801	0.447	-0.0931
Statistics (Lognormal ROS Estimates)	--	--	--	-6.92	0.842	-0.122

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.926	0.696	0.714	0.995

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.858	0.767	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.507	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.529	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.991	0.887	Data Appear Normal
Lilliefors (Detects Only)	0.335	0.425	Data Appear Normal
Lilliefors (NDs = DL)	0.416	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.421	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.0776	0.213	Data Appear Normal

User Selected Options

Date/Time of Computation ProUCL 5.19/27/2017 3:54:50 PM

From File WorkSheet.xls

Full Precision OFF

Dixon's Outlier Test for Arsenic

Total N = 16

Number NDs = 8

Number Detects = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

Note: NDs excluded from Outlier Test

1. Data Value 0.102 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.281

For 10% significance level, 0.102 is not an outlier.

For 5% significance level, 0.102 is not an outlier.

For 1% significance level, 0.102 is not an outlier.

2. Data Value 0.00608 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.047

For 10% significance level, 0.00608 is not an outlier.

For 5% significance level, 0.00608 is not an outlier.

For 1% significance level, 0.00608 is not an outlier.

User Selected Options

Date/Time of Computation ProUCL 5.19/28/2017 11:52:22 AM

From File WorkSheet.xls

Full Precision OFF

Dixon's Outlier Test for Calcium

Total N = 16

Number NDs = 0

Number Detects = 16

10% critical value: 0.454

5% critical value: 0.507

1% critical value: 0.595

Note: NDs excluded from Outlier Test

1. Data Value 201 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.447

For 10% significance level, 201 is not an outlier.

For 5% significance level, 201 is not an outlier.

For 1% significance level, 201 is not an outlier.

2. Data Value 77.3 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.268

For 10% significance level, 77.3 is not an outlier.

For 5% significance level, 77.3 is not an outlier.

For 1% significance level, 77.3 is not an outlier.

User Selected Options

Date/Time of Computation	ProUCL 5.19/27/2017 3:39:01 PM
From File	WorkSheet.xls
Full Precision	OFF

Dixon's Outlier Test for pH

Total N = 15

Number NDs = 0

Number Detects = 15

10% critical value: 0.472

5% critical value: 0.525

1% critical value: 0.616

Note: NDs excluded from Outlier Test

1. Data Value 7.63 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.508

For 10% significance level, 7.63 is an outlier.

For 5% significance level, 7.63 is not an outlier.

For 1% significance level, 7.63 is not an outlier.

2. Data Value 6.81 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.442

For 10% significance level, 6.81 is not an outlier.

For 5% significance level, 6.81 is not an outlier.

For 1% significance level, 6.81 is not an outlier.

User Selected Options

Date/Time of Computation ProUCL 5.19/27/2017 3:36:41 PM

From File WorkSheet.xls

Full Precision OFF

Dixon's Outlier Test for TDS

Total N = 16

Number NDs = 0

Number Detects = 16

10% critical value: 0.454

5% critical value: 0.507

1% critical value: 0.595

Note: NDs excluded from Outlier Test

1. Data Value 578 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.087

For 10% significance level, 578 is not an outlier.

For 5% significance level, 578 is not an outlier.

For 1% significance level, 578 is not an outlier.

2. Data Value 316 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.221

For 10% significance level, 316 is not an outlier.

For 5% significance level, 316 is not an outlier.

For 1% significance level, 316 is not an outlier.

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User Selected Options

Date/Time of Computation	ProUCL 5.110/3/2017 10:23:39 AM
From File	Data Sept28.xls
Full Precision	OFF
Confidence Coefficient	95%
Coverage	95%
Different or Future K Observations	1
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	16	Number of Missing Observations	0
Number of Distinct Observations	10		
Number of Detects	8	Number of Non-Detects	8
Number of Distinct Detects	8	Number of Distinct Non-Detects	2
Minimum Detect	0.00608	Minimum Non-Detect	0.015
Maximum Detect	0.102	Maximum Non-Detect	0.05
Variance Detected	0.00116	Percent Non-Detects	50%
Mean Detected	0.0364	SD Detected	0.0341
Mean of Detected Logged Data	-3.689	SD of Detected Logged Data	0.946

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.524	d2max (for USL)	2.443

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	**0.0263**	**KM SD**	**0.0255**
95% UTL95% Coverage	0.0907	95% KM UPL (t)	0.0724
90% KM Percentile (z)	0.059	95% KM Percentile (z)	0.0682
99% KM Percentile (z)	0.0856	95% KM USL	0.0886

31.8

31.8	10/17/2016 - Initial Hazard Potential Classification Assessment Report for CCR Surface Impoundments	Initial Hazard Potential October 2016	CWLP	29616	29621

Electronic Filing: Received, Clerk's Office 02/13/2020

City Water, Light & Power
Ash Impoundments
Springfield, Sangamon County, Illinois

Initial Hazard Potential Classification Assessment Report for Coal Combustion Residuals Surface Impoundments

October 2016

Prepared for:
City Water, Light & Power
3100 Stevenson Drive
Springfield, Illinois 62703

Prepared by:

ANDREWS ENGINEERING INC
3300 Ginger Creek Drive
Springfield, IL 62711
Tel: (217) 787-2334; Fax: (217) 787-9495

Resp. to 4th RTP
CWLP - 29616

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1. INTRODUCTION

City Water, Light and Power (CWLP) Lakeside Ash Pond and Dallman Ash Pond are coal combustion residuals (CCR) surface impoundments. An assessment of the hazard potential classification for the CCR surface impoundments was conducted as required by 40 CFR Part 257.73:

> *257.73 (a)(2) Periodic hazard potential classification assessments. (i) The owner or operator of the CCR unit must conduct initial and periodic hazard potential classification assessments of the CCR unit according to the timeframes specified in paragraph (f) of this section. The owner or operator must document the hazard potential classification of each CCR unit as either a high hazard potential CCR surface impoundment, a significant hazard potential CCR surface impoundment, or a low hazard potential CCR surface impoundment. The owner or operator must also document the basis for each hazard potential classification.*
>
> *257.73 (f) Timeframes for periodic assessments—(1) Initial assessments. Except as provided by paragraph (f)(2) of this section, the owner or operator of the CCR unit must complete the initial assessments required by paragraphs (a)(2), (d), and (e) of this section no later than October 17, 2016. The owner or operator has completed an initial assessment when the owner or operator has placed the assessment required by paragraphs (a)(2), (d), and (e) of this section in the facility's operating record as required by § 257.105(f)(5), (10), and (12).*

Andrews Engineering, Inc. (AEI) reviewed aerial maps and current hazard potential classification status information regarding the Lakeside Ash Pond and Dallman Ash Pond as part of this initial hazard potential classification assessment. A summary of this information, as well as conclusions for the assessment is provided below.

2. CCR UNIT INFORMATION

Both the Lakeside Ash Pond and the Dallman Ash Pond are owned and operated by CWLP. The ponds are operated under National Pollutant Discharge Elimination System (NPDES) Permit Number IL0024767.

The Lakeside Ash Pond is primarily a diked embankment with some incising along the east perimeter and was placed into service prior to 1958. The original Lakeside Ash Pond has been divided into four separate ponds since it was expanded vertically in 1988, including three lime softening ponds and the settling pond. The vertical expansion consists of berms built on top and inside of the existing embankments. The current Lakeside Ash Pond is approximately 27.6 acres and ceased receiving ash in 2009.

The second impoundment, the Dallman Ash Pond, which is a diked embankment, was placed into service in approximately 1976 and is approximately 34.5 acres. Fly ash and bottom ash are sluiced to the Dallman Ash Pond with raw lake water.

Settled water from both the Dallman Ash Pond and Lakeside Ash Pond flow into opposite sides of a Clarification Pond before being discharged to Sugar Creek at Outfall 004 pursuant to the aforementioned NPDES permit.

3. CURRENT CLASSIFICATION

The Dallman Ash Pond and the original (lower) portion of the Lakeside Ash Pond are not regulated by a state agency and were never designated a potential hazard rating. The expansion portion of the Lakeside Ash Pond is regulated by the Illinois Department of Natural Resources (IDNR) and was assigned a Hazard Classification of "Class III," which corresponds to U.S. Corps of Engineers (USACE) "Low Hazard Potential" category. Additionally, Lakeside Ash Pond is listed in the National Inventory of Dams (NID) with a Hazard Classification of "Low."

This rating was determined by IDNR under the following classification system provided by 17 Ill. Adm. Code 3702.30(a)(1):

> *Dams will be categorized in one of three classes, according to the degree of threat to life and property in the event of a dam failure. The three classes of dams are:*
>
> *A) Class I − Dams located where failure has a high probability for causing loss of life or substantial economic loss in excess of that which would naturally occur downstream of the dam if the dam had not failed. A dam has a high probability for causing loss of life or substantial economic loss if it is located where its failure may cause additional damage to such structures as a home, a hospital, a nursing home, a highly traveled roadway, a shopping center, or similar type facilities where people are normally present downstream of the dam. This is similar to U.S. Army Corps of Engineers HIGH HAZARD POTENTIAL category as defined in the Corps Guidelines, and the U.S. Soil Conservation Service Class (c) dams as defined in Soil Conservation Service Technical Release No. 60.*
>
> *B) Class II – Dams located where failure has a moderate probability for causing loss of life or may cause substantial economic loss in excess of that which would naturally occur downstream of the dam if the dam had not failed. A dam has a moderate probability for causing loss of life or substantial economic loss if it is located where its failure may cause additional damage to such structures as a water treatment facility, a sewage treatment facility, a power substation, a city park, a U.S. Route or Illinois Route highway, a railroad or similar type facilities where people are downstream of the dam for only a portion of the day or on a more sporadic basis. This is similar to U.S. Army Corps of Engineers SIGNIFICANT HAZARD POTENTIAL category and the U.S. Soil Conservation Service Class (b) dams.*
>
> *C) Class III – Dams located where failure has low probability for causing loss of life, where there are no permanent structures for human habitation, or minimal economic loss in excess of that which would naturally occur downstream of the dam if the dam had not failed. A dam has a low probability for causing loss of life or minimal economic loss if it is located where its failure may cause additional damage to agricultural fields, timber areas, township roads or similar type areas where people seldom*

are present and where there are few structures. This corresponds to U.S. Army Corps of Engineers LOW HAZARD POTENTIAL category and U.S. Soil Conservation Service Class (a) dams.

4. CLASSIFICATION ANALYSIS

The following information was considered for the hazard potential classification analysis of the CWLP surface impoundments performed by Paul Van Metre, P.E., in October 2016:

4.1 Downstream Conditions

Both the Dallman Ash Pond and Lakeside Ash Pond are immediately adjacent to Sugar Creek. There are no homes, recreational facilities, businesses, roads, or other permanent structures immediately downstream of the impoundments. The floodplain area adjacent to the immediate downstream Sugar Creek is entirely comprised of agricultural fields and timber areas. The closest structures downstream along Sugar Creek from the ash ponds are a pedestrian bridge servicing the Lost Bridge Trail system at more than 4,000 feet downstream from Dallman Ash Pond, and a vehicle bridge for IL Route 29 at more than a mile downstream from Dallman Ash Pond.

4.2 Safety Factor Assessment

A Safety Factor Assessment was performed by AEI for both the Dallman Ash Pond and Lakeside Ash Pond. This assessment included slope stability analyses for critical sections in the surface impoundments, including the constructed berms and underlying soils. Although there is a lack of construction records for the impoundments, conservative parameters derived from published literature, available geotechnical data from subsurface drilling and testing programs, and field surveys were used to assess factors of safety. The assessment concluded that all applicable factors of safety under 257.73(e) for both surface impoundments were exceeded by the results of these analyses.

4.3 Additional Information

The eastern portion of the original Lakeside Ash Pond is incised. The entire ash pond abuts the Lake Springfield dam to the south. The northern portion of the ash pond is separated by a roadway from the Unit 1 landfill and the clarification pond. The only portions of the Lakeside Ash Pond with open downstream slopes are the west dike of the original ash pond and the vertical expansion berms, which were constructed on the east, west and south boundaries of the ash pond.

The entire Dallman Ash Pond is partially incised. Material from the center of the ash pond were excavated and utilized in the construction of the dikes. The Dallman Ash Pond abuts the CWLP landfills to the east and the clarification pond to the south. The only open downstream slopes of the Dallman Ash Pond are on the west and south dikes.

A stability analysis was performed by Testing Service Corporation (TSC) in 1994 for the design of the adjacent Unit 2 Landfill. The landfill is located in the northeastern half of the site which is directly adjacent to the east of the Dallman Ash Pond and north of the Lakeside Ash Pond. This analysis included a review of all of the subsurface studies performed at the site (72 borings in total) as well as five additional borings drilled as part of the stability analysis study. Laboratory testing completed on cohesive soil samples from these five borings included analyses on:

moisture content, in-place dry density, unconfined compressive strength, and Atterberg limits. In addition, one sample was selected for triaxial shear testing, and another for direct shear testing.

The TSC analysis for Unit 2 included an evaluation of settlement and bearing capacity for the foundation, and mass stability for the various excavated and constructed slopes of the landfill. Both static and seismic conditions for short- and long-term scenarios were evaluated using the geologic data acquired from the aforementioned study. The safety factors resulting from these analyses exceeded all requirements for new solid waste landfills in Illinois under 35 Ill. Adm. Code 811.304.

The geologic characteristics at the site were determined via subsurface boring programs related to permitting and monitoring of the landfill units as well as the drilling conducted for the monitoring program currently implemented for the ash impoundments. The geologic characteristics were determined to be consistent throughout the site. The structural characteristics of the soils also apply to the entire site, which includes the ash ponds.

4.4 Hazard Classification

Based on the information presented in this report, there is a low probability of a failure for either unit. In addition, there is a low probability of a failure to cause loss of life, and a failure would cause minimal economic loss. Therefore, both the Dallman Ash Pond and the entire Lakeside Ash Pond qualify as "**Low Hazard Potential CCR Surface Impoundments**" under the qualifications described in Ill. Adm. Code 3702.30(a)(1), quoted in Section 3.

5. STATEMENT

This Initial Hazard Potential Classification Assessment Report for Coal Combustion Residuals Surface Impoundments was completed for CWLP by Andrews Engineering, Inc. in accordance with the requirements under 40 CFR Part 257.73.

Paul M. Van Metre, P.E.

10-14-2016
Date



31.9

31.9	10/17/2016 - Initial Safety Factor Assessment for CCR Surface Impoundments	Initial Safety Factor October 2016	CWLP	29622	29854

Electronic Filing: Received, Clerk's Office 02/13/2020

City Water, Light & Power
Ash Impoundments
Springfield, Sangamon County, Illinois

Initial Safety Factor Assessment for Coal Combustion Residuals Surface Impoundments

October 2016

Prepared for:
City Water, Light & Power
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Springfield, Illinois 62703

Prepared by:

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Resp. to 4th RTP
CWLP - 29622

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APPENDIX G: Dallman Ash Pond Slope Stability Analysis

1. INTRODUCTION

City Water, Light and Power (CWLP) Lakeside Ash Pond and Dallman Ash Pond are coal combustion residuals (CCR) surface impoundments. An Initial Safety Factor Assessment of the CCR surface impoundments was conducted as required by 40 CFR Part 257.73:

257.73(e): Periodic safety factor assessments. (1) The owner or operator must conduct an initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety for each CCR unit achieve the minimum safety factors specified in paragraphs (e)(1)(i) through (v) of this section for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations.

257.73(f): (1) Initial assessments. Except as provided by paragraph (f)(2) of this section, the owner or operator of the CCR unit must complete the initial assessments required by paragraphs (a)(2), (d), and (e) of this section no later than October 17, 2016. The owner or operator has completed an initial assessment when the owner or operator has placed the assessment required by paragraphs (a)(2), (d), and (e) of this section in the facility's operating record as required by § 257.105(f)(5), (10), and (12).

Analysis is performed herein for the Initial Safety Factor Assessment of the existing ash ponds at Springfield City Water, Light and Power, Lakeside and Dallman Ash Ponds, Springfield, Illinois, as required per 40 CFR 257.73(e). Based upon historical geotechnical data and the existing conditions of the ash ponds, all factors of safety exceed the regulatory minimums as demonstrated within this report.

Information reviewed for this report includes the following documents:

- Coal Ash Impoundment Site Assessment Final Report (May 2011)
- Historical Aerial Photographs (April 1995 – March 2014)
- Engineering Report: Proposed Embankment Modification; CWLP Ash Disposal Area (July 1987).
- Construction Grading Plan for the Dallman Ash Pond (August 1976)

2. BACKGROUND

CWLP operates a series of ash and lime sludge clarification or settling ponds east of the power plant complex in Springfield, Illinois. The ponds are operated under National Pollutant Discharge Elimination System (NPDES) Permit Number IL0024767.

The Lakeside Ash Pond is primarily a diked embankment with some incising along the east perimeter and was placed into service prior to 1958. The original Lakeside Ash Pond was been divided into four separate ponds since it was expanded vertically in 1988: three lime softening ponds and the settling pond. The current Lakeside Ash Pond is approximately 27.6 acres and ceased receiving ash in 2009.

The second impoundment, the Dallman Ash Pond, which is a diked embankment, was placed into service in approximately 1976 and is approximately 34.5 acres. Fly ash and bottom ash are sluiced to the Dallman Ash Pond with raw lake water.

Settled water from both the Dallman Ash Pond and Lakeside Ash Pond flow into opposite sides of a Clarification Pond before being discharged, typically, to Sugar Creek at Outfall 004.

3. GEOMETRY OF THE STRUCTURES

According to personal interviews with CWLP staff, the most recent change made to the CCR surface impoundment was a vertical expansion to the Lakeside Ash Pond system in 1988. The vertical expansion consists of berms built on top and inside of the existing embankments in such a way that the toe of the outer slope of the expansion berms match up with the top of the inner slope of the existing embankments, typically identified as upstream construction. The vertical expansion berms are approximately ten feet in height.

A site map drawing containing an aerial photograph and approximate boundaries for all of the CWLP CCR Units, including the ash and lime softening ponds, is provided in Appendix A.

No changes to the geometry of the structures are applicable for this report. No changes are apparent due to structure movement or deformation.

4. GEOTECHNICAL INFORMATION

4.1 Lakeside Ash Pond Geotechnical Data

A review of the historical documents found a previous geotechnical investigation and stability analysis, which was conducted prior to the upstream construction of Lakeside Ash Pond. The results of that geotechnical investigation are utilized within this assessment of the safety factors. Additionally, a literature review of technical papers was conducted to determine the geotechnical parameters for the fly ash within the impoundments. Provided in Table 1 are highly conservative geotechnical parameters based upon the previous geotechnical investigation utilized in the static and seismic slope stability model.

Included in Appendix B are copies of the historical soils logs and cross sections that support the geotechnical parameters provided in Table 1. Technical papers supporting the ash geotechnical parameters are included in Appendix C.

TABLE 1

Lakeside Ash Pond

Soil Description	Density (pcf)	Total Strengths (Short Term)		Effective Strengths (Long Term)	
		ϕ (degrees)	c (psf)	ϕ' (degrees)	c (psf)
Ash	100	15	0	25	0
Embankment	120	0	1,400	32	145
Sandy Silty Clay w/Clayey Silt	120	0	1,800	32	190
Sandy Silty Clay	120	0	1,000	32	190
Shale	130	0	2,000	0	2,000

4.2 Dallman Ash Pond Geotechnical Data

A review of the historical documents revealed the original construction plans, with cross sections provided, was completed. More recent site investigations have been conducted in the area during the installation of piezometers, which provide the stratigraphic and in situ strengths of earthen materials that correlate well with the Lakeside Ash Ponds geotechnical data. The historical data have been used to develop conservative geotechnical parameters for slope stability analysis as provided below in Table 2.

Included in Appendix D are copies of the boring log and cross section that support the geotechnical parameters provided in Table 2.

TABLE 2

Dallman Ash Pond

Soil Description	Density (pcf)	Total Strengths (Short Term)		Effective Strengths (Long Term)	
		ϕ (degrees)	c (psf)	ϕ' (degrees)	c (psf)
Ash	100	15	0	25	0
Embankment	120	0	1,400	32	145
Rip-Rap	140	40	0	40	0
Silty Clay	120	0	1,800	32	190
Clayey Silt	120	0	1,400	32	190
Sandy Silty Clay	120	0	1,000	32	190
Sand w/Silt	120	34	0	34	0
Shale	130	0	2,000	0	2,000

4.3 Seismic Ground Motion

CWLP is susceptible to potential seismic activity as provided by the USGS Earthquake Hazards Program. Included in Appendix E of this geotechnical engineering report is the 2008 National Seismic Hazard Mapping Program's Probabilistic Seismic Hazard Analysis for the site (Latitude 39.762 North, Longitude 89.597 West). The Peak Horizontal Ground Acceleration is approximately 0.09965 g. The maximum acceleration of (aHmax = 0.10g) was selected for use in stability calculations.

5. SLOPE STABILITY ANALYSIS

The static and seismic slope stability model utilized for the following analysis was the Morgenstern and Price Circular Search Method within the Slope/W computer-based slope stability modeling software. Morgenstern and Price satisfies all conditions of equilibrium.

The periodic safety factor assessment requires that each CCR unit document whether the calculated factors of safety for each CCR unit achieve the minimum safety factors. The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50. The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40. The calculated seismic factor of safety must equal or exceed 1.00. For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

The Lakeside and Dallman Ash Ponds are not susceptible to liquefaction since the embankments are constructed of a sandy silty clay, thus analyses for each are not included below. Liquefaction occurs in fine grained non-cohesive soils. The embankments at CWLP are constructed of cohesive soils.

5.1 Lakeside Ash Pond Slope Stability

The slope stability analysis was performed on a critical cross section, previously identified as Section 2 in the Engineering Report: Proposed Embankment Modification; CWLP Ash Disposal Area (July 1987)., Based upon a review of this report and existing conditions, Section 2 appears to remain the critical cross section. Section 2 is located on the north side of the Lakeside Ash Pond next to the Clarification Pond. For a very conservative analysis, the slope was analyzed as if the Clarification Pond was drained and dredged back to the pre-existing grades of approximately 535 feet MSL.

The Lakeside Ash Pond is not susceptible to liquefaction since the embankment is constructed of a sandy silty clay; thus, analysis is not included below.

5.1.1 Long-Term Static Slope Stability Analysis

The long-term static slope stability analysis was performed on the Lakeside Ash Pond cross section using the geotechnical parameters as provided in Table 1. The long-term analysis utilizes the effective shear strength parameters, which are the drained condition. The long-term static slope stability analysis found that the factor of safety for the most critical failure surface was 1.532. The critical failure surface and stability report are included in Appendix F-1. This analysis verifies that Lakeside exceeds the factor of safety for the long-term, maximum storage pool loading condition and the maximum surcharge pool loading condition since the analysis was performed filled with ash and the pool elevation matching the top of the embankment.

5.1.2 Short-Term Static Slope Stability Analysis

The short-term static slope stability analysis was performed on the Lakeside Ash Pond cross section using the geotechnical parameters as provided in Table 1. The short-term analysis utilizes the total shear strength parameters, which are the undrained condition. The short-term static slope stability analysis found that the factor of safety for the most critical failure surface was 1.640. The critical failure surface and stability report are included in Appendix F-2.

5.1.3 Seismic Slope Stability Analysis

The seismic slope stability analysis was performed on the Lakeside Ash Pond cross section using the geotechnical parameters as provided in Table 1. The seismic analysis utilizes the total shear strength parameters, which are the undrained condition since a seismic event occurs in a short period of time. In addition, a horizontal acceleration of 0.10g was utilized within the modeling to represent the peak horizontal ground acceleration anticipated for CWLP. The seismic slope stability analysis found that the factor of safety for the most critical failure surface was 1.260. The critical failure surface and stability report are included in Appendix F-3. This analysis verifies that Lakeside exceeds the seismic factor of safety with maximum surcharge pool loading condition.

5.2 Dallman Ash Pond Slope Stability

The slope stability analysis was performed on a critical cross section based upon a review of the historical construction diagrams, cross sections and the available stratigraphic data. Section 10+00 is located on the north side of the Dallman Ash Pond near the relocated Sugar Creek. For a very conservative analysis, the slope was analyzed as if Sugar Creek had nearly zero flow at approximately 520 feet MSL.

5.2.1 Long-Term Static Slope Stability Analysis

The long-term static slope stability analysis was performed on the Dallman Ash Pond cross section using the geotechnical parameters as provided in Table 2. The long-term analysis utilizes the effective shear strength parameters, which are the drained condition. The long-term static slope stability analysis found that the factor of safety for the most critical failure surface was 2.245. The critical failure surface and stability report are included in Appendix G-1. This analysis verifies that Dallman exceeds the factor of safety for the long term, maximum storage pool loading condition and the maximum surcharge pool loading condition since the analysis was performed filled with ash and the pool elevation matching the top of the embankment.

5.2.2 Short-Term Static Slope Stability Analysis

The short-term static slope stability analysis was performed on the Dallman Ash Pond cross section using the geotechnical parameters as provided in Table 2. The short-term analysis utilizes the total shear strength parameters, which are the undrained condition. The short-term static slope stability analysis found that the factor of safety for the most critical failure surface was 2.897. The critical failure surface and stability report are included in Appendix G-2.

5.2.3 Seismic Slope Stability Analysis

The seismic slope stability analysis was performed on the Dallman Ash Pond cross section using the geotechnical parameters as provided in Table 2. The seismic analysis utilizes the total shear strength parameters, which are the undrained condition since a seismic event occurs in a short period of time. In addition, a horizontal acceleration of 0.10g was utilized within the modeling to represent the peak horizontal ground acceleration anticipated for CWLP. The seismic slope stability analysis found that the factor of safety for the most critical failure surface was 1.754. The critical failure surface and stability report are included in Appendix G-3. This analysis verifies that Dallman exceeds the seismic factor of safety with maximum surcharge pool loading condition.

Resp. to 4th RTP
CWLP - 29629

6. SUMMARY

The analyses indicate that Lakeside and Dallman Ash Ponds provide factors of safety equal to or greater than minimum values as required by 40 CFR 257.73(e). This is predicated upon the assumption that cohesive and frictional shear strengths of materials meet or exceed those used in the analyses. Table 3 below provides a summary of the slope stability results.

TABLE 3

Slope Stability Results

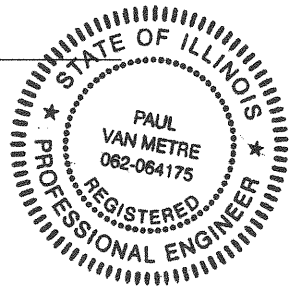
Cross Section	Stability Model Results	40 CFR 257.73 Minimum F.S.
Lakeside Long Term Static	1.532	1.5
Dallman Long Term Static	2.245	
Lakeside Short Term Static	1.640	1.4
Dallman Short Term Static	2.897	
Lakeside Seismic	1.26	1.0
Dallman Seismic	1.754	

7. STATEMENT

This Initial Safety Factor Assessment for Coal Combustion Residuals Surface Impoundments was completed for CWLP by Andrews Engineering, Inc. in accordance with the requirements under 40 CFR Part 257.73(e) and 257.73(f).

Paul M. Van Metre, P.E.

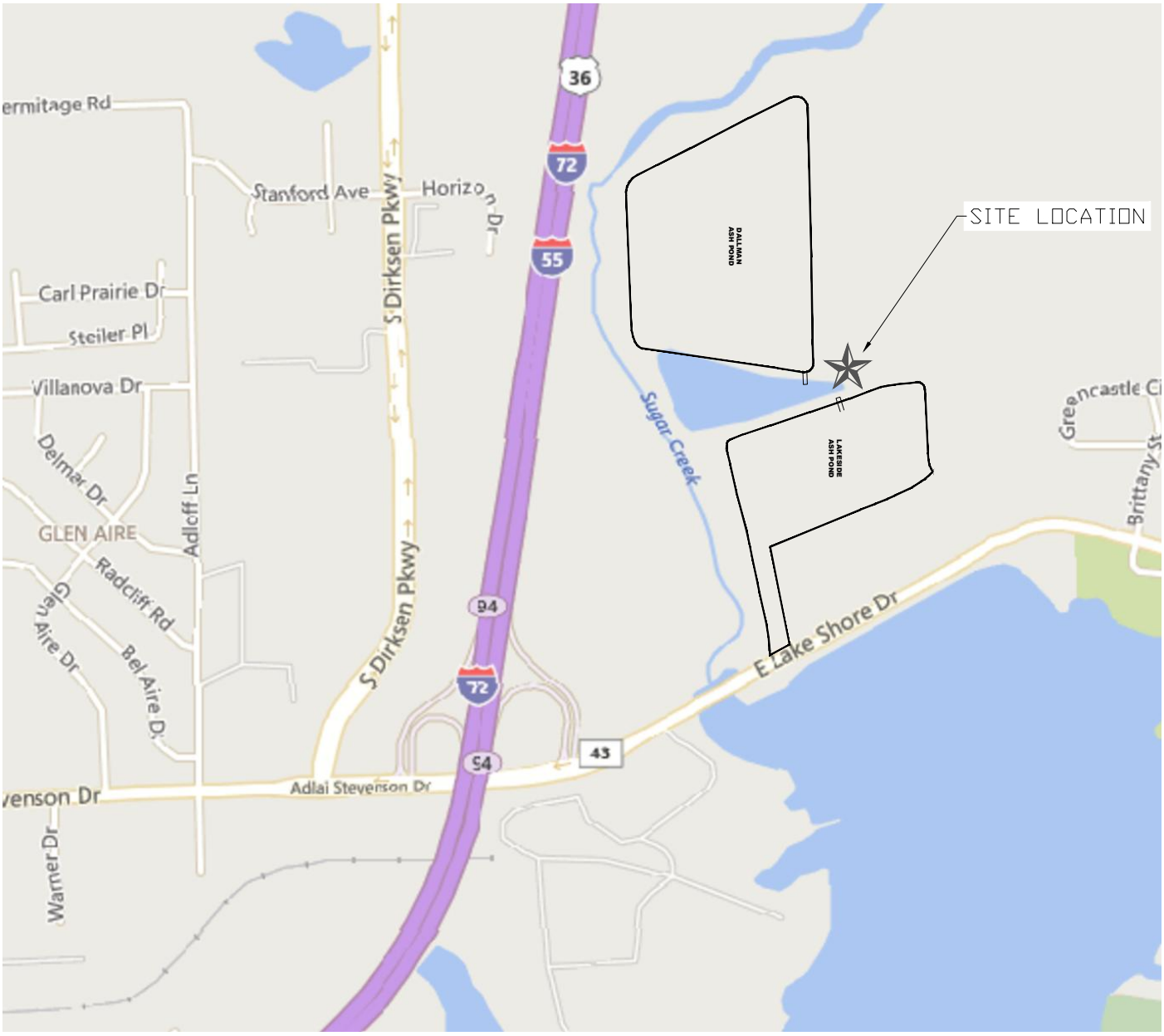
10-13-2016
Date



APPENDIX A

Site Map

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SITE LOCATION

N

0 500 1000 2000

SCALE: IN FEET

NOTE:
BASE IMAGE DERIVED FROM BING

ANDREWS ENGINEERING, INC.
3300 Ginger Creek Drive, Springfield, IL 62711-7233
Tel (217) 787-2334 Fax (217) 787-9495
Pontiac, IL • Naperville, IL • Indianapolis, IN • Warrenton, MO
Professional Design Engineering and Land Surveying Firm #184-001541

APPROVED BY: PMV | DESIGNED BY: PMV | DRAWN BY: RMC

SITE LOCATION MAP

PLANS PREPARED FOR

CWLP

SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: OCTOBER 2016

PROJECT ID: 150077/0011

SHEET NUMBER:

FIG. 1

Resp. to 4th RTP

CWLP - 29631

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J:\S\Springfield CWLP\CWLP\dwg\SURFACE IMPOUNDMENTS.dwg Tab: FIGURE 2A Last Saved: October 13, 2016, by Ryan Curtis Plotted: Thursday, October 13, 2016 10:06:59 AM

REVISIONS

NO.	DATE	DESCRIPTION	BY

ANDREWS
ENGINEERING, INC.
3300 GINGER CREEK DRIVE
SPRINGFIELD, ILLINOIS 62711-7233
PH (217) 787-2334 FAX (217) 787-9495
PONTIAC, IL • LOMBARD, IL • INDIANAPOLIS, IN • WARRENTON, MO
PROFESSIONAL DESIGN ENGINEERING AND LAND SURVEYING FIRM #184-001541

APPROVED BY: PMV | DESIGNED BY: PMV | DRAWN BY: MPN

CWLP COAL COMBUSTION RESIDUALS SURFACE IMPOUNDMENTS

PLANS PREPARED FOR
CITY, WATER, LIGHT & POWER
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE:
OCTOBER 2016

PROJECT ID:
150077/0011

SHEET NUMBER:

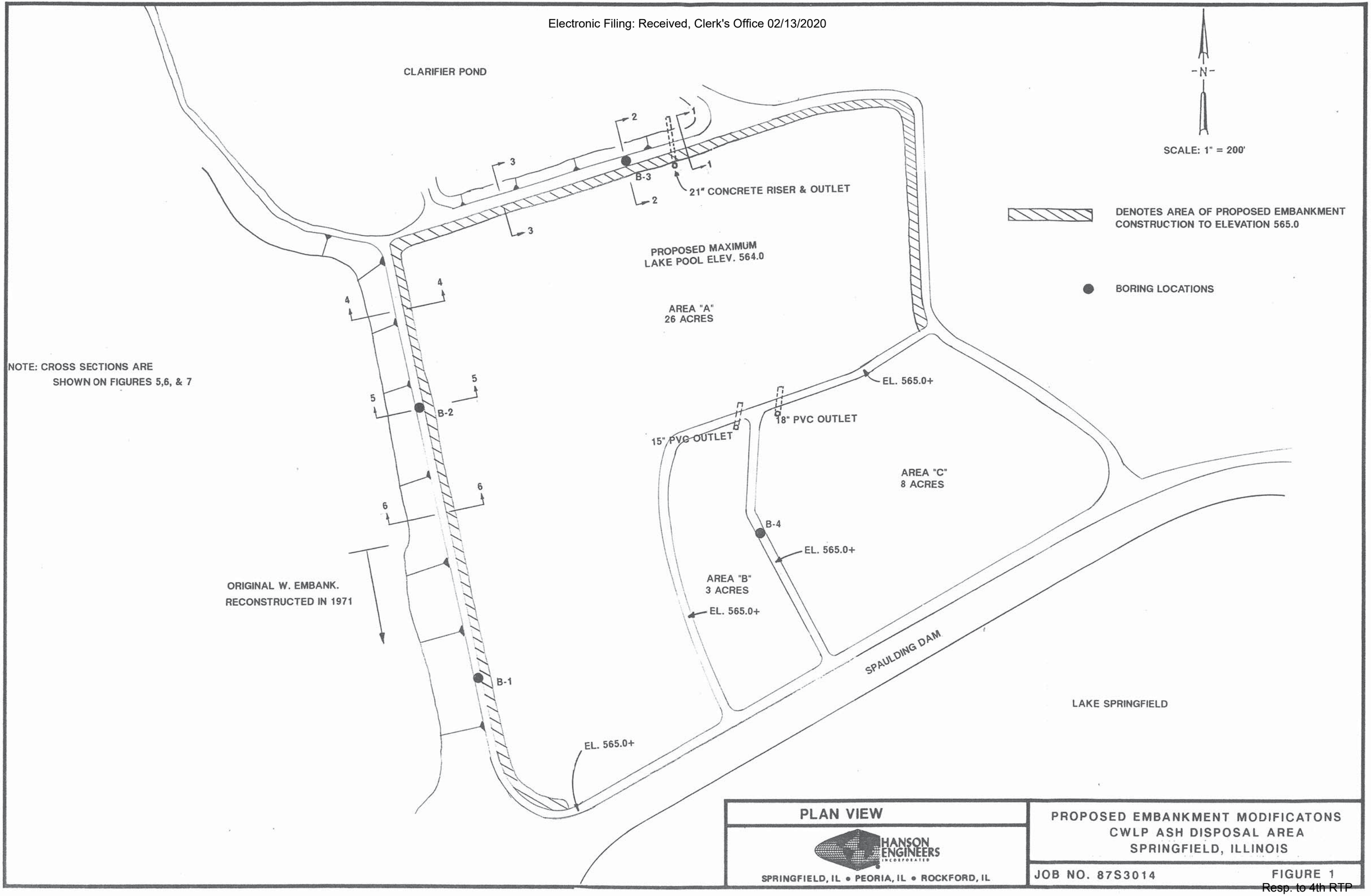
FIG. 2A

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APPENDIX B

Lakeside Soils Logs and Cross Section

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PLAN VIEW

HANSON ENGINEERS INCORPORATED

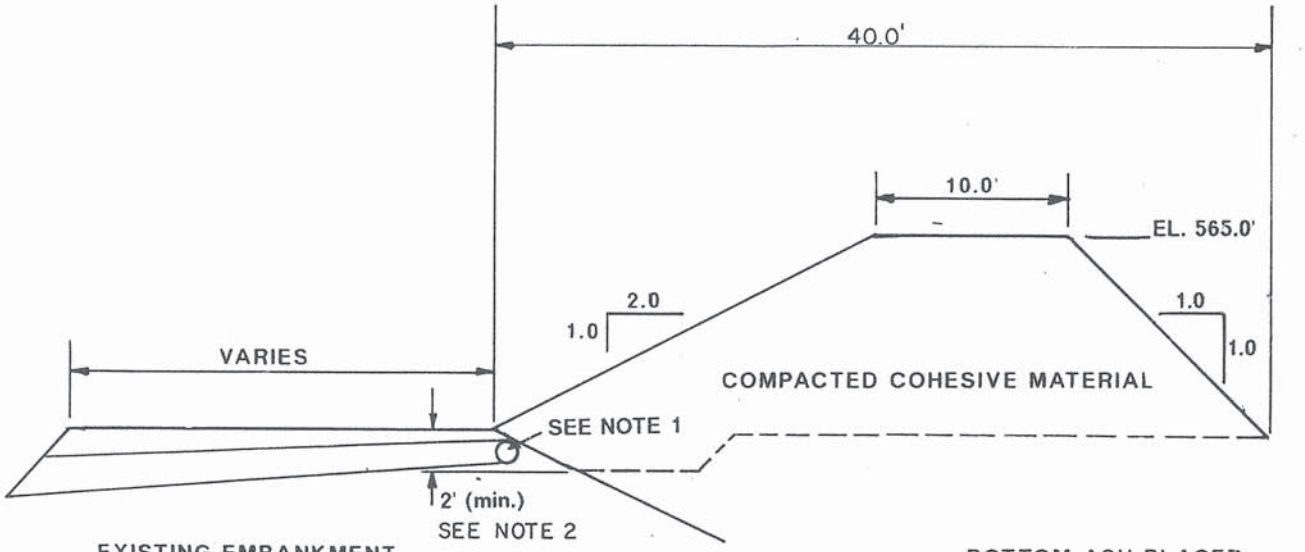
SPRINGFIELD, IL • PEORIA, IL • ROCKFORD, IL

PROPOSED EMBANKMENT MODIFICATONS
CWLP ASH DISPOSAL AREA
SPRINGFIELD, ILLINOIS

JOB NO. 87S3014

FIGURE 1

Resp. to 4th RTP
CWLP - 29634



TYPICAL SECTION

NOTE: 1 - FILTER FABRIC WRAPPED PERFORATED CORRUGATED DRAINAGE PIPE WITH NON-PERFORATED OUTLETS INTO CLARIFIER POND. PIPE IS SURROUNDED WITH BED OF BOTTOM ASH

NOTE: 2 - COMPACTED COHESIVE MATERIAL "KEYED" INTO STABLE WORKING SURFACE A MINIMUM DEPTH OF 2 ft. FOR SEEPAGE CONTROL

EMBANKMENT CONFIGURATION	PROPOSED EMBANKMENT MODIFICATONS CWLP ASH DISPOSAL AREA SPRINGFIELD, ILLINOIS
HANSON ENGINEERS INCORPORATED SPRINGFIELD, IL • PEORIA, IL • ROCKFORD, IL	JOB NO. 87S3014 FIGURE 2

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Resp. to 4th RTP
CWLP - 29635

OPERATOR CMP

DATE June-2-1987

JOB NO.

HANSON ENGINEERS INCORPORATED

LABORATORY SOIL TEST DATA

PROJECT NAME AND LOCATION
CWLP
Ash Pond Study
Springfield, Illinois

BOR.	SAMP.	DEPTH	ELEV.	N	STRENGTH TESTS Qu	M	P	W	γ_w	γ_D	SPECIAL TESTS	SAMPLE DESCRIPTION
	Ground Surface Elev = 557.6											
1	1	2'-6"	555.1	14				6				Bottom Ash
	2	5'-0"	552.6	3				10				" "
	3	7'-6"	550.1	5				31				" " Dk. gray v.f. sandy silt
	4	10'-0"	547.6	1				79				Drk. gray v.f. sandy silt.
	5	12'-6"	545.1	4	0.92	B	0.8	33				Gray v.f. sandy silty clay.
	6	15'-0"	542.6	4			3.6	67				Gray silty f. sand. (fly ash).
	7	17'-6"	540.1	9				46				Fly ash.
	8	20'-0"	537.6	8				61				" "
	9	22'-6"	535.1	5	0.71	Sh	1.3	26				Yel. brn. & gray v.f. sandy silty clay / ox. spots.
	10	25'-0"	532.6	15	2.27	B	1.8/38	21				Mix colored v.f sandy silty clay (tr. f.-c. sand & f. gravel)
	11	27'-6"	530.1	9	1.86	B	2.4	27				Drk. gray v.f. sandy silty clay.
	12	30'-0"	527.6	8	0.50	B	0.6	33				" " " " " " " "
	Ground Surface Elev = 555.5											
2	1	2'-6"	553.0	21	5.89	BSp	4.5+	14				Brn. gray v.f. sandy silty clay / ox. spots.
	2	5'-0"	550.5	20	2.27	B	2.4	27				Yel. brn & gray v.f. sandy silty clay (tr. ox. spots.)
	3	7'-6"	548.0	10	1.86	B	2.2	29				Grn. & drk. brn v.f. sandy silty clay (tr. ox. spots.)
	4	10'-0"	545.5	12	2.68	BSh	2.4	25				Yel brn & gray v.f. sandy silty clay / ox. spots.
	5	12'-6"	543.0	13	2.68	B	2.9	27				Grn. gray clay (tr. silt & ox. spots.)
	6	15'-0"	540.5	12	2.33	B	2.4	28				Brn. gray v.f. sandy silty clay / ox. spots.
	7	17'-6"	538.0	15	1.94	BSh	2.6	27				Yel. brn & gray v.f. sandy silty clay (tr. chard pts.)
	8	20'-0"	535.5	14	2.27	B	2.5	28				" " & " " " " " " (" " " ")
	9	22'-6"	533.0	15	2.68	B	2.8	28				" " & " " " " " " (" " " ")
	10	25'-0"	530.5	9	1.16	B	1.1	26				" " & " " " " " " clayey silt / chard. pts.
	11	27'-6"	528.0	8	0.54	B	0.6	23				" " & " " " " " " silt (tr. chard pts.)
	12	30'-0"	525.5	6	0.89	B	0.7	24				" " & " " " " " " " / chard pts.
	13	35'-0"	520.5	5	0.78	B	0.8	23				" " & " " " " " " " & brn. f.-m. sand.
	14	40'-0"	515.5	19				14				Brn. gray f.-m. sand.
	14A	40'	515.5	19				29				Gray shaley clay.

Resp. to 4th RTP

CWLP - 29636

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OPERATOR CMP

DATE June-2-1987

JOB NO.

HANSON ENGINEERS INCORPORATED

LABORATORY SOIL TEST DATA

PROJECT NAME AND LOCATION
CWL&P
Ash Pond Study
Springfield, Illinois

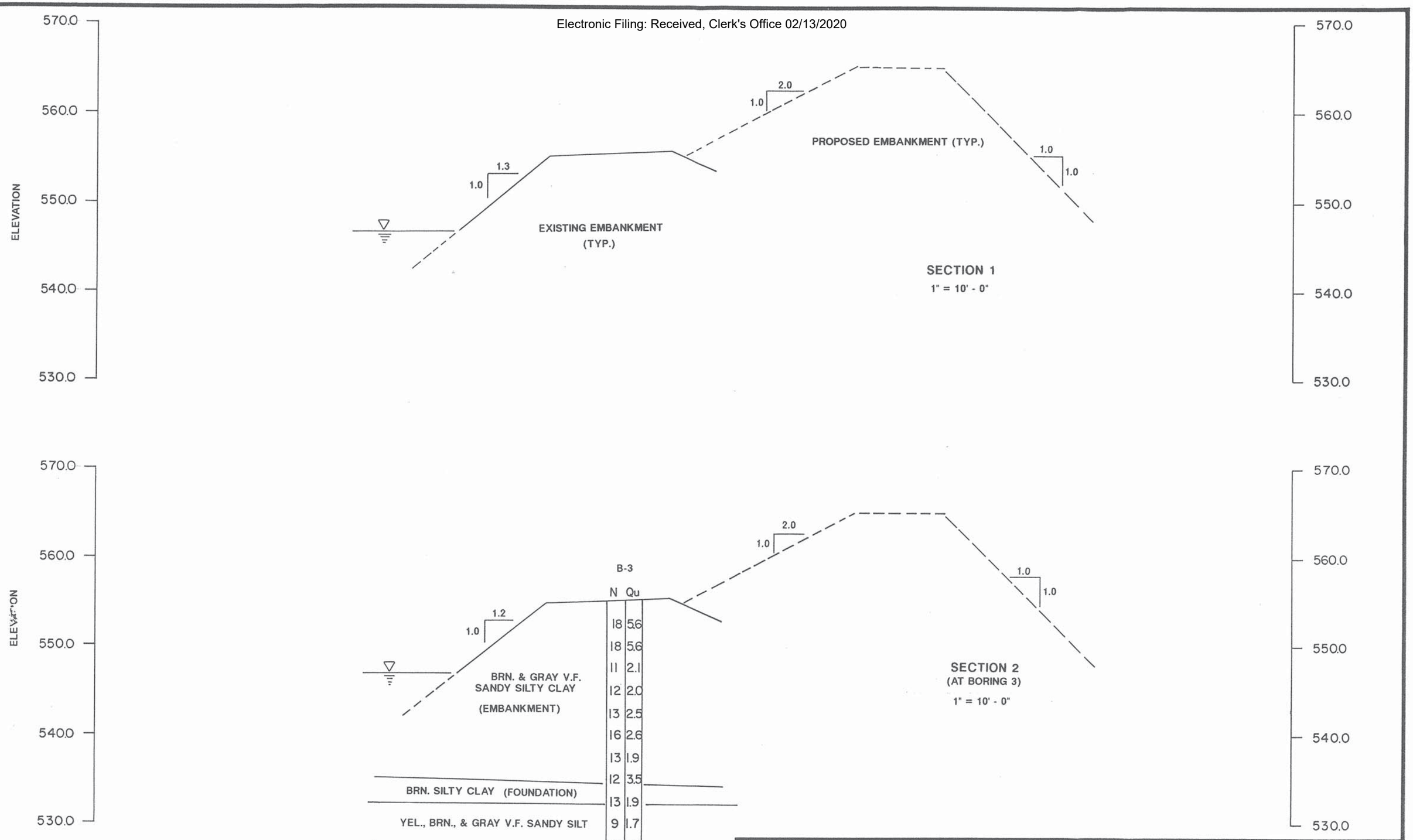
BOR.	SAMP.	DEPTH	ELEV.	N	STRENGTH TESTS Qu	M	P	W	γ_W	γ_D	SPECIAL TESTS	SAMPLE DESCRIPTION
	Ground Surface Elev = 555.2											
3	1	2'6"	552.7	18	5.56	BSh	4.5+	21				Brn. & drk. brn. v.f. sandy silty clay (tr. chard. pts. & sm. roots)
	2	5'0"	550.2	18	5.62	BSp	4.5+	22				Drk. gray clay (tr. chard. pts. & sm. roots.)
	3	7'6"	547.7	11	2.13	BSh	2.4	26				Yel. brn. & gray. v.f. sandy silty clay (tr. chard pts.)
	4	10'0"	545.2	12	1.94	BSh	2.1	29				" " & drk. gray clay (tr. ox. spots.)
	5	12'6"	542.7	13	2.52	B	2.6	25				" " & gray v.f. sandy silty clay (tr. chard. pts.)
	6	15'0"	540.2	16	2.62	B	2.6	26				Drk. gray v.f. sandy silty clay.
	7	17'6"	537.7	13	1.86	B	1.6	28				Yel. brn. & gray v.f. sandy silty clay (tr. chard. pts.)
	8	20'0"	535.2	12	3.50	BSh	3.0/4.5+	21				Drk. gray v.f. sandy silty clay.
	9	22'6"	532.7	13	1.94	B	2.2	28				Yel brn & gray v.f. sandy silty clay & clayey silt/chard. pts
	10	25'0"	530.2	9	1.71	B	1.7	26				" " & " " " " silt / chard. pts.
	11	27'6"	527.7	7	1.24	B	1.2	27				" " & " " " " " / " " .
	12	30'0"	525.2	21	3.49	B	3.6	26				Brn. gray clay.
	Ground Surface Elev = 566.2											
4	1	2'6"	563.7	5	3.05	Sh	2.8	20				Yel. brn. & gray v.f. sandy silt.
	2	5'0"	561.2	11	1.71	Sp	2.7	25				" " & " " " " " & fly ash.
	3	7'6"	558.7	7	1.65	BSh	2.2	13				" " & " v.f.-m. sandy silt (tr. c. sand.)
	4	10'0"	556.2	10	1.47	BSh	1.9	22				" " & " clay / brn. silty f. sand (tr. fly ash.)
	5	12'6"	553.7	8				18				Fly ash.
	6	15'0"	551.2	7				27				" " .
	7	17'6"	548.7	1				94				Drk. gray silty v.f. sand (fly ash)
	8	20'0"	546.2	2				108				" " " " " " " (" ")
	9	25'0"	541.2	1				129				" " " " " " " (" ")
	10	30'0"	536.2	16	2.68	B	2.3	31				" " v.f. sandy silty clay.

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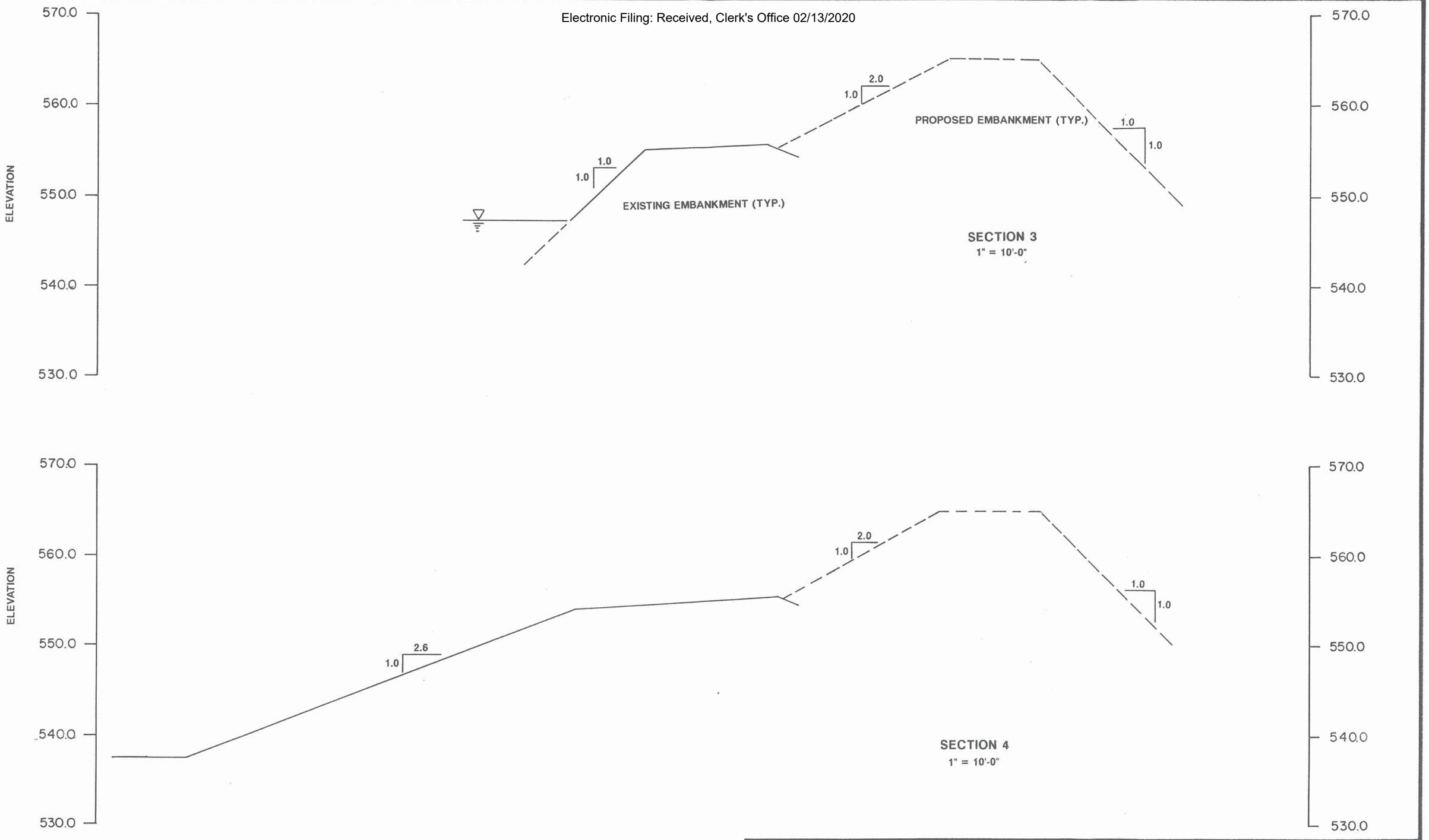
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PROPOSED EMBANKMENT MODIFICATONS
CWLP ASH DISPOSAL AREA
SPRINGFIELD, ILLINOIS

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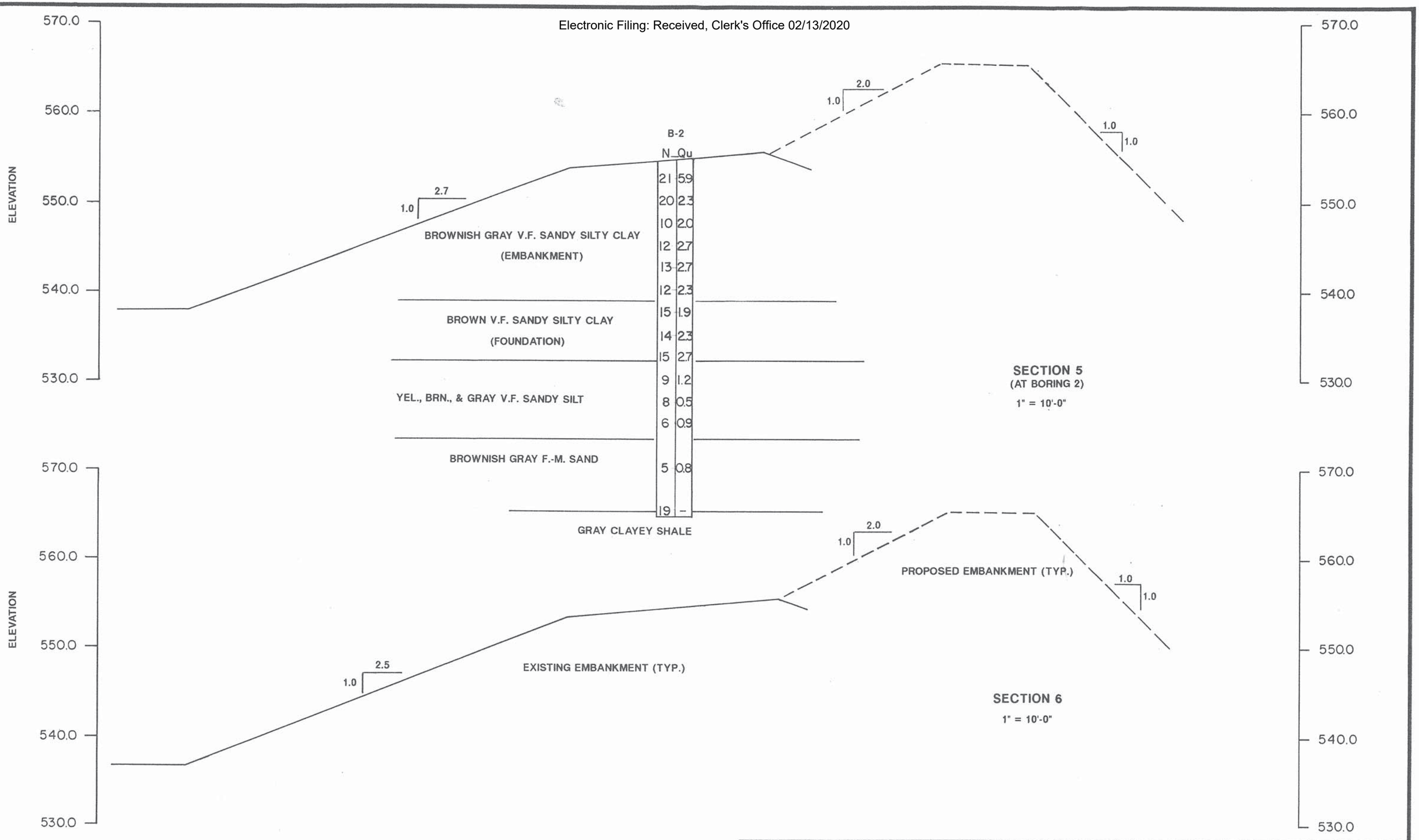
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PROPOSED EMBANKMENT MODIFICATONS
CWLP ASH DISPOSAL AREA
SPRINGFIELD, ILLINOIS

JOB NO. 87S3014 FIGURE 6

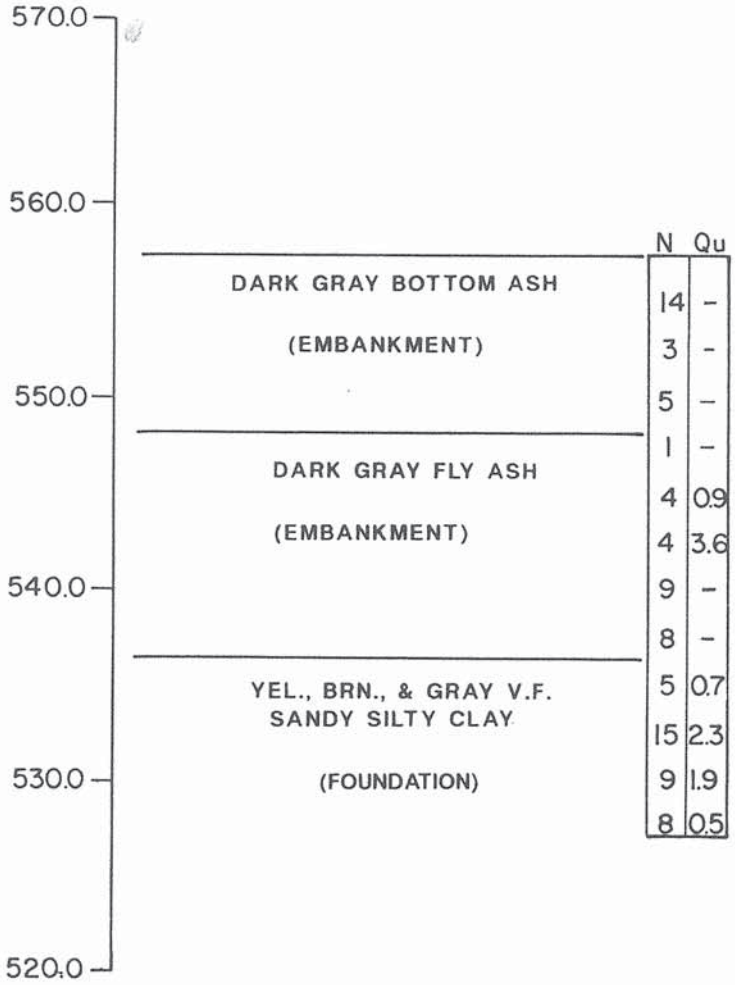
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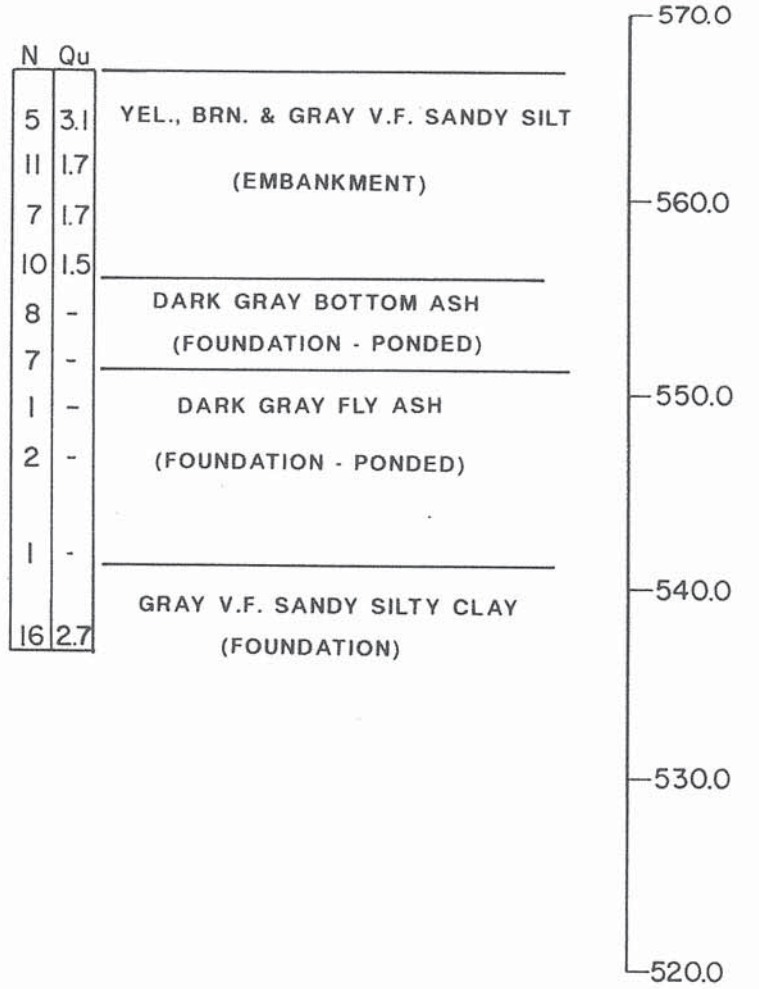


CROSS SECTIONS	PROPOSED EMBANKMENT MODIFICATONS CWLP ASH DISPOSAL AREA SPRINGFIELD, ILLINOIS
HANSON ENGINEERS INCORPORATED SPRINGFIELD, IL • PEORIA, IL • ROCKFORD, IL	JOB NO. 87S3014 FIGURE 7

BORING 1



BORING 4



BORING PROFILES

HANSON ENGINEERS INCORPORATED

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PROPOSED EMBANKMENT MODIFICATONS
CWLP ASH DISPOSAL AREA
SPRINGFIELD, ILLINOIS

JOB NO. 87S3014 FIGURE 8

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APPENDIX A

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LOG OF BORING

CONTRACTED WITH HANSON ENGINEERS — BORING NO. B-1
PROJECT NAME CWLP ASH POND — CONTRACT NO.
LOCATION PER PLAN
DATUM — HAMMER WT. 140# — HAMMER DROP 30" — HOLE DIA. 6"
SURFACE ELEV. — CORE DIA. — CASING
DATE STARTED 5-18-87 — COMPLETED 5-18-87 — DRILLING METHOD HSA

ELEV.	DESCRIPTION	STRATA DEPTH	DEPTH SCALE	SAMPLES BLOWS FT.	NO.	TYPE	RECOV.	QP	NOTES
		0.0	30						
	Blk. bot. ash, tr. f. gravel fill moist-wet		5	6-7-7	1	ss	14"	--	
				3-2-1	2	ss	8	--	
				3-2-3	3	ss	10	--	WATER 5-18-87 DD 5.0' 8:45am BAR 20.5' 10:15am AAR 4.6' 10:35am
		9.2							
	Blk. fly ash		10	2-1-0	4	ss	12	--	DWL 4.0' 6:35pm
				2-2-2	5	ss	15	0.8	
	wet		15	6-2-2	6	ss	14	0.9	
				4-4-5	7	ss	18	--	
			20	3-5-3	8	ss	18	--	

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LOG OF BORING

CONTRACTED WITH HANSON ENGINEERS BORING NO. B-1
PROJECT NAME CWLP ASH POND CONTRACT NO.
LOCATION PER PLAN
DATUM HAMMER WT. 140# HAMMER DROP 30" HOLE DIA. 6"
SURFACE ELEV. CORE DIA. CASING
DATE STARTED 5-18-87 COMPLETED 5-18-87 DRILLING METHOD HSA

ELEV.	DESCRIPTION	STRATA DEPTH	DEPTH SCALE	SAMPLES BLOWS FT.	NO.	TYPE	RECOV.	QP	NOTES
		0.0	30						
		23.1		3-2-3	9	ss	18"	1.2	
	Green gray silty clay, tr. f.m. sand, tr. f. gravel moist	25.7	25	6-8-7	10	ss	18	4.5+	
	Dk. gray silty clay moist	30.0	30	4-4-	11	ss	18	3.1	
				3-4-4	12	ss	18	2.0	
	END OF BORING 30.0'								

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CONTRACTED WITH HANSON ENGINEERS BORING NO. B-2
PROJECT NAME CWLP ASH POND CONTRACT NO.
LOCATION
DATUM HAMMER WT. 140# HAMMER DROP 30" HOLE DIA. 6"
SURFACE ELEV. CORE DIA. CASING
DATE STARTED 5-18-87 COMPLETED 5-18-87 DRILLING METHOD HSA

ELEV.	DESCRIPTION	STRATA DEPTH	DEPTH SCALE	SAMPLES BLOWS FT.	NO.	TYPE	RECOV.	QP	NOTES
		0.0	30						
	10" white rock, brn. gray silty clay fill moist	3.3		8-10-11	1	ss	15"	4.5+	
	Light brn. silty clay fill moist	5.8	5	8-9-11	2	ss	16	3.0	
	Brn. green blk. silty clay fill moist			3-5-5	3	ss	15	2.1	WATER 5-18-87 DD 28.5' 12:00pm BAR 18.5' 1:55pm AAR WCI 15.0' 2:
			10	3-5-7	4	ss	16	2.4	
				3-6-7	5	ss	13	2.0	Dwl 14.0' 6:30pm
			15	3-5-7	6	ss	18	1.7	
				5-6-9	7	ss	18	3.2	
			20	5-6-8	8	ss	18	3.2	

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CONTRACTED WITH HANSON ENGINEERS BORING NO. B-2
PROJECT NAME CWLP ASH POND CONTRACT NO.
LOCATION PER PLAN
DATUM HAMMER WT. 140# HAMMER DROP 30" HOLE DIA. 6"
SURFACE ELEV. CORE DIA. CASING
DATE STARTED 5-18-87 COMPLETED 5-18-87 DRILLING METHOD HSA

ELEV.	DESCRIPTION	STRATA DEPTH	DEPTH SCALE	SAMPLES BLOWS FT.	NO.	TYPE	RECOV.	QP	NOTES
		0.0	30						
		22.7		4-6-9	9	ss	18"	3.5	
	Brn. gray silty clay, tr. f. sand moist	25.4	25	3-3-6	10	ss	18	1.8	
	Brn. gray clayey silt, some f. sand, occas. 1-3" f. sand seams a wet			3-4-4	11	ss	18	1.5	
			30	2-3-3	12	ss	18	0.5	
		31.5							
	Brn. f.m. sand wet								
			35	2-2-3	13	ss	18	1.2	
		39.8		11-11-12	14	ss	18	2.5	
	Brn. f.m. sand wet	40.0	40						
	END OF BORING 40.0'								

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CONTRACTED WITH HANSON ENGINEERS BORING NO. B-3
PROJECT NAME CWLP ASH POND CONTRACT NO.
LOCATION PLAN
DATUM HAMMER WT. 140# HAMMER DROP 30" HOLE DIA. 6"
SURFACE ELEV. CORE DIA. CASING
DATE STARTED 5-18-87 COMPLETED 5-18-87 DRILLING METHOD HSA

ELEV.	DESCRIPTION	STRATA DEPTH	DEPTH SCALE	SAMPLES BLOWS FT.	NO.	TYPE	RECOV.	QP	NOTES
		0.0	30						
	5" white rock, brn. gray blk. silty clay fill moist	4.5		7-6-12	1	ss	14"	4.5+	
	Blk. silty clay fill moist		5	6-9-9	2	ss	18	4.5+	
		8.3		5-5-6	3	ss	16	1.7	WATER 5-18-87 DD 24.0' 3:50pm BAR 12.4' 4:05pm AAR 10.0' 4:25pm
	Brn. green blk. silty clay fill moist		10	3-4-8	4	ss	17	2.5	DWL 9.5' 6:45pm
		17.9		3-6-7	5	ss	18	2.2	
	Blk. gray silty clay fill moist		15	3-6-8	6	ss	18	2.4	
				5-6-7	7	ss	18	2.3	
		20.6	20	3-4-8	8	ss	18	3.0	

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CONTRACTED WITH HANSON ENGINEERS BORING NO. B-3
PROJECT NAME CWLP ASH POND CONTRACT NO.
LOCATION PER PLAN
DATUM HAMMER WT. 140# HAMMER DROP 30" HOLE DIA. 6"
SURFACE ELEV. CORE DIA. CASING
DATE STARTED 5-18-87 COMPLETED 5-18-87 DRILLING METHOD HSA

ELEV.	DESCRIPTION	STRATA DEPTH	DEPTH SCALE	SAMPLES BLOWS FT.	NO.	TYPE	RECOV.	QP	NOTES
		0.0	30						
	Brn. gray silty clay moist-wet		25	5-6-9	9	ss	18"	2.0	
				3-4-5	10	ss	18	2.0	
				3-3-4	11	ss	18	1.6	
		28.2							
	Gray brn. clay, little silt moist	30.0		6-9-12	12	ss	18	3.8	
			30						
	END OF BORING 30.0'								

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CONTRACTED WITH HANSON ENGINEERS BORING NO. B-4
PROJECT NAME CWLP ASH POND CONTRACT NO.
LOCATION PER PLAN
DATUM HAMMER WT. 140# HAMMER DROP 30" HOLE DIA. 6"
SURFACE ELEV. CORE DIA. CASING
DATE STARTED 5-18-87 COMPLETED 5-18-87 DRILLING METHOD HSA

ELEV.	DESCRIPTION	STRATA DEPTH	DEPTH SCALE	SAMPLES BLOWS FT.	NO.	TYPE	RECOV.	QP	NOTES
		0.0	30						
	Brn. silty clay fill moist	4.0		3-3-2	1	ss	10"	3.5	
	Brn. gray blk. silty clay fill moist		5	4-5-6	2	ss	12	3.2	
				3-3-4	3	ss	10	2.5	WATER 5-18-87 DD 11.0' 5:15pm BAR 22.0' 6:00pm AAR 9.8' 6:30pm
		10.5	10	3-5-5	4	ss	13	2.5	DWL 9.5' 6:50pm
	Blk. bot. ash fill wet			5-4-4	5	ss	18	--	
		15.2	15	5-4-3	6	ss	16	--	
	Blk. fly ash fill wet			1-1-0	7	ss	18	0.2	
			20	0-0-2	8	ss	.8	0.2	

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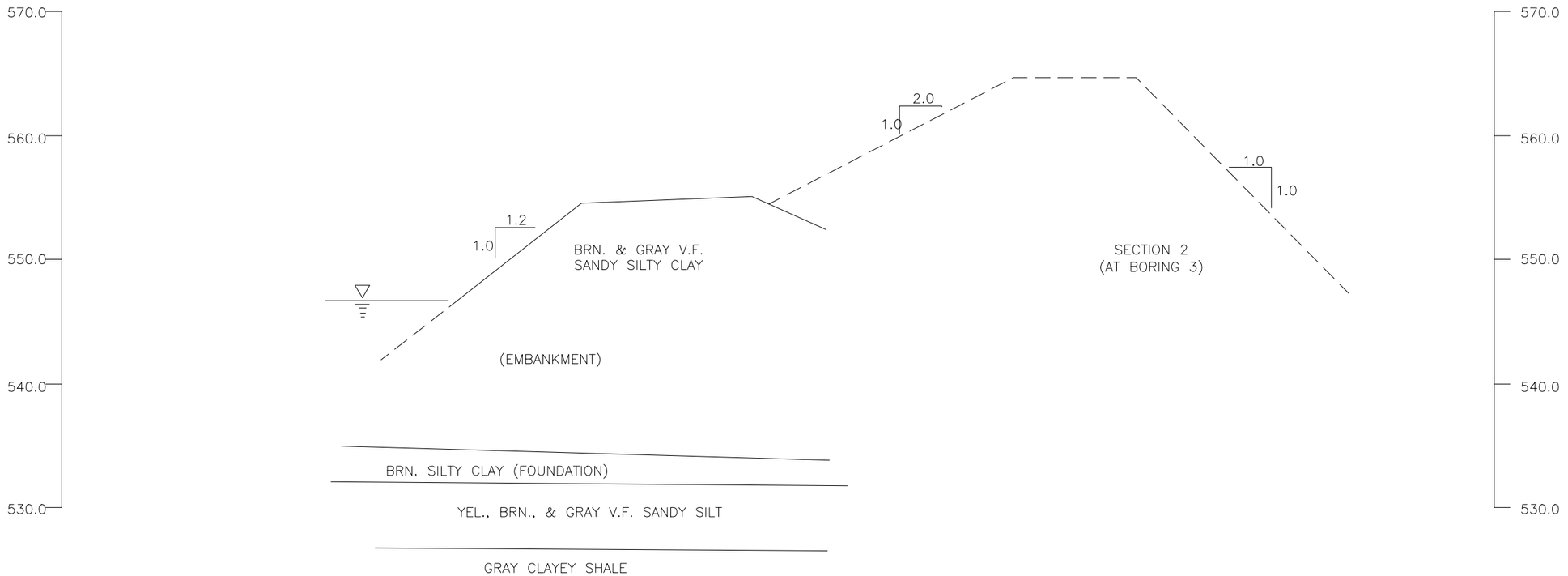
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PROJECT NAME CWLP ASH POND — CONTRACT NO.
LOCATION PER PLAN
DATUM — HAMMER WT. 140# — HAMMER DROP 30" — HOLE DIA. 6"
SURFACE ELEV. — CORE DIA. — CASING
DATE STARTED 5-18-87 — COMPLETED 5-18-87 — DRILLING METHOD HSA

ELEV.	DESCRIPTION	STRATA DEPTH	DEPTH SCALE	SAMPLES BLOWS FT.	NO.	TYPE	RECOV.	QP		NOTES
		0.0	30							
				1-0-1	9	ss	18"	0.5		
		25.5	25							
	Blk. gray clay, tr. silt moist									
		30.0		4-6-10	10	ss	18	3.3		
			30							
	END OF BORING 30.0'									

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LAKESIDE ASH POND CROSS-SECTION 2

PLANS PREPARED FOR
CITY, WATER, LIGHT & POWER
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: OCTOBER 2016

PROJECT ID: 150077/0011

SHEET NUMBER:

X-SEC.

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APPENDIX C

Fly Ash Technical Papers

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Engineering Characteristics of Coal Combustion Residuals and a Reconstitution Technique for Triaxial Samples

Nicholas A. Lacour

Thesis submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Master of Science
In
Civil Engineering

Adrián Rodriguez-Marek, Chair
Joseph Dove
James Martin

19 June, 2012
Blacksburg, Virginia

Keywords: coal combustion residuals, fly ash, bottom ash, surface impoundments

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Engineering Characteristics of Coal Combustion Residuals and a Reconstitution Technique for Triaxial Samples

Nicholas Alexander Lacour

ABSTRACT

Traditionally, coal combustion residuals (CCRs) were disposed of with little engineering consideration. Initially, common practice was to use a wet-scrubbing system to cut down on emissions of fly ash from the combustion facilities, where the ash materials were sluiced to the disposal facility and allowed to sediment out, forming deep deposits of meta-stable ash. As the life of the disposal facility progressed, new phases of the impoundment were constructed, often using the upstream method. One such facility experienced a massive slope stability failure on December 22, 2008 in Kingston, Tennessee, releasing millions of cubic yards of impounded ash material into the Watts Bar reservoir and damaging surrounding property. This failure led to the call for new federal regulations on CCR disposal areas and led coal burning facilities to seek out geotechnical consultants to review and help in the future design of their disposal facilities. CCRs are not a natural soil, nor a material that many geotechnical engineers deal with on a regular basis, so this thesis focuses on compiling engineering characteristics of CCRs determined by different researchers, while also reviewing current engineering practice when dealing with CCR disposal facilities. Since the majority of coal-burning facilities used the sluicing method to dispose of CCRs at one point, many times it is desirable to construct new "dry-disposal" phases above the retired ash impoundments; since in-situ sampling of CCRs is difficult and likely produces highly disturbed samples, a sample reconstitution technique is also presented for use in triaxial testing of surface impounded CCRs.

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Acknowledgments

I would like to thank Dr. Adrián Rodriguez-Marek, my advisor, for his guidance throughout my thesis work and throughout my academic career at Virginia Tech. I would also like to thank my parents for their encouragement and support throughout my entire academic career. Lastly, I would like to thank my grandmother for passing on my great-grandparents' rock collection that first sparked my interest in geology and undoubtedly led to my interest in geotechnical engineering.

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Chapter 1

Introduction and Background

Ever since the promulgation of the Resource Conservation and Recovery Act in 1976, there has been debate on the proper waste classification of coal combustion by-products. They have traditionally been disposed of in a fashion similar to that of mine tailings wastes. However, the failure of the Kingston Fossil Plant's main disposal cell on December 22, 2008 has once again led to discussions on how to properly regulate the disposal of these materials. From an engineering standpoint, geotechnical engineers have very little experience with coal combustion wastes, which have some unique engineering properties that set them apart from naturally occurring soils. A comprehensive literature review and compilation of engineering properties of coal combustion residual materials is consolidated and compared between researchers from different nations. Additionally, a triaxial sample reconstitution technique is proposed for surface impounded coal combustion residuals (different types of coal combustion residuals are addressed in section 1.1) which minimizes particle segregation and ensures constant density across the height of the sample. This chapter presents an introduction to the thesis and presents a brief summary of the December 22, 2008 slope stability failure at the Tennessee Valley Authority's (TVA's) Kingston power plant, which served as an inspiration for this thesis.

1.1 Introduction

Coal is the most commonly used fuel in generating electrical energy in the United States. In 2009, coal-powered steam turbines produced 45% of the almost 4 trillion kilowatt-hours of

consumed energy in the US (Energy Information Administration 2010). With the burning of such large quantities of coal, there is naturally also a large amount of ash and other byproducts. The four main types of byproducts of burnt coal as described by the Environmental Protection Agency (EPA 2011) are:

Fly Ash: mostly spherical silt to clay-sized particles composed mostly of silica removed from plant exhaust gases through the use of electrostatic precipitators or bag-houses with secondary scrubber systems.

Bottom Ash: coarse, porous, angular fine sand to fine gravel-sized particles of agglomerated ash formed in pulverized ash furnaces.

Boiler Slag: molten bottom ash collected at the base of slag tap and cyclone type furnaces that is quenched with water, causing it to fracture, crystallize, and form pellets. It is composed of hard, black, angular particles that have a smooth, glassy appearance.

Flue Gas Desulfurization (FGD) Material: product of a process used for reducing SO_2 emissions from the gas system of a coal-fired boiler. Depending on the scrubbing process, the material is either predominantly calcium sulfite ($CaSO_3$), calcium sulfate ($CaSO_4$), or a mixture of the two. It consists of small, fine, particles. Calcium Sulfate FGD material can be used in place of gypsum ($CaSO_4 \cdot 2H_2O$) in wallboard manufacturing or in cement production, while calcium sulfite can be used as embankment and road base material.

There are beneficial reuses for each of these byproducts, though generation almost always outweighs demand. In order to avoid confusion, when referring to these byproducts, the definitions outlined by EPA (*Federal Register* 2010) will be used. When referring to burnt-coal byproducts being beneficially used, the term Coal Combustion Products (CCPs) will be used, while Coal Combustion Residuals (CCRs) will be used when referring to byproducts that are destined for disposal.

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Use of CCPs are unique to the application in which they are being utilized. Therefore, the focus of this thesis is on the geotechnical engineering properties and design and monitoring considerations for CCR landfills and surface impoundments.

Depending on the type of system used to remove fly ash from and/or to desulfurize the exhaust gases of boilers used in electricity generation, CCRs have traditionally been disposed of using either a dry (or, more accurately, a moisture conditioned) placement method or a hydraulic sluicing method . Again referring to EPA definitions (*Federal Register* 2010), any disposal area where CCRs are disposed of using a dry method will be referred to as a CCR landfill, while any area that CCRs are disposed of hydraulically will be referred to as a CCR surface impoundment. A CCR surface impoundment is a disposal area much akin to a mine tailings dam disposal area, or to a dredge spoil area. While CCR landfill wastes are placed using backhoes or other heavy equipment and compacted in a moist condition, CCR surface impoundment wastes are simply the result of a wet-scrubbing removal system for fly ashes; the effluent from these wet-scrubbing processes is then often mixed with bottom ashes and hydraulically placed in a disposal area contained by some sort of dike system.

As a result of the Kingston Fossil Plant failure, EPA found it necessary to reexamine regulatory policies regarding the disposal of CCRs:

With the promulgation of 42 U.S.C. §6901 (1976), commonly known as the Resource Conservation and Recovery Act (RCRA), CCRs were not initially specified as hazardous (subtitle C) or solid wastes (subtitle D). In 1980, the Solid Waste Disposal Act amendments to RCRA were enacted, one of which was the “Bevill Amendment”, 42 U.S.C. §6921 (b)(3)(A)(i). This amendment temporarily exempted CCRs from subtitle C regulation, classifying them as subtitle D, which is subject to state regulation. In 1988, EPA released a report entitled *Wastes from the Combustion of Coal by Electric Utility Power Plants* in which they concluded that the four above-mentioned CCRs did not exhibit hazardous characteristics according to RCRA regulations and would therefore not be regulated under Subtitle C. However, it was not until August 9, 1993 that EPA issued the final regulatory determination applicable to these CCRs (*Federal Register* 1993), stating that regulation of them as hazardous wastes was unwarranted (Dockter and Jagiella 2005).

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Most recently, on June 21, 2010, EPA announced their intent to regulate CCRs generated from the combustion of coal at electric utilities under the RCRA. The EPA announcement introduced two options:

- EPA would reverse the 1993 and 2000 exemptions of CCRs under the Bevill Amendment and list them as special wastes subject to regulation under subtitle C of RCRA when they are destined for disposal in landfills or surface impoundments.
- EPA would leave the Bevill determination in place while regulating the disposal of CCRs under subtitle D of RCRA by issuing national minimum criteria.

Regardless of the chosen alternative, EPA is also proposing to establish dam safety requirements in order to address the stability of CCR surface impoundments to prevent catastrophic releases like that at the TVA Kingston plant. EPA has suggested the adoption of the Hazard Potential Classification System for Dams, developed by the U.S. Army Corps of Engineers, since it would be relatively straightforward in its application to surface impoundments.

The main purpose of this thesis is to consolidate current published material on the properties of CCRs and to quantify the variability within the engineering properties of CCRs between countries, individual power plants, and CCR types. Furthermore, CCR impoundment areas are plentiful across the U.S. and power generating companies would prefer to begin dry disposal of CCRs directly over retired CCR surface impoundments. In order to do this, a geotechnical site investigation must be performed, in which the static and dynamic shear strengths of the surface impounded materials are analyzed. Since CCRs tend to be non-plastic in nature, undisturbed sampling is often difficult, time consuming, costly, and anything but "undisturbed." Therefore, a second objective of this thesis is to analyze a slurry deposition specimen reconstitution technique that is easier and less costly than undisturbed sampling, in order to determine if this specimen reconstitution technique forms samples of uniform relative density without particle segregation.

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1.2 Kingston Fossil Plant Failure

The Kingston Fossil Plant is a coal-fired electrical power plant constructed and operated by the Tennessee Valley Authority (TVA). Construction on the facility began in 1951 and the first coal-fired electrical unit began in 1954. Ash slurries were initially released into a slack water area created by a two dikes with a gap in-between to allow water from the Watts Bar Reservoir to enter. The ash slurries and the waters of the reservoir were then allowed to commingle until the two dikes were connected in 1958, separating the reservoir and the ash disposal area. This slack water area collected silt and clay sediments from the period of 1942 to 1954; after 1954, disposed ash was added to the silts and clays being deposited and with the construction of the closure dike, additional clay runoff sediment was deposited along with the runoff silts, reservoir clays, and disposed ash. This formed a slick, weak layer found by AECOM to be a major contribution to the ash disposal area's failure in December of 2008 (Walter and Butler 2009).

The AECOM Root Cause Analysis report attributed the failure as most likely due to creep in the aforementioned weak layer due to active loading in a dredge cell contained within the disposal area. This creep caused an initial failure of various disposal phase dikes founded on older disposed ash deposits, which, in turn, caused progressive failure of upstream ashes, leading to undrained loading and subsequent failure of the downstream ash material and disposal area perimeter dike. The upstream progressive failure stopped upon reaching a former divider dike within the disposal area. The estimated ash released in the failure was 5.4 million cubic yards. Figure 1 provides an aerial photograph of the disposal area before and after the slope failure.

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Figure 1: Aerial photographs comparing the Kingston Fossil Plant ash disposal area before and after the massive slope failure on December 22, 2008.

While this failure may have occurred because of a very unique site condition, AECOM did note in their Root Cause Analysis report that "extensive void ratio data in un-failed areas of the Dredge Cells showed a lack of significant consolidation of the wet ash with depth," which would indicate that strength would not increase significantly with depth in the disposed ash material. This property also raises the question of stability of these sort of disposal areas under dynamic loading. If surface-impounded coal ashes do not tend to increase in density with depth, this could leave a very deep, potentially liquefiable layer of CCRs at a given site, rather than just a single liquefaction-prone layer (which is usually the case in naturally-deposited soils).

The entire Root Cause Analysis report and other investigatory data for the Kingston Fossil Plant failure can be accessed on the TVA website at http://www.tva.gov/kingston/rca/.

1.3 Outline

This thesis is composed of eight chapters. The first chapter introduces the background as well as inspiration for the thesis topic. Chapters two and three provide consolidated research results on the static and dynamic engineering properties of CCRs, respectively. Chapter four discusses

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similarities between mine tailings disposal areas and CCR disposal areas and provides some guidance on how monitoring techniques developed for mine tailings disposal areas can be directly applied or slightly modified so that they can be applied to CCR disposal areas. Chapters five and six address how slope stability and settlement analyses can differ for CCR materials as opposed to naturally occurring soils. Chapter seven provides a review of common triaxial reconstitution techniques used on granular materials, while also analyzing a reconstitution technique to determine if it produces homogenous samples in terms of grain size distribution and relative density with height. Finally, chapter eight provides some final observations for each chapter, as well as a summary of topics that require further research in the future.

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Chapter 2

Engineering Characterization of CCRs

Index and mechanical properties of soils provide the basic information required to design earth retaining structures, foundations, and earthen embankments and to perform slope stability analyses; determining the index properties and running field and laboratory tests to determine these properties is the first step in any geotechnical engineering application. In any given region, there is a large body of literature from past projects describing the local soils that engineers can use as a resource to accelerate this initial process. CCRs, however, are not a natural soil and have characteristics that make their behavior in certain situations markedly different than natural soils of similar grain size; additionally, coal ashes can vary considerably from one site to another based on differences in the coal source, coal preparation methods, type of power plant unit, and combustion temperatures (Yudbhir and Honjo 1991). This chapter outlines some of the major differences in the properties of CCRs as compared to other soils and compiles some CCR characteristics obtained from published technical literature. Additionally, test data from engineering reports for five specific coal combustion plants in the U.S. are included; however, information identifying the specific plants has been omitted at the request of the plant operators. These five plants are referred to as Site 1 through Site 5 consistently throughout this thesis.

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2.1 Specific Gravity

Perhaps one of the most unusual characteristics of CCRs is their wide range of specific gravities. While some CCRs may have specific gravities of around 2.7 or even 2.8, some have been reported to have specific gravities as low as 1.47. Table 1 provides some values of specific gravity (G_s) determined for CCRs by researchers in different countries.

Table 1: Reported specific gravities of CCRs from different countries

Reference	Type of CCR	Country	G_s
Martin et al. (1990)	Fly Ash	USA	2.03-2.49
Tu et al. (2007)		USA	2.10-2.40
Kim and Prezzi (2008)		USA	2.30-2.81
Site 3		USA	2.42-2.71
Site 4		USA	2.21-2.73
Sridharan et al. (1998)		India	1.95-2.31
Pandian and Balasubramonian (1999)		India	1.97-2.55
Prashanth et al. (1999)		India	2.03-2.67
Sridharan et al. (2001)		India	2.07-2.55
Trivedi and Sud (2004)		India	1.72-2.03
Pandian (2004)		India	1.95-2.55
Das and Yudhbir (2005)		India	2.14-2.62
Prakash and Sridharan (2006)		India	1.95-2.55
Prakash and Sridharan (2009)		India	1.66-2.55
Jakka et al. (2010)		India	2.18-2.27
Raymond (1961)		UK	2.05-2.26
Sherwood (1975)		UK	1.90-2.37
Indraratna and Nutalaya (1991)		Canada	1.90-2.90
		Thailand	2.27-2.45
Kolay and Kismoor (2009)		Malaysia	2.11-2.31
Muhardi et al. (2010)		Malaysia	2.50-2.70
Site 1	Surface Imp.	USA	2.13-2.30
Site 2		USA	2.16-2.26
Site 3		USA	2.55-2.62
Site 4		USA	2.20-2.47
Site 5		USA	2.29-2.61

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Reference	Type of CCR	Country	G_s
Sridharan et al. (1998)		India	1.91-2.15
Sridharan et al. (2001)		India	1.96-2.66
Trivedi and Sud (2002)		India	1.60-2.10
Trivedi and Sud (2004)		India	1.98-2.00
Pandian (2004)		India	1.91-2.50
Prakash and Sridharan (2006)		India	1.91-2.50
Bera et al. (2007)		India	2.16-2.23
Prakash and Sridharan (2009)		India	1.64-2.66
Skarzynska et al. (1989)		UK	2.10-2.24
		Poland	1.90-2.31
Seals et al. (1972)	Bottom Ash	USA	2.28-2.78
Sridharan et al. (1998)		India	1.82-2.15
Sridharan et al. (2001)		India	1.98-2.19
Pandian (2004)		India	1.82-2.15
Prakash and Sridharan (2006)		India	1.66-2.17
Prakash and Sridharan (2009)		India	1.47-2.19
Jakka et al. (2010)		India	2.50-2.59
Kolay and Kismoor (2009)		Malaysia	2.09-2.32

Despite the wide range of specific gravities observed for CCRs, most researchers recognize that they usually have a specific gravity lower than that of natural soils (Prakash and Sridharan 2009, Trivedi and Singh 2004b, Tu et al. 2007). It logically follows that since the unit weight of CCRs is less than that of natural soils, horizontal earth pressures in CCRs will be less than that of natural soils as well. Prakash and Sridharan (2009) cite this as a property that makes them ideal for use as backfill material for retaining structures or as a lightweight fill in other construction applications.

Many factors contribute to variability in the specific gravity of coal ashes, such as the parent coal and the combustion and cooling processes. Figure 1 compares variability of the specific gravity of different coal ashes from different countries. Additionally, some of the research studies done on ash from several different plants have a much higher variability than studies done on specific sites, indicating that variability in the specific gravity of CCRs within a given plant is lower than the specific gravity of CCRs within the country where that plant is in. Examining Figure 2, it is interesting to note the clear difference in the mean values of specific gravity between US coal ashes and Indian coal ashes; this may be due to higher iron contents in

US coals. Table 2 provides percentages of major constituent oxides in CCRs from different countries by weight, which shows how much the mineralogy of CCRs can vary between countries, another factor that can account for high variability in the specific gravity of CCRs from different countries (Yudbhir and Honjo 1991). Loss on ignition (LOI) for the CCRs is also reported in Table 2, that is, the loss in mass of the samples upon strong heating.

Table 2: Percentages by weight of major oxide constituents of CCRs from different countries (after Yudbhir and Honjo 1991).

Constituents	USA	UK	Canada	India	Thailand	Japan	Hong Kong	China	Australia	S. Africa	Poland	Germany
SiO_2	28-59	37-54	37-59	13-64	27-34	50-62	38-77	44-55	44-73	40-53	43-52	48
Al_2O_3	7-38	17-33	12-24	14-31	19-28	22-30	14-46	20-32	16-33	24-35	19-34	25
Fe_2O_2	4-42	6-22	3-39	3-24	20-24	4-7	1-18	1-17	3-6	5-11	1-13	7
CaO	0-13	1-27	1-13	1-34	11-16	3-7	0-16	5-9	0-9	5-10	2-9	3
LOI	0-48	0-27	0-10	0-16	0-2	1-6	4-8	3-9	1-9	2-11	2-10	-
Glass Content	54-87	54-87	54-95	-	-	56-58	-	29-40	49-60	29-43	-	-

Note: LOI = loss on ignition

2.2 Consolidation Properties and Volume Stability

CCRs have historically been disposed of in two major ways: collected from boilers hydraulically and diverted to a surface impoundment or collected through electrostatic precipitators or flue gas desulfurization systems and dry-placed into CCR landfills. In either of these disposal alternatives, there is traditionally no defined level of compactive effort used and depending on future uses of the disposal sites, the consolidation characteristics of CCRs can be of interest to geotechnical engineers. Again, since CCRs are not naturally occurring soils, there has been little testing on their consolidation properties and volume stability. Table 3 provides compression and recompression indices and coefficients of consolidation determined by different researchers.

Few researchers report a value for the recompression index; in a disposal area, there would not necessarily be an unloading-reloading process during normal operations. Whenever recompression indices are reported, it is usually in reference to reuse of CCRs in construction applications. Furthermore, the recompression indices reported are extraordinarily low. The reported values of coefficient of consolidation, c_v, are highly variable, as might be expected for materials that have non-typical stress histories. Furthermore, it is important to note that values of

c_v cannot be determined using the traditional Taylor or Casagrande methods, since the majority of deformation for laboratory consolidation tests is complete within one minute; therefore, it is necessary to take deformation readings at very small time intervals (Yudbhir & Honjo 1991). It is also important to note that reported values of c_v mean little independent of the vertical effective stress at which that value was recorded, since the coefficient of consolidation is dependent on both the compressibility of the material and the permeability of the material, based on Terzaghi's original one-dimensional consolidation equation:

$$c_v = \frac{1}{\gamma_w}\frac{k_v}{m_v} \tag{1}$$

where c_v = coefficient of consolidation
γ_w = unit weight of water
k_v = vertical coefficient of permeability
m_v = coefficient of compressibility

Since both k_v and m_v generally decrease with increasing overburden stress, but not necessarily at the same rate, it is hard to relate the coefficient of consolidation to the compression and recompression indices in a general manner. Consequently, the values of c_v reported in Table 3 should not be taken as "typical" values, because of how c_v is mathematically defined.

Some of the variability of compression and recompression indices and coefficient of consolidation of CCRs can be attributed to the type of CCR. For example, it is logical to assume that bottom ash would have a higher coefficient of consolidation, since it has a higher hydraulic conductivity and a lower compressibility than fly ash. For this reason, variability plots for fly ash and surface impounded ash have been presented separately from those for bottom ash. Figures 3 through 5 present variability plots for the compression and recompression indices for different types of CCRs. Since the recompression index of bottom ash is rarely determined by researchers, the variability plot for recompression index includes fly ash, surface impounded ash, and bottom ash. Figure 6 presents a variability plot for the coefficient of consolidation for CCRs at different placement conditions.

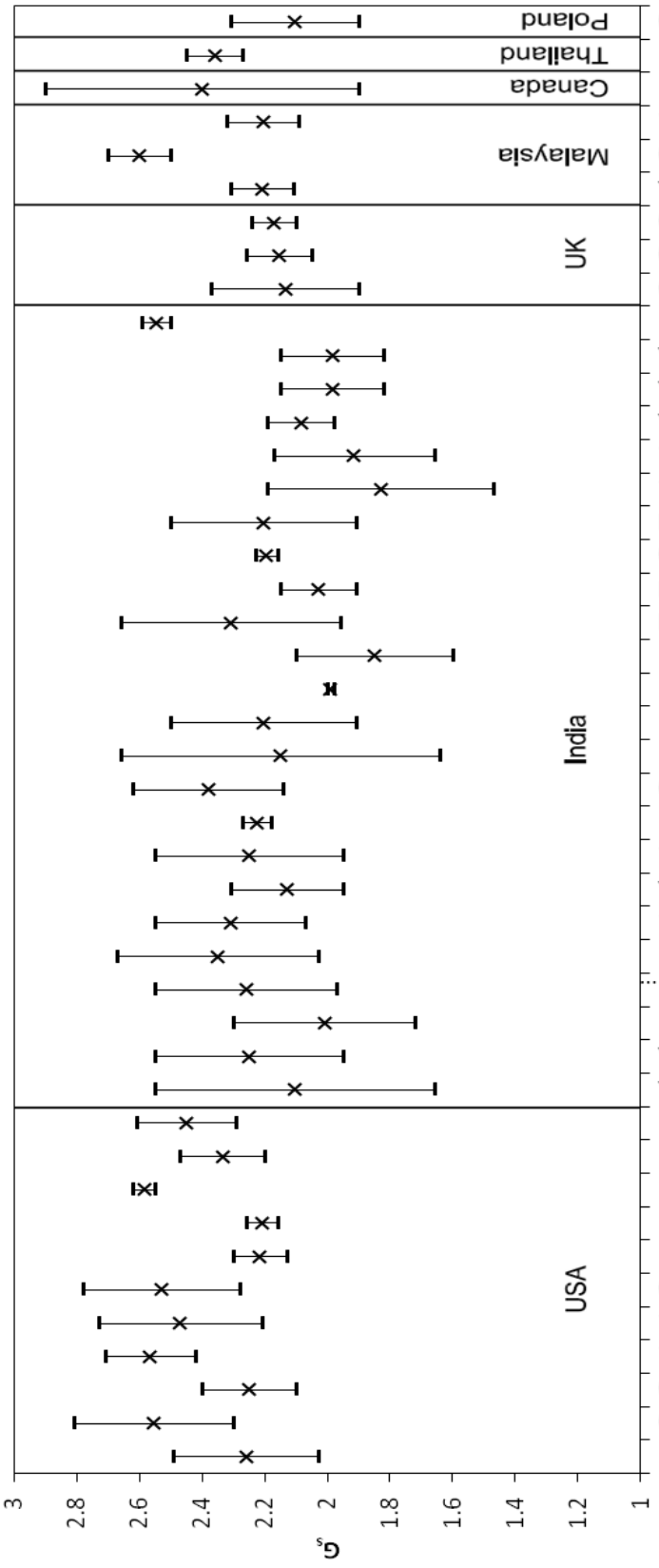


Figure 2: Variability plot for the specific gravities determined by studies performed in different countries.

Table 3: Compression and recompression indices and coefficients of consolidation for CCRs reported by different researchers.

Reference	Type of CCR	Country	C_c	C_r	C_v (cm^2/s)	Vertical Stress (psi)
Tu et al. (2007)	FA Resed.	USA	0.0390-0.0640	0.0035-0.0072	2.00-70.0	0.203-150
Site 1	SI	USA	0.080-0.710	0.0100-0.0300	-	0.694-111
Pandian and Balasubramonian (1999)	FA	India	-	-	0.00200-0.0802	0.73-116
Trivedi and Sud (2002)	SI/MH	India	0.00600-0.0100	0.000300-0.00300	-	3.34-116
Kaniraj and Gayathri (2004)	FA Comp.	India	0.0410-0.0840	0.00800	0.080-2.00	1.42-182
Pandian (2004)	FA	India	0.0490-0.284	-	1.16×10^{-5}-1.27×10^{-4}	7.12-113
	SI	India	0.0520-0.300	-	2.93×10^{-7}-8.17×10^{-4}	0.00-56.9
	BA	India	0.0570-0.484	-	7.57×10^{-7}-3.35×10^{-5}	0.00-56.9
Madhyannapu et al. (2008)	FA Resed.	India	0.100-0.167	0.00400-0.00800	-	
Prakash and Sridharan (2009)	FA Comp.	India	-	-	0.140-3.25	-
	SI Comp.	India	-	-	0.960-10.0	-
	BA Comp.	India	-	-	1.43-10.15	-
Jakka et al. (2010)	FA Comp.	India	0.079-0.246	0.018-0.023	-	7.26-29.0
	BA Comp.	India	0.051-0.059	0.013-0.024	-	7.26-29.0
Kolay and Kismoor (2009)	FA Comp.	Malaysia	0.0490-0.0510	-	-	319-2467
	SI Comp.	Malaysia	0.0780	-	-	319-2468
	BA Comp.	Malaysia	0.103-0.113	-	-	319-2469
Muhardi et al. (2010)	FA Comp.	Malaysia	0.150	-	3.00×10^{-5}-1.53×10^{-4}	-
	BA Comp.	Malaysia	1.54	-	-	-
Yudhbir and Honjo (1991)	FA Comp.	-	0.0300-0.375	-	-	-
	FA SI	-	0.0650-0.610	-	-	-
	FA SID	-	0.610-0.885	-	-	-
CAPCO (1990)	FA Comp.	Hong Kong	-	-	9.51×10^{-3}-1.90^{-2}	-
Haws et al. (1985)	FA Comp.	UK	-	-	9.51×10^{-4}-6.34×10^{-3}	-
Koo (1991)	FA Comp.	Thailand	-	-	3.17×10^{-4}-7.61×10^{-3}	-

FA = fly ash
BA = bottom ash
SI = surface impoundment ash
SID = surface impoundment/loose dry dump ash
MH = mixed hopper ash
Comp. = compacted
Resed. = resedimented

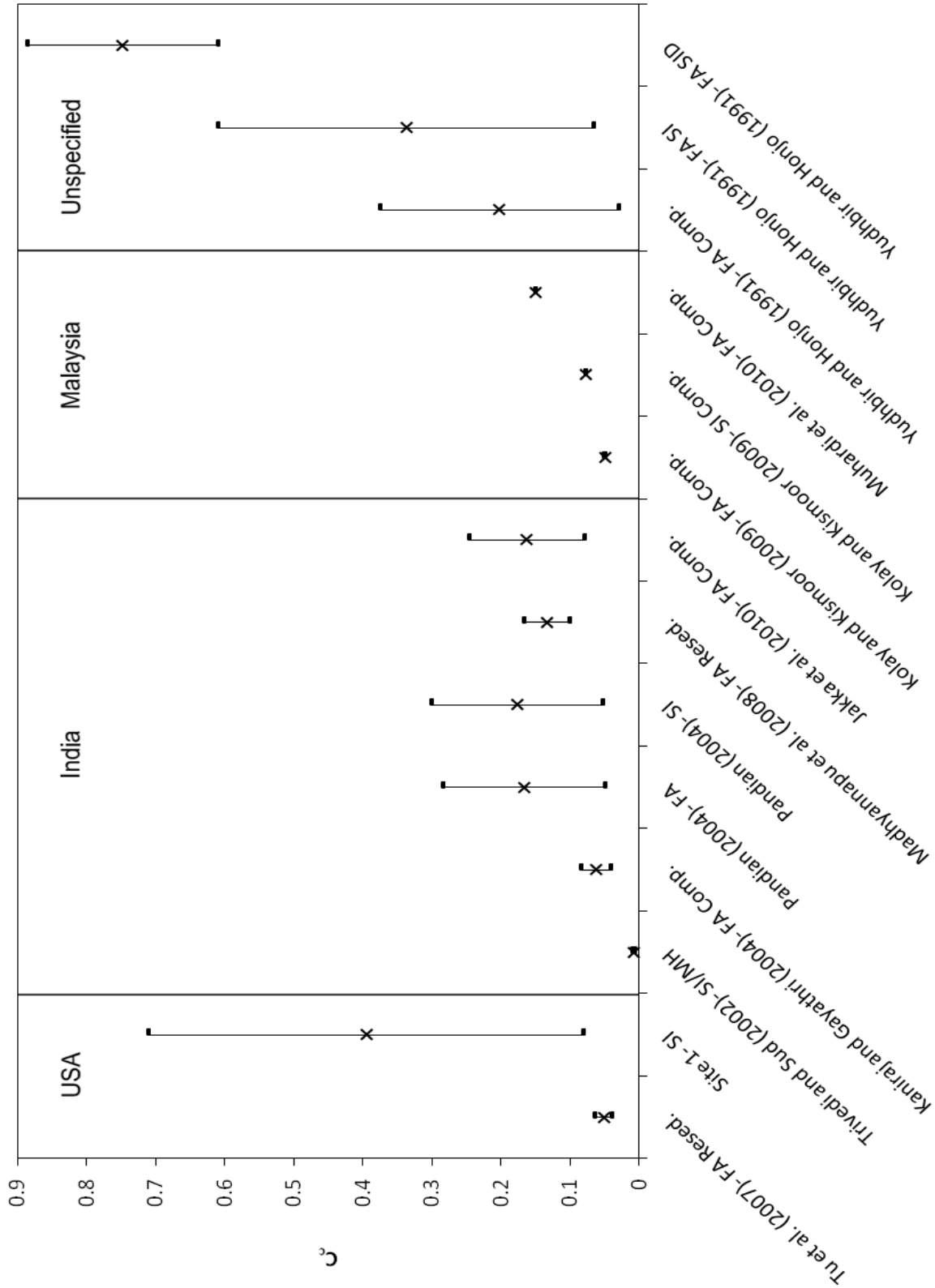


Figure 3: Variability plot for the compression indices of studies done on fly ashes and surface impounded ashes.

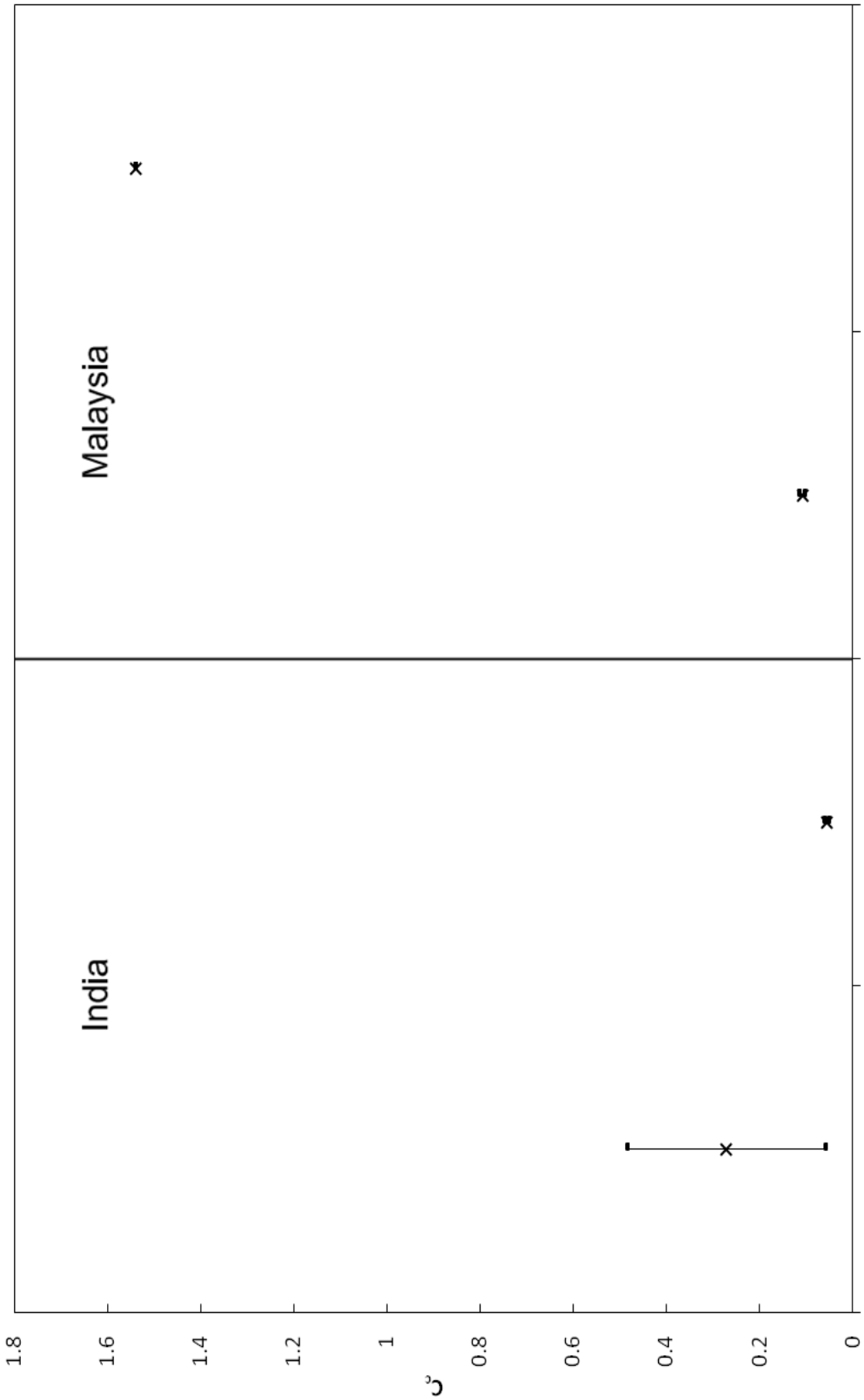


Figure 4: Variability plot of the compression indices for studies done on bottom ashes.

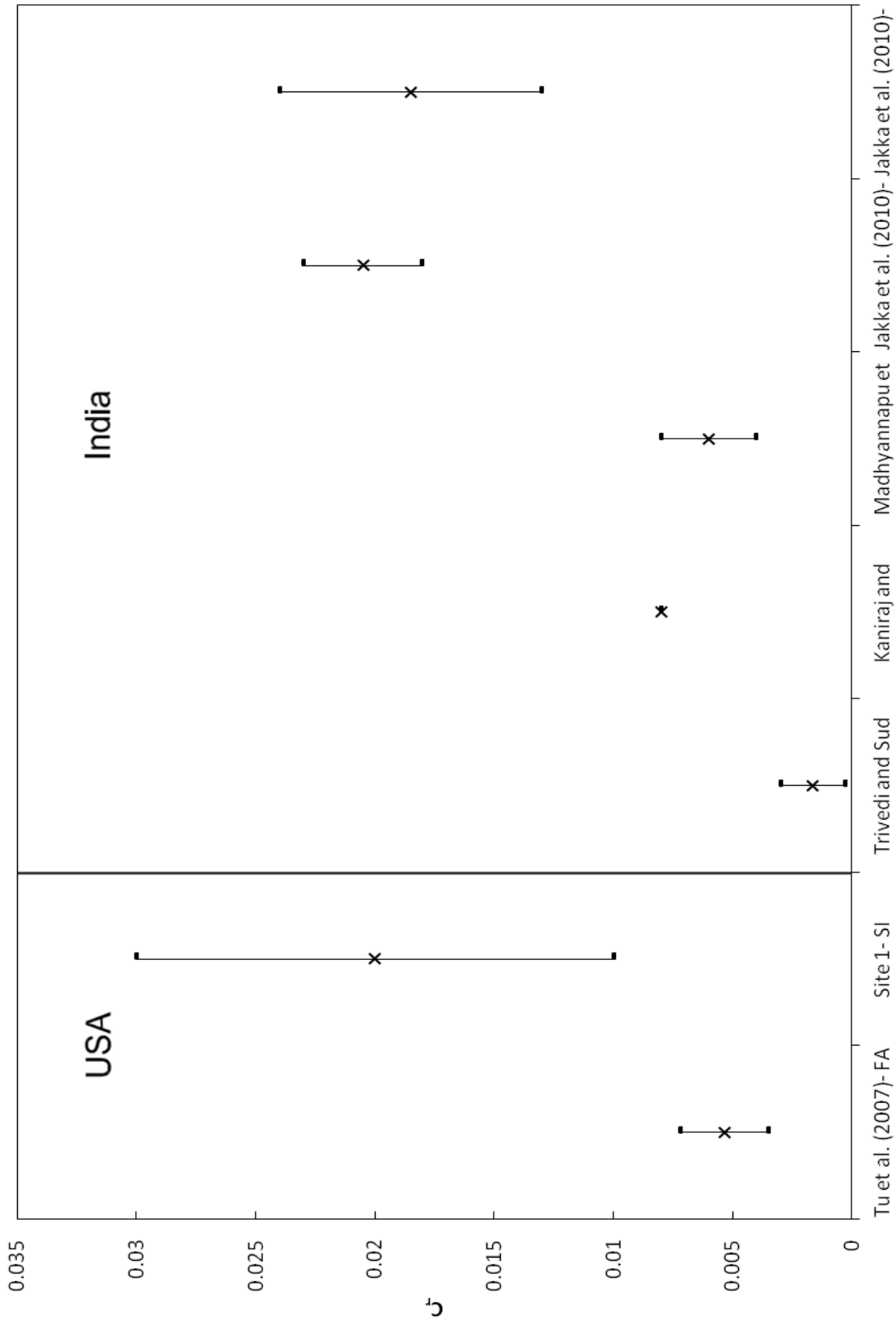


Figure 5: Variability plot of the recompression indices for studies done on fly ashes, bottom ashes, and surface impounded ashes

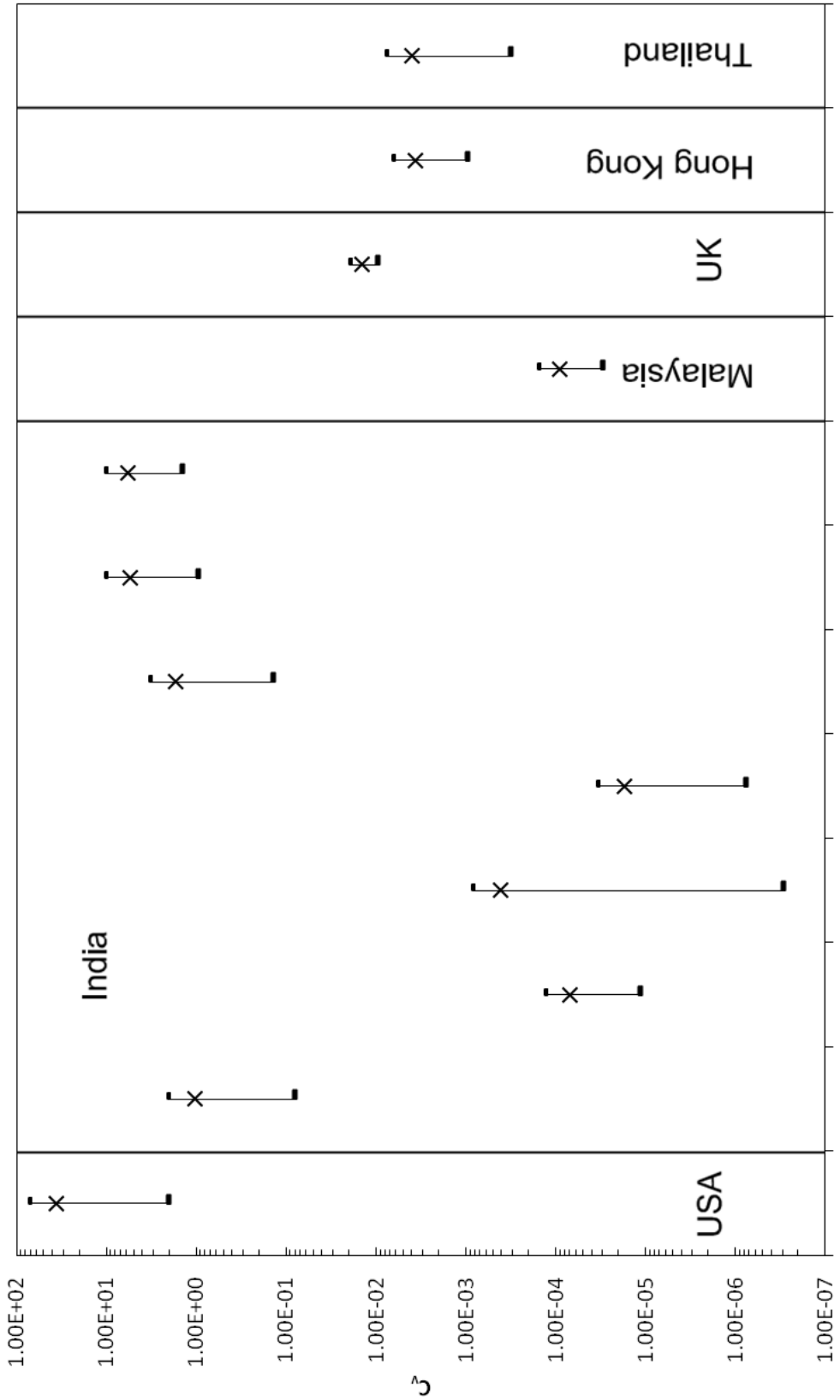


Figure 6: Variability plot for the coefficient of consolidation of studies done on fly ash, bottom ash, and surface impounded ash.

If structures are to be built on former CCR disposal areas or dry-disposed ashes are to be placed on hydraulically-placed deposits, volume stability of CCRs can also be of engineering concern. Swell, shrink, and collapse potentials are the three main types of volume instability examined for soils.

According to Sridharan and Prakash (2009), the swell potential of a soil can be examined through the use of the free swell ratio (FSR) which is defined as

$$FSR = \frac{V_d}{V_k} \tag{2}$$

where V_d = sediment volume of 10 g of oven-dried soil that passes a 425 μm sieve placed in a 100 ml jar which is then filled with de-aired water.

V_k = a sample identical to V_d except the solute is carbon tetrachloride or kerosene.

Note: a fume hood is required if there are any hazardous materials associated with the samples being tested

The swell potential can be determined based on the ranges of FSR as outlined in Table 4:

Table 4: Classification of Soils based on FSR (adapted from Sridharan and Prakash 2000)

FSR	Soil Type	Swell Potential
≤1.0	Nonswelling	Negligible
1.0-1.5	Mixture of swelling and nonswelling	Low
1.5-2.0	Swelling	Moderate
2.0-4.0	Swelling	High
>4.0	Swelling	Very High

Additionally, ASTM D4829 (2003), "Standard Test Method for Expansion Index of Soils," provides a standardized method of determining the swell potential of soils based on the expansion index (EI_{50}). In order to determine the EI_{50} of a soil, a dried soil sample must first be mixed with distilled water to the approximate optimum moisture content and allowed to sit in an air-tight container for at least 16 hours. Then, the conditioned soil is compacted in a 4.01 inch diameter mold in two two-inch lifts using 15 well-distributed blows of a 5.5 lb, 2.00 inch diameter rammer dropped from a height of 12 inches. Once the sample degree of saturation (S) is measured to be within 40% to 60%, the sample is loaded into a consolidometer and consolidated

for 10 minutes under a load of 1.0 psi before the initial reading on the dial indicator is taken. The specimen is then inundated with distilled water while periodic readings of the dial indicator are made in accordance with test D2435 (2003) for 24 hours or until the rate of expansion becomes less than 0.0002 inches per hour. The EI of a soil is then defined as

$$EI_{50} = EI_{meas} - (50 - S_{meas}) \cdot \frac{65 + EI_{meas}}{220 - S_{meas}} \quad (3)$$

where S_{meas} = the degree of saturation measured in the test

and

$$EI_{meas} = \frac{\Delta H}{H_1} \cdot 1000 \quad (4)$$

where ΔH = the change in height ($D_2 - D_1$) of the sample, mm
H_1 = initial height, mm
D_1 = initial dial reading, mm
D_2 = final dial reading, mm

The shrink potential of soils is usually assessed based on that soil's shrinkage limit, which is outlined in ASTM D4943 (2002) and calculated according to equation 5:

$$SL = w - \left[\frac{(V - V_d) \cdot \rho_w}{m_s}\right] \cdot 100 \quad (5)$$

where w = moisture content of the soil at the time it was placed in the dish (%)
V = the volume of the wet soil pat = volume of the dish
V_d = volume of the dry soil pat
ρ_w = density of water
m_s = mass of the dry soil pat

However, CCRs are generally non-plastic and ASTM D4943 is only applicable when the soil is cohesive in nature. Based on the fact that CCRs generally have a uniform gradation it can be assumed that they would have a high shrinkage limit (Prakash and Sridharan, 2009).

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The collapse potential of a soil is the percent change in volume of a specimen after inundation. It is usually determined using oedometer tests and, as a result, can either be expressed mathematically in terms of height or void ratio, according to equation 6.

$$C_p = \frac{\Delta h}{h_0} = \frac{\Delta e}{(1 + e_0)} \tag{6}$$

where Δh = change in height of the specimen upon inundation
h_0 = the height of the specimen prior to inundation
Δe = change in void ratio of the specimen upon inundation
e_0 = void ratio of the specimen prior to inundation

Since collapse potential can change given different applied stress levels and overconsolidation states, there are any number of typical collapse potential values for a given soil, depending on the in-situ stress and the preconsolidation pressure of the soil. Generally, if the collapse potential is below 1%, there is no danger of collapse of soil structure (Mudhyannapu et al. 2008, Trivedi and Sud 2004).

It is important to note that collapse potential increases dramatically for some dry-disposed coal ashes when tested in a moist condition as opposed to a dry condition; even soils that classify as non-collapsible in a dry condition can become collapsible in a moist condition. This is due to the presence of soluble substances not present in the coal ashes disposed of using wet disposal methods (Trivedi and Sud 2004).

2.3 Hydraulic Conductivity

An important soil property for seepage calculations for earthen embankments is hydraulic conductivity. This is an especially important property for CCR surface impoundments, since they tend to be deposited in a meta-stable structure. In addition, the CCRs are often used to construct embankments as the surface impoundments are raised. Hydraulic conductivity of CCRs deposited in surface impoundments can display anisotropy as a result of its cyclic, lacustrine-style deposition. For engineering purposes, the hydraulic conductivity of both the compacted embankment material and the disposed CCR material will be of interest, as these values are used in erosion analyses. Table 5

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presents hydraulic conductivities of different types of CCRs from different countries as determined by various researchers. Due to the fact that there are different disposal methods for CCRs and different types of CCRs that are often co-disposed of, there is a wide variety of placement conditions, each of which can potentially create a different soil fabric and therefore a different range of hydraulic conductivities.

The CCRs were divided into two groups in order to assess variability in hydraulic conductivity: fly ash and surface impounded ash/bottom ash. This was done because oftentimes surface impounded ash is made up of both fly ash and bottom ash; this fact, coupled with its loose placement condition ensures hydraulic conductivity will be at the material's naturally highest value. Figures 7 and 8 are variability plots hydraulic conductivity of fly ashes and surface impounded ash/bottom ash from different countries, as determined by different researchers. It is important to note that not all researchers specified whether it fly ash tested was class c or class f (class c exhibits self-cementing properties); this fact could be a further contributor to the variability in values of hydraulic conductivity of fly ashes.

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Table 5: Values of hydraulic conductivity for different CCRs for different countries as determined by different researchers (adapted from Prakash Sridharan 2009)

Reference	Country	CCR Type	Testing Condition	k (cm/s)
Seals et al. (1972)	USA	BA	Relative density = 50%	5.0×10^{-3} to 0.094
McLaren and DiGioia (1987)		Class F FA	$\gamma_{d\,max_SP}$, $\gamma_{d\,max_MP}$	1.3×10^{-5}
		Class F FA	SI or poorly compacted	1.8×10^{-5}
		Class C FA	$\gamma_{d\,max_SP}$, $\gamma_{d\,max_MP}$	1.1×10^{-5}
Martin et al. (1990)		FA	$\gamma_{d\,max_SP}$	1.8×10^{-5} to 1.2×10^{-4}
		BA	$\gamma_{d\,max_SP}$	1.2×10^{-3}
Yudbhir and Honjo (1991)		Class C FA	$\gamma_{d\,max}$	1.0×10^{-7} to 2.0×10^{-7}
		Class F FA	$\gamma_{d\,max}$	2.0×10^{-6} to 6.0×10^{-5}
Glogowski et al. (1992)		Eastern US FA	-	1.9×10^{-5}
		Western US FA	-	3.1×10^{-5}
Site 1		SI	Undisturbed	1.1×10^{-3} to 1.7×10^{-2}
Site 3		FA-SI	Undisturbed	7.0×10^{-7} to 6.5×10^{-7}
		BA	Bulk Recompacted	2.3×10^{-6}
Site 4		FA-Comp.	Undisturbed	1.3×10^{-7} to 8.2×10^{-5}
		SI	Undisturbed	1.6×10^{-5} to 6.3×10^{-5}
Site 5		FA-Comp.	Undisturbed	1.5×10^{-5} to 8.0×10^{-4}
		SI	Undisturbed	4.8×10^{-6} to 4.0×10^{-4}
Pandian and Balasubramonian (1999)	India	FA	Compacted to 0.95 $\gamma_{d\,max}$ and saturated	1.4×10^{-5} to 4.2×10^{-4}
Kaniraj and Gayathri (2004)		FA	$\gamma_{d\,max}$	4.7×10^{-6} to 6.0×10^{-6}
Prakash and Sridharan (2009)		FA	Compacted at $\gamma_{d\,max}$ and saturated	8.0×10^{-6} to 1.9×10^{-4}
		SI	-	5.0×10^{-5} to 9.6×10^{-4}
		BA	-	9.9×10^{-5} to 7.1×10^{-4}
Jakka et al. (2010)		FA	loose	7.0×10^{-7} to 2.1×10^{-6}
		FA	dense	3.5×10^{-7} to 9.4×10^{-7}
		BA	loose	6.0×10^{-6} to 1.3×10^{-5}
		BA	dense	1.4×10^{-6} to 3.7×10^{-6}
Indraratna et al. (1991)	Thailand	Class C FA	$\gamma_{d\,max_SP}$	4.0×10^{-7} to 7.0×10^{-7}
		Class C FA	$\gamma_{d\,max_SP}$, 2 weeks curing	$<10^{-7}$
Gray and Lin (1972)	UK	FA	$\gamma_{d\,max}$	5.0×10^{-7} to 8.0×10^{-5}
Porbaha et al. (2000)	Japan	FA	Slurry (e_i = 0.85 to 1.02)	10^{-5} to 10^{-4}
Skarzynska et al. (1989)	Poland	SI	-	1.5×10^{-5} to 5×10^{-5}
Chan et al. (1986)	Canada	FA	in situ	10^{-7} to 10^{-4}
		BA	-	4.8×10^{-4} to 3.4×10^{-3}
Gitari et al. (2009)	South Africa	FA	Air flush core samples, constant head	4.6×10^{-5} to 6.9×10^{-5}
		BA	Air flush core samples, constant head	8.1×10^{-5} to 4.9×10^{-4}
		FA/BA Dry Dump	Field Slug Tests	2.3×10^{-5} to 9.6×10^{-3}

Note: FA = fly ash; SI = surface impoundment ash; BA = bottom ash; OMC = optimum moisture content; e_i = initial void ratio; FA-SI = surface impounded fly ash; FA-DS = dry-stacked fly ash; FA Comp. = field-compacted fly ash

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Figure 7: Variability plot of the hydraulic conductivity of fly ashes from different countries, as determined by different researchers.

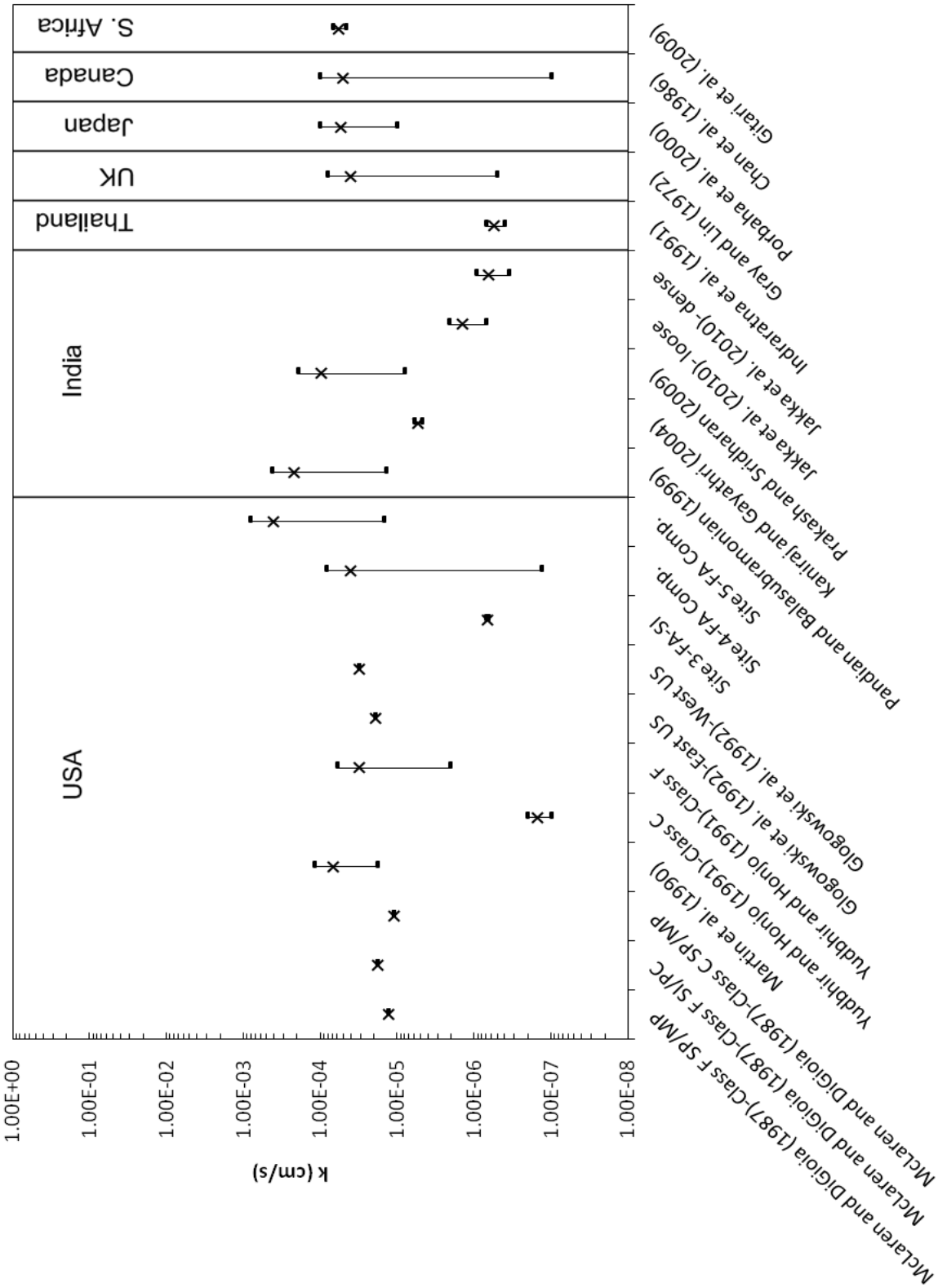


Figure 7: Variability plot of the hydraulic conductivity of fly ashes from different countries, as determined by different researchers.

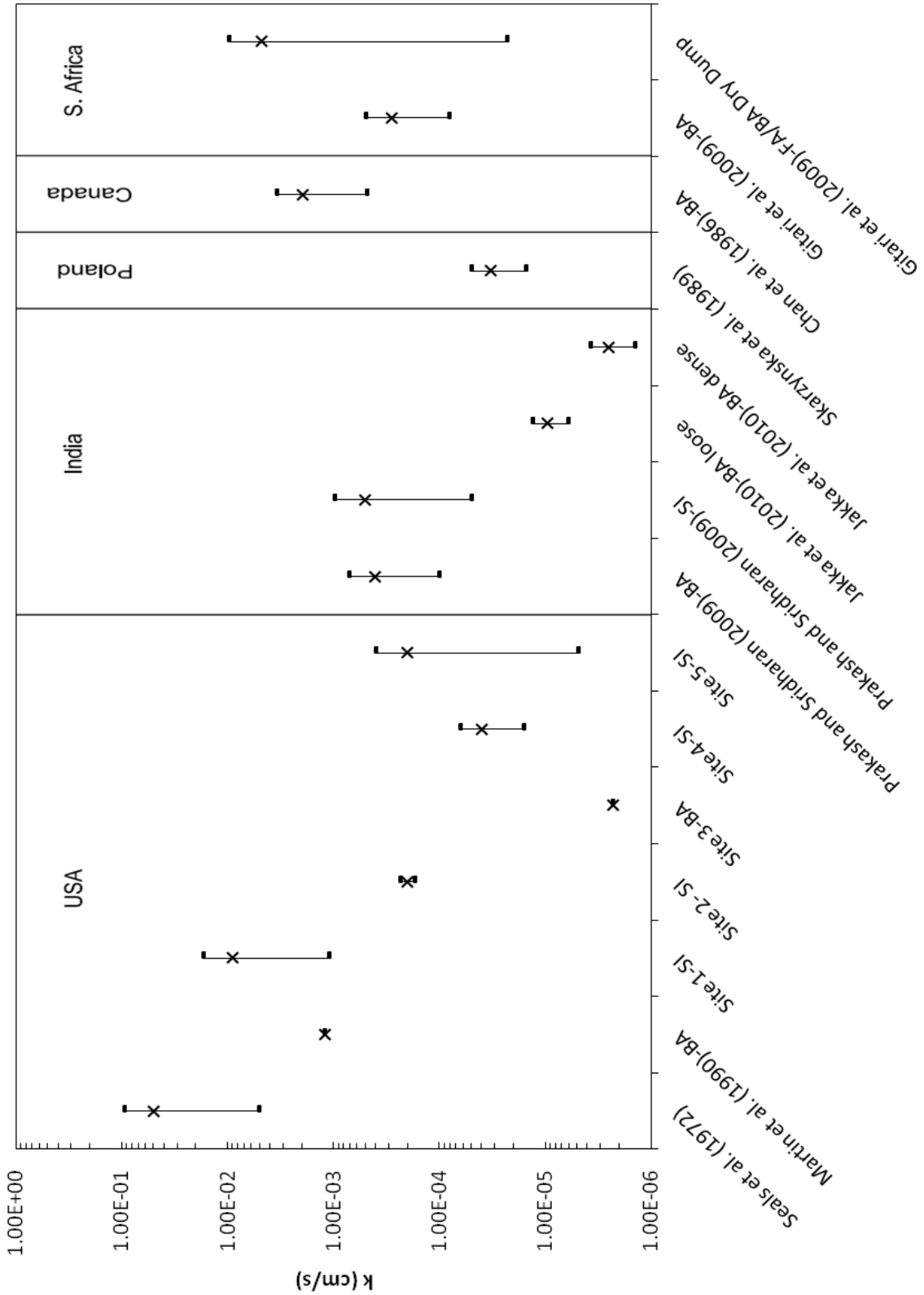


Figure 8: Variability plot of the hydraulic conductivity of surface impounded ashes and bottom ashes from different countries, as determined by different researchers.

2.4 Shear Strength

X-ray diffraction studies indicate that CCRs do not contain any of the clay minerals responsible for the cohesive portion of shear strength in soils (Trivedi and Singh 2004a, Trivedi and Singh 2004b, Ward and French 2005), which means that CCRs must derive their strength entirely from the frictional interaction between ash particles. Through the use of a scanning electron microscope (SEM), it is possible to study the morphological characteristics of coal ash particles and get an idea of their angularity, which would in turn offer clues as to the source of their frictional strength. As shown in Figures 9 and 10, bottom ash is much more angular than fly ash. In general, this can be associated with higher friction angles than fly ash at low confining stresses, which is usually the case. At high confining stresses, the higher angularity could lead to more particle breakage for bottom ash, and consequently to a larger degradation of their frictional resistance.

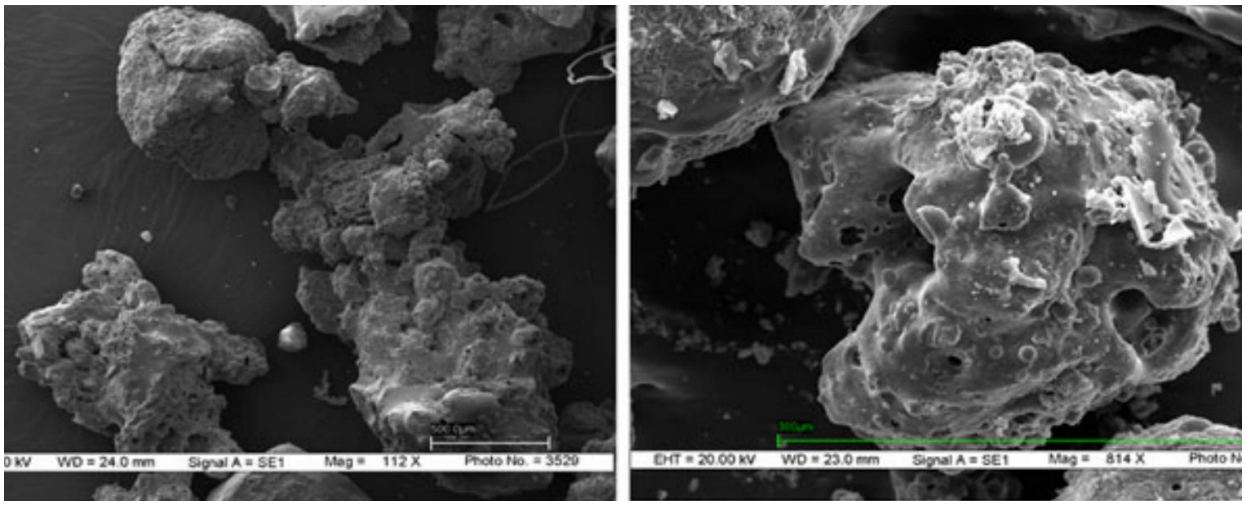


Figure 9: Micrographs of bottom ash particles magnified 112 and 373 times (Jakka et al. 2010)

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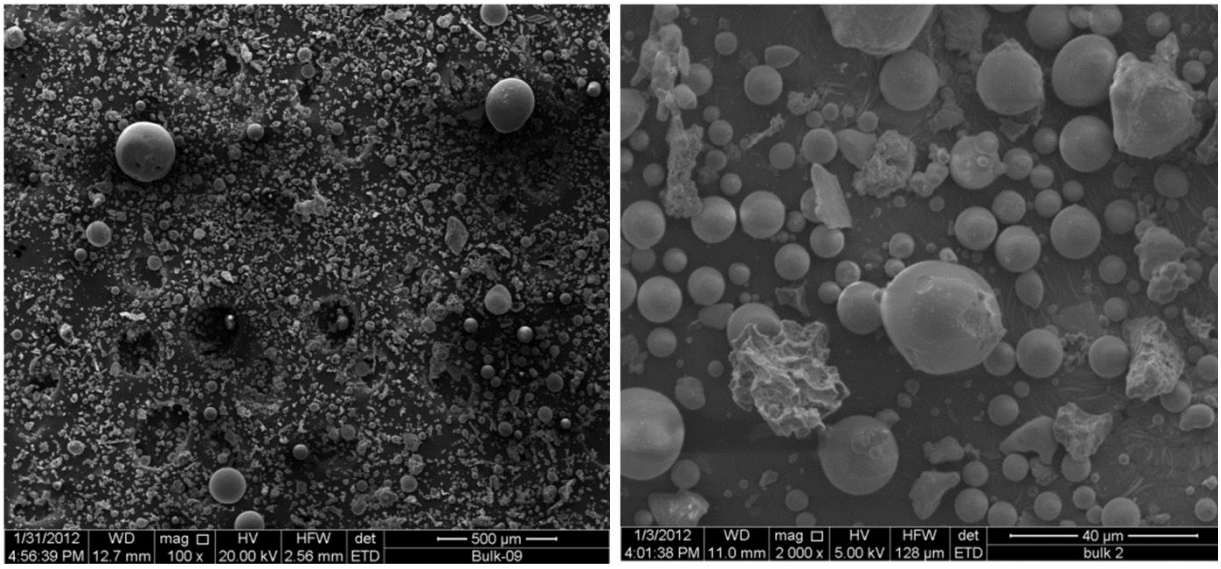


Figure 10: Micrographs of fly ash magnified 100 and 2,000 times (courtesy of Kevin Foster).

Shear strength parameters can be determined using several different laboratory test procedures. For CCRs, the most commonly performed tests are the direct shear test, consolidated drained triaxial test, and the consolidated undrained triaxial test. While the consolidated undrained triaxial test provides both effective and total stess strength parameters, most researchers only report effective strength parameters. This is undoubtedly because the rate of loading because of disposal is usually small enough that pore pressure dissipations are able to complete prior to the next disposal cycle; additionally, total strength parameters from CU tests can be misleading because of their dependence on the value of backpressure at which the specimen is sheared. Tables 6 through 8 report shear strength parameters of different CCRs from direct shear, consolidated drained, and consolidated undrained tests, respectively, reported in different studies. Figures 11 through 13 provide variability plots for the effective stress friction angles determined by various studies, compared on the basis of test type. Figures 14 through 16 provide variability plots on the basis of CCR type, while Figure 17 is a variability plot for the total stress parameters for all types of CCRs, since these parameters are not always reported. Variability plots were not made for values of cohesion since CCRs are usually reported to be non-plastic and the cohesions reported were either apparent cohesions of compacted, unsaturated samples or of samples that may have had self-cementing properties that would not be common to

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all disposed CCR materials. All acronymns used with the variability plots are consistent with those used in the Tables; for the Figures 14 through 16, DS, CD, and CU designate "direct shear test," "consolidated drained triaxial test," and "consolidated undrained triaxial test," respectively.

Table 6: Shear strength parameters determined by different researchers using the direct shear test.

Reference	Country	CCR Type	Condition	ϕ'_p (°)	c'_p (psf)
Kim & Prezzi (2008)	USA	FA	Comp. DoO	32.9-35.8	100-403
		FA	Comp. WoO	31.7-34.4	104-380
		FA	Comp. Sat.	30.2-34.5	58-276
Site 5		SI	Comp. Sat.	26.8-42.2	0
		SI	Undisturbed	23.4-35.4	0
Pandian (2004)	India	FA	Loose Dry	29.0-36.0	-
		SI	Loose Dry	29.0-34.0	-
		BA	Loose Dry	32.0-34.0	-
		FA	Loose Sat.	27.0-37.0	-
		SI	Loose Sat.	25.0-40.0	-
		BA	Loose Sat.	30.0-37.0	-
		FA	Comp.	28.0-42.0	205-819
		SI	Comp.	29.0-38.0	328-1024
		BA	Comp.	30.0-37.0	205-410
		FA	Comp. Sat.	28.0-41.0	-
		SI	Comp. Sat.	29.0-36.0	-
		BA	Comp. Sat.	30.0-37.0	-
Prakash &Sridharan (2009)		FA	Loose	29.0-33.0	-
		SI	Loose	30.0-33.0	-
		BA	Loose	31.0-34.0	-
		FA	Comp.	32.0-37.0	334-543
		SI	Comp.	30.0-33.0	272-334
		BA	Comp.	31.0-34.0	209-397
		FA	Comp. Sat.	32.0-35.0	0
		SI	Comp. Sat.	29.0-32.0	0
		BA	Comp. Sat.	30.0-33.0	0
Kolay & Kismoor (2009)	Malaysia	FA	Comp. Sat.	30.6-34.9	162-168
		SI	Comp. Sat.	26.2	70
		BA	Comp. Sat.	26.6	3.0-14
Muhardi et al. (2010)		FA	Comp.	23.0	251
		FA	Comp. Sat.	26.0	63
		BA	Comp.	32.0	79
		BA	Comp. Sat.	31.0	0

Note: ϕ'_p = peak effective friction angle; c'_p = peak effective cohesion; Comp. = compacted; Sat. = saturated; DoO = Dry of Optimum; WoO = Wet of Optimum

Table 7: Shear strength parameters determined by different researchers using the consolidated drained triaxial test.

Reference	Country	CCR Type	Condition	RC (%)	ϕ' (°)	c' (psf)
Kim & Prezzi (2008)	USA	FA	Reconst.	95	33.5-47.1	0
		FA	Reconst.	90	27.9-37.9	0
Site 5		SI	Reconst.	-	27.1-31.0	0
Pandian (2004)	India	FA	Reconst.	100	33.0-37.0	418-1942
		FA	Reconst.	100	33.0-43.0	0
Prakash &Sridharan (2009)		FA	Reconst.	95	33.0-43.0	0
Jakka et al. (2010)		FA	Reconst.	-	32.9-37.0	0
		BA	Reconst.	-	33.7-41.7	0
Muhardi et al. (2010)	Malaysia	FA	Reconst.	-	41.0	522
		BA	Reconst.	-	46.0	0
Indraratna et al. (1991)	Thailand	FA	Reconst.	-	26.0	731
		FA	Reconst. Pozz.	-	36.0	37594

Note: Reconst. = reconstituted; Pozz. = pozzolanic curing allowed to occur

Table 8: Shear strength parameters determined by different researchers using the consolidated undrained triaxial test.

Reference	Country	CCR Type	Condition	RC (%)	ϕ (°)	c (psf)	ϕ' (°)	c' (psf)
Site 1	USA	SI	Undist.	-	11.1-19.5	0-950	25.2-33.0	90-190
Site 2		SI	Undist.	-	12.0-45.5	640-2580	31.8-32.1	0-140
Site 3		FA	Reconst.		-	-	36.0	14.3
		SI	Undist.	-	-	-	39.6	0
		BA	Reconst.		-	-	41.0-44.0	0-261
Site 4		FA	DS, Undist.	-	3.4-37.7	200-1900	28.7-36.7	0-400
		SI	Undist.	-	18.3-27.4	400-1600	29.5-38.6	0-740
Prakash &Sridharan (2009)	India	FA	Reconst.	95	20.0-41.0	0	26.0-39.0	334-2005
		SI	Reconst.	95	25.0-34.0	0-1170	28.0-36.0	585-2109
		BA	Reconst.	95	24.0-35.0	0-564	24.0-35.0	585-1149
Jakka et al. (2010)		FA	Reconst.	-	-	-	22.3-38.5	0
		BA	Reconst.	-	-	-	32.2-42.6	0
Muhardi et al. (2010)	Malaysia	FA	Reconst.	-	41.0	710	-	-
		BA	Reconst.	-	44.0	0	-	-
Indraratna et al. (1991)	Thailand	FA	Reconst.	-	20.0	0	26.0	0

Note: Undist. = undisturbed; Reconst. = reconstituted; DS = dry-stacked in field

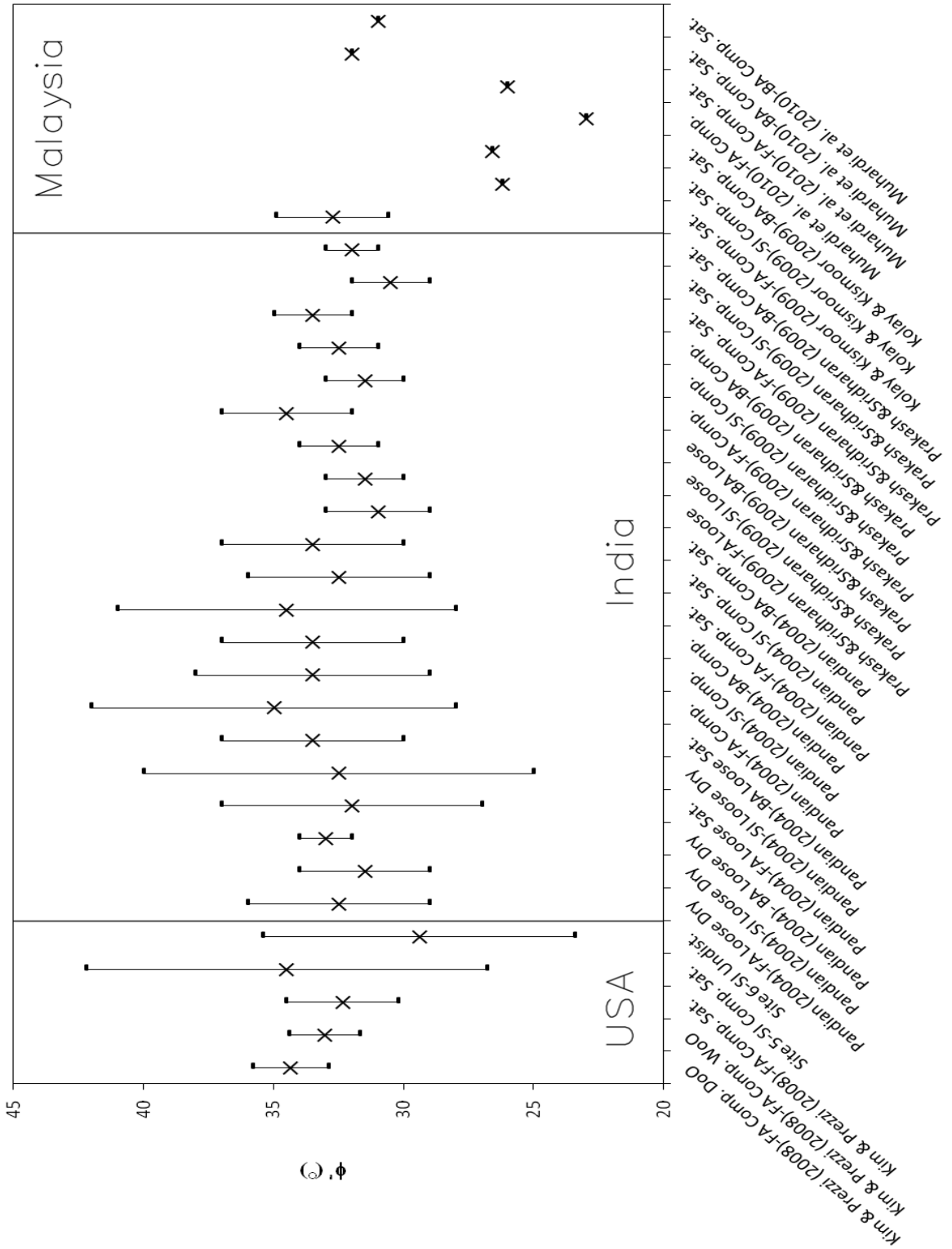


Figure 11: Variability plot of effective stress friction angle of various CCRs as determined by different researchers using the direct shear test.

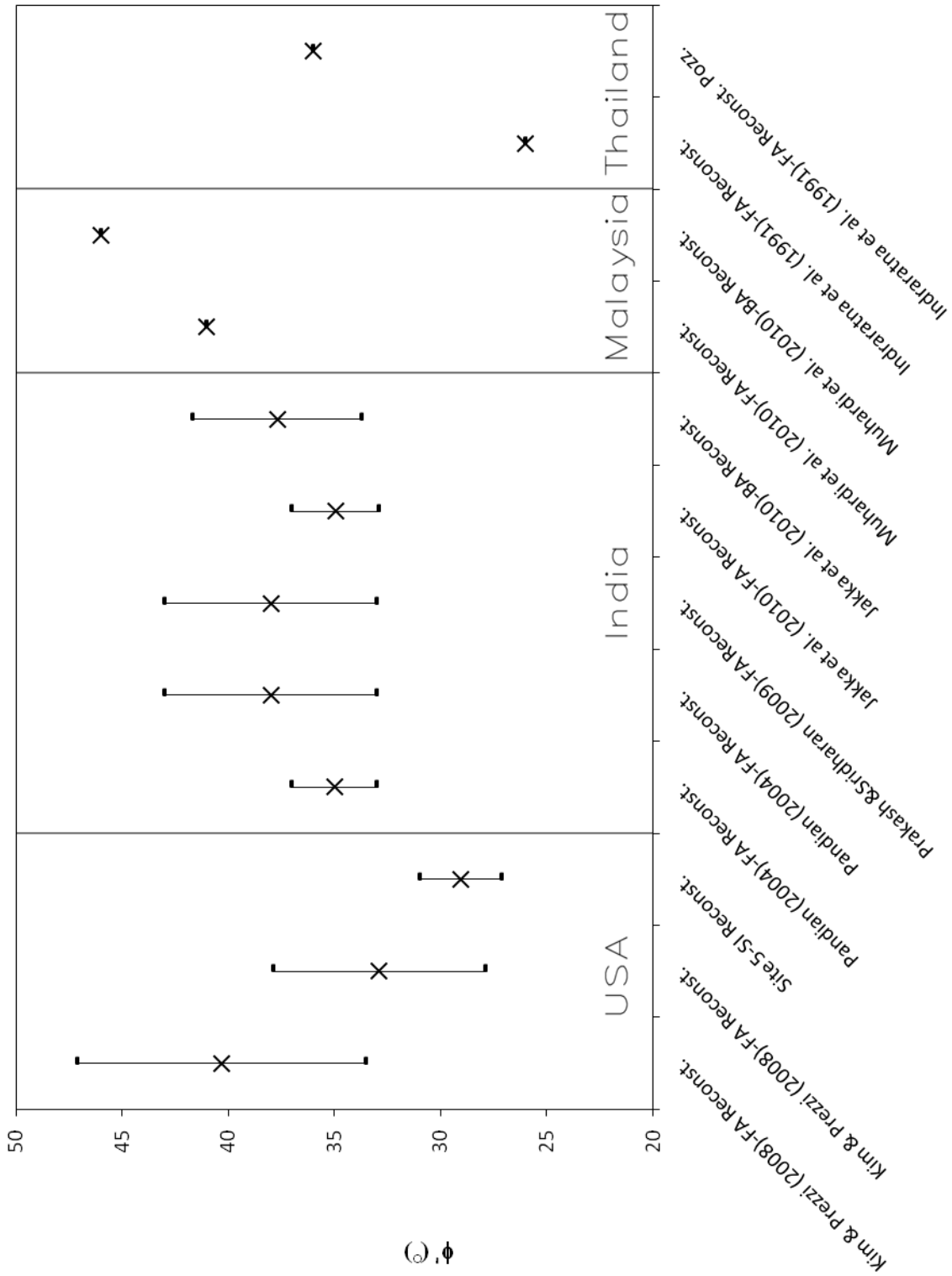


Figure 12: Variability plot of the effective stress friction angle of various CCRs as determined by different researchers using the consolidated drained triaxial test.

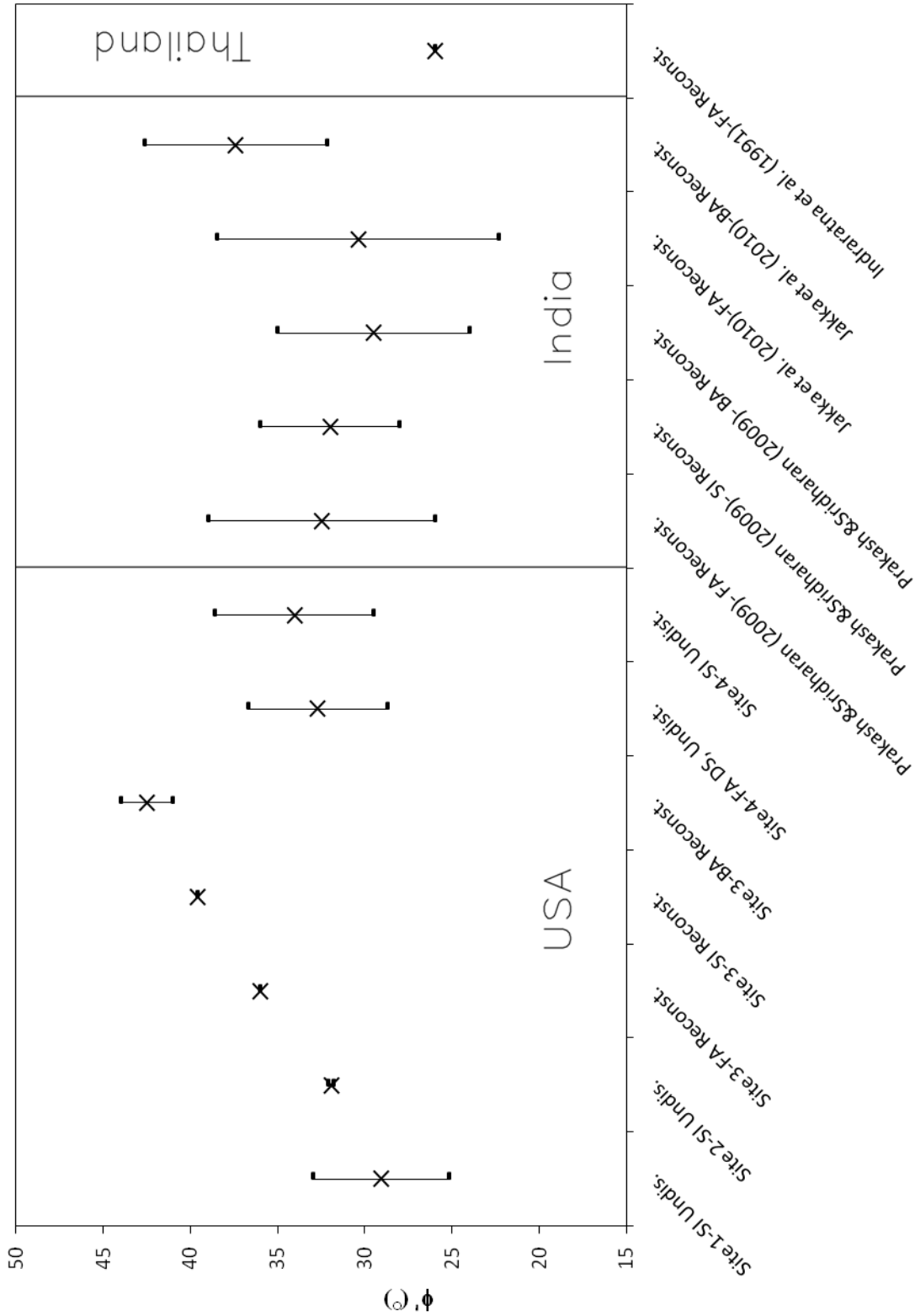


Figure 13: Variability plot of the effective stress friction angle of various CCRs as determined by different researchers using the consolidated undrained triaxial test.

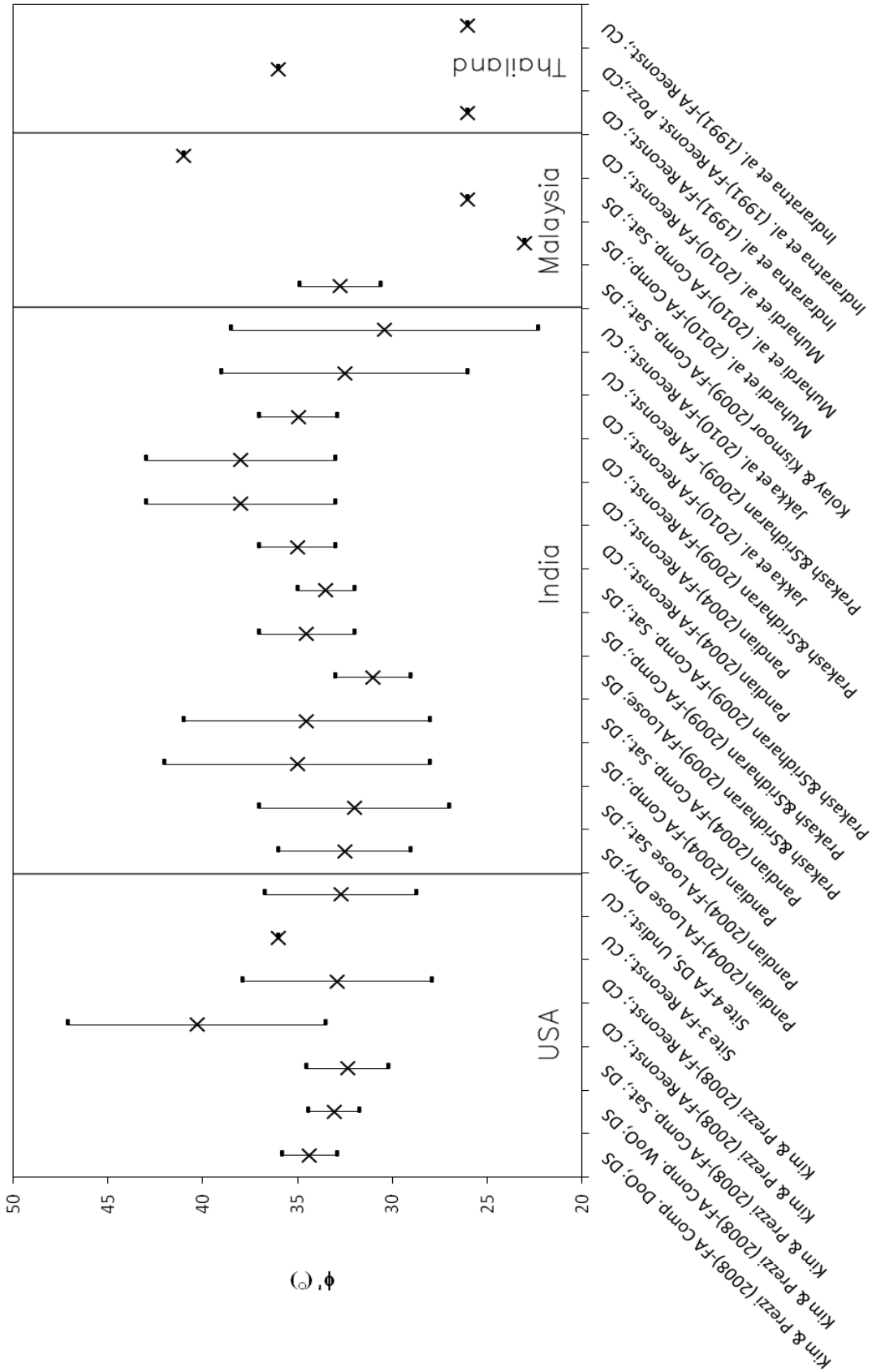


Figure 14: Variability plot of the effective stress friction angle of fly ashes for all shear strength tests performed by various researchers.

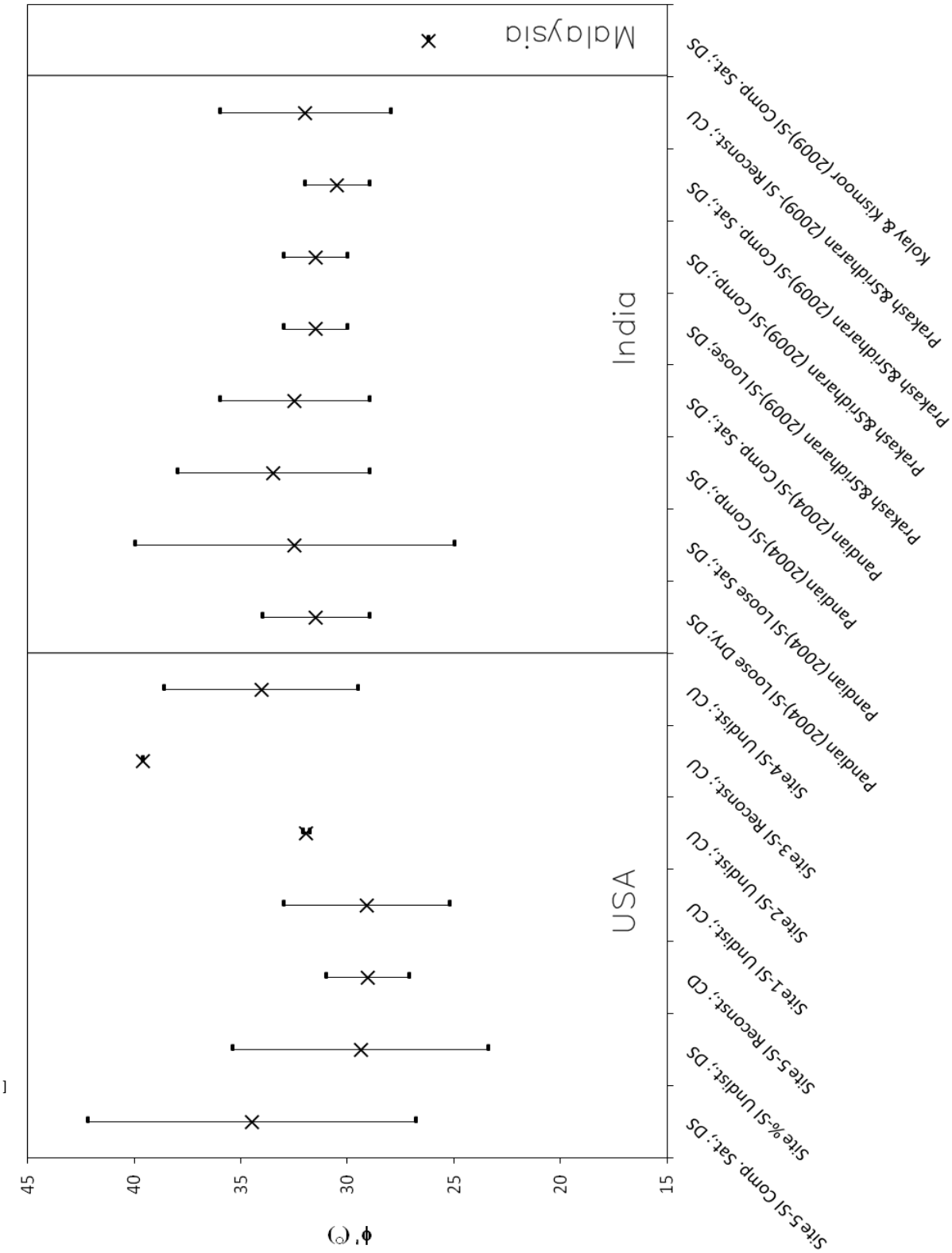


Figure 15: Variability plot of the effective stress friction angle of surface impounded ashes for all shear strength tests performed by various researchers.

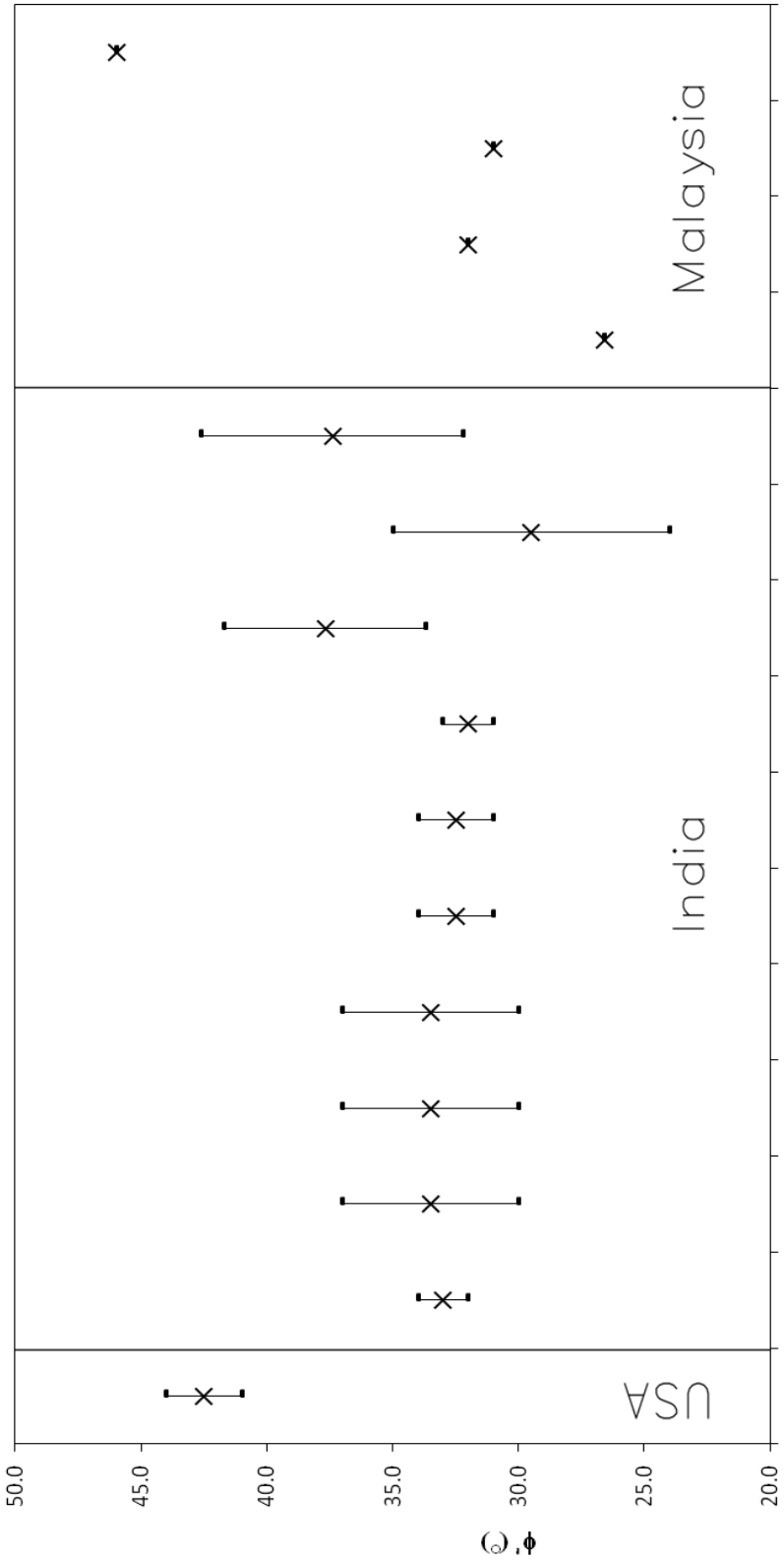


Figure 16: Variability plot of the effective stress friction angle of bottom ashes for all shear strength tests performed by various researchers.

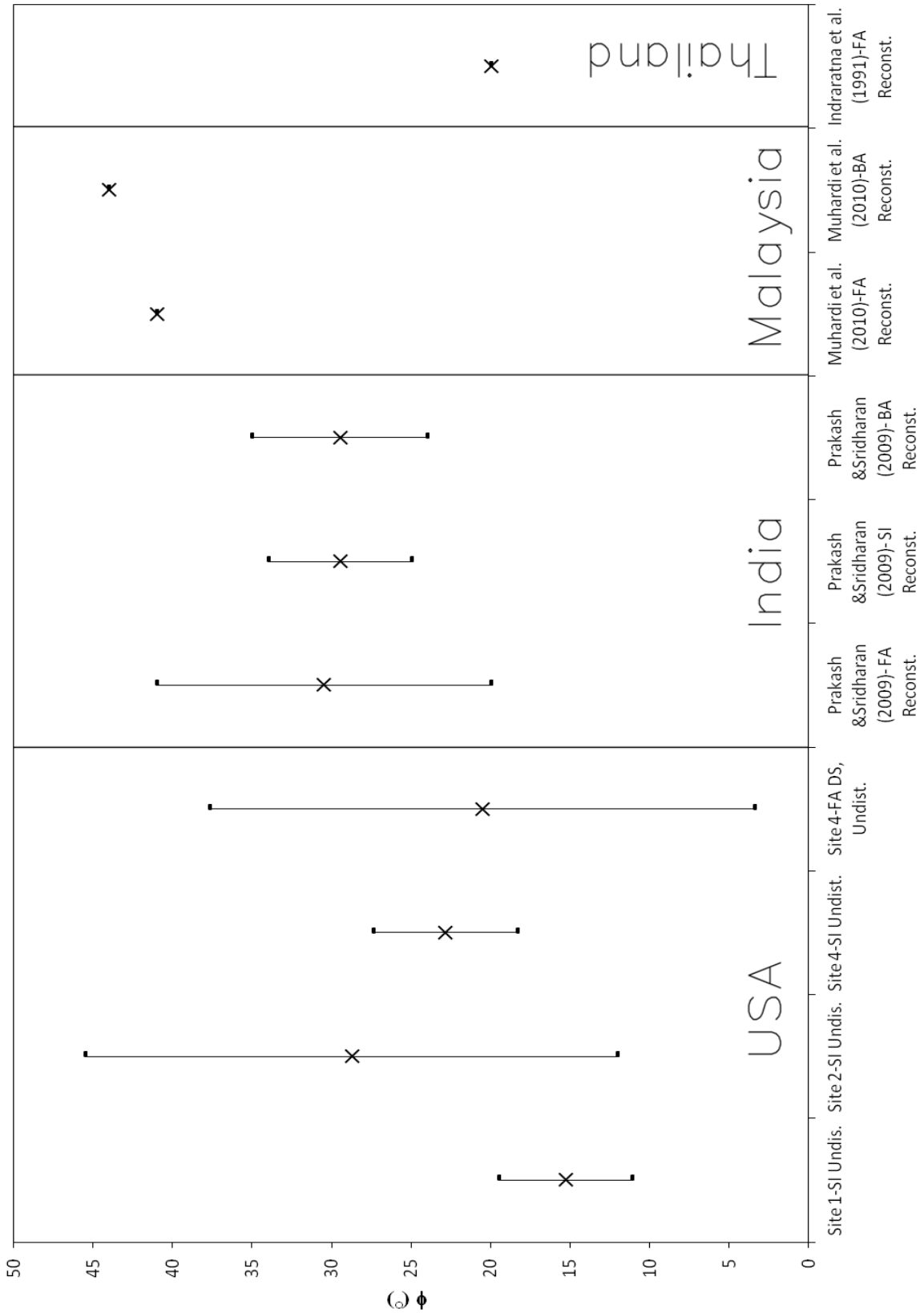


Figure 17: Variability plot of the total stress friction angle of all CCRs as determined by consolidated undrained triaxial tests performed by various researchers.

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2.5 Compaction Characteristics

Since CCRs are often used in the construction of embankments for CCR disposal areas, an understanding of their compaction characteristics is necessary to control stability and seepage of the CCR disposal areas. A unique consideration when studying the compaction characteristics of CCRs is their generally low specific gravity. Since CCRs tend to have lower specific gravities and higher air voids than natural soils, their maximum dry density tends to be lower and their optimum moisture content higher than most natural soils (Bera et al. 2007, Prashanth et al. 1999, Trivedi and Singh 2004a). Trivedi and Singh (2004a) associate the high optimum water content of CCRs with the porous nature of the particles; most of the water is absorbed by the particles at lower water contents such that the particles are not workable until higher moisture contents. The lower dry density and higher corresponding water contents of CCRs results in a compaction curve that appears "flatter" than those of most natural fine-grained soils, as shown in Figure 18. The "A-Z soils" included in the plots for comparison are for natural soils from Ohio, as published by J. G. Joslin in the proceedings of the 1958 ASTM Symposium on Soil Testing in Highway Design and Construction.

Bera et al. (2007) also developed empirical models to predict the maximum dry density and optimum moisture content of a specific surface impounded ash, as long as both of these values are known for the standard proctor test:

$$MDD_E = 1.60783 \cdot MDD_{proc} + 1.85727\left(\frac{E}{E_{proc}}\right) - 6.89047 \quad (7)$$

$$OMC_E = 1.73090 \cdot OMC_{proc} - 9.01750\left(\frac{E}{E_{proc}}\right) - 25.33520 \quad (8)$$

where MDD_E = maximum dry density at a given applied energy
MDD_E = maximum dry density for a proctor test
E = amount of energy input for given condition
E_{proc} = amount of energy input for a proctor test
OMC_E = optimum moisture content for a given applied energy
OMC_{proc} = optimum moisture content for a proctor test

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It should be noted, however, that these relationships were developed using test data from Indian CCRs. Therefore, before using these relationships, it should be verified that they apply to the specific CCRs in question.

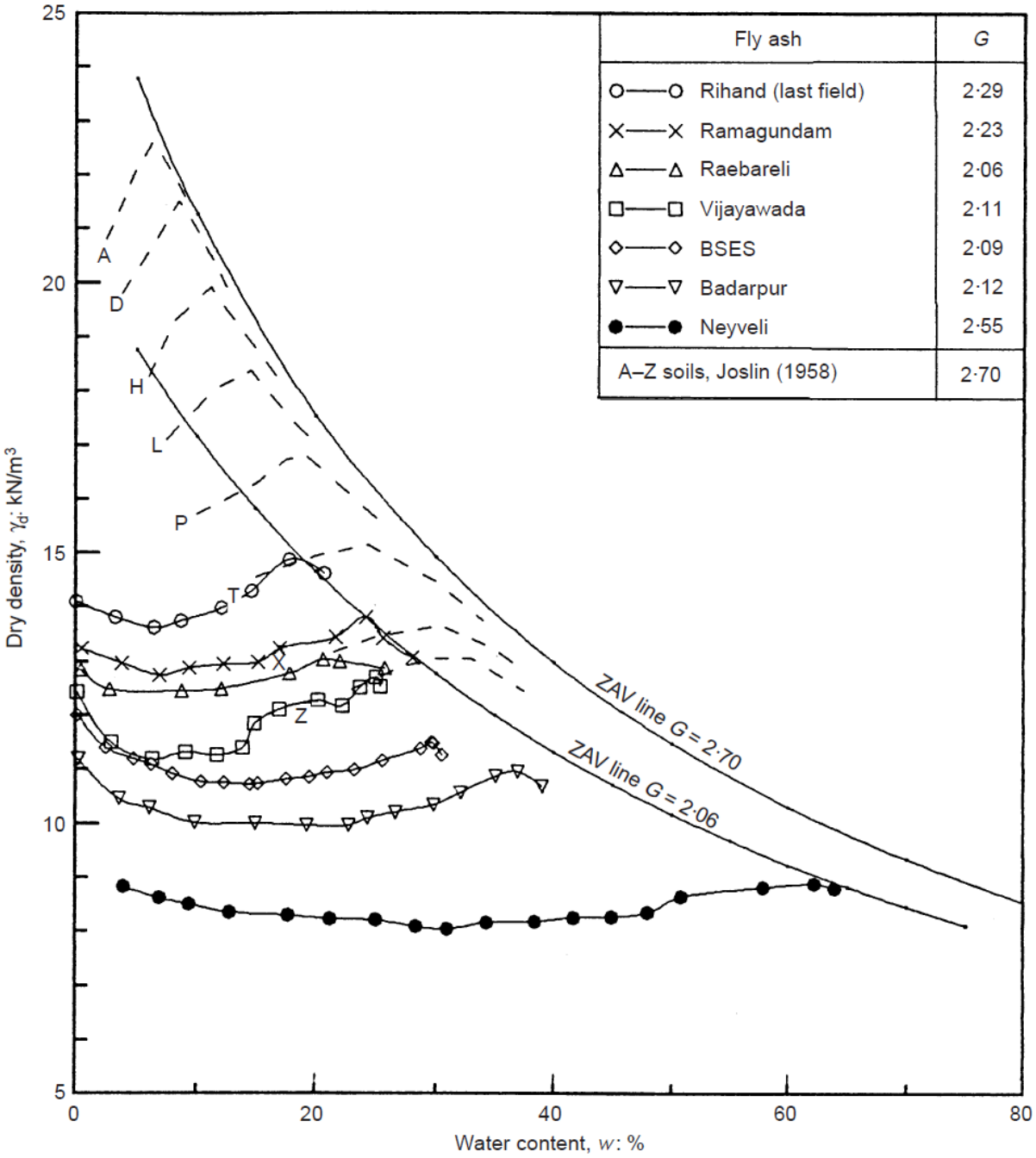


Figure 18(a): Compaction curves for different Indian fly ashes compared to those for several natural soils (Sridharan et al. 2001)

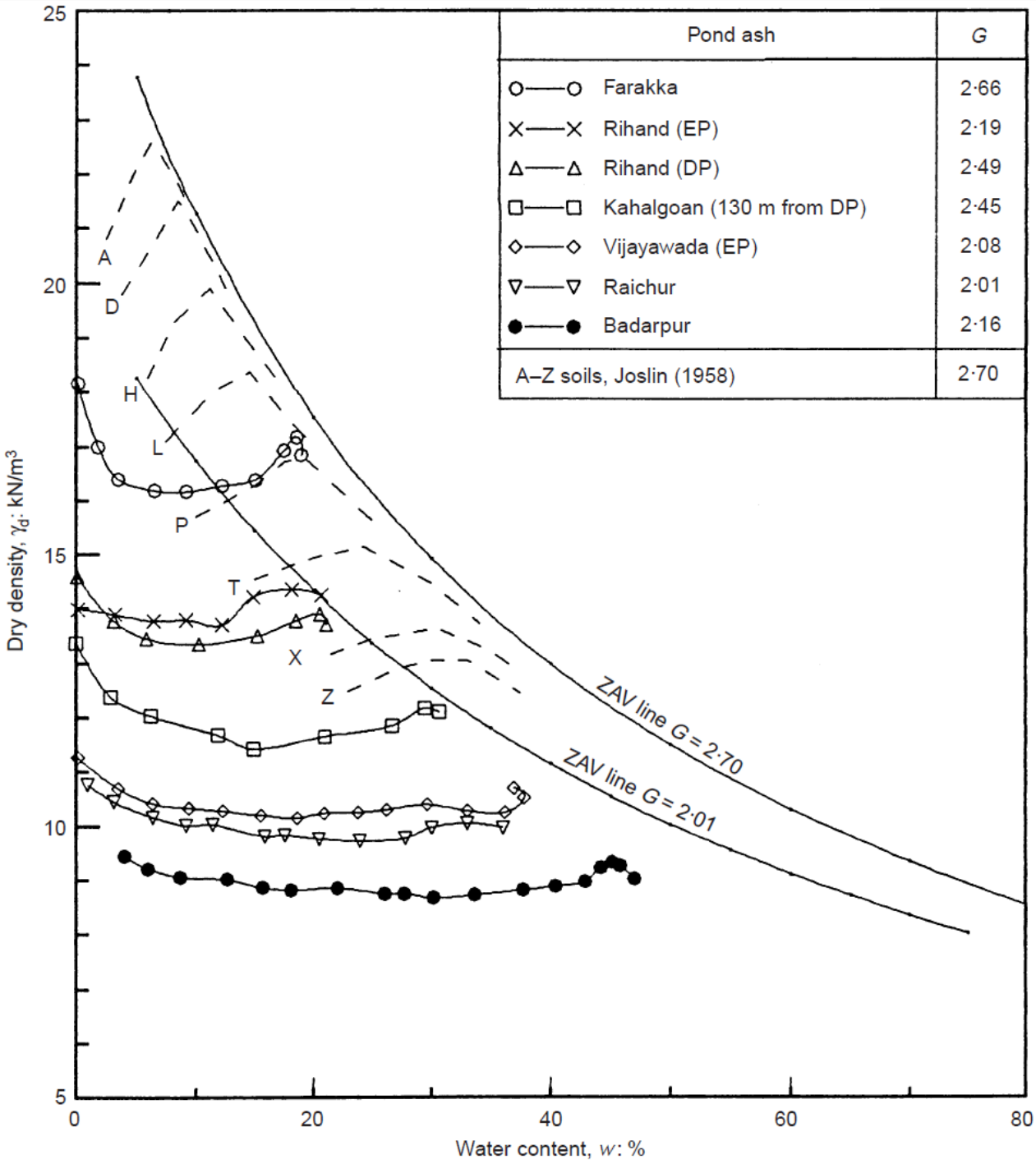


Figure 18(b): Compaction curves for different Indian surface impoundment ashes compared to those for several natural soils (Sridharan et al. 2001)

In Figures 17(a) and 17(b), the CCRs sometimes have a higher dry density at a dry condition (w = 0%). This is not a practical condition to use in construction or disposal situations, however, as there would be considerable dust pollution during placement (Sridharan et al. 2001).

Chapter 3

Dynamic Properties of CCRs

Regardless of the fact that CCRs are often composed of mostly fine-grained particles, they are still granular, non-plastic particles that exhibit no cohesion other than apparent cohesion in the moist state (Kaniraj and Gayathri 2004, Prakash and Sridharan 2009). Based on their grain-size, many CCRs could be classified as fine-grained soils, (which are commonly considered to have a lower liquefaction potential), but since these CCRs are also generally non-plastic, they have the potential of being liquefaction-prone. Liquefaction potential of CCRs is higher in the case of impounded CCRs, since these tend to exist at a saturated or nearly saturated state in-situ (and saturation is a necessary condition for liquefaction). In addition, the high moisture contents imply that impounded CCRs will have no negative pore pressures to help stabilize the soil mass under dynamic loading. Furthermore, the generally metastable structure of impounded CCRs makes their dynamic properties of great importance, even at low intensities of shaking. There have been a limited number of publications on the dynamic properties of CCRs; while this section presents and discusses currently published information on the dynamic properties of CCRs, there is still a need for further research in this area.

3.1 Cyclic Shear Strength Properties of CCRs

The most common laboratory test used to assess the dynamic properties of soils is the cyclic triaxial shear test. Cyclic triaxial testing apparatuses are expensive and provide very specific results, so very few commercial consultant firms own or even have access to them. Therefore,

cyclic triaxial testing has traditionally been done at the academic level and has seen little use in commercial consulting. Given the specialized nature of the cyclic triaxial test, there is limited research published on the cyclic triaxial properties of CCRs. Since the cyclic shear strength properties of CCRs is a very specific topic, the research available on this topic is from academics of varied nationalities, all of whom have slightly different methods of analyzing the raw data; as a result, comparing results can be difficult.

Despite differences in how to analyze and present cyclic triaxial test results between researchers, it is useful to compare results using fundamental parameters of cyclic response, such as plots of excess pore pressure (usually excess pore pressure ratio) versus number of loading cycles, or plots of the cyclic stress ratio ($CSR=\sigma_d/2\sigma_{3c}'$) versus number of loading cycles, which represents a measure of how the shear strength of the material in question degrades with cyclic loading. Figures 19 and 20 present some typical plots comparing excess pore pressures to the number of cycles to initial liquefaction, and Figures 21 through 23 present plots of CSR versus number of loading cycles to liquefaction (generally defined as 5% double-amplitude axial strain) for different surface impounded CCRs at different confining stresses and relative densities.

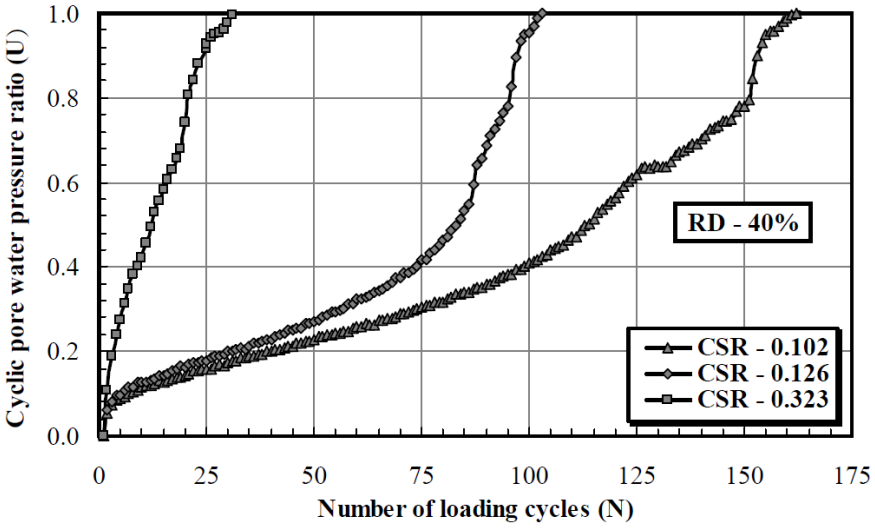


Figure 19: Plot of excess pore pressure ratio versus number of loading cycles for compacted Indian surface impoundment ash at different cyclic stress ratios and 1 Hz loading frequency (Mohanty et al. 2010).

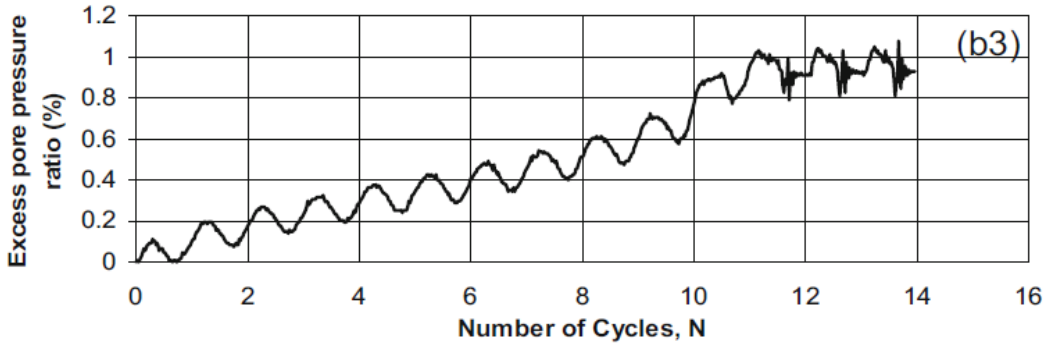


Figure 20: Plot of excess pore pressure ratio versus number of loading cycles for compacted Indian surface impoundment ash at a cyclic stress ratio of 0.10 and confining pressure of 2214 psf and 0.1 Hz loading frequency (Jakka et al. 2010)

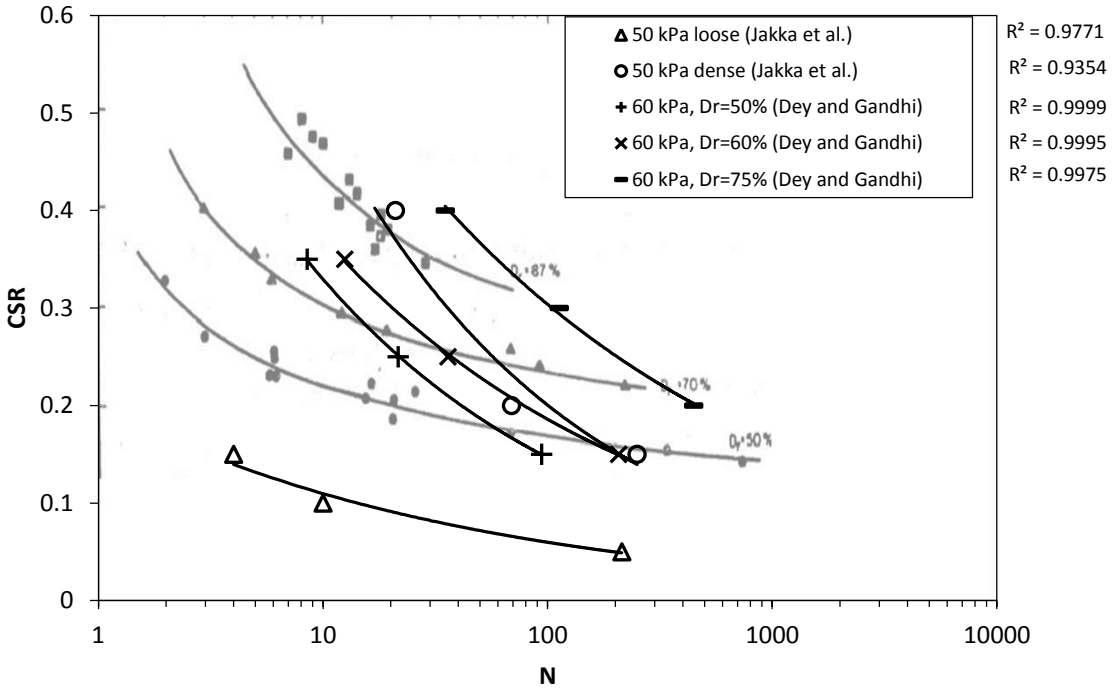


Figure 21: Plot of CSR versus number of loading cycles to liquefaction for different surface impounded CCRs tested by different researchers at confining stresses close to 50 kPa. Jakka et al. loaded specimens at 0.1 Hz to 1 Hz and Dey and Gandhi loaded specimens at 1 Hz. For comparison, curves for sands tested at the same confining pressure are superimposed (Mulilis et al 1976).

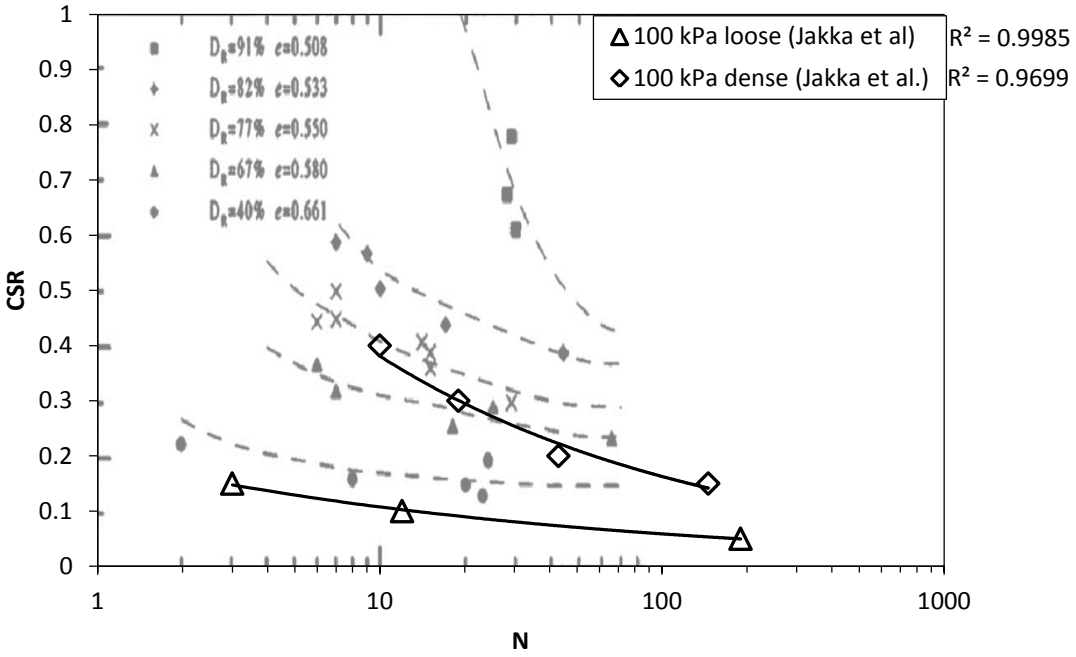


Figure 22: Plot of CSR versus number of loading cycles to liquefaction for surface impounded CCRs tested by Jakka et al (2010) at a confining pressure of 100 kPa. For comparison, curves for C778 sand at the same confining pressure are superimposed (Carraro et al 2003).

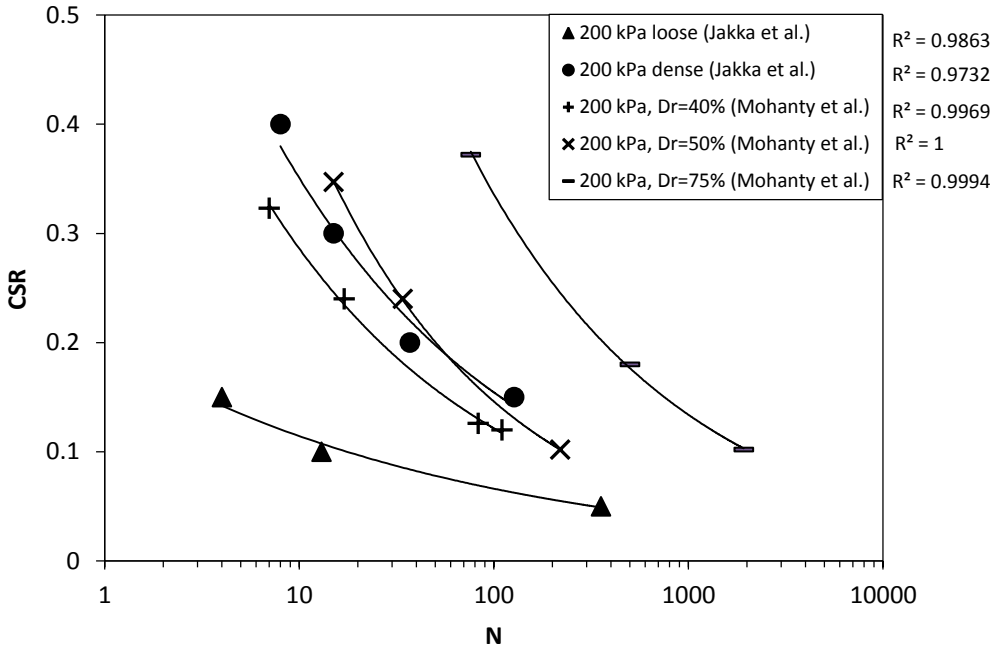


Figure 23: Plot of CSR versus number of loading cycles to liquefaction for different surface impounded CCRs tested by different researchers at 200 kPa confining stress. Jakka et al. loaded specimens at 0.1 Hz to 1 Hz and Mohanty et al. loaded specimens at 1 Hz.

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For the two plots of CSR versus number of cycles to initial liquefaction where results for surface impounded CCRs are compared to tests done on sands, it is apparent that the CCRs tested tend to be more resistant to liquefaction than natural sands at higher CSRs, but less resistant to liquefaction at lower CSRs. As more cyclic triaxial tests are run on surface impounded CCRs, it will be more apparent as to whether this is an actual trend, or just an apparent trend in these three studies.

Lastly, many researchers include a plot of the hysteresis loops for a cyclically-tested triaxial sample. This is simply a plot of the deviator stress versus the axial strain through a single load cycle, at which point the plot begins again, creating a nearly-symmetrical shape about the origin of the plot. The area contained within all of these loops represents the cumulative energy dissipated by the soil being tested (Yoshimoto et al. 2006). The cumulative dissipated energy method was used by Towhata and Ishihara (1985) in order to analyze cyclic shear behavior and liquefaction strength of soils. Figure 24 shows a diagram illustrating the dissipation energy contained within a hysteresis loop.

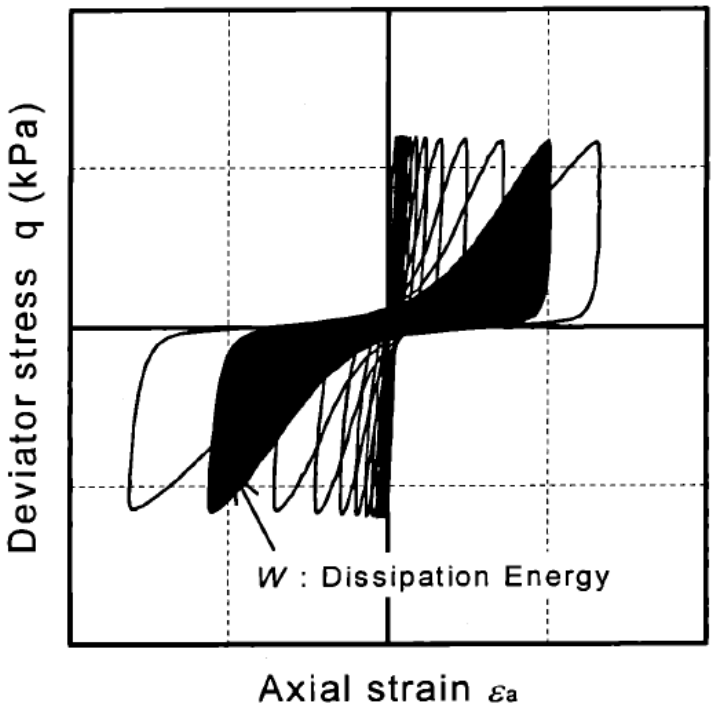


Figure 24: Example of how to determine the energy dissipated by a soil throughout a single loading cycle (Yoshimoto et al. 2006).

Chapter 4

CCR Failure Modes and Monitoring Practices

The critical failure mode for a CCR impoundment is not necessarily the same as for a CCR landfill, since differences in placement techniques for each have a significant effect on the fabric and shear strength properties of the CCRs. Determining the failure modes and developing monitoring practices for CCR impoundments can be done using the same methods as for mine tailings dams because of their similar structure. CCR landfills can be monitored much like any other earthen embankment (with material properties being the major difference), except that unlike most embankments, there is no end of construction until the landfill is retired.

4.1 Surface Impoundments

The observational method is a method of risk management outlined by Dr. Ralph Peck as the process of making design adjustments based on observed behavior in a given structure. The design can be adjusted to be either more or less conservative in order to optimize design (Martin and Davies 2000). This method of risk management is ideal for use with tailings dams since tailings dams are continuously constructed until they are retired; the same is true of CCR surface impoundments, which indicates that such methods could easily be applied to CCR surface impoundment monitoring programs. Figure 25 is a flow chart illustrating the risk management process utilizing the observational method, as applied to tailings dam design; however, the

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process is general enough that the same or a slightly modified flow chart could be used for surface impounding ash structures.

Another important consideration when developing a monitoring plan for surface impoundments is whether the dikes were constructed using the upstream or downstream methods, since use of the upstream method can lead to weaker dike foundations and an increased probability of sudden or catastrophic failure (Martin and Davies 2000). The upstream construction method consists of constructing the dike of a new phase of a disposal area partly on the top of the previous phase dike and partly on the upstream disposed material; contrarily, the downstream construction method consists of constructing the new phase dike partially on the previous phase dike and partially on land downstream of the disposal area. Figure 26 illustrates that the weaker foundations of mine tailings constructed using the upstream method is evident based on the prevalence of certain failure modes for upstream tailings dams as compared to other types of tailings dams (slope failure and earthquake failure constitute 59% of failure modes for upstream tailings dams, compared to 24% for other types of tailings dams).

Taking all of these factors into consideration, a sample surveillance plan schedule for a mine tailings impoundment is provided in Figure 27. As with the risk management chart presented in Figure 25, this flowchart is general enough that it could be used in its current form, or slightly modified in developing a surveillance plan for CCR surface impoundments.

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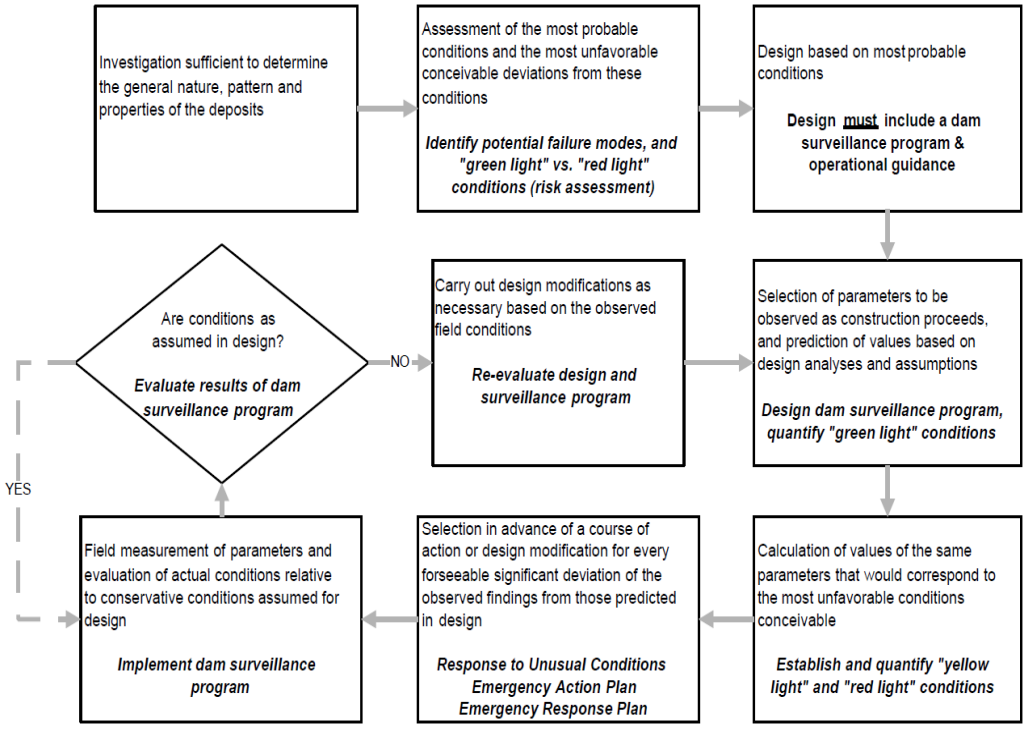


Figure 25: Flow chart illustrating risk management utilizing the observational method (after Martin and Davies 2000)

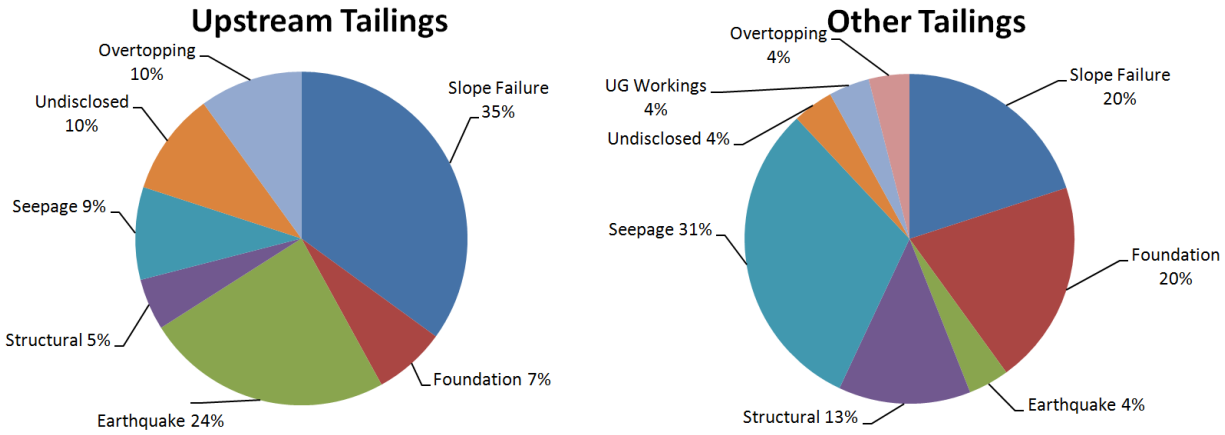


Figure 26: Comparison of failure modes of upstream mine tailings dams as compared to other types of mine tailings dams (modified from Martin and Davies 2000)

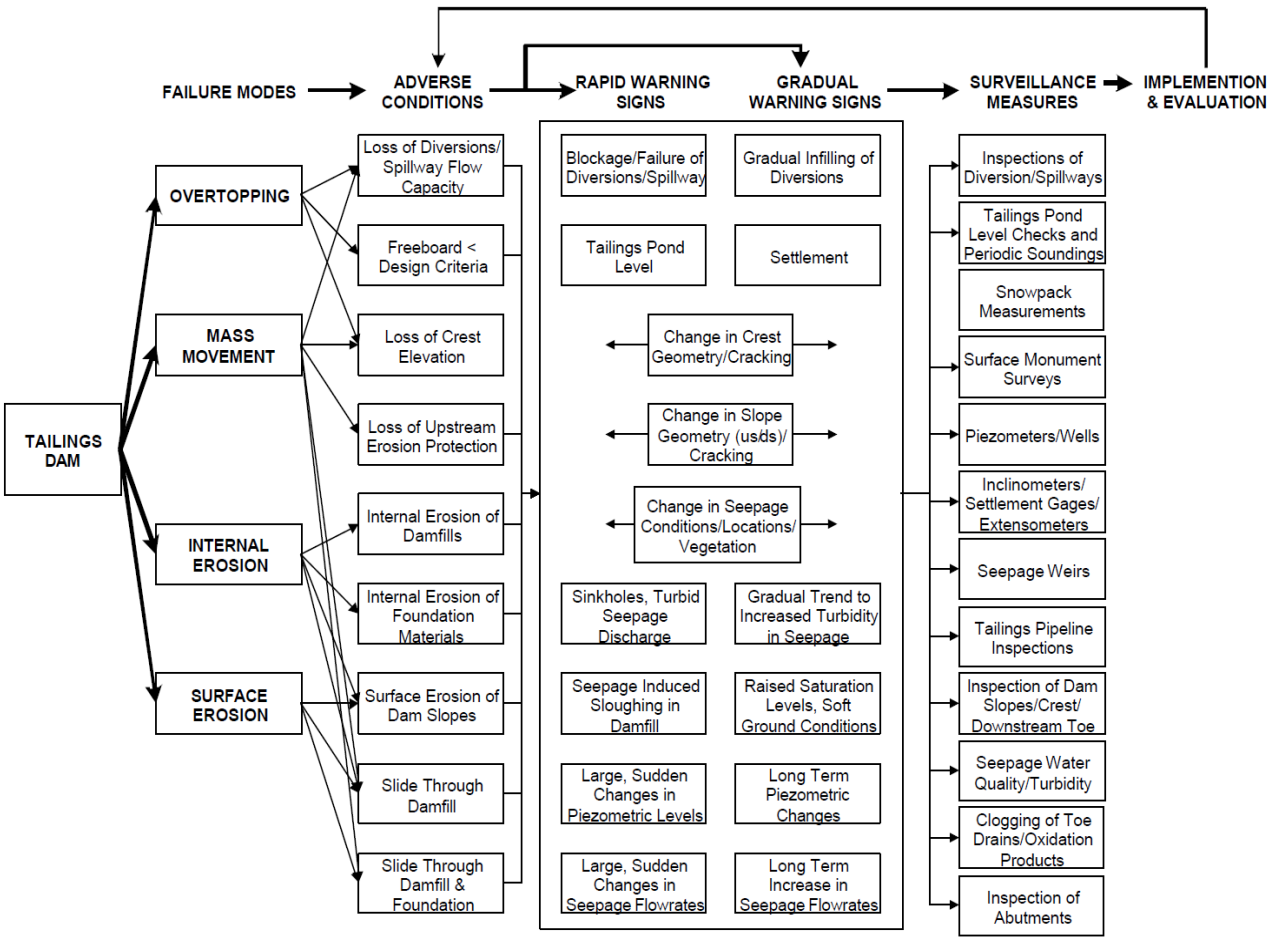


Figure 27: Sample surveillance plan schedule for a mine tailings impoundment (after Martin and Davies 2000)

Since CCR surface impoundments can have containment dikes constructed out of CCR material, natural soils, or a combination of both and these landfills have the potential to collect precipitation. An analysis procedure that can be used alongside the observational method is to treat them as earthen dams according to recommendations of the Bureau of Reclamation and the Army Corps of Engineers.

The Bureau of Reclamation's *Dam Safety Risk Analysis Best Practices Training Manual* (Scott et al. 2010) provides an overview in Chapter 1 of their recommended method for determining potential failure modes of dams for use in conducting risk analyses of dams. In Chapter 1, the authors identify determination of potential failure modes of dams as the basis for risk evaluations, making it one of the most important steps in risk analysis of a dam. They recommend a comprehensive and thorough review of all relevant background information such

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as, but not limited to, geology, design, analysis and construction documentation, flood and seismic loadings, operations, dam safety evaluations, and performance and monitoring documentation. Additionally, they recommend a site examination, including questioning of the operations personnel as to how unusual events are handled and what they consider to be the vulnerabilities of the structure. The data review process should include several qualified professionals from different disciplines to ensure a thorough investigation. Lastly, the authors outline three major parts in describing a potential failure mode:

- **The initiator**, or what causes the initiation or onset of the failure mode
- **Failure progression**, a step-by-step outline of mechanisms that lead to failure
- **The resulting impacts**, a description of the expected method and magnitude of a failure if it were to occur

For more in-depth guidance on determining failure modes and developing a risk analysis program for a specific structure, the U.S. Bureau of Reclamation's *Dam Safety Risk Analysis Best Practices Training Manual* can be accessed online at http://www.usbr.gov/ssle/damsafety/Risk/methodology.html, entitled "Complete Best Practices Document."

4.2 CCR Landfills

CCR landfills are generally placed at a moist state and compacted to some degree, being constructed in a similar manner to regular earthen embankments. As a result, they can be analyzed like any other earthen embankment, with special attention paid to the engineering properties and placement conditions of the CCR materials used in the embankment. The placement method for CCR materials in CCR landfills results in less uncertainty in their fabric and relative density, generally resulting in an overall more stable structure than with surface impoundments.

Ideally these compacted CCR embankments would remain well-drained, but depending on the geology of the site and variability in the hydraulic conductivity of the CCR materials, monitoring

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the groundwater table within these areas and how it is affected by rainfall patterns is good practice, unless it is clearly apparent that such monitoring is unnecessary. An additional consideration with CCR landfills is the need to continually condition the landfill surface with water in order to cut down on dust pollution and surface erosion. Ideally, slopes of CCR landfills should be seeded as soon as is feasible, in order to manage surface erosion and eliminate the need to continually condition the moisture of the slopes.

One unique case would be for sites where a CCR landfill is constructed over a retired surface impoundment. This is an appealing option to most CCR disposers, since land area can be reused, negating or delaying the need to purchase new land to construct a disposal area. Since the foundation material cannot be as well-characterized as the material being placed, a more rigorous design and monitoring procedure would be necessary, perhaps the same as or similar to those discussed in section 4.1.

4.3 Failure Modes

Failure modes for CCR surface impoundments and landfills include all of the usual failure modes for a dam or embankment. However, since disposal operations continue for years or decades, the need to continually monitor disposal areas for signs indicating the initiation of a particular failure mode is very important. Since surface impounded CCRs generally have a less stable structure than CCR landfills, they will generally tend to require more vigorous monitoring. Because of the differences in disposal methods between CCR surface impoundments and CCR landfills, the most likely failure modes will not be the same for each structure.

The most common failure modes for earthen dams and embankments include internal erosion or piping (of embankment or foundation materials), surface erosion leading to global instability, excessive seepage leading to an embankment breach, overtopping during a storm event, loss of freeboard due to excessive embankment settlements or subsidence, lateral movement of the embankment, and failure as a result of a seismic event (MSHA 2009; Martin and Davies 2000). Many of these failure modes are included in Figure 27, with common warning signs indicating the initiation of these failure modes.

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The majority of these failure modes can be recognized with good monitoring practices, with the exception of failures due to seismic events, for obvious reasons. There is little data on the performance of CCR disposal areas during seismic events and also very little data on the dynamic properties of CCR materials. As a result, dynamic properties of CCRs is an area where further research and laboratory testing is required.

The overall uncertainty in the engineering properties of CCR materials make it necessary to be more vigilant with monitoring practices in order to recognize when different failure modes are initiated so that remedial actions can be taken to prevent costly failures, both on an economic and life scale. Since surface impoundments often most closely resemble tailings dams in their design, a good reference for monitoring practices and identifying failure modes for surface impoundments is the MSHA 2009 "Engineering and Design Manual: Coal Refuse Facilities," which can be accessed at:

http://www.msha.gov/Impoundments/DesignManual/ImpoundmentDesignManual.asp.

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Chapter 5

Slope Stability of CCRs

The basic principles of slope stability and methods of assessing slope stability of CCR surface impoundments and landfills are the same as for naturally occurring soils; however, the results of these analyses can be very different based on the unique properties of CCR materials. For example, while an ash might have a high percentage of clay-sized particles, they rarely have any cohesion at all and may be very prone to erosion; many naturally occurring soils with clay-sized particles have a cohesive component of strength and are usually considered erosion resistant. In most instances, CCR disposal areas will not be loaded enough to incur excess pore pressures that will not be fully dissipated by the next loading cycle (the next workday). For this reason, it is generally only necessary to perform effective-stress steady-state shear strength slope stability analyses for CCR disposal areas. Special analyses, such as rapid draw-down analyses may be necessary as dictated by site geometry and design rainfall events.

5.1 Limit Equilibrium and Finite Element Analyses

The majority of slope stability analyses today are performed using commercial software programs that utilize limiting equilibrium analyses and/or finite element analyses of slope stability and seepage through slopes. It is good practice and the recommendation of the United

States Army Corps of Engineers (USACE) that some sort of check be done on the results of these software programs. In their Slope Stability Manual (EM 1110-2-1902), the USACE states that, "verification should be commensurate with the level of risk associated with the structure," and that one or more of the following methods should be used in verification of the initial analyses:

- Graphical (force polygon) method
- Spreadsheet calculations
- A second slope stability program
- Slope stability charts

The following example is of a slope stability analysis of a CCR surface impoundment using a limit equilibrium-based software program that also has a built-in finite element groundwater seepage option. The premise of this example is that a client wants to construct a dry-stacked CCR landfill on top of a retired surface impoundment. A thin layer with increased cohesion was included at the surface of all slopes in order to eliminate infinite slope failures that are solved with vegetation; this layer is not included in the table of strata properties, presented in Table 9.

Table 9: Summary of shear strength and hydraulic parameters used in CCR surface impoundment slope stability example.

Strata	γ (pcf)	N	σ_0' (tsf)	ϕ' (°)	c' (psf)	k (ft/s)	Sources
SI CCRs	92.0	N/A	N/A	25.2	0	2.55×10^{-6}	LT
Compacted CCRs	103.5	N/A	N/A	33.0	0	3.61×10^{-7}	Tables 6-8, Table 5
Embankment Fill	112.7	N/A	N/A	33.8	0	1.79×10^{-8}	LT
RR Embankment Fill	122.0	4.0	0.34	33.7	0	3.00×10^{-8}	Kulhawy and Mayne (1990)/LT
Alluvium	110.0	11.0	0.88	40.6	100	3.28×10^{-8}	Kulhawy and Mayne (1990)/LT
Saprolite	110.0	35.0	1.2	29.6	420	9.35×10^{-7}	LT
Partially Weathered Rock	120.0	N/A	N/A	30.0	500	3.28×10^{-9}	Assumed based on parent material
Bedrock	170.0	N/A	N/A	30.0	1.4×10^{5}	3.28×10^{-10}	Barton and Choubey (1977)

Note: LT = laboratory testing

Analyses were performed for six different conditions: three geometries, each with an in-situ water table and a hypothetical high water table. Figure 28 shows the in-situ subsurface conditions, while Figures 29 through 31 provide the output results with slip surfaces below specified factors of safety shown for the six geometries considered. All slip surfaces shown with a factor of safety value are the lowest factor of safety for that slope geometry.

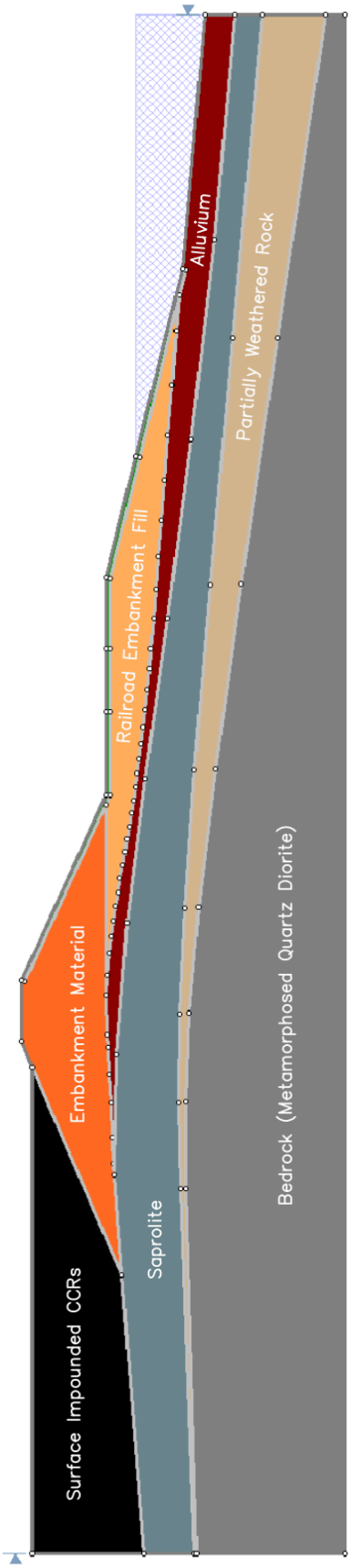


Figure 28: Subsurface profile of a slope stability example for an SI CCR embankment.

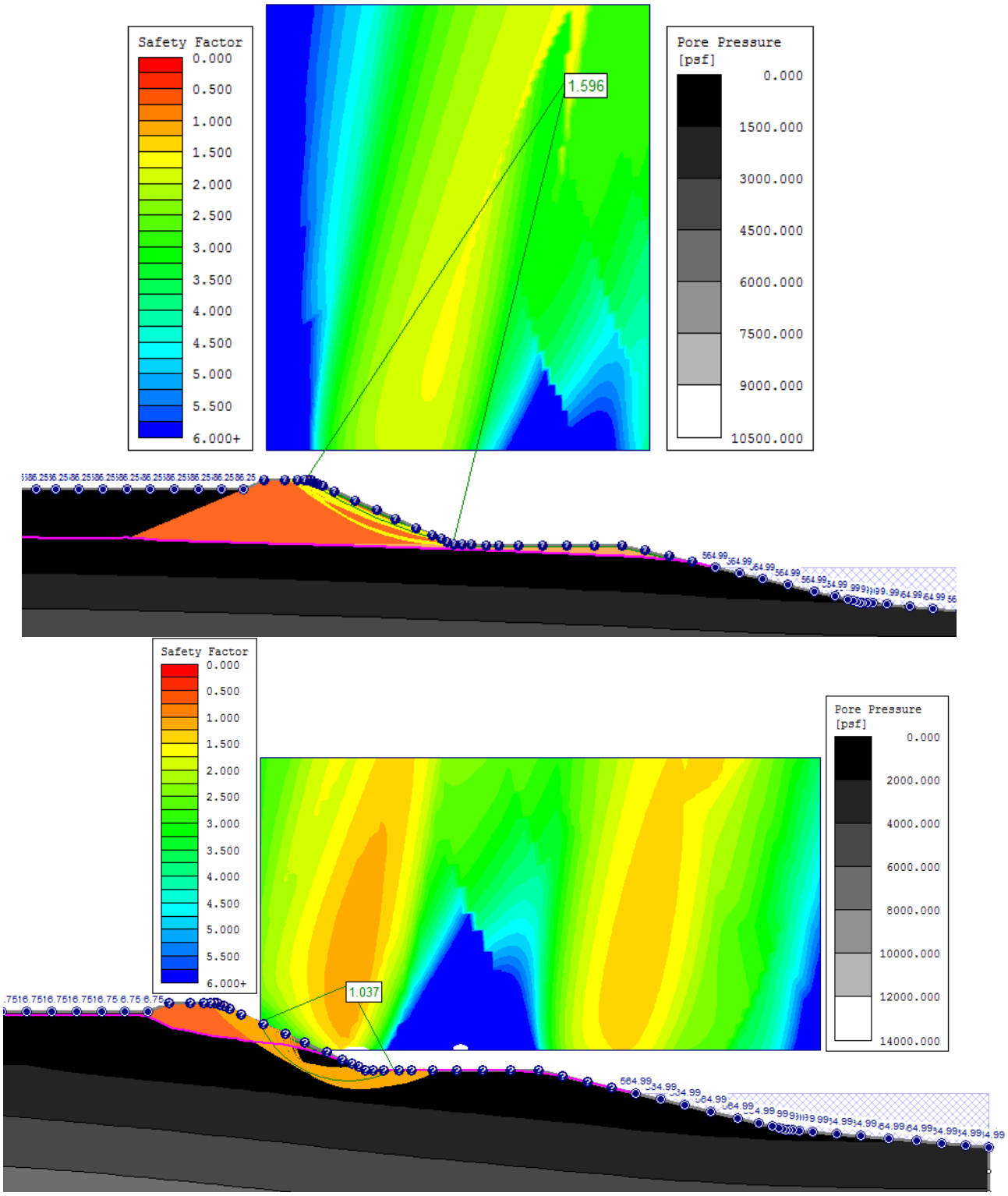


Figure 29: Analyses for the in-situ condition, first with the in-situ measured water table (above) and then with a hypothetical higher water table (below). Slip surfaces are shown for factors of safety below 1.7 for the above case and between 1.0 and 1.2 for the below case.

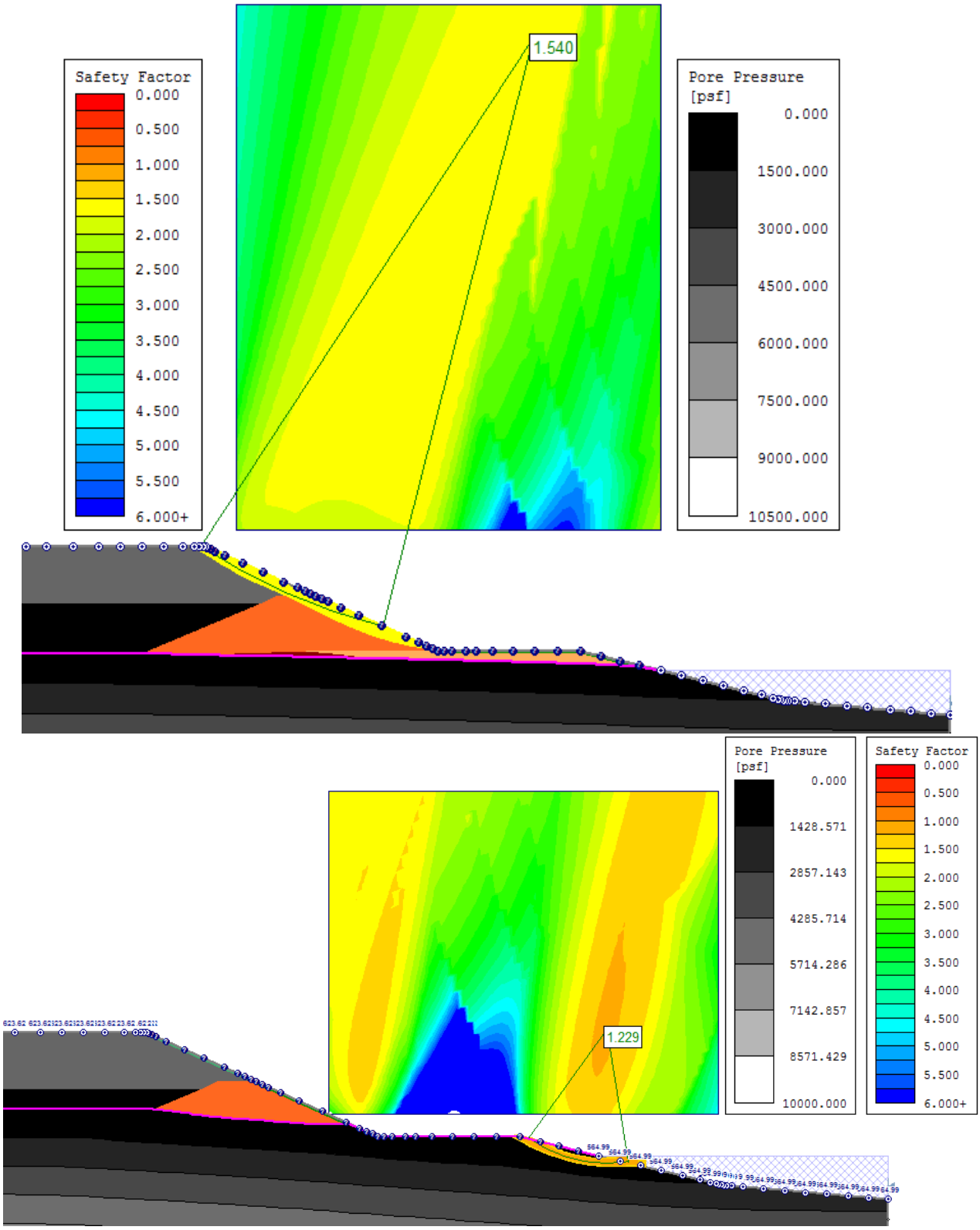


Figure 30: Analyses for an added upstream dry-disposed cell over the surface impoundment, for the in-situ water table (above) and for a hypothetical higher groundwater table (below). Slip surfaces with factors of safety between 1.5 and 1.6 are shown in the above case and between 1.2 and 1.3 for the below case.

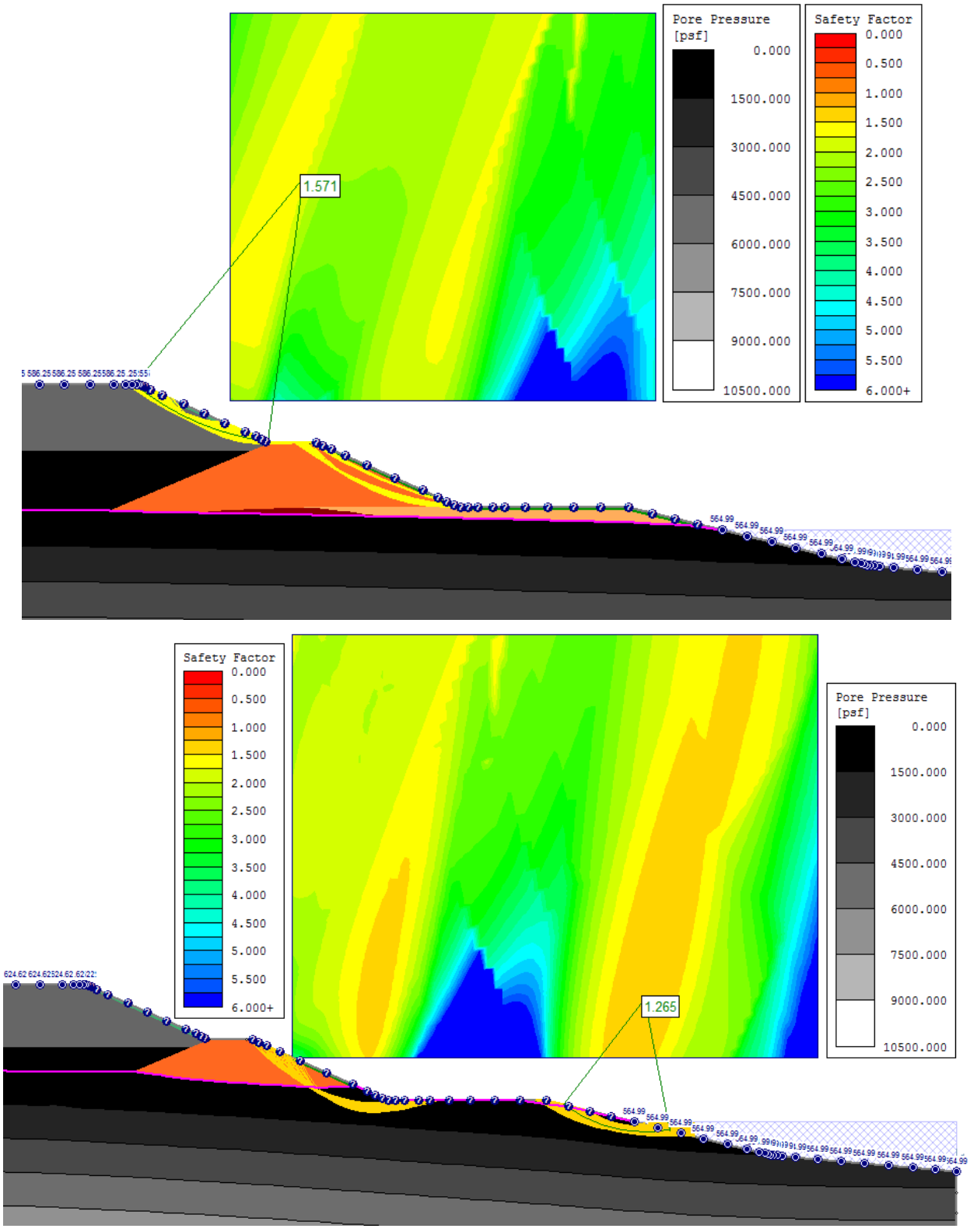


Figure 31: Analyses for an added upstream dry-disposed cell above the surface-impoundment for the in-situ groundwater table (above) and for a hypothetical higher groundwater table (below). Slip surfaces with factors of safety between 1.5 and 1.7 are shown for the above case and between 1.2 and 1.4 for the below case.

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In all of the geometries considered in these analyses, a thin layer with a low cohesion was included in order to eliminate infinite slope failures that are easily remediated by keeping the slopes moist or vegetated. In addition, all of the geometries analyzed for the in-situ phreatic surface resulted in acceptable factors of safety, since the in-situ water table is so low compared to the site geometry. However, with a slight rise in the water level (perhaps as the result of a 100-year storm event), the factors of safety drop dramatically. This is the result of the fact that the embankment is constructed out of nonplastic soils that completely derive their strength from the frictional component of shear strength. As the water table rises, buoyancy effects decrease the effective overburden pressures in the geometry, thereby decreasing the slope shear strength and decreasing the factors of safety of all surfaces considered. Furthermore, the very low permeability of the embankment material makes this water table condition a real possibility, if no form of drainage through the slope is provided.

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Chapter 6

Settlement Calculations for CCRs

It is common to see consolidation data reported for CCRs in research publications. However, given that CCRs often tend to be fairly free-draining, it would seem odd to use these values to determine settlement of CCRs, given that a structure or embankment were constructed over previously disposed CCRs. However, any methods developed to calculate settlements in sands are not necessarily applicable to CCRs or to silt-sized materials either. In this chapter, a comparison of common methods of calculating settlements will be made for CCRs at a specific site where a test fill was performed and actual CCR settlements monitored.

6.1 Test Fill Results

The results of a test fill of compacted, dry-placed fly ash performed over an approximately uniform 50 ft deep deposit of surface impounded ash was provided by S&ME. The test fill was 20 ft high and had lateral dimensions of 250 ft by 250 ft. The side-slopes all-around were 3H to 1V, making the entire footprint of the fill about 370 ft by 370 ft, or 136,900 ft^2. For the purposes of these analyses and the sake of simplicity this load will be characterized as a constant 20 ft load over the 250 ft square footprint of the test fill. The recorded settlements at the center of the test fill area were between 18.0 and 19.5 inches.

6.2 Settlement Calculation by Consolidation Theory

For increased accuracy, the surface impounded layer is divided into sub-layers and the settlements calculated for each layer and added together for the overall settlement. It is assumed that since the CCR material has not been loaded in the past that it is in the normally consolidated condition and that they unit weights of the surface impounded CCRs and dry-placed CCRs are 95 pcf and 100 pcf, respectively. Four sets of consolidation tests were performed on the impounded CCR material that made up the foundation for the test fill; the compression ratio for the test closest to the depth of the layer being considered is used in calculating the settlement in that layer. The water table is located 8 ft below the ground surface:

Table 10: Consolidation settlements calculated for test fill placed over a CCR surface impoundment.

Layer	T_L (ft)	D_{CL} (ft)	P_0 (psf)	ΔP (psf)	P_f (psf)	c_{ec}	S_i (in)
1	5	2.5	237.5	2000	2237.5	0.20225	11.82
2	10	10	587.7	2000	2587.7	0.20225	15.62
3	15	22.5	832.2	2000	2832.2	0.07299	6.99
4	20	40	1158.2	2000	3158.2	0.07299	7.63
						Σ	42.07

Note: T_L = layer thickness, D_{CL} = depth to center of layer, P_0 = initial stress condition, D_P = change in stress, P_f = final stress condition, and S_i = settlement for a specific layer

As displayed in Table 10, the settlements estimated using consolidation theory are just over twice the amount observed in the test fill. This is not really surprising since CCR materials do not tend to behave like soils where consolidation theory is used to calculate settlements; generally, plots of volumetric strain vs. normal stress from consolidation tests performed on CCRs do not have clearly log-linear portions corresponding to a recompression and compression ratio. As a result, depending on what values are assumed for $c_{\varepsilon c}$ and $c_{\varepsilon c}$, the settlement could either be greatly overestimated or underestimated, depending on different individuals' interpretations of the plot.

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6.3 Settlement Calculation by D'Appolonia Method

The D'Appolonia (D'Appolonia et al. 1970) method of calculating settlements in sand is based on elasticity theory and can be applied to this sort of example with some moderate assumptions. Equation 8 is the equation developed by D'Appalonia et al. (1970):

$$\rho = \mu_0 \mu_1 \frac{qB}{M} \tag{9}$$

where ρ = settlement
μ_0, μ_1 = geometry factors from Figure 36
q = applied bearing pressure
B = footing width
M = 1-dimensional compression modulus

Figure 32 provides plots used to determine the geometry factors, while the applied bearing pressure and footing width are the same as determined in section 6.2. From logs of CPT tests performed at the test fill location, the average M measured over the depth of the CCR deposit was about 45 tsf (based on CPT correlations).

Given the dimensions of the test fill given in section 6.1 and Figure 32, μ_0 is estimated as 1.0 (since the fill is at the ground surface) and μ_1 would likely be around 0.14. The settlement can now be calculated as:

$$\rho = 1.0 \cdot 0.14 \cdot \frac{1 \text{ tsf} \cdot 250 \text{ ft}}{45 \text{ tsf}} = 0.777 \text{ ft} = 9.33 \text{ in}$$

The most obvious problems with applying this method to placement of a fill is that it was developed for shallow foundations, which are a rigid structure and it was developed for sands, while CCRs are usually classified as silts according to the USCS. Tan and Duncan (1991) cite that this method tends to underestimate settlements around 50% of the time, as it certainly does in this case.

Since this method underestimates the settlements observed at this site by about 50 percent, it may be useful to determine what value of compressibility modulus actually give an accurate settlement:

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$$M = \mu_0 \mu_1 \frac{qB}{\rho} = 1.0 \cdot 0.14 \cdot \frac{1 \text{ tsf} \cdot 250 \text{ ft}}{1.5833 \text{ ft}} = 22.1 \text{ tsf}$$

This value for the compressibility modulus is equivalent to an average modulus calibrated to the observed settlements. While one data point is not sufficient to develop a correlation, if enough settlement tests were conducted for CCR materials, it would be possible to develop a CPT-*M* correlation that better predicts settlements than the one used in this investigation.

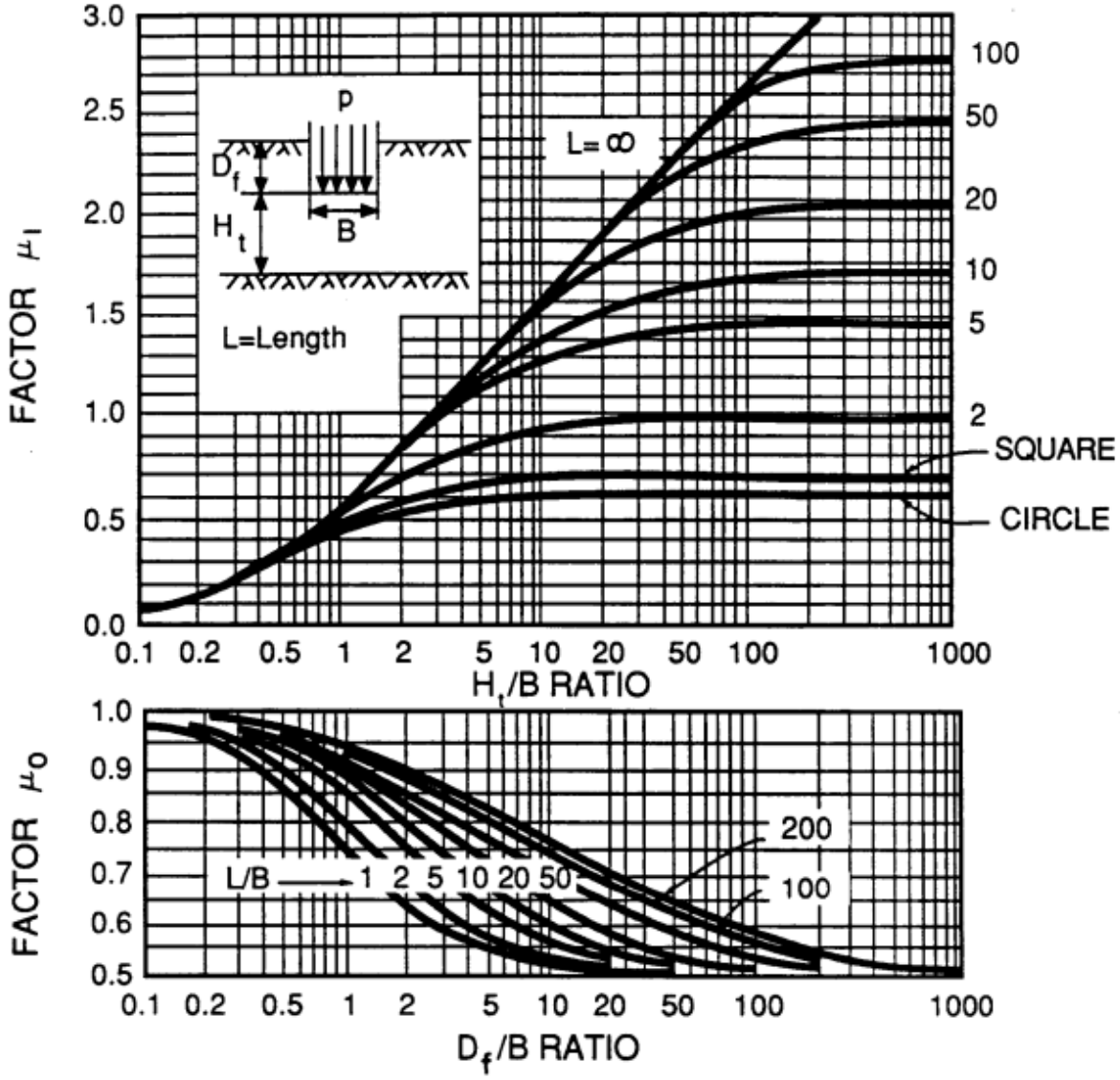


Figure 32: Plots published by D'Appolonia et al. (1970) to determine the values of the geometry factors to be used in footing settlement analyses.

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6.4 Other Observations

As an alternative to specific methods of settlement calculations, if it is assumed that the fill is of large lateral extent, a basic calculation of settlement can be made using *M*, the pressure applied by the fill, and the depth of the soil strata being filled:

$$S = \frac{PZ}{M} \tag{10}$$

where P = the pressure applied as a result of the fill
Z = the depth of the soil where settlements are being considered

Again using a value of M = 45 tsf, the settlement is calculated as 13.33 inches. This is still an under-estimate of settlement for this test fill, but given that a CPT correlation for *M* in CCR materials was developed, it may be possible to calculate more precise estimates of settlement. Reduction factors could then be applied to equation 10 in order to attain an acceptable level of reliability.

A comparison of Young's modulus of soil (E_s) can also be made using Hooke's Law and the observed settlement:

$$E_s = \frac{PZ}{S} \tag{10}$$

where P = the pressure applied as a result of the fill
Z = the depth of the soil where settlements are being considered
S = the observed settlements after fill placement

versus the correlation of CPT tip resistance (q_t) to E_s used in Schmertmann's CPT settlement calculation method:

$$E_s \approx 2.5 \cdot q_t \tag{11}$$

Using Hooke's Law with a settlement of 19 inches and an applied fill pressure of 1 tsf, the E_s calculated is 31.6 tsf. Using the CPT correlation given in equation 11, the average CPT tip resistance over the depth of the CCR deposit below the test fill was about 17 tsf, which would return an E_s value of 42.5 tsf.

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The accuracy of these values of E_s are questionable, however, Hooke's law assumes a linear-elastic stress-strain condition and the CPT correlation was developed for use with sandy soils. Ideally, CPT correlations should be developed specifically for CCR materials and E_s, which would require a large volume of CPT tests and data analysis.

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Chapter 7

Reconstitution Technique for Surface Impounded CCRs

Sample reconstitution techniques try to balance process simplicity with matching the in-situ fabric of the soil as closely as possible. Some reconstitution techniques commonly used on sand and non-plastic silt materials include moist tamping methods, air and water-pluviated methods, and slurry deposited methods. In this chapter, a brief overview of these various methods is given and a technique not yet applied to coal ash materials is analyzed when used with surface impounded CCR materials (will be referred to as SI CCRs throughout this chapter).

7.1 Moist Tamping

The first moist tamping method was proposed by Ladd (1978) in a paper entitled "Preparing Test Specimens Using Undercompaction." In this method, specimens are formed by hand-tamping of moist soil (w% = 20% to 70%) in equal lifts within a triaxial sample split mold, while increasing the dry mass of soil in each subsequent lift. The soil samples should be mixed with water at least 16 hours prior to use and the lift thickness should not exceed 1 inch for specimens with a diameter of less than 4 inches. Ladd provided an equation to calculate the percent under-compaction for each layer placed:

$$U_n = U_{ni} - \left[\frac{(U_{ni} - U_{nt})}{n_t - 1} \times (n - 1)\right] \quad (11)$$

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where U_{ni} = percent under-compaction selected for first layer
U_{nt} = percent under-compaction selected for final layer (normally zero)
n = number of layer being considered
n_i = first (initial) layer
n_t = total number of layers (final layer)

The U_{ni} of the first layer is usually between 0% for very dense specimens and 15% for very loose specimens. In order to determine the correct U_{ni}, a series of cyclic triaxial tests must be run with the same effective consolidation stresses and CSR, but with different values of U_{ni}. The specimen then observed during testing and the following observations indicate an inappropriate value of U_{ni}:

- Excessive necking or bulging in any part of the specimen during cyclic loading.
- Non-uniform vertical strains during unconsolidated-undrained loading.
- A honeycomb soil fabric structure at either end of the specimen.
- A non-uniform dry unit weight along the height of the specimen.

Other moist tamping techniques modify this method slightly, usually by either changing the method in which under-compaction is addressed or by defining a specific compaction energy to be used in compacting the sample. This method can be laborious if the correct value of U_{ni} must be determined, since a whole test regime must be completed. Additionally, with regards to hydraulically-placed soils, the fabric of the sample does not match in-situ conditions well.

7.2 Air/Water Pluviation

"Pluviation" or "raining" of soil is a technique first published by Kolbuszweski in 1948. In this technique, the soil is pluviated from a separate apparatus into the soil mold, either in a dry state, or in water. These apparatuses vary in complexity and have various opening sizes and diffuser designs. By controlling the flow rate of the soil through the diffuser and the fall height of the sand, it is possible to place the soil at varying relative densities (Rad and Tumay 1987).

While air-pluviated samples can provide relatively uniform specimens and is a good technique for modeling Aeolian deposits of poorly graded sands and silts, well-graded sands or sands with

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high fines content have a tendency to segregate. Furthermore, the fabric of the sample can be disturbed during the saturation phase of triaxial testing due to fines washing out of their original placement (Keurbis and Vaid 1988). Air-pluviation would not likely model the fabric of surface-impounded CCRs well, since these CCRs are deposited in a hydraulic environment. Furthermore, the high content of non-plastic fines in CCRs would make loss of soil due to dust very high.

Similarly, water-pluviated specimens form uniform samples of poorly graded soils, though usually at lower relative densities than air-pluviated specimens, since soils fall at a slower velocity through water than through air. However, with well-graded soils, or soils with high fines contents, particle segregation can be a problem with this technique (Keurbis and Vaid 1988). Particle segregation would also be an issue with surface impounded CCRs, since these tend to be a mixture of bottom ash and fly ash.

7.3 Slurry Deposition Techniques

Like the previous two methods, there are several different slurry deposition methods. The first slurry deposition method was first developed by Keurbis and Vaid (1988), which is the technique that is being assessed for use on surface impounded CCRs in this thesis, with some slight modifications. For the sake of avoiding any redundancy, the procedure for this technique will be outlined with specific reference to its use on SI CCRs, with departures from the original procedure of Keurbis and Vaid noted.

7.4 Slurry Deposition Technique Applied to SI CCRs

The basic premise of the slurry deposition technique is to form a lean (just enough water to allow for effective soil mixing), saturated slurry of soil that can then be deposited directly from a mixing tube into a triaxial split-mold, with minimal disturbance to the mixture. The slurry should be lean enough to avoid the development of sedimentation currents during the transfer from the mixing tube to the split-mold, but not so lean that mixing becomes difficult. In addition, the procedure ensures that the sample will be fully or very close to fully saturated upon completion. The samples are deposited very loosely initially and can be densified to higher relative densities

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by vibration. In their original slurry deposition method, Keurbis and Vaid recommend de-airing the soil-water mixture and then pluviating it into the mixing tube in order to better ensure saturation. However, CCRs can be fine enough that a considerable amount of the sample (of a specific grain-size) can be lost in the pluviation process. Therefore, the CCR samples prepared using this method are simply added to de-aired water directly into the mixing tube in order to minimize sample loss during the preparation process; if saturation ratios using this method are unacceptable, a soil-water mixture can de-aired under a vacuum or by boiling and then transferred directly to the mixing tube. The apparatus required for the CCR slurry deposition technique are as follows:

- Acrylic mixing tube, with an outer diameter slightly smaller than the target diameter of the sample being formed and a plug to seal off one end. The end opposite of the mixing tube will have rubber gasket seal glued around the rim. The other dimensions of this tube will be discussed later.



Figure 33: Acrylic mixing tube with a rubber stopper on one end and rubber gasket seal glued to the opposite end.

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- A thin metal disk approximately the same diameter as the bottom porous disk used in testing.

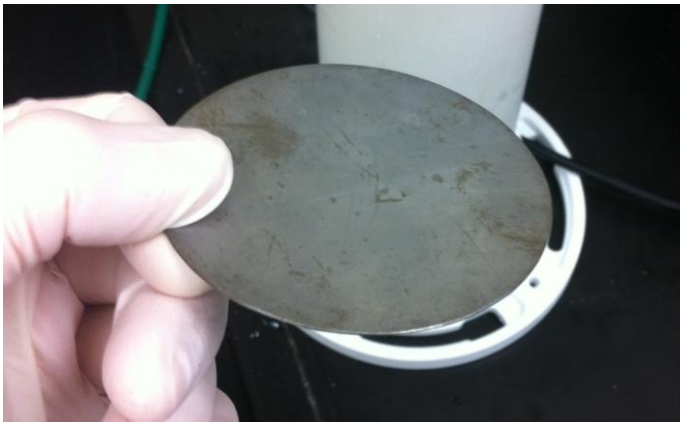


Figure 34: Thin metal disk approximately the same diameter of the bottom porous disk.

- A rubber or latex membrane with a smaller diameter than the mixing tube. Standard store-bought balloons can be cut to fit and are a cheap, readily available alternative.
- Water bath container for the acrylic mixing tube, large enough to completely submerge the mixing tube.

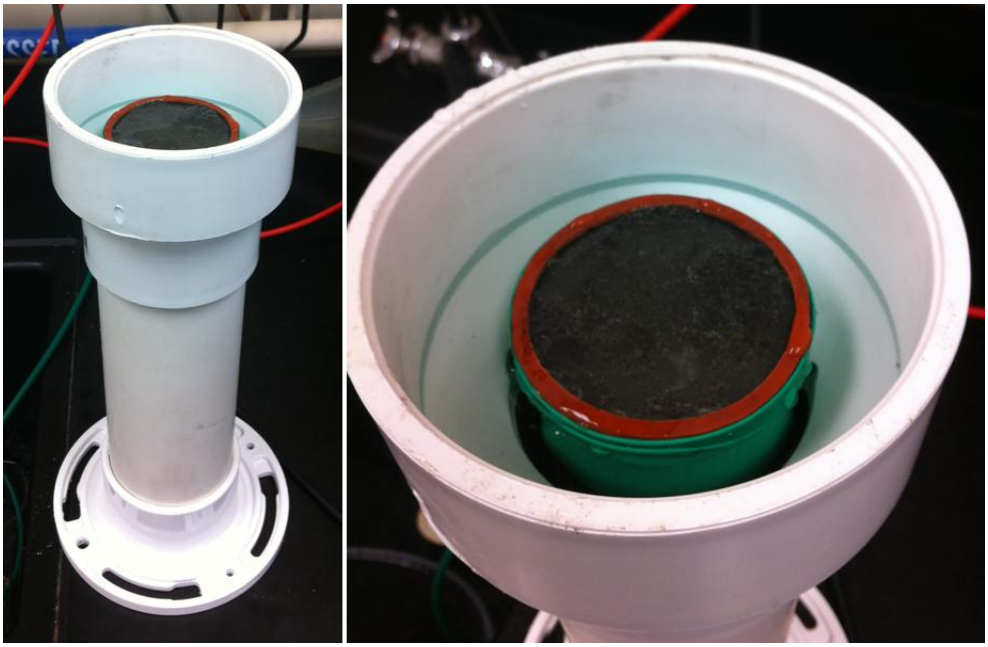


Figure 35: Water bath large enough to completely submerge the mixing tube and allow for easy placement of the porous disk and metal plate. The rubber membrane can also be seen rolled down around the mixing tube.

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- Water bath container for the triaxial cell base-platen that can at least submerge the bottom drainage line and the porous disk when the mixing tube is placed on it.

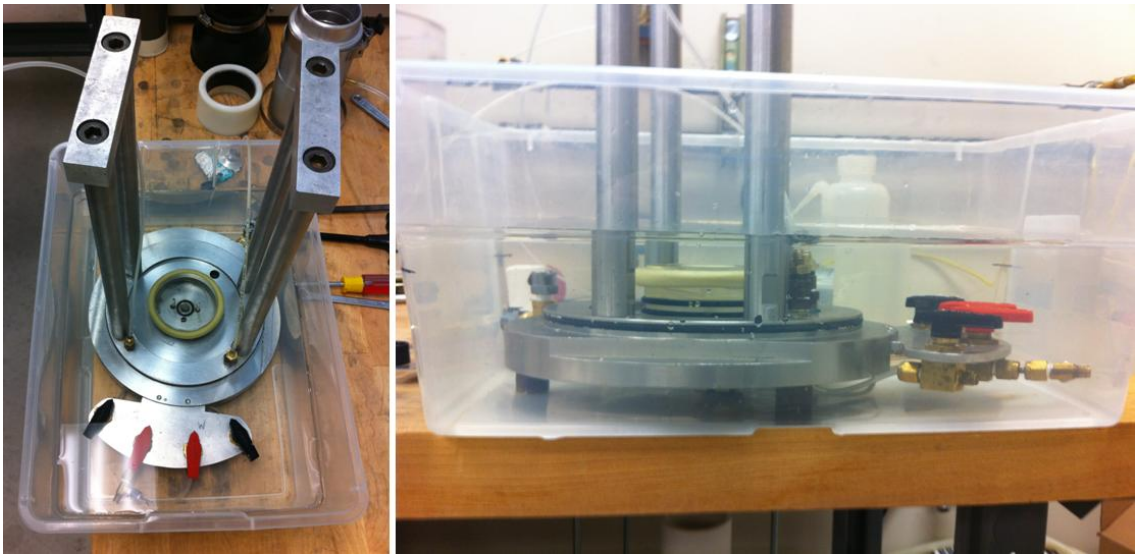


Figure 36: Water bath large enough to accommodate the bottom of the triaxial cell and submerge the bottom platen.

- A split-mold triaxial sample former.
- A collar that fits over the split-mold to accommodate the temporary increased volume of the sample when it is first placed.

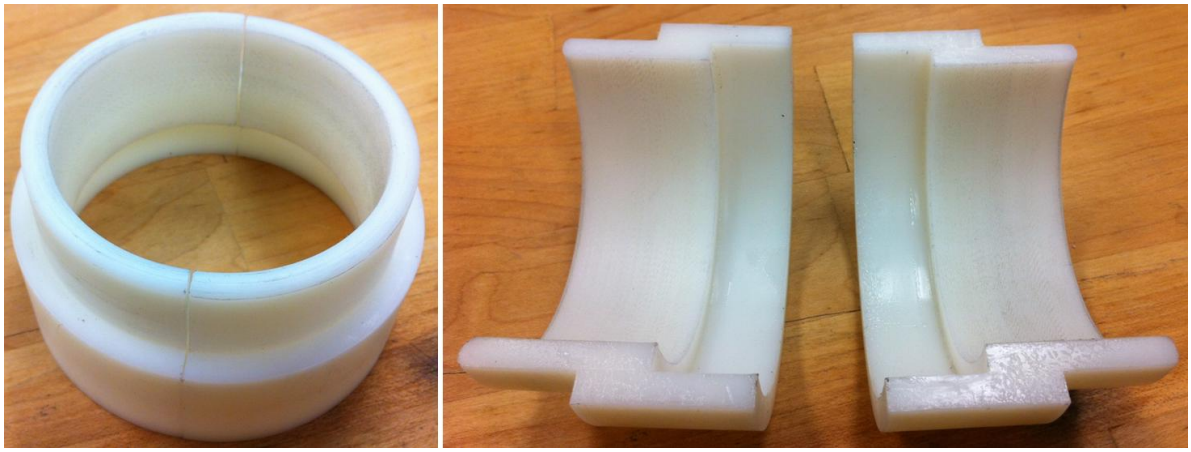


Figure 37: A custom-made split-collar to accommodate the additional volume of soil when the slurry is first placed in the specimen split-mold. This collar was machined out of nylon to fit the dimensions of the split-mold being used and the flexible collar used to accommodate the extra water volume when the slurry was placed.

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- A small mechanical shaker or mallet to densify the sample once it is placed. If a mallet is used, a heavier mallet is best, as it transfers more energy than a standard rubber mallet.

In their original slurry-deposition method, Keurbis and Vaid made their soil-water mixtures using dried soil; for SI CCRs, this would be impractical because of the dust that would be lost in handling it in a dry state. Thus, it is recommended that the SI CCRs be mixed at a target water content in order to make it more workable. Once the soil is well-mixed, several small samples should be oven-dried to verify that the moisture content of the soil is homogenous.

The mixing tube should have the thin rubber membrane rolled down over the end with the rubber gasket seal and the other end plugged with the stopper. The moist CCR specimen is placed in the mixing tube, which should then be filled with de-aired water (some water can be in the tube prior to adding the moist soil in order to help collapse the structure of the moist CCRs and decrease their volume during placement in the tube). The mixing tube is now placed into the de-aired-water bath. Once the mixing tube is in the water-bath, a saturated, de-aired porous disk with a filter paper attached is placed on the open end, such that it is completely submerged in the water bath; some fines will escape the mixing tube while it is submerged and before the porous disk is placed over the opening (see Figure 38), so these fines should be put into a container to be oven-dried and weighed in order to adjust the dry mass of the sample.

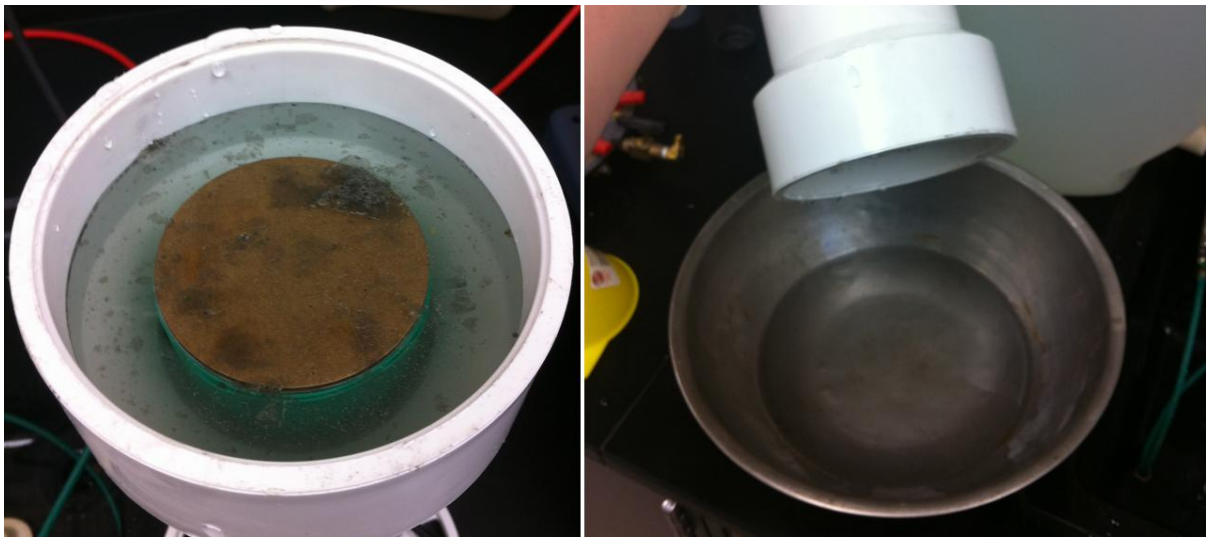


Figure 38: Placement of the porous disk and transferring of the fines lost in the water bath to a container to be oven-dried and weighed.

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At this point, the thin rubber membrane is rolled over the porous disk, such that a small portion of the center of the disk is exposed. The thin, metal disk is now placed over the porous disk and membrane and the mixing tube is withdrawn from the water bath, while keeping firm pressure on the metal disk. The securing of the porous disk with the thin rubber membrane and placement of the metal disk are shown in Figure 39.

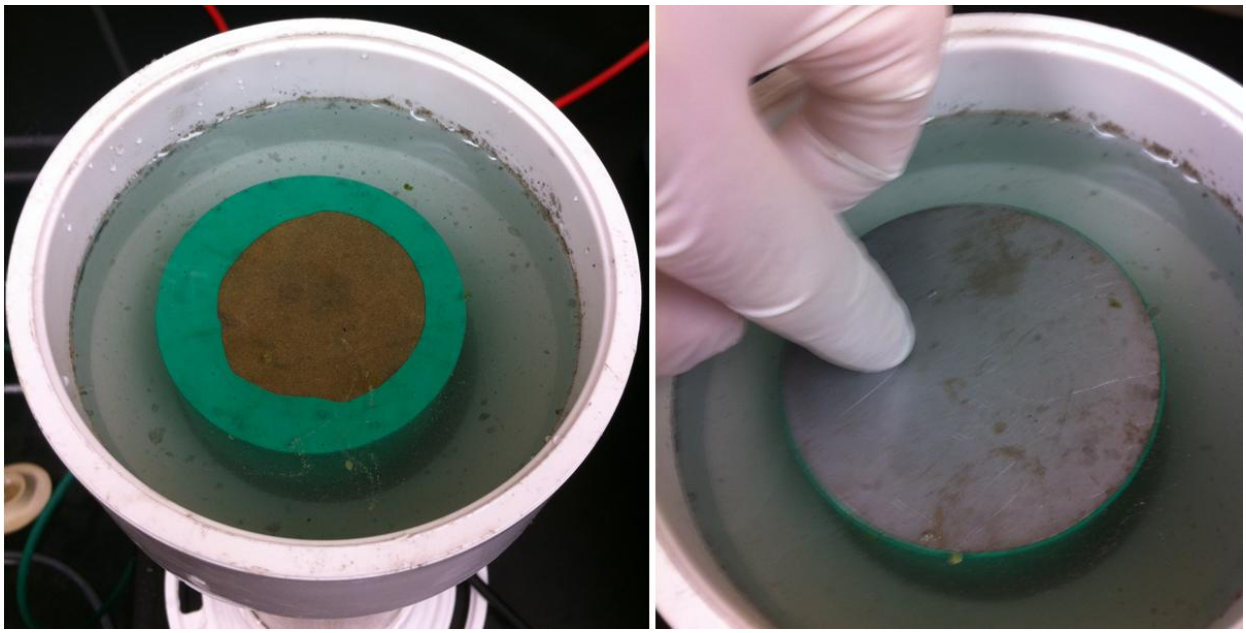


Figure 39: Securing of the porous disk with the thin rubber membrane and placement of the thin metal disk over the opening in the membrane.

Now the mixing tube is removed from the water bath while maintaining firm pressure on the thin metal disk and the soil slurry mixed vigorously, end-over-end for the next twenty minutes, to ensure homogeneity of the slurry. After twenty minutes has passed, the mixing tube is placed disk-end down and the mixture is allowed to settle to its loosest stable state. When the mixture has stabilized, the metal disk is removed (it should be held in place by suction when the mixing tube is lifted), the membrane rolled back to the edges of the porous stone, and the entire apparatus placed porous-disk-down onto the base platen, which is submerged in another de-aired water-bath. The rubber membrane around the mixing tube is now rolled up and off of the mixing tube. The sample membrane has been rolled down around and attached to the bottom platen with two o-rings prior to submerging the base platen in the de-aired water-bath and it is now rolled up and over the outside of the mixing tube. The entire bottom platen can now be removed from the water bath and the split mold formed around the mixing tube and sample membrane. Rolling of

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the membrane over the mixing tube and placement of the split mold and collars after removal of the triaxial cell base from the water bath is illustrated in Figure 40.

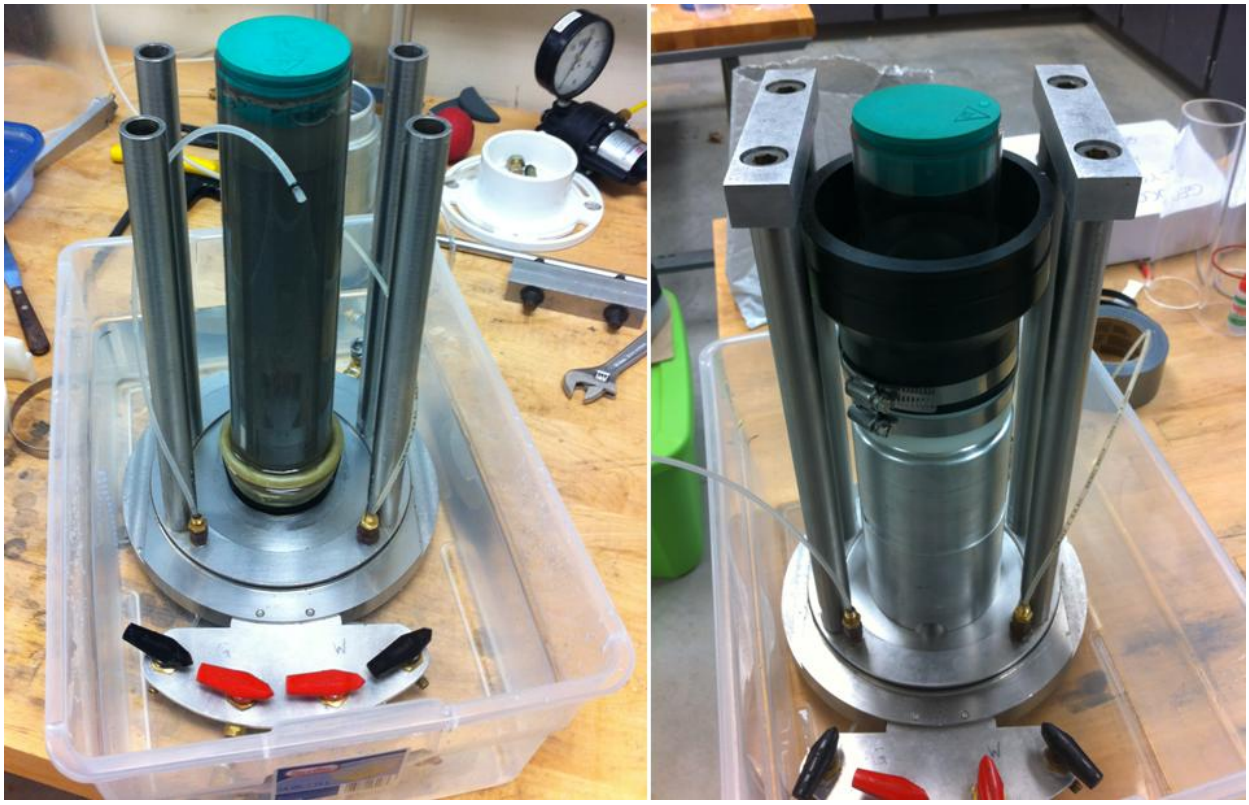


Figure 40: Rolling up the membrane around the mixing tube and placement of the specimen split-mold, the slurry extension collar, and the water extension collar after removal of the triaxial cell base from the water bath.

Once the extension collars for the split-mold is attached, a vacuum is applied between the split mold and the membrane; then, if additional volume is required to accommodate water volume, either a larger membrane can be secured using a hose clamp, or a flexible rubber PVC connection can be used (the flexible PVC connection was used in this experiment, as shown in the right-hand photograph in Figure 40). The last step before transferring the slurry to the split mold is to add a de-aired water bath to the split mold, outside of the mixing tube; this ensures minimal disturbance of the CCR material as it is transferred from the mixing tube to the split-mold. The rubber plug on the mixing tube can now be removed and the mixing tube slowly extruded, such that disturbance to the slurry is minimized as it is deposited in the split-mold. When the mixing tube has been fully extruded, the water level can be adjusted by allowing drainage through the drainage lines on the bottom platen (alternatively, some of the water and fines mixture at the top can be basted off and put into the same container as the fines from the

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mixing tube water bath and oven-dried and later weighed to save time). Once the water level has dropped enough to allow removal of the extra membrane or flexible PVC connection, the slurry can be densified by attaching the top platen (which also has a filter-paper applied), applying a small pressure, and vibrating the sample if necessary, while allowing excess pore pressures to dissipate through top and bottom drainage lines, as shown in Figure 41. This should be done such that the piezometric pressure is the same across the sample, which was postulated to form specimens of sand at uniform densities with height by Vaid and Negussey (1988).



Figure 41: Setup used to densify SI CCR slurry-deposition samples. Notice that the short-circuit between the top and bottom drainage is being used to drain the sample as it is densified with the top platen applied. The top platen fits snugly enough into the extension collar to keep a water-proof seal. The white piece on the top of the triaxial base is simply a part to keep the piston plumb as the slight pressure is applied to the top of the sample during densification.

This vibrating can be accomplished with either a mechanical shaker or by tapping the side of the split mold gently with a mallet. However compaction of specimens to high relative densities can take quite a long time using a mallet, so a mechanical shaker would be preferable for SI CCR specimens. Once the target sample height is reached (and thereby the target sample volume reached), the extension collar is removed, the membrane is secured to the top platen with two o-

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rings, and a small vacuum pressure is applied to the sample to allow removal of the split mold. The dimensions of the sample are then measured and the sample is placed into the triaxial testing apparatus.

The dimensions of the acrylic mixing tube are determined based on the minimum density of the largest volume of soil that will be used in making a sample. That is, the length of the tube is determined based on the amount of soil required in forming the densest sample to be tested, placed at a zero percent relative density. Keurbis and Vaid found that this volume, increased by five to ten percent is sufficient to allow for adequate slurry mixing, while avoiding large particle sedimentation distances. A sample calculation determining the appropriate length for a mixing tube is included in the appendix.

7.5 Analysis of Slurry Deposition Technique with SI CCRs

In order to assess the slurry deposition technique as applied to SI CCRs, relative density and gradation were determined for the top, middle, and bottom portions of the sample. Since CCRs tend to be non-plastic and negative pore water pressures in a moist sample are not high enough to ensure no disturbance of fabric during the verification process, a gelatin solidification technique developed by Emery et al. (1973) for use with sand specimens was modified for use in this experiment. Gelatin was chosen as the solidifying agent because it is easily dissolved using heat after the volume of each individual slice of the specimen is determined. Then, by adding bromelain, a proteolytic enzyme, the gelatin is broken down, leaving a brittle crystal that can then be avoided when selecting a sample to run a hydrometer test on, and that can be washed out when the gradation is analyzed above the #200 sieve.

SI CCRs have a wide range of hydraulic conductivities (a result of how they are generated and placed), sometimes being similar to sands and other times being more similar to silts. For this reason, the time required to permeate these samples with a gelatin solution is much longer than for clean sand samples. As a result, it was determined that a lower concentration should be used than recommended by Emery et al., such that the solution remains a liquid at room temperature, but is solidified by surrounding the sample in the split mold with an ice-bath; this is explained in more detail in the following paragraphs.

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Once the compaction of the slurry deposited sample was complete, height measurements were made at four locations (front, back, right, and left sides of the top platen) using the frame of the triaxial cell and a Mitutoyo micrometer. The height of the sample was determined by subtracting the thicknesses of all the component parts that are not soil from the heights measured from the bottom platen to the triaxial cell frame at four points (front, back, right, and left sides). This was done as a quality-control measure to ensure that the overall relative density across the sample was close to the target relative density. A 0.75% by-mass gelatin solution is then permeated through the specimen by applying an elevation head between the gelatin reservoir and bottom drainage lines of the specimen and allowing drainage through the top drainage lines (not more than 18 inches). About two specimen pore volumes were permeated through the specimen to ensure complete replacement of the pore fluid. After the gelatin flushing of the specimen was complete, the drainage lines were all closed and an ice-bath was packed around the specimen, as shown in Figure 42. For this experiment, the ice bath was maintained over the height of the sample for a period of four hours, which was found to be adequate to solidify the specimen.

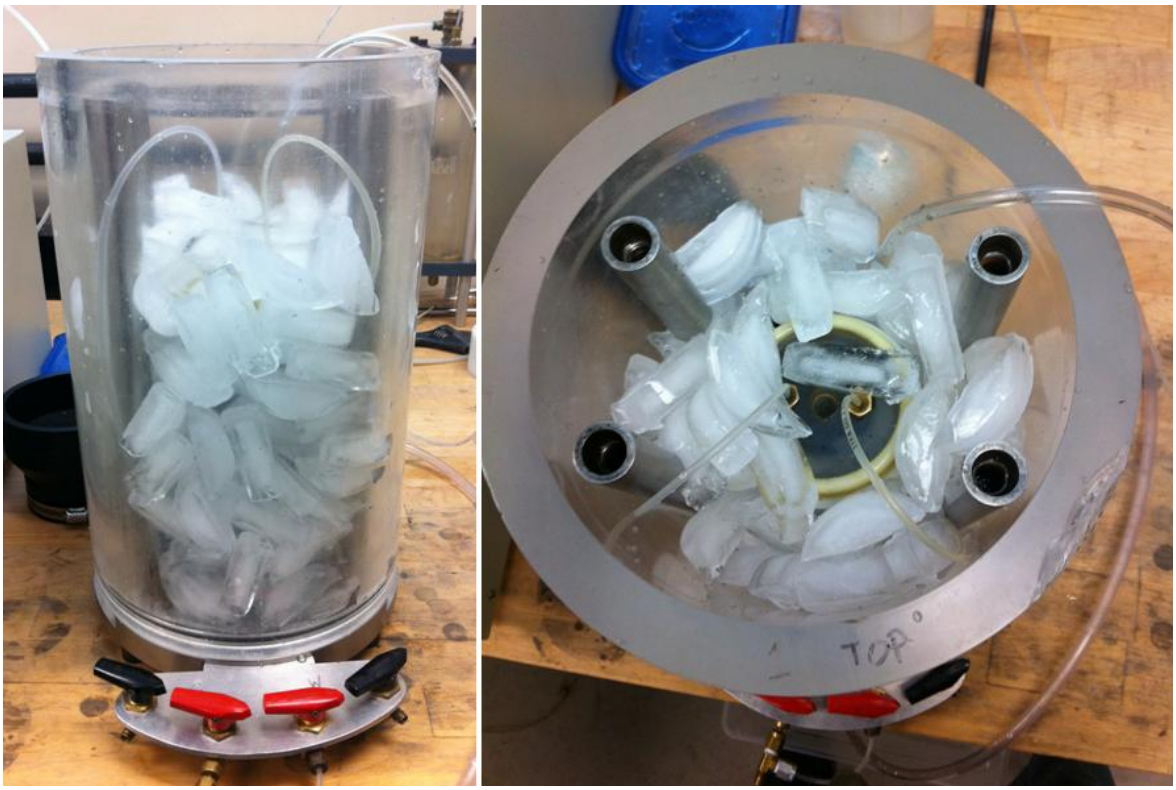


Figure 42: Ice bath placed around the compacted specimen for a period of four hours to set the gelatin.

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After the four hours, the ice bath was removed and the specimen was removed from the split mold and taken out of the membrane, as shown in Figure 43, and cut into three approximately even-sized portions.

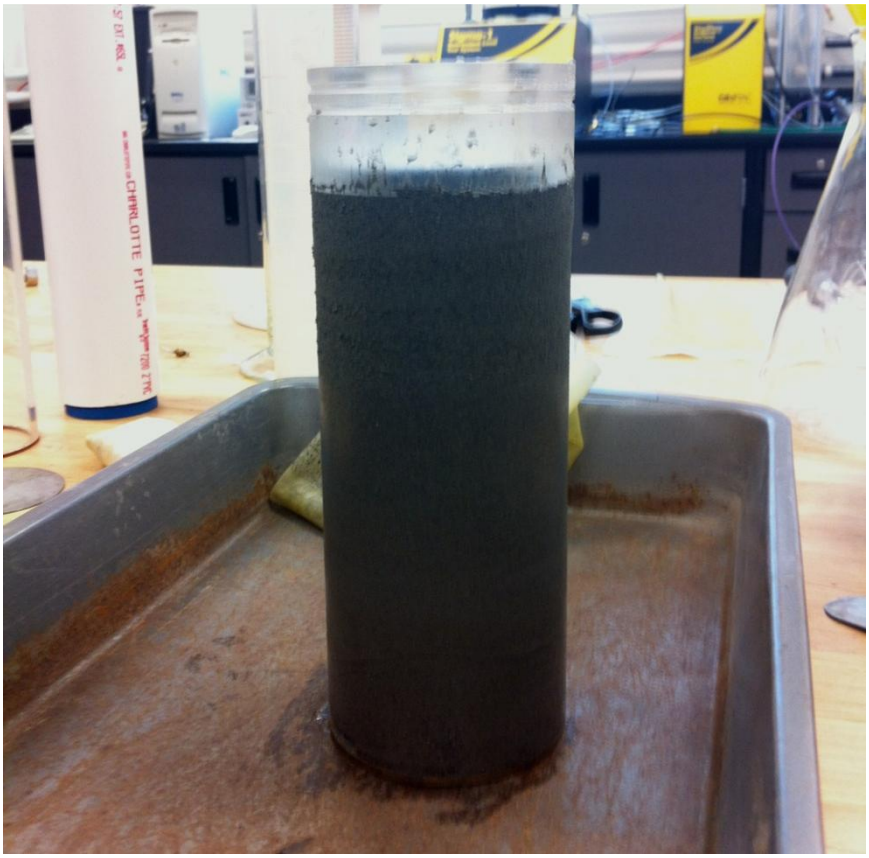


Figure 43: Specimen removed from the split mold and membrane following gelatin curing period.

The mass of these portions was taken and the volume determined using water displacement, as shown in Figure 44. These two measurements allow for the calculation of the density of each slice. It can be assumed that each of the slices is composed only of a mixture of gelatin and CCR material for the purposes of determining the relative density of each slice. The specific gravity of the gelatin solution was determined by permeating a portion of the solution through a piece of filter paper into a graduated cylinder and also placing this in an ice-bath for four hours, after which the mass and volume of the gelatin were measured and used to calculate the specific gravity at that temperature (ranged from 1.000 to 1.008). The specific gravity of the CCR material was determined according to ASTM D854, courtesy of Kevin Foster. Since the overall

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density of each slice is known, and the density of both component materials is known, it is possible to calculate the volume of each component according to equations 12 and 13.

$$V_{s_slice} = \frac{\rho_{slice} \cdot V_{Slice} \frac{G_G M_{slice}}{\rho_{slice}}}{G_S - G_G} \tag{12}$$

where V_{s_slice} = volume of solids of the specimen slice
ρ_{slice} = density of the specimen slice
V_{slice} = volume of the specimen slice
G_G = specific gravity of the gelatin solution after ice-bath
M_{slice} = mass of the specimen slice
G_S = specific gravity of the CCR material

$$V_{g_slice} = \frac{M_{slice}}{\rho_{slice}} - V_{s_slice} \tag{13}$$

where V_{g_slice} = volume of gelatin of the specimen slice

Since it is assumed that the gelatin completely permeated the pore space of the sample, the volume of the gelatin is equal to the volume of voids in the slice and the void ratio can be calculated, which can then be used to calculate the relative density.

Once the densities of the slices has been determined, each slice is placed in its own container and allowed to dissolve (which will occur at room temperature), after which the Bromelain is added (a mass ratio of 1:10 of Bromelain to gelatin was found to be sufficient) and allowed to sit for two hours before placing it in an oven maintained at 110° C until it dried completely. ASTM D422-63 was followed in the particle-size analyses performed on each of the three slices for each sample, except for a few changes based on the properties of the CCR materials:

- The soil was not separated at the #10 sieve, since the material retained on the #10 sieve represented such a small portion of the sample. Additionally, in separating the samples at this sieve, there was the potential to lose specific particle sizes due to dust losses. Each of the hydrometer tests were separated on the #10 sieve following the test and the mass was adjusted accordingly for the hydrometer analysis calculations. This also

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eliminates the need to perform the calculation given in section 16 of the ASTM specification.

- A dry sample was used in each hydrometer test, since there would have been considerable time delays waiting for the specimen to dry at room-temperature (especially considering the presence of gelatin and bromelain in the specimens.

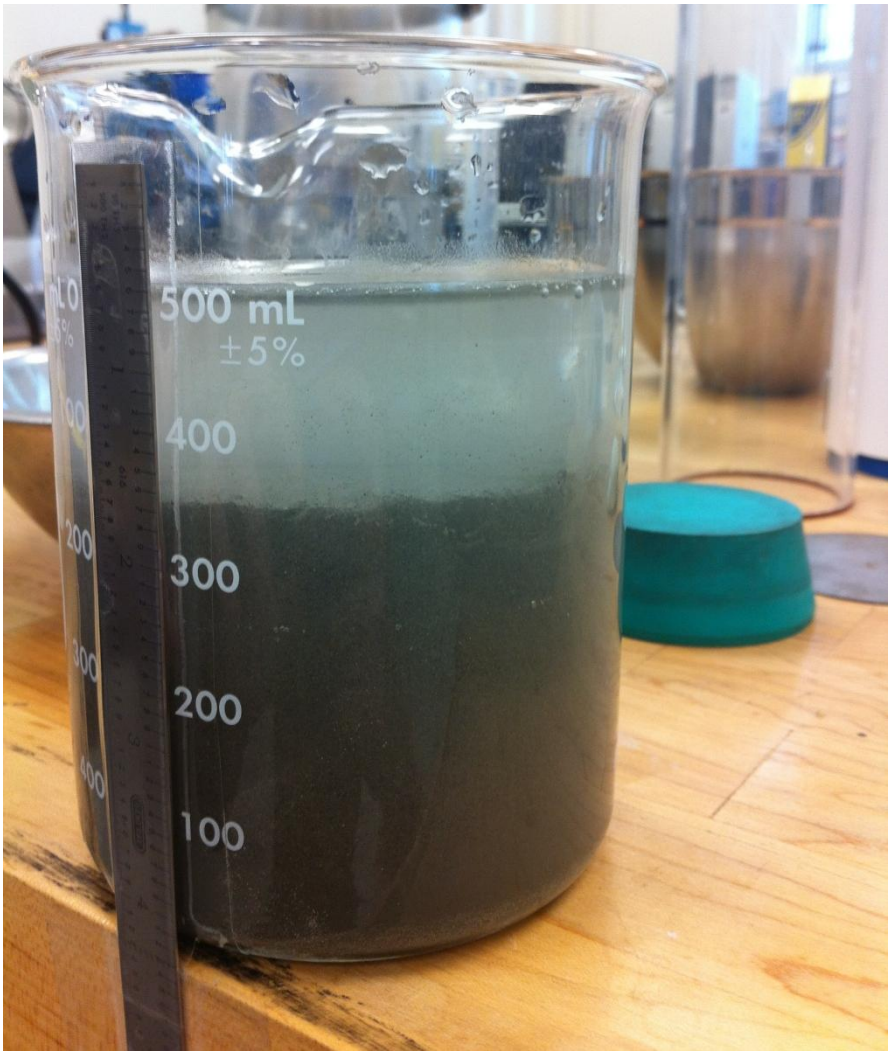


Figure 44: Each specimen slice volume was determined using water displacement. A 500 mL capacity beaker and a ruler incremented at 1/100" were used to do this. The vertical distance between a 100 mL addition of water to the beaker and the equation for the volume of a cylinder was used to calculate the diameter of the beaker; with the diameter known, it was determined that volumes could be measured accurately to ± 1.4 cm^3.

A dry sample of each of the slices could then be chosen to use in a hydrometer test (Bromelain-gelatin crystals were avoided in order to ensure they did not affect the results) to determine the

grain size distribution for soil passing the #200 sieve. This soil was then added back to the rest of the dried specimen slice and washed on a #200 sieve to be included in a grain-size analysis for the particles with diameters greater than 75 μm.

Three different specimens were prepared, all at a target relative density of 70%. The first two specimens were deposited without a water bath within the split mold, while the last one was deposited with a water bath within the split mold. Table 11 makes a comparison of overall specimen slice densities and relative densities for the three specimens showing that, with or without a water bath inside the split mold, all three specimens had an increase in relative density down the height of the specimen. The top slice on the last specimen had not fully cured and as a result deformed some during the mass and volume measurements, undoubtedly resulting in the negative value of relative density. However, the bottom two slices of all three specimens are very consistent and the overall increase in relative density down the height of the specimen indicates that the densification technique that Vaid and Negussey (1988) cite as producing specimens of uniform density does not apply to SI CCR materials. Additionally, the very high values of relative density for all of the bottom slices indicate that the maximum and minimum void ratios determined for the material do not necessarily reflect the actual minimum and maximum void ratios; this could be the result of an inaccurate calculation of the specific gravity of the material, since that is a direct parameter for determining void ratio or an indication that the standards ASTM D4253 and D4254 are not appropriate methods for determining the minimum and maximum densities of CCR materials.

Table 11: Specimen relative density and density summary. The bottom two rows summarize relative density and density data for the entire specimen.

	Specimen 1		Specimen 2		Specimen 3	
	D_r	ρ (g/cm^3)	D_r	ρ (g/cm^3)	D_r	ρ (g/cm^3)
Top Slice	45%	1.63	27%	1.60	-13%	1.54
Middle Slice	93%	1.72	79%	1.69	76%	1.69
Bottom Slice	117%	1.78	113%	1.77	112%	1.77
Average	85%	1.71	73%	1.69	58%	1.67
From Dimensions	73%	-	70%	-	70%	-

The gradation curves presented for each specimen in Figures 45 through 47 show little segregation of particle size, with the most notable trend being that the bottom slice did tend to

have a higher percentage of coarser particles within it; whether this phenomenon is solely the result of the placement method or the densification technique or whether both factors contribute is unclear and would require further study to determine. A comparison of the different slice gradations across specimens, presented in Figures 48 through 50, shows a very consistent gradation across the height of the sample between trials, indicating that this slight gradation difference is caused by a either the placement technique or the densification technique, though which of the one responsible cannot be stated with any certainty at this time. However, the effect of the placement technique and densification technique could be investigated easily through further testing. It is also interesting to note for specimen three, where a water-bath was used in the split-mold during slurry placement, that the gradations vary slightly more than for the two specimens, where a water-bath was not included. This may indicate that a water-bath allows sedimentation currents to form, while direct transfer without a water-bath minimizes the development of such currents. More reconstitutions would need to be made in order to perform meaningful statistical analyses on variation in gradation between samples made with and without water-baths to verify this claim. Lastly, Figure 51 plots all gradations on a single plot to make the extent of variation in the grain size distributions of the three specimens clear.

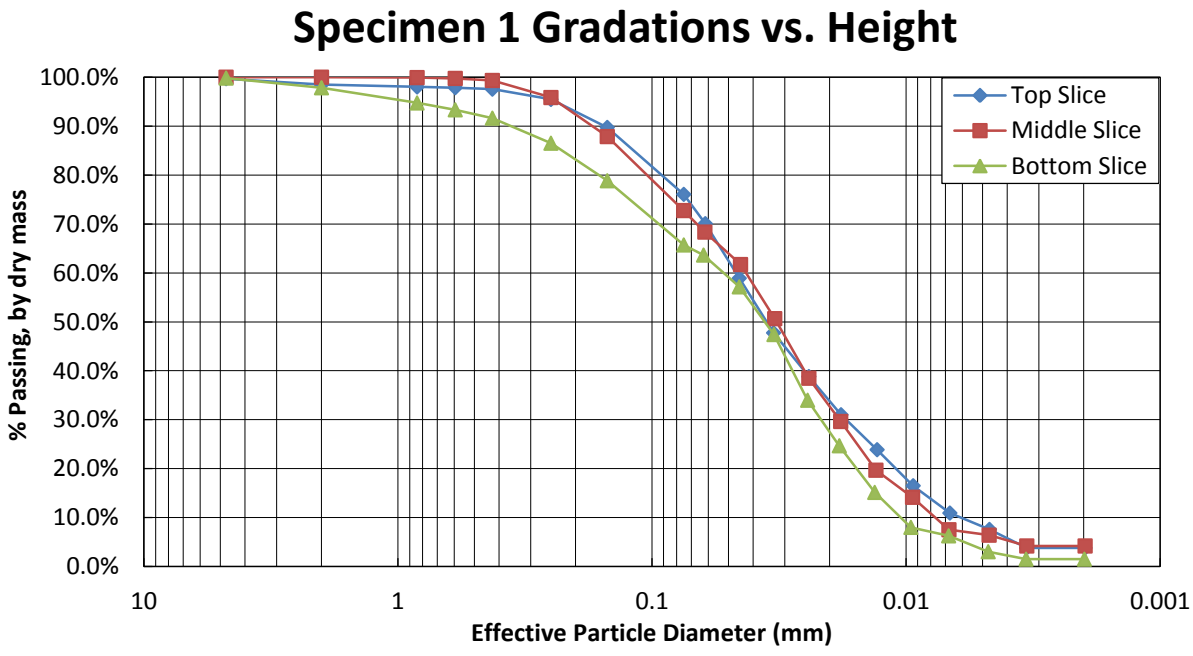


Figure 45: Plot comparing grain-size distributions across the height of specimen one.

While the results of the three reconstitutions performed for this thesis provide some insight, a statement cannot be made about the suitability of the slurry deposition method for use with SI CCRs at this time. However, it can be said that the densification technique used in this investigation is unsuitable for SI CCR materials; if an alternative densification method could be developed, a simple investigation could be undertaken to determine if the slight particle segregation observed in this investigation was due to the vibratory compaction technique used, or if it was the result of the slurry deposition technique itself.

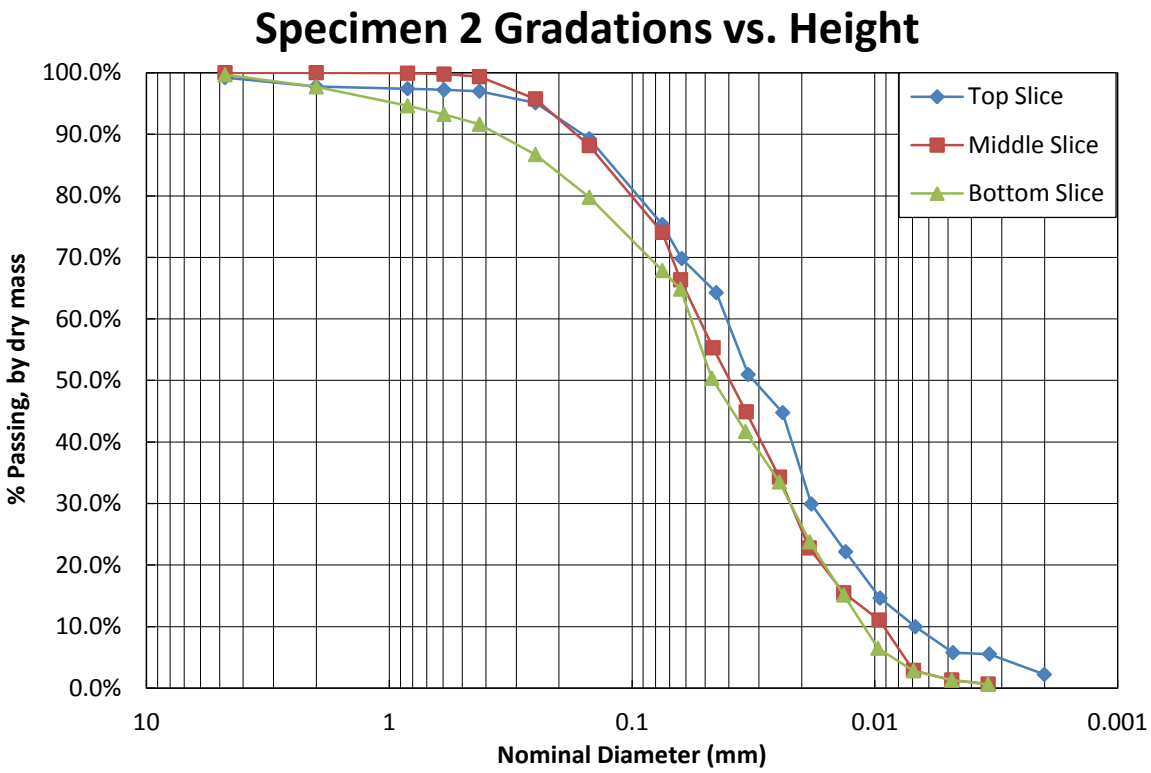


Figure 46: Plot comparing grain-size distribution across the height of specimen two.

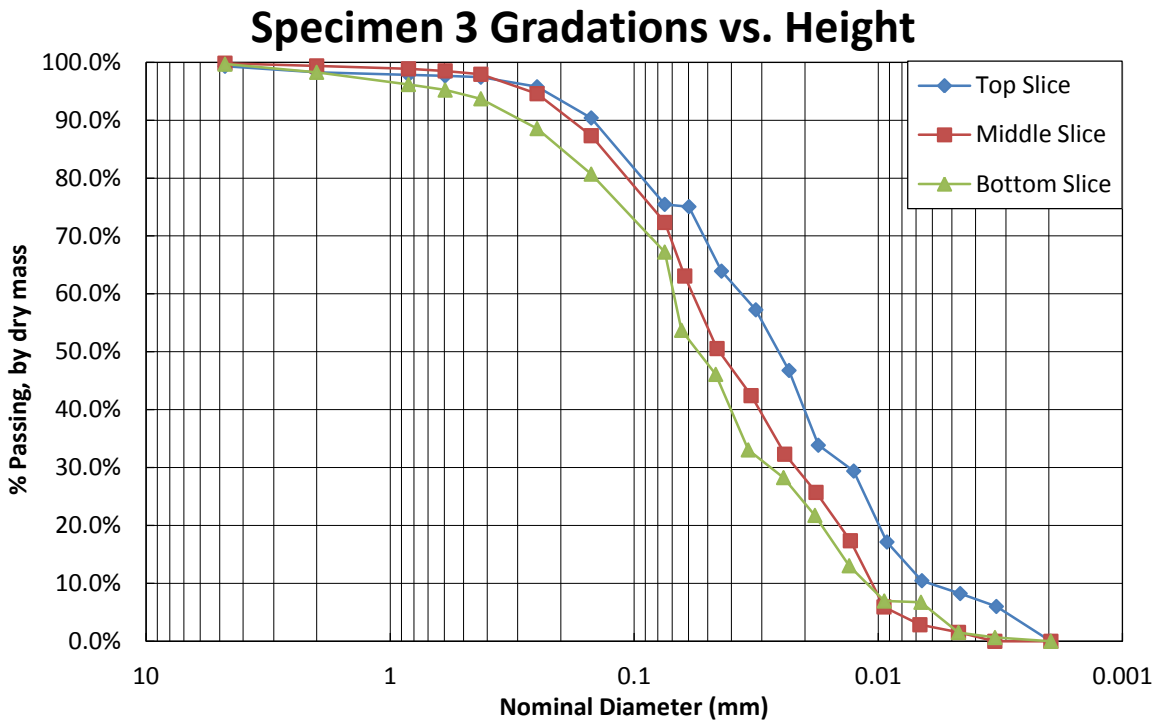


Figure 47: Plot comparing grain-size distribution across the height of specimen three.

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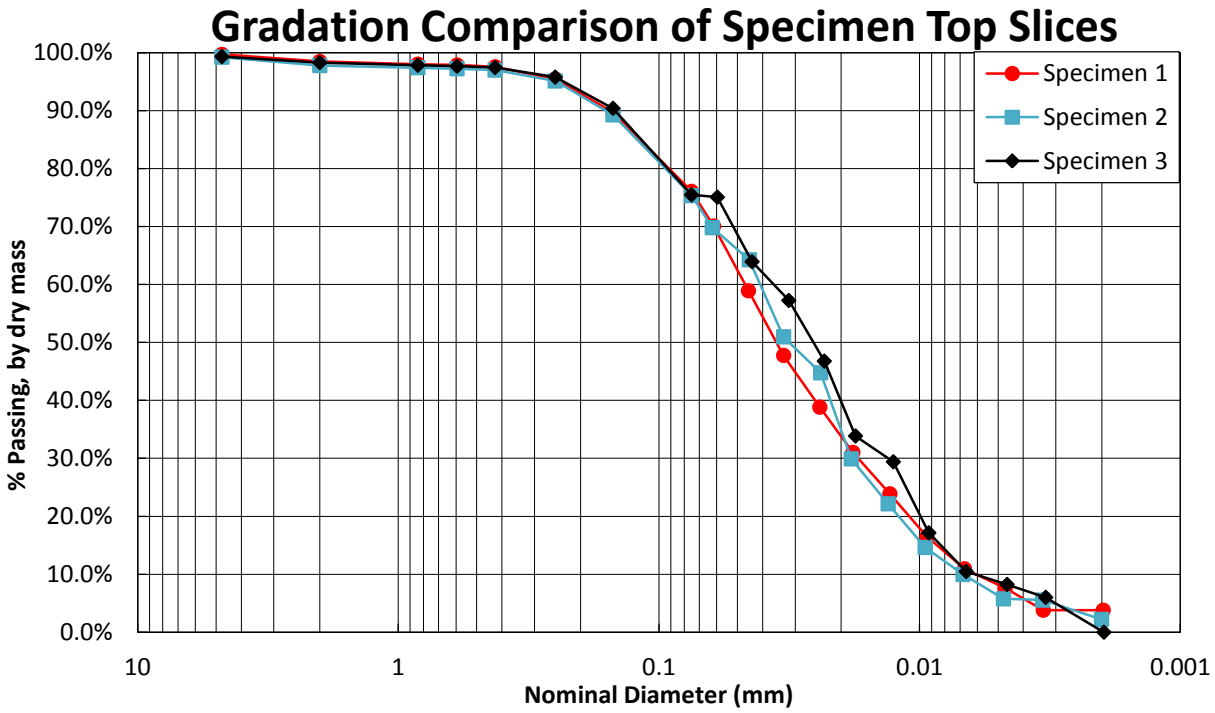


Figure 48: Plot comparing grain-size distributions of the top slices of all three specimens.

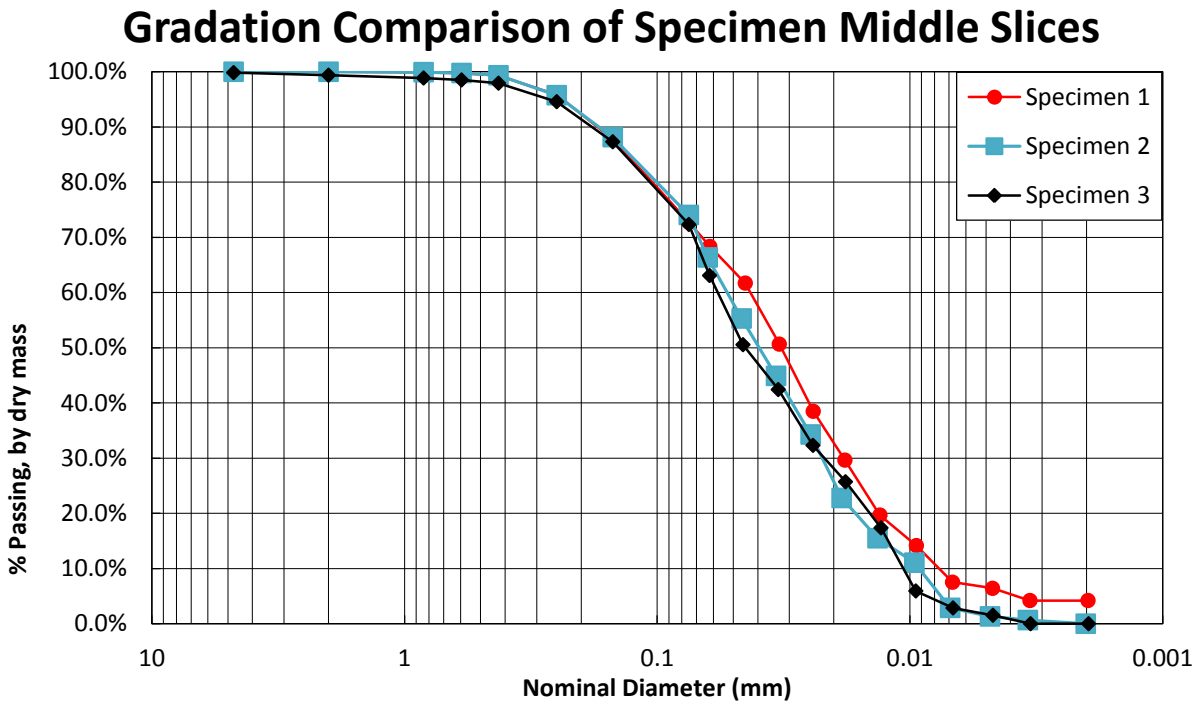


Figure 49: Plot comparing grain-size distribution of the middle slices of all three specimens.

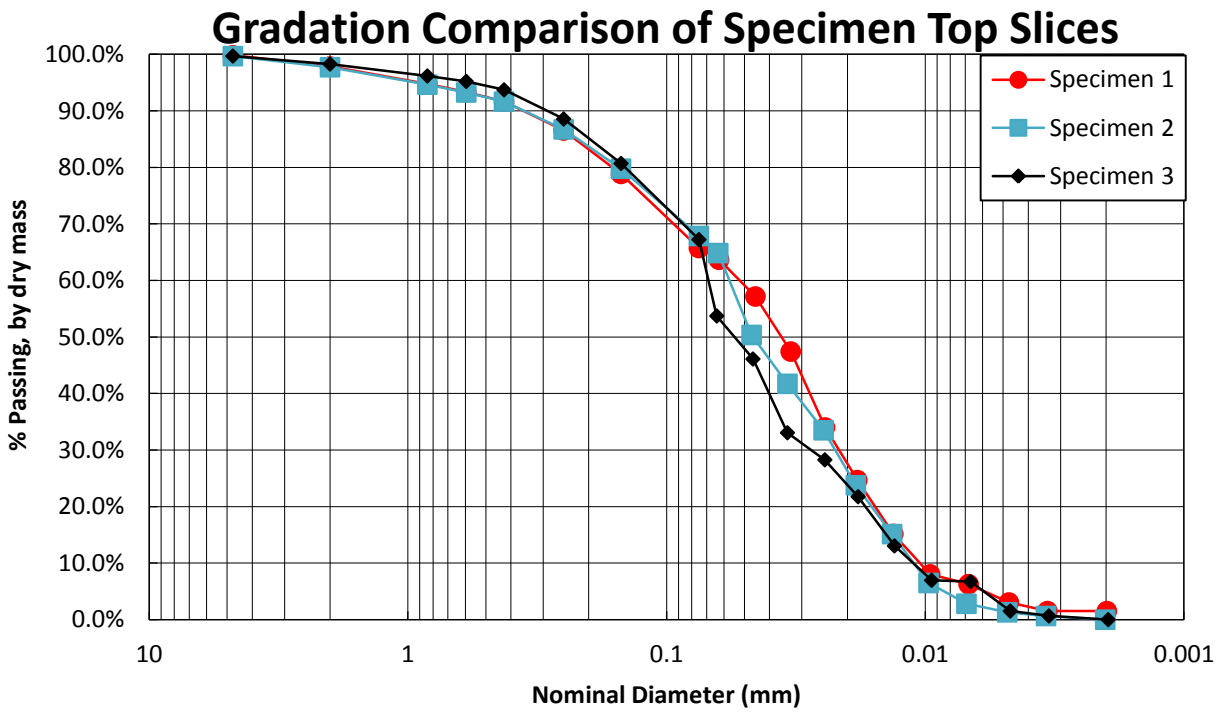


Figure 50: Plot comparing grain-size distribution for the bottom slices of all three specimens.

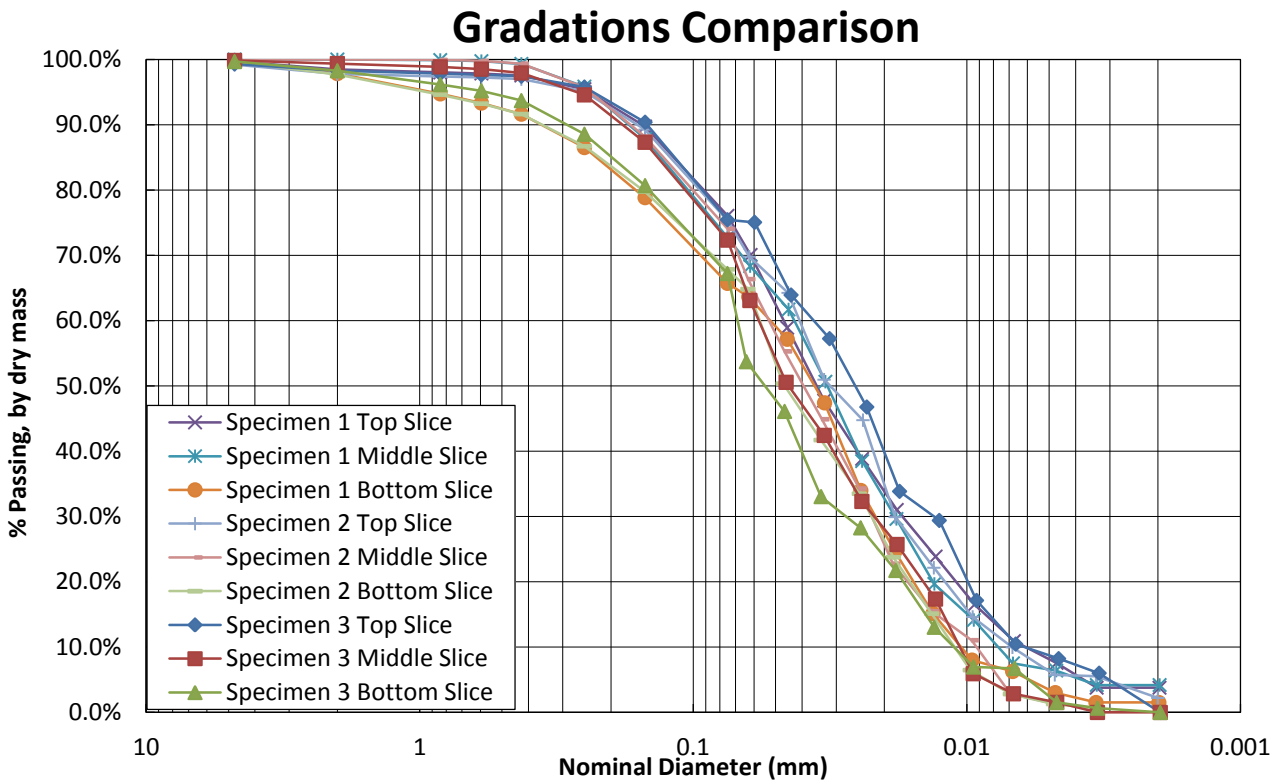


Figure 51: Comparison of all gradations for all three samples.

Examining Figure 51, it is obvious that a considerable amount of variability entered into gradation data with the portion of the graph that was determined using the hydrometer test. This may be the result of slight variations in temperature over the course of the test, regardless of the fact that the room temperature was thermostat-regulated. If temperature readings of the soil suspension had been take at each reading and used in calculating the values derived from Stokes' Law, this variability may have been reduced considerably. The maximum variability in the sieve analysis data for a given nominal diameter was about 10% by mass, while the maximum variability in the hydrometer analysis data for a given nominal diameter was about 25%.

Chapter 8

Conclusions

8.1 Engineering Characterization of CCRs

Geotechnical designs and analyses when working with CCRs are similar to those for natural soils in many respects. The physical and engineering properties of CCRs are what differentiate them from natural soils of similar grain size. Consequently, the single most important aspect of working with CCRs is determining their physical and engineering characteristics. As a result of current and past CCR disposal methods, determining variability in their properties across a given site is also important. As evidenced by the variability plots of the different engineering properties of CCRs, variability can vary greatly to very little within a specific site. However, since the coal source for a given site will inevitable vary, so will the engineering properties of the resulting ash. Because of the differences in properties of CCRs between given sites and from that of natural soils of similar grain size, a more thorough site investigation and laboratory testing schedule will almost always be necessary than for natural soils.

8.2 Dynamic Properties of CCRs

Being a mostly granular and non-plastic material, the characterization of the dynamic properties of CCRs is important to ensure that current and future CCR disposal areas are designed in order to withstand seismic events. Currently there is very little data on the dynamic

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properties of CCRs and the data that is available is usually from different countries, whose CCRs may not be similar enough in makeup to merit comparison with CCRs in the U. S.; more dynamic laboratory testing is required before such a conclusion can be made.

8.3 CCR Failure Modes and Monitoring Practices

The two main types of CCR disposal areas, surface impoundments and landfills, are very different in their construction and therefore are prone to different failure modes. As a result, monitoring practices should be tailored to the type of disposal area it applies to. Despite the fact that there is a lack of literature and precedence regarding monitoring of CCR disposal areas, their design tends to be similar enough to mine tailings dams that monitoring practices for tailings dams could easily be adapted and applied to CCR disposal areas. The flowcharts developed by Martin and Davies (2000) provide an excellent template that could be adapted to develop a site monitoring program for CCR disposal areas, especially for surface impoundments.

8.4 Slope Stability of CCRs

Slope stability analyses with CCRs are basically the same as for natural soils, except that there is usually an inherently higher degree of uncertainty in the CCR material. For that reason, analyses involving CCRs should have a degree of conservatism built into every step, unless there is evidence to indicate that such a measure is unnecessary. If the dikes containing surface impounded CCRs are built CCR materials, or other non-plastic soils that have the potential to have low hydraulic conductivity, then a sudden rise in the water table has a deleterious effect on the impoundment’s performance. For this reason, if such conditions do exist, it is good practice to install drainage (if not already installed) to ensure a steady-state water table can be maintained.

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8.5 Settlement Calculations for CCRs

Many researchers report compression and recompression indices for CCR materials. However, since CCRs generally do not have clearly log-linear values of compression and recompression indices, calculating settlements using consolidation theory can yield variable settlements, depending on different individuals' interpretation of standard consolidation tests.

The two methods for settlement of foundations in sand provide very similar results, underestimating settlement considerably. This is possibly the result of scale effects and differences in the mechanics of the materials (silt-sized particles that are the result of an industrial process rather than natural sands). In order to accurately say that none of these settlement calculation methods works well in CCR surface impounded materials, however, more test fills would need to be performed and analyzed in a similar fashion.

8.6 Slurry Deposition Technique Applied to SI CCRs

While it was not verified that the slurry deposition technique can be applied to SI CCR materials, the method shows promise based on the low variability of grain-size distribution across specimen height for the three specimens tested. However, a major drawback to this method is that the original densification method suggested by Keurbis and Vaid (1988), which was for sands and silty sands, does not appear to work for SI CCR material. Furthermore, more investigations would be required to determine whether the gradation differences observed in these three samples are due to particle migration during vibratory densification or to the actual deposition technique; if it is due to the former, a different densification method may make the slurry deposition method a very attractive reconstitution technique because it is relatively easy and has excellent repeatability, as evidenced in the results presented in Chapter 7. All spreadsheets used in specimen preparation and specimen analysis are provided in the appendix.

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8.7 Recommendations for Further Study

As discussed in Chapter two, since CCR materials are the result of an industrial process and not a naturally occurring soil, there is a variety of factors that can affect their engineering properties. Not being a naturally occurring soil, there is a comparatively small body of literature available that reports engineering properties of CCRs. Furthermore, these properties will not necessarily be comparable between different regions. It is therefore necessary to continue research in CCRs, especially with regards to the following:

- Effects of placement condition on the engineering properties of CCRs (i.e. surface impounded vs. moist-compacted).
- Variability in engineering properties of CCRs between disposal sites and within disposal sites (and how to best quantify variability for different properties).
- Dynamic properties of CCRs, to ensure that seismic design of CCR disposal areas is adequate and determine if some disposal areas are higher risk in the event of an earthquake.
- CPT correlations to determine engineering characteristics of CCR materials in-situ.
- The effect of time on the engineering properties of CCRs.
- Determining the most appropriate method to determine c_v of CCR materials, in order to determine if disposal loading rates may be cause for engineering concern.
- "Smarter" technologies that can be adapted to aid in monitoring CCR disposal areas that would better identify gradual changes that may not be readily apparent to daily inspectors.
- Further testing on slurry deposition reconstituted SI CCR samples to analyze soil fabric (a large enough body of tests to analyze statistically). The same method as used in this thesis could be used or methods to determine shear wave velocity across the height of the sample could be used.

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Appendix A

Sample Preparation and Fabric Analysis Spreadsheets

Sample Dimensions:

Note: Sample mold has bevelled top portion, so volume is calculated as two separate cylinders added together

H_{TC} =	0.72	inches	D_{TC} =	2.851	inches
H_{BC} =	5.465	inches	D_{BC} =	2.826	inches
T_{BS} =	0.112	inches	T_M =	0.012	inches
T_{TP} =	1.229	inches	T_{FP} =	0.007	inches

Where
- H_{TC} = height of top cylinder
- H_{BC} = height of bottom cylinder
- D_{TC} = diameter of top cylinder
- D_{BC} = diameter of bottom cylinder
- T_M = latex membrane thickness
- T_{BS} = thickness of bottom porous stone
- T_{TP} = thickness of top platen
- T_{FP} = thickness of filter paper

Measurements of Sample Height (Datum: cell frame):

Reading Loc.	Bottom Platen (in)	Top of Top Platen (in)	Sample Height (in)
Front	**12.247**	4.724	6.182
Back	**12.253**	4.724	6.188
Right	**12.249**	4.724	6.184
Left	**12.251**	4.724	6.186
		AVG:	6.185

So target volume, V_{TAR}, is:

V_{TAR} =	38.13	in^3
	624.9	cm^3

Minimum and maximum void ratios and specific gravity of solids are:

e_{min} =	0.65
e_{max} =	1.2
G_S =	2.22

Mixing Tube Dimensions Calculation Sheet:

D_r =	100%		Where	% V_T Voids =	percent of sample volume occupied by void space
e =	0.65			% V_T Solids =	percent of sample volume occupied by solids
% V_T Voids =	39%			$V_{S_100\%Dr}$ =	Volume of solids to prepare a sample at 100% relative density
% V_T Solids =	61%			$V_{V_0\%Dr}$ =	Volume of voids at a placement relative density of 0%
Mass solids =	840.72	g		V_{TOT} =	Volume of soil to prepare a sample with a target relative density of 100% at an initial relative density of 0%
$V_{S_100\%Dr}$ =	378.70	cm^3			
$V_{V_0\%Dr}$ =	454.44	cm^3			
V_{TOT} =	833.14	cm^3		V_{TUBE} =	Volume of specimen mixing tube
				D_{TUBE} =	Inner diameter of mixing tube
V_{TUBE} =	874.80	cm^3		H_{TUBE_req} =	Height of mixing tube of specified diameter
	53.384	in^3			
D_{TUBE} =	2.5	inches			
H_{TUBE_req} =	10.88	inches			

Specimen 1 Preparation Sheet:

D_{rTAR} =	70%	
M_{ash} =	764.3	g
w (%) =	29.2%	
M_{moist} =	987.9	g

Location	Target H_{TP} (in)	H_{BP} (in)	H_S (in)
Front	4.724	**12.247**	6.168
Back	4.724	**12.253**	6.174
Right	4.724	**12.249**	6.170
Left	4.724	**12.251**	6.172

Location	Initial H_{TP} (in)	Final H_{TP} (in)	H_{BP} (in)	H_{SI} (in)	H_{SF} (in)
Front	N/A	4.732	**12.247**	N/A	6.160
Back	N/A	4.7265	**12.253**	N/A	6.171
Right	N/A	4.728	**12.249**	N/A	6.166
Left	N/A	4.728	**12.251**	N/A	6.168

Fines Lost:		
Tare Name:	Cindy	
Tare:	475.0	g
Gross:	477.24	g
Net:	2.2	g
% Loss:	0.23%	

$G_{gelatin}$:		
Concentration :	0.75 % by mass	
Tare:	126.8	g
Gross:	224.5	g
Net:	97.7	g
Volume:	97.7	cm^3
$G_{gelatin}$:	1.000	

Approximate Placement D_r:		
D_{COLLAR} =	2.822	in
H_{SI_AVG} =	N/A	in
V_{CYL1} =	33.32	in^3
V_{CYL2} =	4.47	in^3
V_{CYL3} =	N/A	in^3
V_{TOT} =	N/A	in^3
V_{SOLIDS} =	N/A	in^3
V_{VOIDS} =	N/A	in^3
e =	N/A	
D_r =	N/A	

Approximate Densified D_r:		
V_{CYL2} =	4.315	in^3
V_{TOT} =	37.64	in^3
	616.74	cm^3
V_{SOLIDS} =	20.95	in^3
	343.29	cm^3
V_{VOIDS} =	16.69	in^3
	273.45	cm^3
e =	0.80	
D_r =	73.35%	

Specimen 1 Fabric Testing Sheet:

Volume Calculation Information:

D_{beaker} =	3.33162	in
$V_{1/100"}$ =	0.0872	in^3
	1.43	cm^3

Top Slice

Mass =	278.67	g	
Weight =	0.614	lb	
Volume =	10.46	in^3	
	171.43	cm^3	
Density =	0.059	lb/in^3	
	1.63	g/cm^3	
$Mass_{Ovendy}$ =	195.87	g	
$Mass_{Ovenwash}$ =	46.9	g	
$\%Pas_{\#200}$ =	76%		

Sieve Analysis

Tare Name:	Tare 1
Tare Mass (g):	329.2
Tare + Dry Soil Mass (g):	525.1
Tare + Dry Soil Mass After Washing (g):	360.3

Subtract this from $Mass_{Ovenwash}$ =>

Sieve No.	Nominal diameter, mm	wt. retained (g)	% retained	% passing
#4	4.75	0.6	0.3%	99.7%
#10	2	2.4	1.5%	98.5%
#20	0.841	0.9	2.0%	98.0%
#30	0.595	0.3	2.1%	97.9%
#40	0.425	0.6	2.5%	97.5%
#60	0.25	4.1	4.5%	95.5%
#100	0.15	11.2	10.3%	89.7%
#200	0.075	26.8	23.9%	76.1%
Pan		1.9	100.0%	0.0%
	% lost:	0.00%		

Hydrometer Analysis

Time readings begin:	6/14/2012 8:23
Hydrometer Type:	152H
Composite Correction:	5.6
Dry mass of soil tested (g):	50.0
$M_{Retained\ on\ \#10\ seive}$ (g):	1.2
Dry mass of soil past #10 (g):	48.8
W (dry mass of soil represented) (g):	49.6
Temperature (° F):	69
G_s correction factor (ASTM D 422, Table 1); Interpolated!:	1.11
K (ASTM eq. 4, based on temp and G_s):	0.0193
% Passing #10 Sieve:	98.5%

Elapsed time (min)	Reading	Comp. Reading	L (cm) (ASTM table 2)	P (ASTM eqn. 2)	D (mm) (ASTM eqn. 4)
1	37	31.4	10.2	70%	0.0617
2	32	26.4	11.0	59%	0.0453
4	27	21.4	11.9	48%	0.0332
8	23	17.4	12.5	39%	0.0241
15	19.5	13.9	13.1	31%	0.0180
30	16.3	10.7	13.6	24%	0.0130
60	13	7.4	14.2	17%	0.0094
120	10.5	4.9	14.6	11%	0.0067
250	9	3.4	14.8	8%	0.0047
500	7.3	1.7	15.1	4%	0.0034
1440	7.3	1.7	15.1	4%	0.0020

Middle Slice

| | | |

Bottom Slice

| | | |

| Summary | | |

Specimen 2 Preparation Sheet:

D_{rTAR} =	70%	
M_{ash} =	764.3	g
w (%) =	29.2%	
M_{moist} =	987.8	g

Location	Target H_{TP} (in)	H_{BP} (in)	H_S (in)
Front	4.724	**12.247**	6.168
Back	4.724	**12.253**	6.174
Right	4.724	**12.249**	6.170
Left	4.724	**12.251**	6.172

Location	Initial H_{TP} (in)	Final H_{TP} (in)	H_{BP} (in)	H_{SI} (in)	H_{SF} (in)
Front	4.245	4.729	**12.247**	6.648	6.163
Back	4.245	4.728	**12.253**	6.653	6.170
Right	4.245	4.731	**12.249**	6.649	6.163
Left	4.246	4.725	**12.251**	6.650	6.171

Fines Lost:		
Tare Name:	Cindy	
Tare:	475.0	g
Gross:	476.3	g
Net:	1.3	g
% Loss:	0.13%	

$G_{gelatin}$:		
Concentration :	0.75 % by mass	
Tare:	126.8	g
Gross:	224.8	g
Net:	98	g
Volume:	98	cm^3
$G_{gelatin}$:	1.000	

Approximate Placement D_r:		
D_{COLLAR} =	2.825	
H_{IS_AVG} =	0.465	
V_{CYL1} =	33.66	in^3
V_{CYL2} =	4.52	in^3
V_{CYL3} =	2.86	in^3
V_{TOT} =	41.04	in^3
V_{SOLIDS} =	20.97	in^3
V_{VOIDS} =	20.07	in^3
e =	0.96	
D_r =	44%	

Approximate Densified D_r:		
V_{CYL2} =	4.36	in^3
V_{TOT} =	38.02	in^3
	622.98	cm^3
V_{SOLIDS} =	20.97	in^3
	343.69	cm^3
V_{VOIDS} =	17.04	in^3
	279.29	cm^3
e =	0.81	
D_r =	70.43%	

Specimen 2 Fabric Testing Sheet:

Volume Calculation Information:

D_{beaker} =	3.33162	in
$V_{1/100"}$ =	0.087	in^3
	1.43	cm^3

Top Slice

Mass =	237	g	
Weight =	0.522	lb	
Volume =	9.07	in^3	
	148.57	cm^3	
Density =	0.058	lb/in^3	
	1.60	g/cm^3	
$Mas_{Ovendry}$ =	165.8	g	
$Mas_{Ovenwash}$ =	41.1	g	
$\%Pas_{\#200}$ =	75%		

Sieve Analysis

			Sieve No.	Nominal diameter, mm	wt. retained (g)	% retained	% passing
Tare Name:	Tare 4		#4	4.75	1.3	0.8%	99.2%
Tare Mass (g):	329.8		#10	2	2.4	2.2%	97.8%
Tare + Dry Soil Mass (g):	495.6		#20	0.841	0.6	2.6%	97.4%
Tare + Dry Soil Mass After Washing (g):	371.9		#30	0.595	0.3	2.8%	97.2%
			#40	0.425	0.4	3.0%	97.0%
			#60	0.25	3.1	4.9%	95.1%
			#100	0.15	9.7	10.7%	89.3%
			#200	0.075	23.1	24.7%	75.3%
Subtract this from $Mass_{Ovenwash}$ =>			Pan		1	100.0%	0.0%
				% lost:	0.12%		

Hydrometer Analysis

		Elapsed time (min)	Reading	Comp. Reading	L (cm) (ASTM table	P (ASTM eqn. 2)	D (mm) (ASTM eqn. 4)
Time readings begin:	6/15/2012 17:13	1	36.5	31.5	10.3	70%	0.0624
		2	34	29	10.7	64%	0.0450
Hydrometer Type:	152H	4	28	23	11.7	51%	0.0332
Composite Correction:	5	8	25.2	20.2	12.2	45%	0.0240
Dry mass of soil tested (g):	50.0	15	18.5	13.5	13.3	30%	0.0183
$M_{retained on \#10 selve}$ (g):	1.2	30	15	10	13.8	22%	0.0132
Dry mass of soil past #10 (g):	48.8	60	11.6	6.6	14.4	15%	0.0095
W (dry mass of soil represented) (g):	49.9	120	9.5	4.5	14.7	10%	0.0068
Temperature (° F):	68	250	7.6	2.6	15.0	6%	0.0048
G_s correction factor (ASTM D 422, Table 1); Interpolated!:	1.11	500	7.5	2.5	15.1	6%	0.0034
K (ASTM eq. 4, based on temp and G_s):	0.0194	1440	6	1	15.3	2%	0.0020
% Passing #10 Sieve:	97.8%						

Middle Slice

| | | |

Bottom Slice

| | | |

| Summary | | |

Specimen 3 Preparation Sheet:

D_{rTAR} =	70%	
M_{ash} =	764.3	g
w (%) =	29.2%	
M_{moist} =	987.8	g

Location	Target H_{TP} (in)	H_{BP} (in)	H_S (in)
Front	4.724	**12.247**	6.168
Back	4.724	**12.253**	6.174
Right	4.724	**12.249**	6.170
Left	4.724	**12.251**	6.172

Location	Initial H_{TP} (in)	Final H_{TP} (in)	H_{BP} (in)	H_{SI} (in)	H_{SF} (in)
Front	4.447	4.735	**12.247**	6.446	6.157
Back	4.449	4.734	**12.253**	6.449	6.164
Right	4.451	4.734	**12.249**	6.443	6.160
Left	4.446	4.735	**12.251**	6.450	6.161

Fines Lost:		
Tare Name:	Cindy	
Tare:	475.0	g
Gross:	477.3	g
Net:	2.3	g
% Loss:	0.23%	

$G_{gelatin}$:		
Concentration:	0.75% by mass	
Tare:	126.8	g
Gross:	225.55	g
Net:	98.75	g
Volume:	98	cm^3
$G_{gelatin}$:	1.008	

Approximate Placement D_r:		
D_{COLLAR} =	2.825	
H_{IS_AVG} =	0.262	in
V_{CYL1} =	33.66	in^3
V_{CYL2} =	4.52	in^3
V_{CYL3} =	1.61	in^3
V_{TOT} =	39.79	in^3
V_{SOLIDS} =	20.95	in^3
V_{VOIDS} =	18.84	in^3
e =	0.90	
D_r =	55%	

Approximate Densified D_r:		
V_{CYL2} =	4.32	in^3
V_{TOT} =	37.98	in^3
	622.34	cm^3
V_{SOLIDS} =	20.95	in^3
	343.24	cm^3
V_{VOIDS} =	17.03	in^3
	279.10	cm^3
e =	0.81	
D_r =	70.34%	

Specimen 3 Fabric Testing Sheet:

Volume Calculation Information:

D_{beaker} =	3.33162	in
$V_{1/100"}$ =	0.087	in^3
	1.43	cm^3

Top Slice

Sieve Analysis						
Mass =	257.6	g				
Weight =	0.568	lb	Tare Name:	Tare 1		
Volume =	10.20	in^3	Tare Mass (g):	329.2		
	167.14	cm^3	Tare + Dry Soil Mass (g):	504.0		
Density =	0.056	lb/in^3	Tare + Dry Soil Mass After Washing (g):	374.0		
	1.54	g/cm^3				
$Mass_{Ovendry}$ =	174.8	g	Subtract this from $Mass_{Ovenwash}$ =>			
$Mass_{Ovenwash}$ =	42.7	g				
$\%Pass_{\#200}$ =	76%					

Sieve No.	Nominal diameter, mm	wt. retained (g)	% retained	% passing
#4	4.75	1.2	0.7%	99.3%
#10	2	1.8	1.7%	98.3%
#20	0.841	0.8	2.2%	97.8%
#30	0.595	0.3	2.3%	97.7%
#40	0.425	0.4	2.6%	97.4%
#60	0.25	2.9	4.2%	95.8%
#100	0.15	9.4	9.6%	90.4%
#200	0.075	26.1	24.5%	75.5%
Pan		2.6	100.0%	0.0%
	% lost:	-0.11%		

Hydrometer Analysis

Elapsed time (min)	Reading	Comp. Reading	L (cm) (ASTM table 2)	P (ASTM eqn. 2)	D (mm) (ASTM eqn. 4)
1	39	33.7	9.9	75%	0.0597
2	34	28.7	10.7	64%	0.0439
4	31	25.7	11.2	57%	0.0317
8	26.3	21	12.0	47%	0.0232
15	20.5	15.2	12.9	34%	0.0176
30	18.5	13.2	13.3	29%	0.0126
60	13	7.7	14.2	17%	0.0092
120	10	4.7	14.7	10%	0.0066
250	9	3.7	14.8	8%	0.0046
500	8	2.7	15.0	6%	0.0033
1440	5.3	0	15.4	0%	0.0020

Time readings begin:	6/16/2012 12:57	
Hydrometer Type:	152H	
Composite Correction:	5.3	
Dry mass of soil tested (g):	50.0	
$M_{retained\ on\ \#10\ sieve}$ (g):	1.2	
Dry mass of soil past #10 (g):	48.8	
W (dry mass of soil represented) (g):	49.7	
Temperature (° F):	71.6	
G_s correction factor (ASTM D 422, Table 1); Interpolated!:	1.11	
K (ASTM eq. 4, based on temp and G_s):	0.0190	
% Passing #10 Sieve:	98.3%	

Middle Slice

| | | |

Bottom Slice

| | | |

| Summary | | |

APPENDIX D

Dallman Boring Log and Cross Section

PSI Information To Build On
Engineering • Consulting • Testing

August 30, 2010

City Water, Light & Power
Environmental Health & Safety
201 East Lake Shore Drive
Springfield, Illinois 62712

Attn: Ms. Sue Corcoran
Tel: 217-757-8610
Fax: 217-757-8615

Re: Piezometer Installation
CWLP Ash Ponds
East Lake Shore Drive
Springfield, Illinois
PSI Report No. 0020522-1 Rev. 1 Page 1 of 22 (including attachments)

Dear Ms. Corcoran:

In general accordance with your instructions, Professional Service Industries, Inc. (PSI) has completed the installation of four (4) temporary piezometers at the periphery of CWLP's ash pond area in Springfield, Illinois. Additionally, certain laboratory analysis was performed, as was in situ hydraulic conductivity (slug) testing. The piezometer locations are identified on the attached location plan. Boring depths and static water levels are shown in the table below.

	AP-1	AP-2	AP-3	AP-4
Date drilled	4/21/2010	4/21/2010	4/21/2010	4/20/2010
Total boring depth (ft)	31.5	20	19.5	60
Piezometer depth from top of first casing above ground surface (ft)	33.15	19.47	19.63	58.93
Piezometer depth from ground surface (ft)	28.34	17.18	17.91	58.31
Well screen length (ft)	10	10	10	10
Static water level from ground surface (5/5/2010)	4.81	3.89	5.16	5.95

The borings were drilled to depths ranging from approximately 17.2 to 58.3 feet below the existing ground surface, respectively. It is PSI's understanding that the purpose for these soil borings is to aid CWLP in assessing the groundwater quality outside the existing CWLP ash ponds. The general boring locations were determined and located in the field by CWLP personnel. With the approval of Ms. Corcoran, AP-2 was offset to the north of the clarifier pond drainage pipe. Depths on the attached boring logs are relative to the ground surface at each boring location.

Water level observations were made during and upon completion of the boring operations and are noted on the boring logs presented herewith. In addition, static water levels were observed

at the time of the slug testing. In relatively impervious soils, the accurate determination of the groundwater elevation may not be possible even after several days of observation. Seasonal variations, temperature and recent rainfall conditions may influence the levels of the groundwater table and volumes of water will depend on the permeability of the soils.

Soil samples were visually classification in the field for logging purposes. The limited laboratory testing program included grain size analysis. Where soil tests are reported, they have been performed in accordance with generally acceptable or applicable standards. Sieve analysis worksheets are appended. Soil samples were conveyed to CWLP upon completion of the well installation activities.

A copy of the boring logs are appended. The stratification of the soils on the log represents the soil conditions in the actual boring location. Lines of demarcation represent the approximate boundaries between the soil types, but the transition may be gradual.

On May 5, 2010, in situ rising head hydraulic conductivity (slug) testing was performed on each of the four piezometers. Testing was conducted by rapidly removing one bailer (1 liter) of groundwater from the well while recording the rate of recovery using a Solinst 3001 level logger. Hydraulic conductivity was estimated using the Hvorslev method. Based on this method, the average hydraulic conductivity was estimated at 2.50E-02. Slug test results and hydraulic conductivity calculations are appended.

PSI appreciates the opportunity to perform these services and if we can be of further service, please contact our office at (217) 544-6663.

Respectfully submitted,
PROFESSIONAL SERVICE INDUSTRIES, INC.

James Gerloff, E.I.
Branch Manager

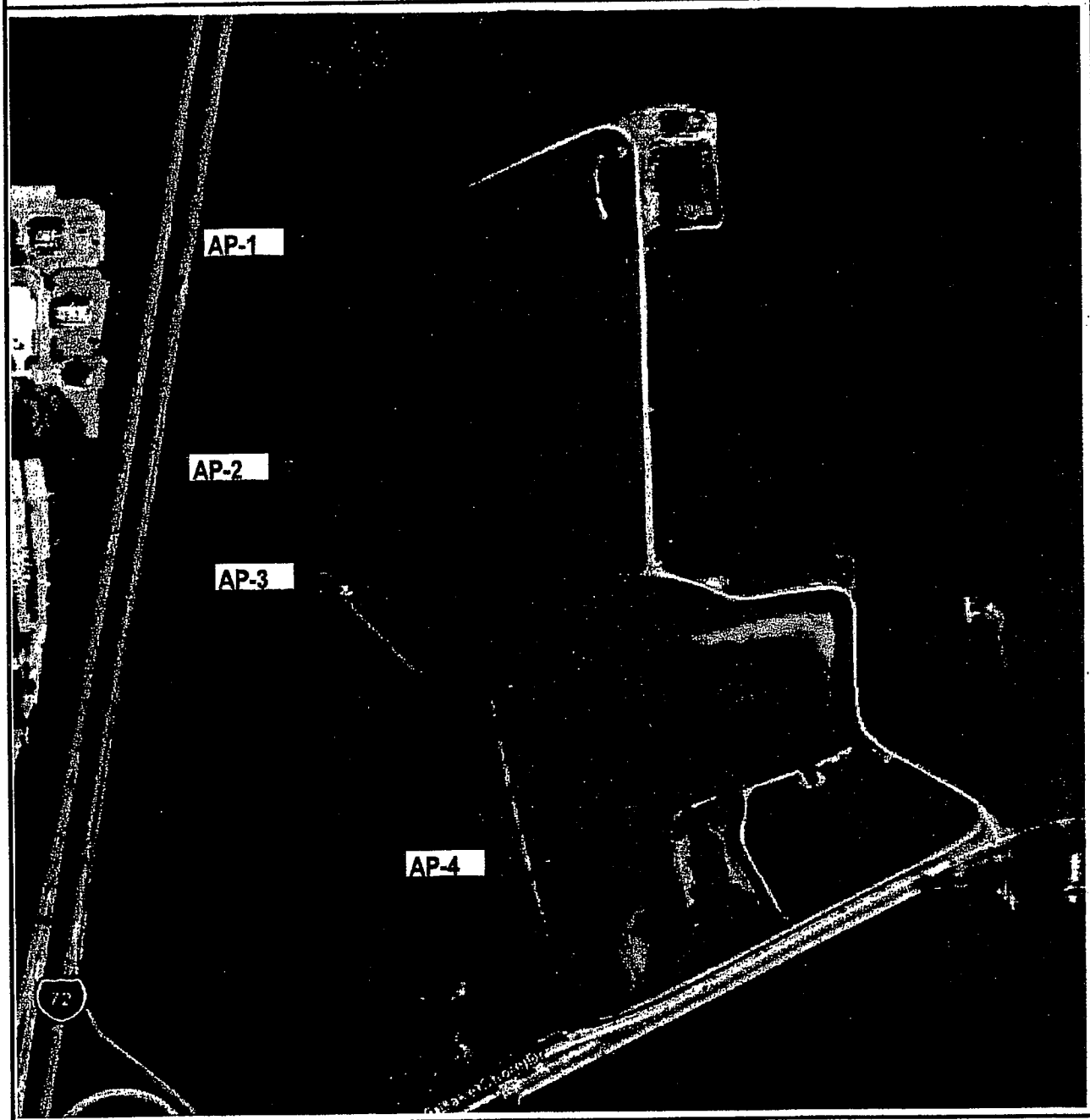
William P. Pongracz, P.E.
Vice President

Attachments: Key to Symbols
Boring Logs (4 pages)
Piezometer Location Plan
In-Situ Hydraulic Conductivity Results (6 pages)
Sieve Analysis Worksheets (8 pages)

Distribution: (1) above

PIEZOMETER LOCATION PLAN

SOURCE:	DATE:	SCALE:	
Google © 2010 / DigitalGlobe © 2010	Nov-05	No Scale	



psi Information To Build On
Engineering • Consulting • Testing
480 North Street, Springfield, Illinois 62704
phone 217/544-6663 fax 217/544-6148

PIEZOMETER LOCATION PLAN

PSI PROJECT No.:	0020522
Project:	Piezometer Installation
Location:	CWLP Ash Pond
	East Lake Shore Drive
	Springfield, Illinois

KEY TO SYMBOLS


Fill (made ground)


USCS Low Plasticity Clay


USCS Silt


USCS Low Plasticity Sandy Clay


USCS Clayey Sand


USCS Well-graded Sand with Silt


USCS Poorly-graded Sand


USCS Well-graded Sand

HSA = Hollow Stem Auger

CFA = Continuous Flight Auger

SPT = Standard Penetration Test

DCP = Dynamic Cone Penetrometer

SS = Split-spoon Sampler

ST = Shelby Tube Sampler

RC = Rock Core

DD = Dry Density

LL = Liquid Limit

PL = Plastic Limit

Qu = Unconfined Compressive Strength

Qp = Pocket Penetrometer

RQD = Rock Quality Designation

REC'D = Rock Core Recovery Percentage

PID = Photo Ionic Detector (ppm)

MR* = Unable to determine depth of water due to mud rotary drilling methods

The borings were advanced into the ground using hollow stem augers. At regular intervals throughout the boring depths, soil samples were obtained with either a 1.4-inch I.D., 2.0-inch O.D., split-spoon sampler or a 3-inch diameter Shelby tube. The split-spoon sampler was first seated 6-inches to penetrate any loose cuttings and then driven an additional foot where possible with blows of a 140 pound hammer falling 30-inches. The number of hammer blows required to drive the sampler each 6-inch increment is recorded in the field. The penetration resistance "N-value" is redesignated as the number of hammer blows required to drive the sampler the final foot and, when properly evaluated, is an index to cohesion for clays and relative density for sands. The split-spoon sampling procedures used during this exploration are in general accordance with ASTM Designation D 1586.

Relatively undisturbed Shelby tube samples were obtained by forcing a section of 3-inch diameter steel tubing into the soil at the desired sampling levels. This sampling procedure was in general accordance with ASTM Designation D 1587. Each tube, together with the encased soil, was carefully removed from the ground, sealed and transported to the laboratory for testing.

Professional Service Industries, Inc.
480 North Street
Springfield, Illinois 62704
Telephone: 217/544-6663
Fax: 217/544-6143

PSI Job No.: 0020522
Project: Piezometer Installation
Location: CWLP Ash Pond
East Lake Shore Drive
Springfield, Illinois

Professional Service Industries, Inc.
480 North Street
Springfield, Illinois 62704
Telephone: 217/544-6663
Fax: 217/544-6143

LOG OF BORING AP-1

Sheet 1 of 1

PSI Job No.: 0020522
Project: Piezometer Installation
Location: CWLP Ash Pond
East Lake Shore Drive
Springfield, Illinois

Drilling Method: Hollow Stem Auger
Sampling Method: Split Spoon
Hammer Type: CME Automatic; ETR = 86%
Boring Location: See attached boring location plan.

WATER LEVELS

While Drilling	9 feet
Upon Completion	N/A
Delay	N/A

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %
	0			1	18	Dark brown silty CLAY, very stiff, slightly moist	CL	7-8-9 N_{60}=24	
				2	18	Dark brown clayey SILT, stiff, slightly moist	ML	5-5-5 N_{60}=14	
	5			3	18	Gray clayey SILT, trace brown, firm, moist		2-2-3 N_{60}=7	
				4	18		ML	2-2-3 N_{60}=7	
	10			5	18			1-2-2 N_{60}=6	
				6	18	Gray silty CLAY, few brown sand, firm, saturated	CL	1-2-2 N_{60}=6	
	15			7	18	Gray sandy CLAY, stiff, saturated	CLS	4-3-4 N_{60}=10	
				8	18	Blue-gray clayey SILT, soft to very stiff, moist to saturated		3-3-4 N_{60}=10	
	20						ML		
				9	18			1-2-1 N_{60}=4	
	25								
				10	18	Gray SAND with SILT, medium dense/very stiff, saturated	SW-SM	6-7-6 N_{60}=19	
	30			11	6	Gray SHALE, hard, slightly moist	CL	50/6"	
						Boring terminated ay -31.5'			
	35								

STANDARD PENETRATION TEST DATA
N in blows/ft
Moisture: PL, LL
0 25 50
STRENGTH, tsf
Qu, Qp
0 2.0 4.0

Additional Remarks

Well Diagram: J-Plug; Concrete Cap; 2" PVC Solid Riser; Bentonite Seal; Sand Filter Pack; 0.01" PVC Slotted Well Screen

Completion Depth: 35.0 ft
Date Boring Started: 4/21/10
Date Boring Completed: 4/21/10
Logged By: Rob Preuss
Drilling Contractor: PSI, Inc.

Sample Types:
Auger Cutting; Split-Spoon; Rock Core; Shelby Tube; Hand Auger; Texas Cone

Latitude:
Longitude:
Drill Rig: ATV D50
Remarks: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Moistures determined by visual methods.

The stratification lines represent approximate boundaries. The transition may be gradual.

Professional Service Industries, Inc.
480 North Street
Springfield, Illinois 62704
Telephone: 217/544-6663
Fax: 217/544-6143

LOG OF BORING AP-2

Sheet 1 of 1

PSI Job No.: 0020522
Project: Piezometer Installation
Location: CWLP Ash Pond
East Lake Shore Drive
Springfield, Illinois

Drilling Method: Hollow Stem Auger
Sampling Method: Split Spoon
Hammer Type: CME Automatic; ETR = 86%
Boring Location: See attached boring location plan.

WATER LEVELS

While Drilling	9 feet
Upon Completion	N/A
Delay	N/A

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			1	10	Dark brown silty CLAY, some sand, stiff, slightly moist (FILL)	CL	4-4-6 N_{60}=14		
	5			2	8	Dark brown silty CLAY, soft to firm, moist	CL	2-2-2 N_{60}=6		
				3	6	Gray silty CLAY, soft to firm, moist	CL	1-1-2 N_{60}=4		
	10			4	18	Gray clayey SILT, soft to firm, saturated		2-2-2 N_{60}=6		
				5	18		ML	2-1-1 N_{60}=3		
				6	18			2-1-2 N_{60}=4		
	15			7	18	Light gray SAND, dense, saturated	SP	4-9-16 N_{60}=36		
	20			8	14	Gray SHALE, hard, slightly moist Boring terminate at -20'	CL	19-24-50/2"		

STANDARD PENETRATION TEST DATA
N in blows/ft @
× Moisture ◪ PL ✚ LL
0 25 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

Well Diagram: J-Plug; Concrete Cap; 2" PVC Solid Riser; Bentonite Seal; Sand Filter Pack; 0.01" PVC Slotted Well Screen

Completion Depth: 20.0 ft
Date Boring Started: 4/21/10
Date Boring Completed: 4/21/10
Logged By: Rob Preuss
Drilling Contractor: PSI, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude:
Longitude:
Drill Rig: ATV D50
Remarks: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Moistures determined by visual methods.

The stratification lines represent approximate boundaries. The transition may be gradual.

Professional Service Industries, Inc.
480 North Street
Springfield, Illinois 62704
Telephone: 217/544-6663
Fax: 217/544-6143

LOG OF BORING AP-3

Sheet 1 of 1

PSI Job No.: 0020522
Project: Piezometer Installation
Location: CWLP Ash Pond
East Lake Shore Drive
Springfield, Illinois

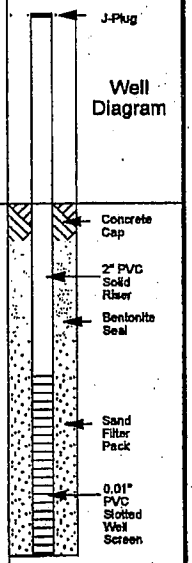
Drilling Method: Hollow Stem Auger
Sampling Method: Split Spoon
Hammer Type: CME Automatic; ETR = 86%
Boring Location: See attached boring location plan.

WATER LEVELS
While Drilling: None feet
Upon Completion: N/A
Delay: N/A

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			1	18	Dark brown silty CLAY, very stiff, slightly moist	CL	6-7-8 N_{60}=21		
	5			2	18	Gray/brown clayey SILT, soft to stiff, moist to saturated	ML	3-3-4 N_{60}=10		
				3	18			1-1-1 N_{60}=3		
	10			4	18	Gray clayey SILT, soft to very stiff, saturated		2-1-2 N_{60}=4		
				5	18			2-2-4 N_{60}=9		
	15			6	16		ML	2-2-4 N_{60}=9		
				7	18			4-4-6 N_{60}=14		
	20			8	10	Gray SHALE, hard, slightly moist Boring terminated at -19.5	CL	32-50/3"		

STANDARD PENETRATION TEST DATA
N in blows/ft
Moisture ✕ PL ◪ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



Well Diagram

Completion Depth: 20.0 ft
Date Boring Started: 4/21/10
Date Boring Completed: 4/21/10
Logged By: Rob Preuss
Drilling Contractor: PSI, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude:
Longitude:
Drill Rig: ATV D50
Remarks: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Moistures determined by visual methods.

The stratification lines represent approximate boundaries. The transition may be gradual.

Professional Service Industries, Inc.
480 North Street
Springfield, Illinois 62704
Telephone: 217/544-6663
Fax: 217/544-6143

LOG OF BORING AP-4

Sheet 1 of 1

PSI Job No.: 0020522
Project: Piezometer Installation
Location: CWLP Ash Pond
East Lake Shore Drive
Springfield, Illinois

Drilling Method: Hollow Stem Auger
Sampling Method: Split Spoon
Hammer Type: CME Automatic; ETR = 86%
Boring Location: See attached boring location plan.

WATER LEVELS
While Drilling 11 feet
Upon Completion N/A
Delay N/A

Station: N/A
Offset: N/A

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %
	0			1	17	Brown silty CLAY, some brown sand, firm to stiff, slightly moist (FILL)	CL	4-4-3 N_{60}=10	
	5			2	18	Brown silty CLAY, trace roots, firm to stiff, moist (FILL)	CL	4-3-2 N_{60}=7	
				3	10	Brown SILT, trace gray, firm to stiff, moist (FILL)	ML	6-3-2 N_{60}=7	
	10			4	12	5" Brown SAND transitioning to Black FLY ASH at 9.4', stiff to very stiff, slightly moist (FILL)		2-2-4 N_{60}=9	
				5	18			2-2-2 N_{60}=6	
	15			6	16		SAND/FLY ASH	2-1-1 N_{60}=3	
				7	16			6-6-5 N_{60}=16	
	20			8	18	Black FLY ASH, some fine sub-round gravel, stiff to very stiff, moist to saturated (FILL)	FLY ASH	3-3-3 N_{60}=9	
						Gray/green (organic?) CLAY, stiff, trace fine sand, moist to saturated			
	25			9	1		CL	3-3-4 N_{60}=10	
	30			10	18	Brown/gray silty CLAY, fiorm to stiff, saturated	CL	2-2-3 N_{60}=7	
	35			11	18	Gray SILT, stiff to very stiff, saturated		3-3-4 N_{60}=10	
				12	18		ML	4-4-4 N_{60}=11	
	45			13	18			4-4-6 N_{60}=14	
	50			14	18	Gray fine to coarse SAND, medium dense, saturated		4-5-7 N_{60}=17	
	55			15	18		SW	5-5-7 N_{60}=17	
				16	1	Gray SHALE, hard, moist	CL	50/1"	
	60					Boring terminated at -60'			

STANDARD PENETRATION TEST DATA
N in blows/ft
Moisture, PL, LL
0 25 50
STRENGTH, tsf
Qu, Qp
0 2.0 4.0

Additional Remarks

Well Diagram: J-Plug; Concrete Cap; 2" PVC Solid Riser; Bentonite Seal; Sand Filter Pack; 0.01" PVC Slotted Screen

Completion Depth: 60.0 ft
Date Boring Started: 4/20/10
Date Boring Completed: 4/20/10
Logged By: Rob Preuss
Drilling Contractor: PSI, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Shelby Tube
Hand Auger
Texas Cone

Latitude:
Longitude:
Drill Rig: ATV D50
Remarks: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Moistures determined by visual methods.

The stratification lines represent approximate boundaries. The transition may be gradual.

In-Situ Hydraulic Conductivity Test Analysis
Utlizing the Hvorslev Slug Test Method[1]

GOVERNING EQUATION:

$$K = (r^2 * \ln(L_e/R))/(2L_eT_o)$$

K is the hydraulic conductivity (cm/sec)
r is the radius of the well casing (cm)
R is the radius of the borehole (cm)
L_e is the length of the well screen (cm)
T_o is the time it takes for the water level to rise or fall 37% of the initial change (sec)

CWLP Ash Ponds, East Lake Shore Drive, Springfield, Illinois **In-Situ Hydraulic Conductivity Analysis[2]**

Test Number	Test Type	L_e (ft)	L_e (cm)	T_o (min)	T_o (sec)	K (cm/sec)
AP-4	Rising Head	10.0	304.8	0.025	1.500	7.64E-02
AP-3	Rising Head	10.0	304.8	0.083	4.980	2.30E-02
AP-2.1	Rising Head	10.0	304.8	0.150	9.000	1.27E-02
AP-2.2	Rising Head	10.0	304.8	0.167	10.020	1.14E-02
AP-1	Rising Head	10.0	304.8	1.667	100.020	1.15E-03

AVERAGE: 2.50E-02

CONSTANTS

r (inch)	r (cm)	R (inch)	R (cm)
2.0	5.08	8.0	20.3

HVORSLEV CALCULATIONS

Test	L_e/R (-)	$\ln(L_e/R)$ (-)	L_eT_o (cm*sec)	K (cm/sec)	
AP-4	15.00	2.71	4.57E+02	**7.64E-02**	
AP-3	15.00	2.71	1.52E+03	**2.30E-02**	
AP-2.1	15.00	2.71	2.74E+03	1.27E-02	
AP-2.2	15.00	2.71	3.05E+03	1.14E-02	AP-2 AVG: **1.21E-02**
AP-1	15.00	2.71	3.05E+04	**1.15E-03**	

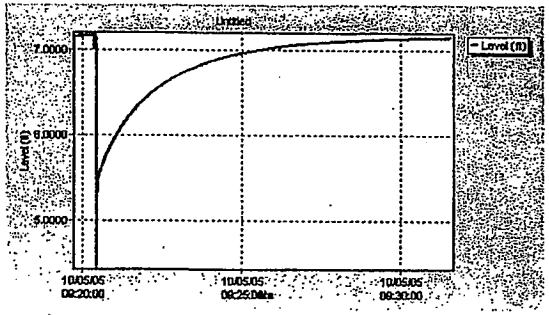
Notes:

[1] Hvorslev slug test method applied as described by C.W. Fetter in Applied Hydrology (Third Edition) published by Prentice-Hall in New Jersey in 1994 on pages 247-251.

[2] In-situ hydraulic conductivity tests conducted on monitoring wells, MW-1 thru MW-4 on May 5, 2010.

Solinst	3001
Report generated:	5/11/2010
Report from file:	...\mw-4.csv
Serial number:	1032398
Unit name:	Solinst 3001
Test name:	AP-1 Test 1
Test defined on:	5/5/2010
Test started on:	5/5/2010 9:20:28
Test stopped on:	5/5/2010 9:21:41
Data gathered using Linear testing	
Time between data points:	1 Seconds
Number of data samples:	75
TOTAL DATA SAMPLES	75
Channel number [1]	
Measurement type:	Level
Unit	feet
Channel number [2]	
Measurement type:	Temperature
Unit	Deg C
Sensor Range:	
Specific gravity:	
Mode:	TOC
User-defined reference*:	33.15 Feet H2O
Referenced on:	test start
Pressure head at reference:	Feet H2O

*Well depth to top of first casing terminating above ground. Does not include above ground extensions.

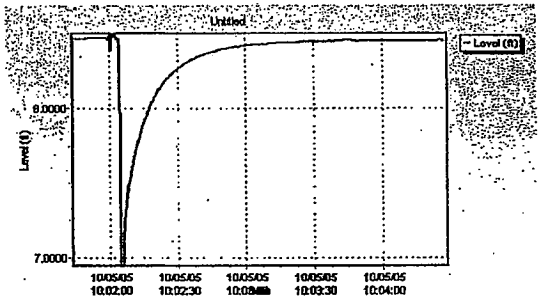


	Date	Time	ET (sec)	Time (min)	Test Time (min)	Temperature	Level	Water Level Bottom of well to TOC* (ft)	Change of Static Water Level (ft)	Water Level Bottom of well to TOC* (ft)	
1	5/5/2010	9:20:27	0	0.000		11.254	7.1703	25.980	0		TEST START
2	5/5/2010	9:20:28	1	0.017	0.000	11.252	5.298	27.852	1.8723		SLUG REMOVED
3	5/5/2010	9:20:29	2	0.033	0.017	11.254	5.3992	27.751	1.7711	0.9450486833	
4	5/5/2010	9:20:30	3	0.050	0.033	11.254	5.4584	27.692	1.7119	0.9134329993	
5	5/5/2010	9:20:31	4	0.067	0.050	11.257	5.4885	27.662	1.6818	0.8973634455	
6	5/5/2010	9:20:32	5	0.083	0.067	11.255	5.519	27.631	1.6513	0.8811045361	
7	5/5/2010	9:20:33	6	0.100	0.083	11.258	5.5421	27.608	1.6282	0.8688025592	
8	5/5/2010	9:20:34	7	0.117	0.100	11.257	5.5658	27.584	1.6045	0.8561457859	
9	5/5/2010	9:20:35	8	0.133	0.117	11.258	5.5919	27.558	1.5784	0.8422072991	
10	5/5/2010	9:20:36	9	0.150	0.133	11.257	5.6074	27.543	1.5629	0.8339148705	
11	5/5/2010	9:20:37	10	0.167	0.150	11.257	5.6237	27.526	1.5466	0.8252042835	
12	5/5/2010	9:20:38	11	0.183	0.167	11.258	5.6423	27.508	1.528	0.8153003531	
13	5/5/2010	9:20:39	12	0.200	0.183	11.259	5.6595	27.491	1.5108	0.8060921968	
14	5/5/2010	9:20:40	13	0.217	0.200	11.258	5.676	27.474	1.4943	0.7972810227	
15	5/5/2010	9:20:41	14	0.233	0.217	11.259	5.6922	27.458	1.4781	0.7884568819	
16	5/5/2010	9:20:42	15	0.250	0.233	11.261	5.7084	27.442	1.4619	0.7808043458	
17	5/5/2010	9:20:43	16	0.267	0.250	11.259	5.7226	27.427	1.4477	0.7732220104	
18	5/5/2010	9:20:44	17	0.283	0.267	11.259	5.7383	27.412	1.432	0.7648634668	
19	5/5/2010	9:20:45	18	0.300	0.283	11.26	5.7519	27.398	1.4184	0.7575709021	
20	5/5/2010	9:20:46	19	0.317	0.300	11.259	5.766	27.384	1.4043	0.7500400455	
21	5/5/2010	9:20:47	20	0.333	0.317	11.261	5.7815	27.369	1.3888	0.741716147	
22	5/5/2010	9:20:48	21	0.350	0.333	11.259	5.7955	27.355	1.3748	0.7342484036	
23	5/5/2010	9:20:49	22	0.367	0.350	11.259	5.8088	27.341	1.3615	0.7271481471	
24	5/5/2010	9:20:50	23	0.383	0.367	11.26	5.8224	27.328	1.3479	0.7199116481	
25	5/5/2010	9:20:51	24	0.400	0.383	11.259	5.8355	27.315	1.3348	0.7129219938	
26	5/5/2010	9:20:52	25	0.417	0.400	11.26	5.8489	27.301	1.3214	0.7057852966	
27	5/5/2010	9:20:53	26	0.433	0.417	11.261	5.8621	27.288	1.3082	0.6987128132	
28	5/5/2010	9:20:54	27	0.450	0.433	11.26	5.875	27.275	1.2953	0.6918226927	
29	5/5/2010	9:20:55	28	0.467	0.450	11.261	5.8867	27.263	1.2836	0.6855738831	
30	5/5/2010	9:20:56	29	0.483	0.467	11.26	5.8996	27.250	1.2707	0.6787883172	
31	5/5/2010	9:20:57	30	0.500	0.150	11.259	5.9124	27.238	1.2579	0.67184746	
32	5/5/2010	9:20:58	31	0.517	0.500	11.259	5.9238	27.226	1.2467	0.6656866519	
33	5/5/2010	9:20:59	32	0.533	0.517	11.259	5.9351	27.215	1.2352	0.6597243436	
34	5/5/2010	9:21:00	33	0.550	0.533	11.26	5.9479	27.202	1.2224	0.6528866274	
35	5/5/2010	9:21:01	34	0.567	0.550	11.259	5.9589	27.191	1.2114	0.6470511607	
36	5/5/2010	9:21:02	35	0.583	0.567	11.258	5.9699	27.180	1.2004	0.641128657	
37	5/5/2010	9:21:03	36	0.600	0.583	11.259	5.9803	27.170	1.19	0.6355551905	
38	5/5/2010	9:21:04	37	0.617	0.600	11.258	5.9928	27.157	1.1775	0.6289056274	
39	5/5/2010	9:21:05	38	0.633	0.617	11.26	6.0028	27.147	1.1675	0.6236646	
40	5/5/2010	9:21:06	39	0.650	0.633	11.258	6.0142	27.136	1.1561	0.6174756332	
41	5/5/2010	9:21:07	40	0.667	0.650	11.257	6.025	27.125	1.1453	0.6117078225	
42	5/5/2010	9:21:08	41	0.683	0.667	11.259	6.0346	27.115	1.1357	0.6065580142	
43	5/5/2010	9:21:09	42	0.700	0.683	11.258	6.0448	27.105	1.1255	0.6011132287	
44	5/5/2010	9:21:10	43	0.717	0.700	11.259	6.0554	27.095	1.1149	0.5954470411	
45	5/5/2010	9:21:11	44	0.733	0.717	11.258	6.0658	27.084	1.1045	0.5898916149	
46	5/5/2010	9:21:12	45	0.750	0.733	11.259	6.0765	27.074	1.0938	0.584420126	
47	5/5/2010	9:21:13	46	0.767	0.750	11.257	6.0864	27.064	1.0839	0.5791138368	
48	5/5/2010	9:21:14	47	0.783	0.767	11.257	6.096	27.054	1.0743	0.5739760252	
49	5/5/2010	9:21:15	48	0.800	0.783	11.257	6.1055	27.045	1.0648	0.5689712276	
50	5/5/2010	9:21:16	49	0.817	0.800	11.259	6.1144	27.036	1.0559	0.5642587767	
51	5/5/2010	9:21:17	50	0.833	0.817	11.257	6.1235	27.027	1.0468	0.5594096436	
52	5/5/2010	9:21:18	51	0.850	0.833	11.259	6.1332	27.017	1.0371	0.5542401641	
53	5/5/2010	9:21:19	52	0.867	0.850	11.257	6.1423	27.008	1.028	0.5493673009	
54	5/5/2010	9:21:20	53	0.883	0.867	11.258	6.1513	26.999	1.019	0.5442803467	
55	5/5/2010	9:21:21	54	0.900	0.883	11.257	6.1613	26.989	1.009	0.5389090363	
56	5/5/2010	9:21:22	55	0.917	0.900	11.258	6.1693	26.981	1.001	0.5346436243	
57	5/5/2010	9:21:23	56	0.933	0.917	11.257	6.1786	26.971	0.9917	0.5296892981	
58	5/5/2010	9:21:24	57	0.950	0.933	11.257	6.1869	26.963	0.9834	0.5252663545	
59	5/5/2010	9:21:25	58	0.967	0.950	11.257	6.196	26.954	0.9743	0.5204376008	
60	5/5/2010	9:21:26	59	0.983	0.967	11.258	6.2045	26.946	0.9658	0.5159636137	
61	5/5/2010	9:21:27	60	1.000	0.983	11.257	6.213	26.937	0.9573	0.5113296267	
62	5/5/2010	9:21:28	61	1.017	1.000	11.256	6.2215	26.929	0.9488	0.5067754299	
63	5/5/2010	9:21:29	62	1.033	1.017	11.258	6.2287	26.921	0.9416	0.5029210953	
64	5/5/2010	9:21:30	63	1.050	1.033	11.255	6.2371	26.913	0.9332	0.4984243481	
65	5/5/2010	9:21:31	64	1.067	1.050	11.257	6.2466	26.903	0.9237	0.4933604216	
66	5/5/2010	9:21:32	65	1.083	1.067	11.257	6.2524	26.898	0.9179	0.4902582403	
67	5/5/2010	9:21:33	66	1.100	1.083	11.255	6.2615	26.889	0.9088	0.4853922481	
68	5/5/2010	9:21:34	67	1.117	1.100	11.256	6.268	26.882	0.9023	0.4819206832	
69	5/5/2010	9:21:35	68	1.133	1.117	11.255	6.2762	26.874	0.8941	0.4775402892	
70	5/5/2010	9:21:36	69	1.150	1.133	11.255	6.2835	26.867	0.8868	0.4736420145	
71	5/5/2010	9:21:37	70	1.167	1.150	11.255	6.2923	26.858	0.878	0.4689419431	
72	5/5/2010	9:21:38	71	1.183	1.167	11.256	6.2979	26.852	0.8724	0.4659650904	
73	5/5/2010	9:21:39	72	1.200	1.183	11.256	6.3053	26.845	0.865	0.4619886511	
74	5/5/2010	9:21:40	73	1.217	1.200	11.255	6.3126	26.837	0.8577	0.4580996541	
75	5/5/2010	9:21:41	74	1.233	1.217	11.254	6.3208	26.829	0.8495	0.4537710274	

Electronic Filing: Received, Clerk's Office 02/13/2020

Solinst	3001
Report generated:	5/11/2010
Report from file:	...\mw-3_1.csv
Serial number:	1032308
Unit name:	Solinst 3001
Test name:	AP-2 Test 1
Test defined on:	5/5/2010
Test started on:	5/5/2010 10:02:05
Test stopped on:	5/5/2010 10:02:58
Data gathered using Linear testing	
Time between data points:	1 Seconds.
Number of data samples:	55
TOTAL DATA SAMPLES	55
Channel number [1]	
Measurement type:	Level
Unit	feet
Channel number [2]	
Measurement type:	Temperature
Unit	Deg C
Sensor Range:	
Specific gravity:	
Mode:	TOC
User-defined reference*:	19.47 Feet H2O
Referenced on:	test start
Pressure head at reference:	Feet H2O

*Well depth to top of first casing terminating above ground. Does not include above ground extensions.

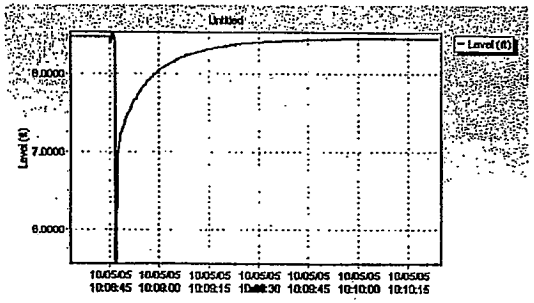


	Date	Time	ET (sec)	Time (min)	Test Time (min)	Temperature	Level	Water Level Bottom of well to TOC* (ft)	Change of Static Water Level (ft)	
1	5/5/2010	10:02:04	0	0.000		11.23	8.4182	11.052	0	TEST START
2	5/5/2010	10:02:05	1	0.017	0.000	11.231	6.9143	12.556	1.5039	SLUG REMOVED
3	5/5/2010	10:02:06	2	0.033	0.017	11.231	7.2562	12.214	1.162	
4	5/5/2010	10:02:07	3	0.050	0.033	11.231	7.3727	12.097	1.0455	
5	5/5/2010	10:02:08	4	0.067	0.050	11.231	7.4828	11.987	0.9354	
6	5/5/2010	10:02:09	5	0.083	0.067	11.231	7.5707	11.899	0.8475	
7	5/5/2010	10:02:10	6	0.100	0.083	11.231	7.6472	11.823	0.771	
8	5/5/2010	10:02:11	7	0.117	0.100	11.231	7.715	11.755	0.7032	
9	5/5/2010	10:02:12	8	0.133	0.117	11.232	7.7747	11.695	0.6435	
10	5/5/2010	10:02:13	9	0.150	0.133	11.232	7.8285	11.642	0.5897	
11	5/5/2010	10:02:14	10	0.167	0.150	11.232	7.878	11.592	0.5402	
12	5/5/2010	10:02:15	11	0.183	0.167	11.231	7.9204	11.550	0.4978	
13	5/5/2010	10:02:16	12	0.200	0.183	11.232	7.9625	11.508	0.4557	
14	5/5/2010	10:02:17	13	0.217	0.200	11.232	8.0004	11.470	0.4178	
15	5/5/2010	10:02:18	14	0.233	0.217	11.232	8.0325	11.438	0.3857	
16	5/5/2010	10:02:19	15	0.250	0.233	11.232	8.0633	11.407	0.3549	
17	5/5/2010	10:02:20	16	0.267	0.250	11.231	8.0906	11.379	0.3276	
18	5/5/2010	10:02:21	17	0.283	0.267	11.23	8.1151	11.355	0.3031	
19	5/5/2010	10:02:22	18	0.300	0.283	11.23	8.1395	11.331	0.2787	
20	5/5/2010	10:02:23	19	0.317	0.300	11.23	8.1616	11.308	0.2566	
21	5/5/2010	10:02:24	20	0.333	0.317	11.23	8.1805	11.290	0.2377	
22	5/5/2010	10:02:25	21	0.350	0.333	11.229	8.2001	11.270	0.2181	
23	5/5/2010	10:02:26	22	0.367	0.350	11.229	8.2158	11.254	0.2024	
24	5/5/2010	10:02:27	23	0.383	0.367	11.229	8.2315	11.239	0.1867	
25	5/5/2010	10:02:28	24	0.400	0.383	11.229	8.2454	11.225	0.1728	
26	5/5/2010	10:02:29	25	0.417	0.400	11.228	8.2589	11.211	0.1593	
27	5/5/2010	10:02:30	26	0.433	0.417	11.228	8.2709	11.199	0.1473	
28	5/5/2010	10:02:31	27	0.450	0.433	11.227	8.2821	11.188	0.1361	
29	5/5/2010	10:02:32	28	0.467	0.450	11.228	8.2931	11.177	0.1251	
30	5/5/2010	10:02:33	29	0.483	0.467	11.227	8.3028	11.167	0.1153	
31	5/5/2010	10:02:34	30	0.500	0.150	11.226	8.3123	11.158	0.1059	
32	5/5/2010	10:02:35	31	0.517	0.500	11.226	8.3207	11.149	0.0975	
33	5/5/2010	10:02:36	32	0.533	0.517	11.225	8.3292	11.141	0.089	
34	5/5/2010	10:02:37	33	0.550	0.533	11.225	8.3355	11.135	0.0827	
35	5/5/2010	10:02:38	34	0.567	0.550	11.224	8.3418	11.128	0.0764	
36	5/5/2010	10:02:39	35	0.583	0.567	11.224	8.3491	11.121	0.0691	
37	5/5/2010	10:02:40	36	0.600	0.583	11.223	8.3548	11.115	0.0634	
38	5/5/2010	10:02:41	37	0.617	0.600	11.223	8.3615	11.109	0.0567	
39	5/5/2010	10:02:42	38	0.633	0.617	11.223	8.3654	11.105	0.0528	
40	5/5/2010	10:02:43	39	0.650	0.633	11.222	8.3729	11.097	0.0453	
41	5/5/2010	10:02:44	40	0.667	0.650	11.222	8.3781	11.094	0.0421	
42	5/5/2010	10:02:45	41	0.683	0.667	11.221	8.3803	11.090	0.0379	
43	5/5/2010	10:02:46	42	0.700	0.683	11.221	8.385	11.085	0.0332	
44	5/5/2010	10:02:47	43	0.717	0.700	11.22	8.3888	11.081	0.0294	
45	5/5/2010	10:02:48	44	0.733	0.717	11.22	8.3922	11.078	0.026	
46	5/5/2010	10:02:49	45	0.750	0.733	11.22	8.3959	11.074	0.0223	
47	5/5/2010	10:02:50	46	0.767	0.750	11.219	8.3983	11.072	0.0199	
48	5/5/2010	10:02:51	47	0.783	0.767	11.219	8.4029	11.067	0.0153	
49	5/5/2010	10:02:52	48	0.800	0.783	11.218	8.4042	11.066	0.014	
50	5/5/2010	10:02:53	49	0.817	0.800	11.218	8.4084	11.062	0.0098	
51	5/5/2010	10:02:54	50	0.833	0.817	11.218	8.4099	11.060	0.0083	
52	5/5/2010	10:02:55	51	0.850	0.833	11.218	8.4117	11.058	0.0065	
53	5/5/2010	10:02:56	52	0.867	0.850	11.218	8.4145	11.056	0.0037	
54	5/5/2010	10:02:57	53	0.883	0.867	11.217	8.416	11.054	0.0022	
55	5/5/2010	10:02:58	54	0.900	0.883	11.216	8.4182	11.052	0	

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Solinst	3001
Report generated:	5/11/2010
Report from file:	...lmw-3_2.csv
Serial number:	1032308
Unit name:	Solinst 3001
Test name:	AP-2 Test 2
Test defined on:	5/5/2010
Test started on:	5/5/2010 10:08:48
Test stopped on:	5/5/2010 10:09:43
Data gathered using Linear testing	
Time between data points:	1 Seconds.
Number of data samples:	57
TOTAL DATA SAMPLES	57
Channel number [1]	
Measurement type:	Level
Unit	feet
Channel number [2]	
Measurement type:	Temperature
Unit	Deg C
Sensor Range:	
Specific gravity:	
Mode:	TOC
User-defined reference*:	19.47 Feet H2O
Referenced on:	test start
Pressure head at reference:	Feet H2O

*Well depth to top of first casing terminating above ground. Does not include above ground extensions.

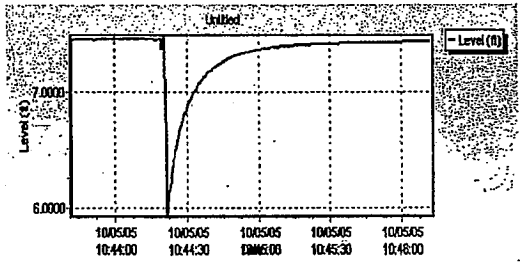


	Date	Time	ET (sec)	Time (min)	Test Time (min)	Temperature	Level	Water Level Bottom of well to TOC* (ft)	Change of Static Water Level (ft)	Drho	
1	5/5/2010	10:08:47	0	0.000		11.111	8.4246	11.045	0		TEST START
2	5/5/2010	10:08:48	1	0.017	0.000	11.114	6.9757	12.494	1.4489		SLUG REMOVED
3	5/5/2010	10:08:49	2	0.033	0.017	11.114	7.2067	12.263	1.2179	0.8405897075	
4	5/5/2010	10:08:50	3	0.050	0.033	11.116	7.3467	12.123	1.0779	0.7438438611	
5	5/5/2010	10:08:51	4	0.067	0.050	11.117	7.4619	12.008	0.9627	0.6644350889	
6	5/5/2010	10:08:52	5	0.083	0.067	11.117	7.5593	11.911	0.8653	0.5972116678	
7	5/5/2010	10:08:53	6	0.100	0.083	11.117	7.6431	11.827	0.7815	0.5393746008	
8	5/5/2010	10:08:54	7	0.117	0.100	11.118	7.7197	11.750	0.7049	0.4864070005	
9	5/5/2010	10:08:55	8	0.133	0.117	11.121	7.7838	11.686	0.6408	0.4422668547	
10	5/5/2010	10:08:56	9	0.150	0.133	11.12	7.8425	11.628	0.5821	0.4017630647	
11	5/5/2010	10:08:57	10	0.167	0.150	11.12	7.8942	11.576	0.5304	0.3660708127	
12	5/5/2010	10:08:58	11	0.183	0.167	11.123	7.9419	11.528	0.4827	0.3331492861	
13	5/5/2010	10:08:59	12	0.200	0.183	11.123	7.9837	11.486	0.4409	0.3042998514	
14	5/5/2010	10:09:00	13	0.217	0.200	11.123	8.0214	11.449	0.4032	0.2782800756	
15	5/5/2010	10:09:01	14	0.233	0.217	11.124	8.0533	11.417	0.3713	0.2562833172	
16	5/5/2010	10:09:02	15	0.250	0.233	11.124	8.0854	11.385	0.3392	0.2341086344	
17	5/5/2010	10:09:03	16	0.267	0.250	11.125	8.1137	11.356	0.3109	0.2146786576	
18	5/5/2010	10:09:04	17	0.283	0.267	11.125	8.1388	11.333	0.2878	0.1986334446	
19	5/5/2010	10:09:05	18	0.300	0.283	11.127	8.1636	11.308	0.261	0.1801386856	
20	5/5/2010	10:09:06	19	0.317	0.300	11.126	8.1829	11.287	0.2417	0.1668162055	
21	5/5/2010	10:09:07	20	0.333	0.317	11.127	8.2006	11.269	0.224	0.1546000411	
22	5/5/2010	10:09:08	21	0.350	0.333	11.127	8.2186	11.251	0.206	0.1421768824	
23	5/5/2010	10:09:09	22	0.367	0.350	11.126	8.2347	11.235	0.1899	0.1310649465	
24	5/5/2010	10:09:10	23	0.383	0.367	11.127	8.2493	11.221	0.1753	0.1209888336	
25	5/5/2010	10:09:11	24	0.400	0.383	11.128	8.2622	11.208	0.1624	0.1120885031	
26	5/5/2010	10:09:12	25	0.417	0.400	11.128	8.275	11.195	0.1496	0.1032507427	
27	5/5/2010	10:09:13	26	0.433	0.417	11.128	8.2863	11.184	0.1383	0.0954617227	
28	5/5/2010	10:09:14	27	0.450	0.433	11.129	8.2973	11.173	0.1273	0.0878658756	
29	5/5/2010	10:09:15	28	0.467	0.450	11.13	8.3084	11.162	0.1162	0.0801987767	
30	5/5/2010	10:09:16	29	0.483	0.467	11.13	8.3162	11.155	0.1094	0.0755005556	
31	5/5/2010	10:09:17	30	0.500	0.150	11.129	8.3253	11.145	0.0993	0.0685247518	
32	5/5/2010	10:09:18	31	0.517	0.500	11.13	8.3319	11.138	0.0927	0.0639579674	
33	5/5/2010	10:09:19	32	0.533	0.517	11.132	8.3386	11.131	0.086	0.0593563473	
34	5/5/2010	10:09:20	33	0.550	0.533	11.132	8.3487	11.121	0.0759	0.0523864596	
35	5/5/2010	10:09:21	34	0.567	0.550	11.131	8.3532	11.117	0.0714	0.0492787633	
36	5/5/2010	10:09:22	35	0.583	0.567	11.132	8.3595	11.111	0.0651	0.0449304377	
37	5/5/2010	10:09:23	36	0.600	0.583	11.132	8.3639	11.106	0.0607	0.0419038651	
38	5/6/2010	10:09:24	37	0.617	0.600	11.133	8.3697	11.100	0.0549	0.0379008514	
39	5/5/2010	10:09:25	38	0.633	0.617	11.133	8.3747	11.095	0.0499	0.0344389923	
40	5/5/2010	10:09:26	39	0.650	0.633	11.133	8.3806	11.089	0.044	0.0303678855	
41	5/6/2010	10:09:27	40	0.667	0.650	11.134	8.3842	11.086	0.0404	0.0278832222	
42	5/5/2010	10:09:28	41	0.683	0.667	11.134	8.3879	11.082	0.0367	0.0253296956	
43	5/5/2010	10:09:29	42	0.700	0.683	11.134	8.3903	11.080	0.0343	0.0236771131	
44	5/5/2010	10:09:30	43	0.717	0.700	11.135	8.3943	11.076	0.0303	0.0209124161	
45	5/5/2010	10:09:31	44	0.733	0.717	11.134	8.3975	11.073	0.0271	0.0187063644	
46	5/5/2010	10:09:32	45	0.750	0.733	11.135	8.3985	11.072	0.0261	0.0180133466	
47	5/5/2010	10:09:33	46	0.767	0.750	11.135	8.4027	11.067	0.0219	0.0151149161	
48	5/5/2010	10:09:34	47	0.783	0.767	11.136	8.4058	11.064	0.0188	0.0129763611	
49	5/5/2010	10:09:35	48	0.800	0.783	11.135	8.4085	11.062	0.0161	0.0111113676	
50	5/5/2010	10:09:36	49	0.817	0.800	11.136	8.4115	11.059	0.0131	0.0090413423	
51	5/6/2010	10:09:37	50	0.833	0.817	11.136	8.4124	11.058	0.0122	0.0084201181	
52	5/5/2010	10:09:38	51	0.850	0.833	11.137	8.4148	11.055	0.0098	0.0067637626	
53	5/5/2010	10:09:39	52	0.867	0.850	11.138	8.4159	11.054	0.0087	0.0060045565	
54	5/5/2010	10:09:40	53	0.883	0.867	11.138	8.4178	11.052	0.0068	0.0046932216	
55	6/5/2010	10:09:41	54	0.900	0.883	11.137	8.4188	11.051	0.0058	0.0040030377	
56	5/5/2010	10:09:42	55	0.917	0.900	11.137	8.4221	11.048	0.0025	0.0017254471	
57	5/5/2010	10:09:43	56	0.933	0.917	11.138	8.4239	11.046	0.0007	0.0004831264	

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Solinst	3001
Report generated:	5/11/2010
Report from file:	...\mw-2_1.csv
Serial number:	1032308
Unit name:	Solinst 3001
Test name:	AP-3 Test 1
Test defined on:	5/5/2010
Test started on:	5/5/2010 10:44:21
Test stopped on:	5/5/2010 11:46:28
Data gathered using Linear testing	
Time between data points:	1 Seconds
Number of data samples:	69
TOTAL DATA SAMPLES	69
Channel number [1]	
Measurement type:	Level
Unit	feet
Channel number [2]	
Measurement type:	Temperature
Unit	Deg C
Sensor Range:	
Specific gravity:	
Mode:	TOC
User-defined reference*:	19.63 Feet H2O
Referenced on:	test start
Pressure head at reference:	Feet H2O

*Well depth to top of first casing terminating above ground. Does not include above ground extensions.



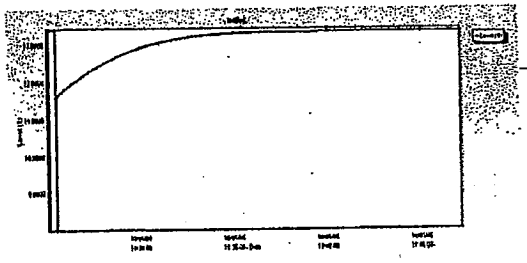
	Date	Time	ET (sec)	Time (min)	Test Time (min)	Temperature	Level	Water Level Bottom of well to TOC* (ft)	Change of Static Water Level (ft)	hhg	
1	5/5/2010	10:44:20	0	0.000		11.841	7.4264	12.204	0		TEST START
2	5/5/2010	10:44:21	1	0.017	0.000	11.841	4.946	14.684	2.4804		SLUG REMOVED
3	5/5/2010	10:44:22	2	0.033	0.017	11.841	6.031	13.599	1.3954	0.592570553	
4	5/5/2010	10:44:23	3	0.050	0.033	11.841	6.2314	13.399	1.195	0.48177183	
5	5/5/2010	10:44:24	4	0.067	0.050	11.839	6.374	13.256	1.0524	0.424288405	
6	5/5/2010	10:44:25	5	0.083	0.067	11.841	6.4939	13.136	0.9325	0.375947425	
7	5/5/2010	10:44:26	6	0.100	0.083	11.841	6.5956	13.034	0.8308	0.334946976	
8	5/5/2010	10:44:27	7	0.117	0.100	11.84	6.6811	12.949	0.7453	0.30047573	
9	5/5/2010	10:44:28	8	0.133	0.117	11.841	6.7553	12.875	0.6711	0.270656512	
10	5/5/2010	10:44:29	9	0.150	0.133	11.84	6.8204	12.810	0.606	0.244316433	
11	5/5/2010	10:44:30	10	0.167	0.150	11.837	6.8768	12.753	0.5496	0.221577165	
12	5/5/2010	10:44:31	11	0.183	0.167	11.839	6.9267	12.703	0.4997	0.201459442	
13	5/5/2010	10:44:32	12	0.200	0.183	11.837	6.9731	12.657	0.4533	0.182782782	
14	5/5/2010	10:44:33	13	0.217	0.200	11.837	7.0111	12.619	0.4153	0.167432872	
15	5/5/2010	10:44:34	14	0.233	0.217	11.839	7.0481	12.582	0.3783	0.152515723	
16	5/5/2010	10:44:35	15	0.250	0.233	11.836	7.0792	12.551	0.3472	0.139977423	
17	5/5/2010	10:44:36	16	0.267	0.250	11.837	7.1094	12.521	0.317	0.127801967	
18	5/5/2010	10:44:37	17	0.283	0.267	11.837	7.1355	12.495	0.2909	0.117278471	
19	5/5/2010	10:44:38	18	0.300	0.283	11.837	7.1579	12.472	0.2685	0.108248678	
20	5/5/2010	10:44:39	19	0.317	0.300	11.834	7.1803	12.450	0.2461	0.099217868	
21	5/5/2010	10:44:40	20	0.333	0.317	11.834	7.1981	12.432	0.2283	0.092041806	
22	5/5/2010	10:44:41	21	0.350	0.333	11.836	7.2175	12.413	0.2089	0.084220287	
23	5/5/2010	10:44:42	22	0.367	0.350	11.834	7.2342	12.396	0.1922	0.077481502	
24	5/5/2010	10:44:43	23	0.383	0.367	11.831	7.2477	12.382	0.1787	0.072044631	
25	5/5/2010	10:44:44	24	0.400	0.383	11.833	7.2613	12.369	0.1651	0.066561645	
26	5/5/2010	10:44:45	25	0.417	0.400	11.831	7.2733	12.357	0.1531	0.061723815	
27	5/5/2010	10:44:46	26	0.433	0.417	11.83	7.2842	12.346	0.1422	0.057329483	
28	5/5/2010	10:44:47	27	0.450	0.433	11.829	7.2947	12.335	0.1317	0.053096275	
29	5/5/2010	10:44:48	28	0.467	0.450	11.829	7.3038	12.326	0.1226	0.049427612	
30	5/6/2010	10:44:49	29	0.483	0.467	11.828	7.313	12.317	0.1134	0.045718433	
31	5/5/2010	10:44:50	30	0.500	0.150	11.83	7.3204	12.310	0.106	0.04273504	
32	5/5/2010	10:44:51	31	0.517	0.500	11.83	7.3277	12.302	0.0987	0.039791969	
33	5/5/2010	10:44:52	32	0.533	0.517	11.827	7.3358	12.294	0.0906	0.036529357	
34	5/6/2010	10:44:53	33	0.550	0.533	11.828	7.3408	12.289	0.0856	0.034510583	
35	5/5/2010	10:44:54	34	0.567	0.550	11.827	7.3465	12.284	0.0799	0.032212846	
36	5/5/2010	10:44:55	35	0.583	0.567	11.827	7.3529	12.277	0.0735	0.029632317	
37	5/5/2010	10:44:56	36	0.600	0.583	11.825	7.3567	12.273	0.0697	0.028100306	
38	5/5/2010	10:44:57	37	0.617	0.600	11.826	7.3618	12.268	0.0646	0.026044185	
39	5/5/2010	10:44:58	38	0.633	0.617	11.825	7.3666	12.263	0.0598	0.024108015	
40	5/5/2010	10:44:59	39	0.650	0.633	11.823	7.3705	12.260	0.0559	0.022536688	
41	5/5/2010	10:45:00	40	0.667	0.650	11.824	7.3748	12.255	0.0516	0.020803096	
42	5/5/2010	10:45:01	41	0.683	0.667	11.823	7.3783	12.252	0.0481	0.019392034	
43	5/5/2010	10:45:02	42	0.700	0.683	11.823	7.3814	12.249	0.045	0.018142235	
44	5/5/2010	10:45:03	43	0.717	0.700	11.821	7.3848	12.245	0.0416	0.01677458	
45	5/5/2010	10:45:04	44	0.733	0.717	11.82	7.3878	12.242	0.0386	0.015562006	
46	5/5/2010	10:45:05	45	0.750	0.733	11.82	7.3908	12.239	0.0356	0.014352824	
47	5/5/2010	10:45:06	46	0.767	0.750	11.819	7.3935	12.237	0.0329	0.013263399	
48	5/5/2010	10:45:07	47	0.783	0.767	11.818	7.3943	12.236	0.0321	0.012941961	
49	5/5/2010	10:45:08	48	0.800	0.783	11.817	7.3971	12.233	0.0293	0.011812615	
50	5/5/2010	10:45:09	49	0.817	0.800	11.816	7.3997	12.230	0.0267	0.010764393	
51	5/5/2010	10:45:10	50	0.833	0.817	11.819	7.4032	12.227	0.0232	0.009333333	
52	5/5/2010	10:45:11	51	0.850	0.833	11.815	7.4038	12.226	0.0226	0.009111434	
53	5/5/2010	10:45:12	52	0.867	0.850	11.817	7.4051	12.225	0.0213	0.008587325	
54	5/5/2010	10:45:13	53	0.883	0.867	11.816	7.4083	12.222	0.0181	0.007297121	
55	5/5/2010	10:45:14	54	0.900	0.883	11.815	7.4088	12.221	0.0178	0.007176262	
56	5/5/2010	10:45:15	55	0.917	0.900	11.813	7.411	12.219	0.0154	0.006208678	
57	5/5/2010	10:45:16	56	0.933	0.917	11.815	7.4116	12.218	0.0148	0.005966476	
58	5/5/2010	10:45:17	57	0.950	0.933	11.814	7.4149	12.215	0.0115	0.004636346	
59	5/5/2010	10:45:18	58	0.967	0.950	11.813	7.4155	12.215	0.0109	0.004394453	
60	5/5/2010	10:45:19	59	0.983	0.967	11.811	7.4162	12.214	0.0102	0.0041124	
61	5/5/2010	10:45:20	60	1.000	0.983	11.811	7.4176	12.212	0.0088	0.003547815	
62	5/5/2010	10:45:21	61	1.017	1.000	11.81	7.4187	12.211	0.0077	0.003104339	
63	5/5/2010	10:45:22	62	1.033	1.017	11.81	7.4192	12.211	0.0072	0.002902758	
64	5/5/2010	10:45:23	63	1.050	1.033	11.808	7.4215	12.209	0.0049	0.001975486	
65	5/5/2010	10:45:24	64	1.067	1.050	11.809	7.4218	12.208	0.0046	0.00185454	
66	5/5/2010	10:45:25	65	1.083	1.067	11.811	7.4231	12.207	0.0033	0.001330451	
67	5/5/2010	10:45:26	66	1.100	1.083	11.81	7.4244	12.206	0.002	0.000806122	
68	5/5/2010	10:45:27	67	1.117	1.100	11.809	7.424	12.206	0.0024	0.000967856	
69	5/5/2010	10:45:28	68	1.133	1.117	11.807	7.4257	12.204	0.0007	0.000282213	
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Electronic Filing: Received, Clerk's Office 02/13/2020

Resp. to 4th RTC
CWLP - 29790

Solinst	3001
Report generated:	5/11/2010
Report from file:	...MW-1.lev
Serial number:	1032308
Unit name:	Solinst 3001
Test name:	AP-4
Test defined on:	5/5/2010
Test started on:	5/5/2010 11:25:32
Test stopped on:	5/5/2010 11:25:51
Data gathered using Linear testing	
Time between data points:	0.5 Seconds
Number of data samples:	41
TOTAL DATA SAMPLES	41
Channel number [1]	
Measurement type:	Level
Unit	feet
Channel number [2]	
Measurement type:	Temperature
Unit	Deg C
Sensor Range:	
Specific gravity:	
Mode:	TOC
User-defined reference*:	58.93 Feet H2O
Referenced on:	test start
Pressure head at reference:	Feet H2O

*Well depth to top of first casing terminating above ground. Does not include above ground extensions.



	Date	Time	ET (sec)	Time (min)	Test Time (min)	Temperature	Level	Water Level Bottom of well to TOC* (ft)	Change of Static Water Level (ft)	Ratio	
1	5/5/2010	11:25:31	0	0.000		12.799	13.4081	45.522	0		TEST START
2	5/5/2010	11:25:31	0	0.000	0.000	12.789	11.9721	46.958	1.436		
3	5/5/2010	11:25:32	0.5	0.008	0.008	12.794	8.02838	50.904	5.38172		SLUG REMOVED
4	5/5/2010	11:25:32	1	0.017	0.017	12.785	11.2523	47.678	2.1558	0.400578254	
5	5/5/2010	11:25:33	1.5	0.025	0.025	12.79	11.5307	47.399	1.8774	0.34884766	
6	5/5/2010	11:25:33	2	0.033	0.033	12.781	11.5481	47.382	1.86	0.345814413	
7	5/5/2010	11:25:34	2.5	0.042	0.042	12.785	11.6979	47.332	1.8102	0.336380866	
8	5/5/2010	11:25:34	3	0.050	0.050	12.776	11.5927	47.337	1.8154	0.337327	
9	5/5/2010	11:25:35	3.5	0.058	0.058	12.78	11.6036	47.326	1.8045	0.335301225	
10	5/5/2010	11:25:35	4	0.067	0.067	12.771	11.6202	47.310	1.7879	0.332217209	
11	5/5/2010	11:25:36	4.5	0.075	0.075	12.775	11.6344	47.296	1.7737	0.329578648	
12	5/5/2010	11:25:36	5	0.083	0.083	12.766	11.6361	47.294	1.772	0.329262764	
13	5/5/2010	11:25:37	5.5	0.092	0.092	12.771	11.6445	47.286	1.7636	0.32770192	
14	5/5/2010	11:25:37	6	0.100	0.100	12.763	11.6514	47.279	1.7567	0.326410606	
15	5/5/2010	11:25:38	6.5	0.108	0.108	12.767	11.6587	47.271	1.7494	0.325063363	
16	5/5/2010	11:25:38	7	0.117	0.117	12.758	11.6626	47.267	1.7455	0.324336567	
17	5/5/2010	11:25:39	7.5	0.125	0.125	12.762	11.669	47.261	1.7391	0.323149479	
18	5/5/2010	11:25:39	8	0.133	0.133	12.752	11.6739	47.256	1.7342	0.322238967	
19	5/5/2010	11:25:40	8.5	0.142	0.142	12.758	11.6784	47.251	1.7287	0.321217009	
20	5/5/2010	11:25:40	9	0.150	0.150	12.749	11.6836	47.246	1.7245	0.320436569	
21	5/5/2010	11:25:41	9.5	0.158	0.158	12.753	11.6884	47.242	1.7197	0.319544461	
22	5/5/2010	11:25:41	10	0.167	0.167	12.743	11.6921	47.238	1.716	0.318867169	
23	5/5/2010	11:25:42	10.5	0.175	0.175	12.748	11.6969	47.233	1.7112	0.31796528	
24	5/5/2010	11:25:42	11	0.183	0.183	12.739	11.7013	47.229	1.7068	0.317147676	
25	5/5/2010	11:25:43	11.5	0.192	0.192	12.745	11.7049	47.225	1.7032	0.316476747	
26	5/5/2010	11:25:43	12	0.200	0.200	12.735	11.7092	47.221	1.6989	0.315679749	
27	5/5/2010	11:25:44	12.5	0.208	0.208	12.74	11.7131	47.217	1.695	0.314956507	
28	5/5/2010	11:25:44	13	0.217	0.217	12.731	11.7157	47.214	1.6924	0.314470353	
29	5/5/2010	11:25:45	13.5	0.225	0.225	12.735	11.7212	47.209	1.6869	0.313449976	
30	5/5/2010	11:25:45	14	0.233	0.233	12.726	11.7248	47.205	1.6833	0.312781044	
31	5/5/2010	11:25:46	14.5	0.242	0.075	12.731	11.7288	47.201	1.6793	0.312037787	
32	5/5/2010	11:25:46	15	0.250	0.250	12.722	11.7311	47.199	1.677	0.311610415	
33	5/5/2010	11:25:47	15.5	0.258	0.258	12.727	11.7354	47.195	1.6727	0.310811417	
34	5/5/2010	11:25:47	16	0.267	0.267	12.719	11.7394	47.191	1.6687	0.310068157	
35	5/5/2010	11:25:48	16.5	0.275	0.275	12.723	11.743	47.187	1.6651	0.309399226	
36	5/5/2010	11:25:48	17	0.283	0.283	12.713	11.7467	47.183	1.6614	0.308711713	
37	5/5/2010	11:25:49	17.5	0.292	0.292	12.718	11.75	47.180	1.6581	0.308098626	
38	5/5/2010	11:25:49	18	0.300	0.300	12.709	11.7529	47.177	1.6552	0.307559645	
39	5/5/2010	11:25:50	18.5	0.308	0.308	12.714	11.7568	47.173	1.6513	0.306834486	
40	5/5/2010	11:25:50	19	0.317	0.317	12.705	11.7612	47.169	1.6469	0.306017407	
41	5/5/2010	11:25:51	19.5	0.325	0.325	12.709	11.7641	47.166	1.644	0.305478546	

Electronic Filing: Received, Clerk's Office 02/13/2020

Resp. to 4th RTC
CWLP - 29791

SIEVE ANALYSIS WORKSHEET

CLIENT: CWLP
Environmental Health & Safety

PROJECT: Piezometer Installation
CWLP Ash Ponds
Springfield, IL

DATE: April 26, 2010

PSI REPORT NO. 0020522-1 Page 1 of 8

GENERAL SAMPLE INFORMATION

SAMPLE TYPE: Clayey SILT, Some Fine to Coarse Sand	SAMPLED BY: PSI DATE SAMPLED: 4/21/2010
SAMPLE SOURCE: AP-1, 3'-7'	TESTED BY: Don Reed DATE TESTED: April 26, 2010
SPECIFICATIONS: ASTM C136	NOTES/OBSERVATIONS NP=Not Provided to PSI

SIEVE ANALYSIS DATA/RESULTS		TEST METHOD
Original "Wet" Sample Mass (OSM) + Pan:	996.3	ASTM C136
Pan Weight:	93.2	
Original "Wet" Sample Mass (OSM):	903.1	
Total "Dry" Sample Mass (TSM) + Pan:	820.4	
Pan Weight:	93.2	
Total "Dry" Sample Mass (TSM):	727.2	
Total "Dry" Washed Sample Mass (TWM) + Pan Wt.	182.6	
Pan Weight:	93.2	
Total "Dry" Washed Sample Mass (TWM), grams	89.4	

Sieve Size metric (English)	Individual Weight (g)	Cumulative Weight (g)	Percent Retained (%)	Percent Passing (%)	Specification
37.5 (1 1/2)	0.0	0.0	0.0	100.0	NP
25 (1)	0.0	0.0	0.0	100.0	NP
19 (3/4)	0.0	0.0	0.0	100.0	NP
16 (5/8)	0.0	0.0	0.0	100.0	NP
12.5 (1/2)	0.0	0.0	0.0	100.0	NP
9.5 (3/8)	0.0	0.0	0.0	100.0	NP
6.3 (1/4)	0.4	0.4	0.1	99.9	NP
4.75 (4)	1.2	1.6	0.2	99.8	NP
2.36 (8)	3.0	4.6	0.6	99.4	NP
1.18 (16)	2.1	6.7	0.9	99.1	NP
0.6 (30)	5.3	12.0	1.7	98.3	NP
0.425 (40)	0.0	12.0	1.7	98.3	NP
0.3 (50)	7.9	19.9	2.7	97.3	NP
0.15 (100)	27.4	47.3	6.5	93.5	NP
0.075 (200)	39.3	86.6	11.9	88.1	NP
Pan					

SIEVE ANALYSIS WORKSHEET

CLIENT: CWLP
Environmental Health & Safety

PROJECT: Piezometer Installation
CWLP Ash Ponds
Springfield, IL

DATE: April 26, 2010

PSI REPORT NO. 0020522-1

GENERAL SAMPLE INFORMATION

SAMPLE TYPE: Clayey SILT, Some Fine to Coarse Sand	SAMPLED BY: PSI DATE SAMPLED: 4/21/2010
SAMPLE SOURCE: AP-1, 10'-15'	TESTED BY: Don Reed DATE TESTED: April 26, 2010
SPECIFICATIONS: ASTM C136	NOTES/OBSERVATIONS NP=Not Provided to PSI

SIEVE ANALYSIS DATA/RESULTS		TEST METHOD
Original "Wet" Sample Mass (OSM) + Pan:	1030.6	ASTM C136
Pan Weight:	93.5	
Original "Wet" Sample Mass (OSM):	937.1	
Total "Dry" Sample Mass (TSM) + Pan:	814.4	
Pan Weight:	93.5	
Total "Dry" Sample Mass (TSM):	720.9	
Total "Dry" Washed Sample Mass (TWM) + Pan Wt.	247.0	
Pan Weight:	93.5	
Total "Dry" Washed Sample Mass (TWM), grams	153.5	

Sieve Size metric (English)	Individual Weight (g)	Cumulative Weight (g)	Percent Retained (%)	Percent Passing (%)	Specification
37.5 (1 1/2)	0.0	0.0	0.0	100.0	NP
25 (1)	0.0	0.0	0.0	100.0	NP
19 (3/4)	0.0	0.0	0.0	100.0	NP
16 (5/8)	0.0	0.0	0.0	100.0	NP
12.5 (1/2)	0.0	0.0	0.0	100.0	NP
9.5 (3/8)	0.9	0.9	0.1	99.9	NP
6.3 (1/4)	0.9	1.8	0.2	99.8	NP
4.75 (4)	3.1	4.9	0.7	99.3	NP
2.36 (8)	21.1	26.0	3.6	96.4	NP
1.18 (16)	40.7	66.7	9.3	90.7	NP
0.6 (30)	31.2	97.9	13.6	86.4	NP
0.425 (40)	0.0	97.9	13.6	86.4	NP
0.3 (50)	14.4	112.3	15.6	84.4	NP
0.15 (100)	14.7	127.0	17.6	82.4	NP
0.075 (200)	25.6	152.6	21.2	78.8	NP
Pan					

SIEVE ANALYSIS WORKSHEET

CLIENT:	CWLP Environmental Health & Safety	PROJECT:	Piezometer Installation CWLP Ash Ponds Springfield, IL
DATE:	April 26, 2010	PSI REPORT NO.	0020522-1 Page 3 of 8

GENERAL SAMPLE INFORMATION

SAMPLE TYPE: Clayey SILT, Some Fine to Coarse Sand	SAMPLED BY: PSI DATE SAMPLED: 4/21/2010
SAMPLE SOURCE: AP-2, 3'-7'	TESTED BY: Don Reed DATE TESTED: April 26, 2010
SPECIFICATIONS: ASTM C136	NOTES/OBSERVATIONS NP=Not Provided to PSI

SIEVE ANALYSIS DATA/RESULTS		TEST METHOD
Original "Wet" Sample Mass (OSM) + Pan:	1706.4	ASTM C136
Pan Weight:	90.7	
Original "Wet" Sample Mass (OSM):	1615.7	
Total "Dry" Sample Mass (TSM) + Pan:	1381.0	
Pan Weight:	90.7	
Total "Dry" Sample Mass (TSM):	1290.3	
Total "Dry" Washed Sample Mass (TWM) + Pan Wt.	420.6	
Pan Weight:	90.7	
Total "Dry" Washed Sample Mass (TWM), grams	329.9	

Sieve Size metric (English)	Individual Weight (g)	Cumulative Weight (g)	Percent Retained (%)	Percent Passing (%)	Specification
37.5 (1 1/2)	0.0	0.0	0.0	100.0	NP
25 (1)	0.0	0.0	0.0	100.0	NP
19 (3/4)	0.0	0.0	0.0	100.0	NP
16 (5/8)	0.0	0.0	0.0	100.0	NP
12.5 (1/2)	0.0	0.0	0.0	100.0	NP
9.5 (3/8)	3.5	3.5	0.3	99.7	NP
6.3 (1/4)	2.3	5.8	0.4	99.6	NP
4.75 (4)	2.7	8.5	0.7	99.3	NP
2.36 (8)	6.6	15.1	1.2	98.8	NP
1.18 (16)	7.0	22.1	1.7	98.3	NP
0.6 (30)	8.0	30.1	2.3	97.7	NP
0.425 (40)	0.0	30.1	2.3	97.7	NP
0.3 (50)	18.1	48.2	3.7	96.3	NP
0.15 (100)	119.7	167.9	13.0	87.0	NP
0.075 (200)	156.2	324.1	25.1	74.9	NP
Pan					

SIEVE ANALYSIS WORKSHEET

CLIENT: CWLP
Environmental Health & Safety

PROJECT: Piezometer Installation
CWLP Ash Ponds
Springfield, IL

DATE: April 26, 2010

PSI REPORT NO. 0020522-1

GENERAL SAMPLE INFORMATION

SAMPLE TYPE: Clayey SILT, Some Fine to Coarse Sand	SAMPLED BY: PSI DATE SAMPLED: 4/21/2010
SAMPLE SOURCE: AP-2, 9'-16'	TESTED BY: Don Reed DATE TESTED: April 26, 2010
SPECIFICATIONS: ASTM C136	NOTES/OBSERVATIONS NP=Not Provided to PSI

SIEVE ANALYSIS DATA/RESULTS		TEST METHOD
Original "Wet" Sample Mass (OSM) + Pan:	1461.6	ASTM C136
Pan Weight:	173.0	
Original "Wet" Sample Mass (OSM):	1288.6	
Total "Dry" Sample Mass (TSM) + Pan:	1178.1	
Pan Weight:	173.0	
Total "Dry" Sample Mass (TSM):	1005.1	
Total "Dry" Washed Sample Mass (TWM) + Pan Wt.	319.2	
Pan Weight:	173.0	
Total "Dry" Washed Sample Mass (TWM), grams	146.2	

Sieve Size metric (English)	Individual Weight (g)	Cumulative Weight (g)	Percent Retained (%)	Percent Passing (%)	Specification
37.5 (1 1/2)	0.0	0.0	0.0	100.0	NP
25 (1)	0.0	0.0	0.0	100.0	NP
19 (3/4)	0.0	0.0	0.0	100.0	NP
16 (5/8)	0.0	0.0	0.0	100.0	NP
12.5 (1/2)	0.0	0.0	0.0	100.0	NP
9.5 (3/8)	0.0	0.0	0.0	100.0	NP
6.3 (1/4)	0.8	0.8	0.1	99.9	NP
4.75 (4)	1.2	2.0	0.2	99.8	NP
2.36 (8)	1.5	3.5	0.3	99.7	NP
1.18 (16)	2.8	6.3	0.6	99.4	NP
0.6 (30)	5.7	12.0	1.2	98.8	NP
0.425 (40)	0.0	12.0	1.2	98.8	NP
0.3 (50)	7.2	19.2	1.9	98.1	NP
0.15 (100)	42.1	61.3	6.1	93.9	NP
0.075 (200)	82.8	144.1	14.3	85.7	NP
Pan					

SIEVE ANALYSIS WORKSHEET

CLIENT: CWLP
Environmental Health & Safety

PROJECT: Piezometer Installation
CWLP Ash Ponds
Springfield, IL

DATE: April 26, 2010

PSI REPORT NO. 0020522-1

GENERAL SAMPLE INFORMATION

SAMPLE TYPE: Clayey SILT, Some Fine to Coarse Sand, Trace Subround Gravel	SAMPLED BY: PSI DATE SAMPLED: 4/21/2010
SAMPLE SOURCE: AP-3, 3'-6'	TESTED BY: Don Reed DATE TESTED: April 26, 2010
SPECIFICATIONS: ASTM C136	NOTES/OBSERVATIONS NP=Not Provided to PSI

SIEVE ANALYSIS DATA/RESULTS		TEST METHOD
Original "Wet" Sample Mass (OSM) + Pan:	816.4	ASTM C136
Pan Weight:	94.6	
Original "Wet" Sample Mass (OSM):	721.8	
Total "Dry" Sample Mass (TSM) + Pan:	663.7	
Pan Weight:	94.6	
Total "Dry" Sample Mass (TSM):	569.1	
Total "Dry" Washed Sample Mass (TWM) + Pan Wt.	195.2	
Pan Weight:	94.6	
Total "Dry" Washed Sample Mass (TWM), grams	100.6	

Sieve Size metric (English)	Individual Weight (g)	Cumulative Weight (g)	Percent Retained (%)	Percent Passing (%)	Specification
37.5 (1 1/2)	0.0	0.0	0.0	100.0	NP
25 (1)	0.0	0.0	0.0	100.0	NP
19 (3/4)	0.0	0.0	0.0	100.0	NP
16 (5/8)	0.0	0.0	0.0	100.0	NP
12.5 (1/2)	0.0	0.0	0.0	100.0	NP
9.5 (3/8)	2.5	2.5	0.4	99.6	NP
6.3 (1/4)	0.4	2.9	0.5	99.5	NP
4.75 (4)	0.4	3.3	0.6	99.4	NP
2.36 (8)	1.3	4.6	0.8	99.2	NP
1.18 (16)	3.6	8.2	1.4	98.6	NP
0.6 (30)	7.6	15.8	2.8	97.2	NP
0.425 (40)	0.0	15.8	2.8	97.2	NP
0.3 (50)	10.2	26.0	4.6	95.4	NP
0.15 (100)	31.7	57.7	10.1	89.9	NP
0.075 (200)	41.5	99.2	17.4	82.6	NP
Pan					

SIEVE ANALYSIS WORKSHEET

CLIENT: CWLP
Environmental Health & Safety

PROJECT: Piezometer Installation
CWLP Ash Ponds
Springfield, IL

DATE: April 26, 2010

PSI REPORT NO. 0020522-1

GENERAL SAMPLE INFORMATION

SAMPLE TYPE: Clayey SILT, Some Fine to Coarse Sand	SAMPLED BY: PSI DATE SAMPLED: 4/21/2010
SAMPLE SOURCE: AP-3, 10'-15'	TESTED BY: Don Reed DATE TESTED: April 26, 2010
SPECIFICATIONS: ASTM C136	NOTES/OBSERVATIONS NP=Not Provided to PSI

SIEVE ANALYSIS DATA/RESULTS		TEST METHOD
Original "Wet" Sample Mass (OSM) + Pan:	1010.5	ASTM C136
Pan Weight:	104.2	
Original "Wet" Sample Mass (OSM):	906.3	
Total "Dry" Sample Mass (TSM) + Pan:	812.2	
Pan Weight:	104.2	
Total "Dry" Sample Mass (TSM):	708.0	
Total "Dry" Washed Sample Mass (TWM) + Pan Wt.	250.7	
Pan Weight:	104.2	
Total "Dry" Washed Sample Mass (TWM), grams	146.5	

Sieve Size metric (English)	Individual Weight (g)	Cumulative Weight (g)	Percent Retained (%)	Percent Passing (%)	Specification
37.5 (1 1/2)	0.0	0.0	0.0	100.0	NP
25 (1)	0.0	0.0	0.0	100.0	NP
19 (3/4)	0.0	0.0	0.0	100.0	NP
16 (5/8)	0.0	0.0	0.0	100.0	NP
12.5 (1/2)	0.0	0.0	0.0	100.0	NP
9.5 (3/8)	0.0	0.0	0.0	100.0	NP
6.3 (1/4)	1.8	1.8	0.3	99.7	NP
4.75 (4)	0.4	2.2	0.3	99.7	NP
2.36 (8)	3.4	5.6	0.8	99.2	NP
1.18 (16)	5.5	11.1	1.6	98.4	NP
0.6 (30)	7.4	18.5	2.6	97.4	NP
0.425 (40)	0.0	18.5	2.6	97.4	NP
0.3 (50)	16.6	35.1	5.0	95.0	NP
0.15 (100)	52.0	87.1	12.3	87.7	NP
0.075 (200)	56.8	143.9	20.3	79.7	NP
Pan					

SIEVE ANALYSIS WORKSHEET

CLIENT: CWLP
Environmental Health & Safety

PROJECT: Piezometer Installation
CWLP Ash Ponds
Springfield, IL

DATE: April 26, 2010

PSI REPORT NO. 0020522-1

GENERAL SAMPLE INFORMATION

SAMPLE TYPE: Composite of FLY ASH and Silty CLAY, With Fine to Coarse Sand, Trace Subround gravel	SAMPLED BY: PSI
	DATE SAMPLED: 4/20/2010
SAMPLE SOURCE: AP-4, 18'-23'	TESTED BY: Don Reed
	DATE TESTED: April 26, 2010
SPECIFICATIONS: ASTM C136	NOTES/OBSERVATIONS NP=Not Provided to PSI

SIEVE ANALYSIS DATA/RESULTS		TEST METHOD
Original "Wet" Sample Mass (OSM) + Pan:	1931.9	ASTM C136
Pan Weight:	147.6	
Original "Wet" Sample Mass (OSM):	1784.3	
Total "Dry" Sample Mass (TSM) + Pan:	1596.1	
Pan Weight:	147.6	
Total "Dry" Sample Mass (TSM):	1448.5	
Total "Dry" Washed Sample Mass (TWM) + Pan Wt.	752.6	
Pan Weight:	147.6	
Total "Dry" Washed Sample Mass (TWM), grams	605.0	

Sieve Size metric (English)	Individual Weight (g)	Cumulative Weight (g)	Percent Retained (%)	Percent Passing (%)	Specification
37.5 (1 1/2)	0.0	0.0	0.0	100.0	NP
25 (1)	0.0	0.0	0.0	100.0	NP
19 (3/4)	0.0	0.0	0.0	100.0	NP
16 (5/8)	8.2	8.2	5.6	94.4	NP
12.5 (1/2)	0.0	8.2	0.6	99.4	NP
9.5 (3/8)	2.5	10.7	0.7	99.3	NP
6.3 (1/4)	12.3	23.0	1.6	98.4	NP
4.75 (4)	10.8	33.8	2.3	97.7	NP
2.36 (8)	52.2	86.0	5.9	94.1	NP
1.18 (16)	144.3	230.3	15.9	84.1	NP
0.6 (30)	132.2	362.5	25.0	75.0	NP
0.425 (40)	0.0	362.5	25.0	75.0	NP
0.3 (50)	110.4	472.9	32.6	67.4	NP
0.15 (100)	75.1	548.0	37.8	62.2	NP
0.075 (200)	53.5	601.5	41.5	58.5	NP
Pan					

SIEVE ANALYSIS WORKSHEET

CLIENT: CWLP
Environmental Health & Safety

PROJECT: Piezometer Installation
CWLP Ash Ponds
Springfield, IL

DATE: April 26, 2010

PSI REPORT NO. 0020522-1 Page 8 of 8

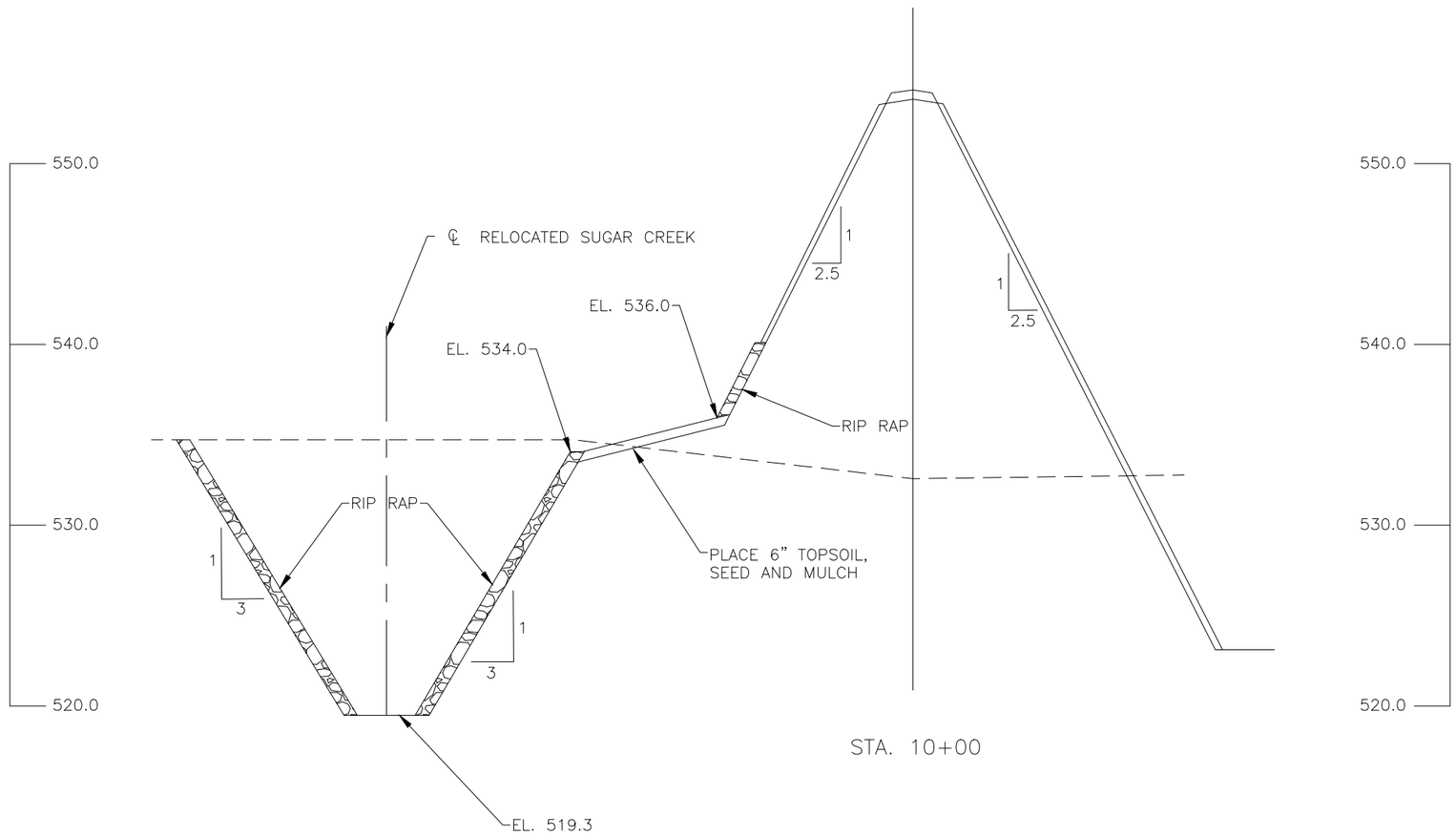
GENERAL SAMPLE INFORMATION

SAMPLE TYPE: Clayey SILT With Fine to Coarse Sand, Trace Subround Gravel	SAMPLED BY: PSI DATE SAMPLED: 4/20/2010
SAMPLE SOURCE: AP-4, 45'-55'	TESTED BY: Don Reed DATE TESTED: April 26, 2010
SPECIFICATIONS: ASTM C136	NOTES/OBSERVATIONS NP=Not Provided to PSI

SIEVE ANALYSIS DATA/RESULTS		TEST METHOD
Original "Wet" Sample Mass (OSM) + Pan:	1855.4	ASTM C136
Pan Weight:	99.7	
Original "Wet" Sample Mass (OSM):	1755.7	
Total "Dry" Sample Mass (TSM) + Pan:	1509.0	
Pan Weight:	99.7	
Total "Dry" Sample Mass (TSM):	1409.3	
Total "Dry" Washed Sample Mass (TWM) + Pan Wt.	584.6	
Pan Weight:	99.7	
Total "Dry" Washed Sample Mass (TWM), grams	484.9	

Sieve Size metric (English)	Individual Weight (g)	Cumulative Weight (g)	Percent Retained (%)	Percent Passing (%)	Specification
37.5 (1 1/2)	0.0	0.0	0.0	100.0	NP
25 (1)	0.0	0.0	0.0	100.0	NP
19 (3/4)	0.0	0.0	0.0	100.0	NP
16 (5/8)	0.0	0.0	0.0	100.0	NP
12.5 (1/2)	0.0	0.0	0.0	100.0	NP
9.5 (3/8)	2.7	2.7	0.2	99.8	NP
6.3 (1/4)	6.7	9.4	0.7	99.3	NP
4.75 (4)	11.0	20.4	1.4	98.6	NP
2.36 (8)	31.4	51.8	3.7	96.3	NP
1.18 (16)	35.3	87.1	6.2	93.8	NP
0.6 (30)	55.9	143.0	10.1	89.9	NP
0.425 (40)	0.0	143.0	10.1	89.9	NP
0.3 (50)	162.8	305.8	21.7	78.3	NP
0.15 (100)	94.7	400.5	28.4	71.6	NP
0.075 (200)	82.5	483.0	34.3	65.7	NP
Pan					

Electronic Filing: Received, Clerk's Office 02/13/2020



STA. 10+00

HORIZ. 0 20 40 80
VERT. 0 4 8 16
SCALE: IN FEET

NOTES:
CROSS-SECTION BASED ON CONSTRUCTION PLAN DRAWINGS
PREPARED BY BURNS & McDONNEL IN AUGUST 1976

J:\S\Springfield CWLP\CWLP\dwg\DALLMAN X-SEC.dwg Tab: Layout1 Last Saved: October 7, 2016, by Ryan Curtis Plotted: Friday, October 07, 2016 4:17:38 PM

REVISIONS

NO.	DATE	DESCRIPTION	BY
		Resp. to 4th RTP	

CWLP - 29800

ANDREWS ENGINEERING, INC.
3300 GINGER CREEK DRIVE
SPRINGFIELD, ILLINOIS 62711-7233
PH (217) 787-2334 FAX (217) 787-9495
PONTIAC, IL • LOMBARD, IL • INDIANAPOLIS, IN • WARRENTON, MO
PROFESSIONAL DESIGN ENGINEERING AND LAND SURVEYING FIRM #184001541

APPROVED BY: PMV | DESIGNED BY: PMV | DRAWN BY: RMC

DALLMAN ASH POND CROSS-SECTION AT STA. 10+00

PLANS PREPARED FOR
CITY, WATER, LIGHT & POWER
SPRINGFIELD, SANGAMON COUNTY, ILLINOIS

DATE: OCTOBER 2016

PROJECT ID: 150077/0011

SHEET NUMBER:

X-SEC.

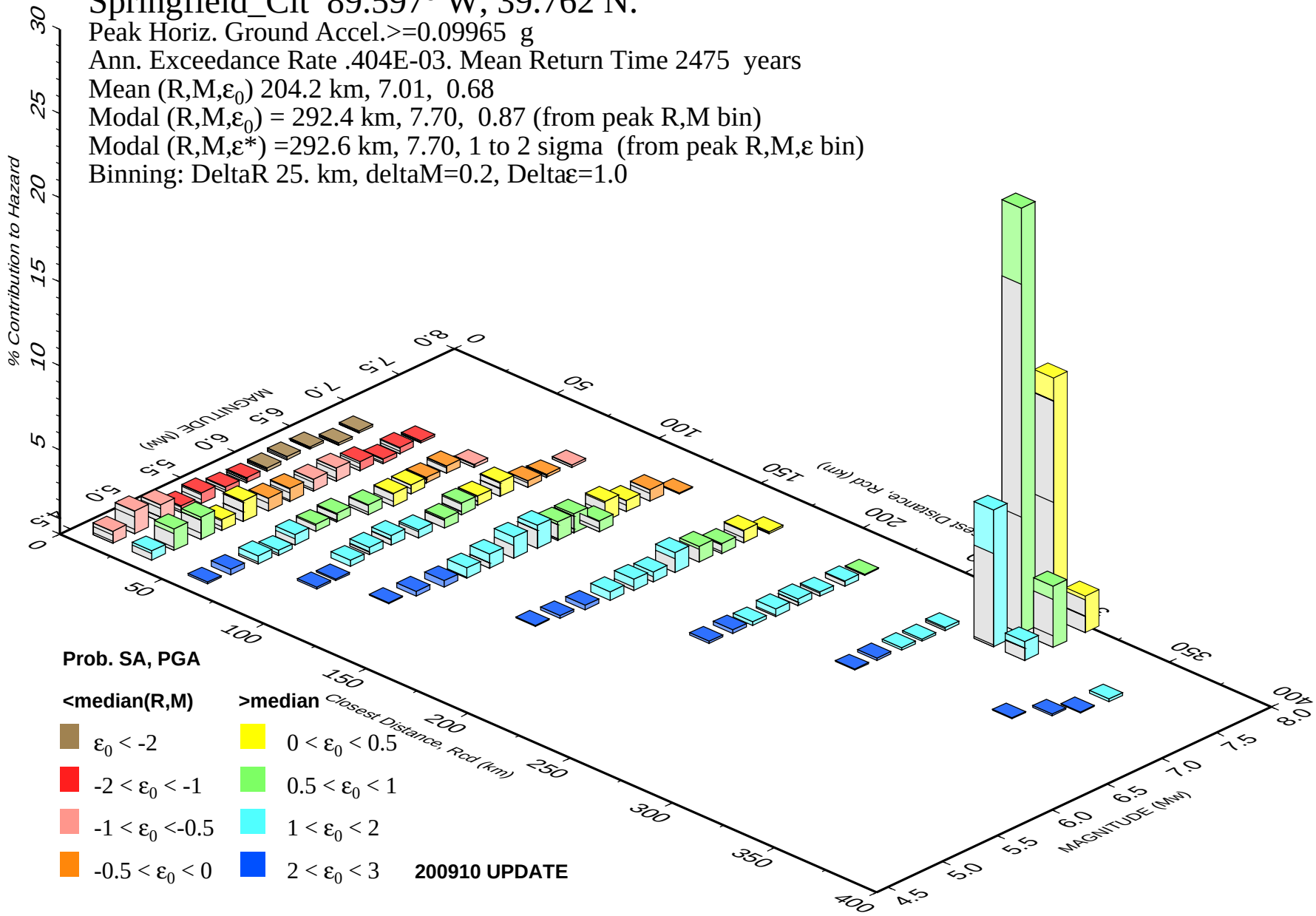
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APPENDIX E

USGS Earthquake Hazards Program
Probabilistic Seismic Hazard Analysis

PSH Deaggregation on NEHRP BC rock
Springfield_Cit 89.597º W, 39.762 N.

Peak Horiz. Ground Accel.>=0.09965 g
Ann. Exceedance Rate .404E-03. Mean Return Time 2475 years
Mean (R,M,ε_0) 204.2 km, 7.01, 0.68
Modal (R,M,ε_0) = 292.4 km, 7.70, 0.87 (from peak R,M bin)
Modal (R,M,ε*) =292.6 km, 7.70, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR 25. km, deltaM=0.2, Deltaε=1.0



Resp. to 4th RTP
CWLP - 29802

GMT 2016 Sep 28 21:22:05 **Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on rock with average vs= 760. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted**

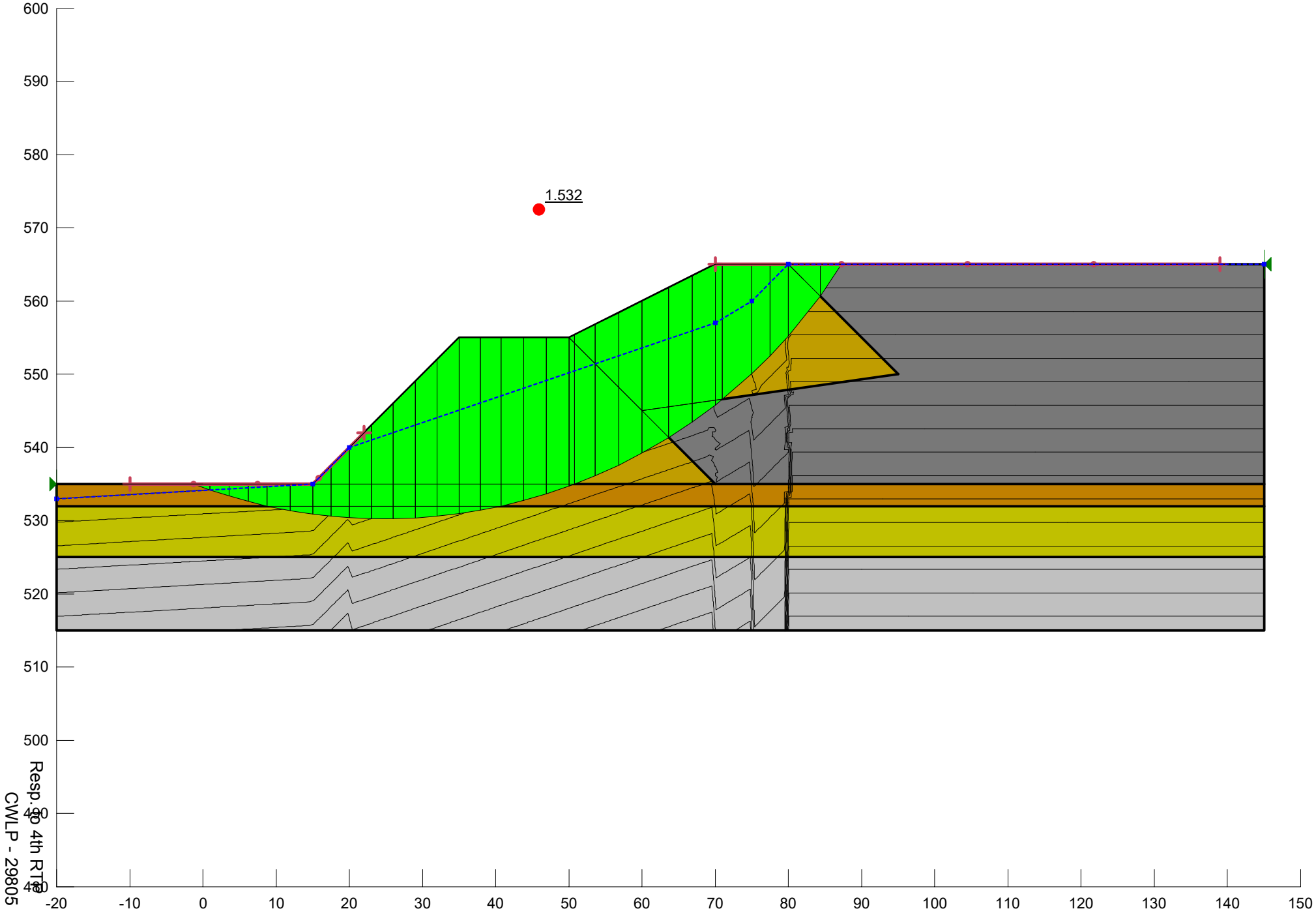
APPENDIX F

Lakeside Ash Pond Slope Stability Analysis

APPENDIX F-1

Long-Term Static Slope Stability Analysis

Electronic Filing: Received, Clerk's Office 02/13/2020



Electronic Filing: Received, Clerk's Office 02/13/2020

CWLP Lakeside Long Term Static

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File Information

File Version: 8.14
Created By: Karl Finke
Last Edited By: Karl Finke
Revision Number: 47
Date: 10/3/2016
Time: 2:09:57 PM
Tool Version: 8.14.1.10087
File Name: CWLP Lakeside Long Term Section 2.gsz
Directory: J:\CWLP Factor of Safety Report\SlopeW\
Last Solved Date: 10/3/2016
Last Solved Time: 2:09:59 PM

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

CWLP Lakeside Long Term Static

Description: CWLP Lakeside
Kind: SLOPE/W
Method: Morgenstern-Price
Settings
    Side Function
        Interslice force function option: Half-Sine
    PWP Conditions Source: Piezometric Line
    Apply Phreatic Correction: Yes
    Use Staged Rapid Drawdown: No
Slip Surface
    Direction of movement: Right to Left
    Use Passive Mode: No
    Slip Surface Option: Entry and Exit
    Critical slip surfaces saved: 1

Resp. to 4th RTP
CWLP - 29806

Electronic Filing: Received, Clerk's Office 02/13/2020

Resisting Side Maximum Convex Angle: 1 °
Driving Side Maximum Convex Angle: 5 °
Optimize Critical Slip Surface Location: No
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 30
F of S Tolerance: 0.001
Minimum Slip Surface Depth: 0.1 ft
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Brn Gry Sandy Silty Clay

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 145 psf
Phi': 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Brn Silty Clay

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 190 psf
Phi': 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Yel Brn Gry VF Sandy Silt

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 190 psf
Phi': 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gray Clayey Shale

Model: Mohr-Coulomb

Resp. to 4th RTP
CWLP - 29807

Electronic Filing: Received, Clerk's Office 02/13/2020

Unit Weight: 130 pcf
Cohesion': 2,000 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Ash

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion': 0 psf
Phi': 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (-10, 535) ft
Left-Zone Right Coordinate: (22, 542) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (70, 565) ft
Right-Zone Right Coordinate: (139, 565) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (-20, 535) ft
Right Coordinate: (145, 565) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
Coordinate 1	-20	533
Coordinate 2	15	535
Coordinate 3	20	540
Coordinate 4	70	557
Coordinate 5	75	560
Coordinate 6	80	565
Coordinate 7	145	565

Resp. to 4th RTP
CWLP - 29808

Electronic Filing: Received, Clerk's Office 02/13/2020

Points

	X (ft)	Y (ft)
Point 1	15	535
Point 2	35	555
Point 3	50	555
Point 4	60	545
Point 5	70	535
Point 6	70	565
Point 7	80	565
Point 8	95	550
Point 9	145	565
Point 10	-20	535
Point 11	145	535
Point 12	-20	532
Point 13	145	532
Point 14	-20	525
Point 15	145	525
Point 16	-20	515
Point 17	145	515

Regions

	Material	Points	Area (ft²)
Region 1	Brn Gry Sandy Silty Clay	1,2,3,4,5	700
Region 2	Brn Gry Sandy Silty Clay	3,6,7,8,4	550
Region 3	Brn Silty Clay	10,1,5,11,13,12	495
Region 4	Yel Brn Gry VF Sandy Silt	12,14,15,13	1,155
Region 5	Ash	8,4,5,11,9,7	2,000
Region 6	Gray Clayey Shale	14,16,17,15	1,650

Current Slip Surface

Slip Surface: 33
F of S: 1.532
Volume: 1,258.2941 ft³
Weight: 150,210.74 lbs
Resisting Moment: 5,434,428.4 lbs-ft
Activating Moment: 3,545,823.9 lbs-ft
Resisting Force: 68,187.197 lbs
Activating Force: 44,512.413 lbs
F of S Rank: 1
Exit: (-1.2751263, 535) ft
Entry: (87.25, 565) ft
Radius: 73.560778 ft
Center: (24.754863, 603.80136) ft

Electronic Filing: Received, Clerk's Office 02/13/2020

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	-0.16048362	534.59869	-28.921787	116.63294	72.880347	190
Slice 2	2.2555676	533.77922	30.633885	239.91856	130.77557	190
Slice 3	4.8583846	532.99536	88.638254	357.95512	168.28786	190
Slice 4	7.4612017	532.31483	140.21555	463.62052	202.08585	190
Slice 5	10.321958	531.68791	189.37551	562.23057	232.9857	190
Slice 6	13.440653	531.13303	234.97122	647.75213	257.93414	190
Slice 7	16.25	530.74473	343.52879	872.41907	330.48732	190
Slice 8	18.75	530.49682	514.99863	1,237.8844	451.70913	190
Slice 9	21.5	530.32797	569.52187	1,633.4497	664.81587	190
Slice 10	24.5	530.25632	630.58214	2,026.2219	872.09255	190
Slice 11	27.5	530.30715	684.79174	2,374.6858	1,055.963	190
Slice 12	30.5	530.48071	732.13642	2,676.6103	1,215.0422	190
Slice 13	33.5	530.77789	772.56714	2,932.1543	1,349.4598	190
Slice 14	36.436779	531.18867	805.44064	2,961.7079	1,347.3854	190
Slice 15	39.310336	531.70991	830.93376	2,787.6141	1,222.6696	190
Slice 16	42.289263	532.3786	850.1832	2,595.7963	1,090.7801	190
Slice 17	45.373558	533.20762	862.4684	2,390.7241	954.96017	190
Slice 18	48.457853	534.1831	866.56169	2,182.7153	822.42405	190
Slice 19	50.392426	534.85408	865.82212	2,074.5141	755.2746	190
Slice 20	52.183471	535.56217	860.27695	2,045.1601	740.39712	145
Slice 21	55.186567	536.85367	845.14961	1,991.516	716.32925	145
Slice 22	58.395522	538.40841	819.21351	1,925.9735	691.58041	145
Slice 23	61.820519	540.29639	778.74635	1,813.4119	646.53076	145
Slice 24	65.230778	542.40704	725.54379	1,765.7584	485.06005	0
Slice 25	68.410259	544.62796	661.78492	1,717.5015	492.28874	0
Slice 26	70.482325	546.18359	509.56053	1,647.8538	530.79489	0
Slice 27	72.982325	548.32026	480.3485	1,367.3352	554.25078	145
Slice 28	76.25	551.30019	310.43404	1,075.0936	477.81232	145
Slice	78.75	553.87819	308.00034	862.30889	346.37042	145

Resp. to 4th RTP
CWLP - 29810

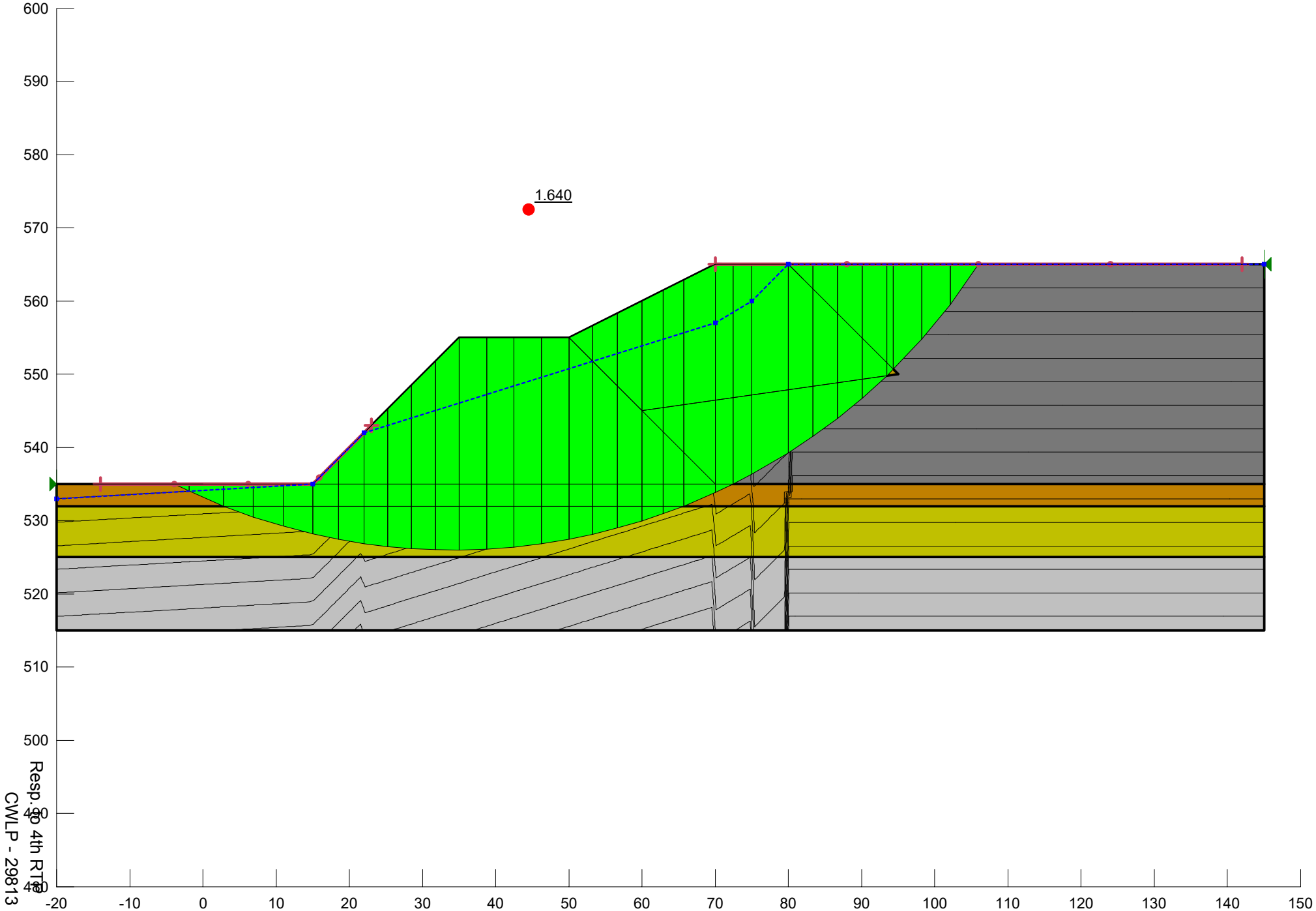
Electronic Filing: Received, Clerk's Office 02/13/2020

29						
Slice 30	82.16908	557.94599	440.16994	557.72891	73.458995	145
Slice 31	85.79408	562.83092	135.35062	184.12653	22.744581	0

APPENDIX F-2

Short-Term Static Slope Stability Analysis

Electronic Filing: Received, Clerk's Office 02/13/2020



Electronic Filing: Received, Clerk's Office 02/13/2020

CWLP Lakeside Short Term Static

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File Information

File Version: 8.14
Created By: Karl Finke
Last Edited By: Karl Finke
Revision Number: 48
Date: 10/3/2016
Time: 2:12:27 PM
Tool Version: 8.14.1.10087
File Name: CWLP Lakeside Short Term Section 2.gsz
Directory: J:\CWLP Factor of Safety Report\SlopeW\

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

CWLP Lakeside Short Term Static

Description: CWLP Lakeside
Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- PWP Conditions Source: Piezometric Line
- Apply Phreatic Correction: Yes
- Use Staged Rapid Drawdown: No

Slip Surface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Resisting Side Maximum Convex Angle: 1 °
- Driving Side Maximum Convex Angle: 5 °

Resp. to 4th RTP
CWLP - 29814

Electronic Filing: Received, Clerk's Office 02/13/2020

Optimize Critical Slip Surface Location: No
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 30
F of S Tolerance: 0.001
Minimum Slip Surface Depth: 0.1 ft
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Brn Gry Sandy Silty Clay

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,400 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Brn Silty Clay

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,800 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Yel Brn Gry VF Sandy Silt

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,000 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gray Clayey Shale

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 2,000 psf

Electronic Filing: Received, Clerk's Office 02/13/2020

Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Ash

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion': 0 psf
Phi': 15 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (-14, 535) ft
Left-Zone Right Coordinate: (23, 543) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (70, 565) ft
Right-Zone Right Coordinate: (142, 565) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (-20, 535) ft
Right Coordinate: (145, 565) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
Coordinate 1	-20	533
Coordinate 2	15	535
Coordinate 3	22	542
Coordinate 4	70	557
Coordinate 5	75	560
Coordinate 6	80	565
Coordinate 7	145	565

Resp. to 4th RTP
CWLP - 29816

Electronic Filing: Received, Clerk's Office 02/13/2020

Points

	X (ft)	Y (ft)
Point 1	15	535
Point 2	35	555
Point 3	50	555
Point 4	60	545
Point 5	70	535
Point 6	70	565
Point 7	80	565
Point 8	95	550
Point 9	145	565
Point 10	-20	535
Point 11	145	535
Point 12	-20	532
Point 13	145	532
Point 14	-20	525
Point 15	145	525
Point 16	-20	515
Point 17	145	515

Regions

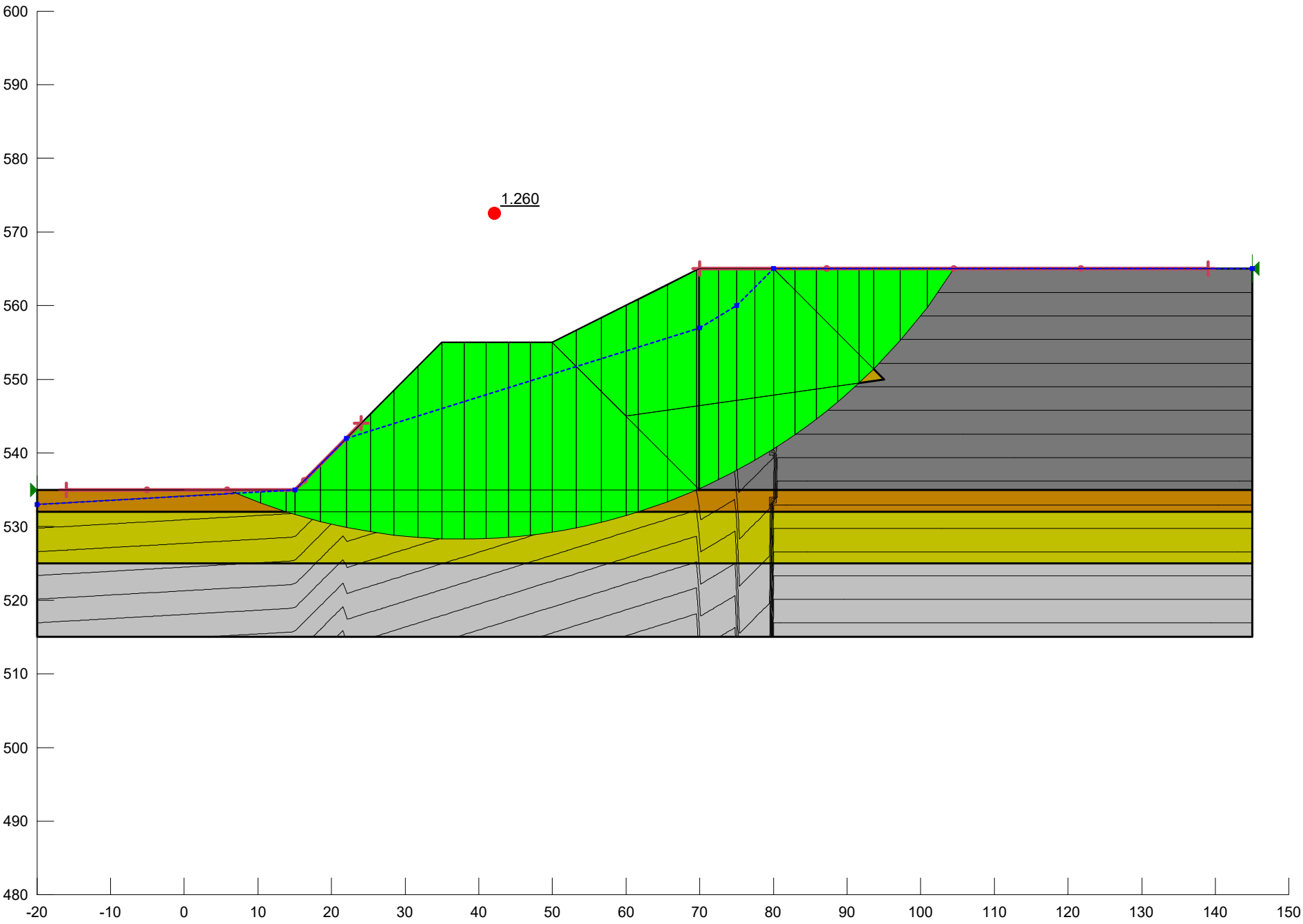
	Material	Points	Area (ft^2)
Region 1	Brn Gry Sandy Silty Clay	1,2,3,4,5	700
Region 2	Brn Gry Sandy Silty Clay	3,6,7,8,4	550
Region 3	Brn Silty Clay	10,1,5,11,13,12	495
Region 4	Yel Brn Gry VF Sandy Silt	12,14,15,13	1,155
Region 5	Ash	8,4,5,11,9,7	2,000
Region 6	Gray Clayey Shale	14,16,17,15	1,650

Resp. to 4th RTP
CWLP - 29817

APPENDIX F-3

Lakeside Seismic Slope Stability Analysis

Electronic Filing: Received, Clerk's Office 02/13/2020



Resp. to 4th RTP
CWLP - 29819

Electronic Filing: Received, Clerk's Office 02/13/2020

CWLP Lakeside Short Term Seismic

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File Information

File Version: 8.14
Created By: Karl Finke
Last Edited By: Karl Finke
Revision Number: 52
Date: 10/3/2016
Time: 2:14:02 PM
Tool Version: 8.14.1.10087
File Name: CWLP Lakeside Short Term Seismic Section 2.gsz
Directory: J:\CWLP Factor of Safety Report\SlopeW\
Last Solved Date: 10/3/2016
Last Solved Time: 2:14:06 PM

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

CWLP Lakeside Short Term Seismic

Description: CWLP Lakeside
Kind: SLOPE/W
Method: Morgenstern-Price
Settings
    Side Function
        Interslice force function option: Half-Sine
    PWP Conditions Source: Piezometric Line
    Apply Phreatic Correction: Yes
    Use Staged Rapid Drawdown: No
Slip Surface
    Direction of movement: Right to Left
    Use Passive Mode: No
    Slip Surface Option: Entry and Exit
    Critical slip surfaces saved: 1

Resp. to 4th RTP
CWLP - 29820

Electronic Filing: Received, Clerk's Office 02/13/2020

Resisting Side Maximum Convex Angle: 1 °
Driving Side Maximum Convex Angle: 5 °
Optimize Critical Slip Surface Location: No
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 30
F of S Tolerance: 0.001
Minimum Slip Surface Depth: 0.1 ft
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Brn Gry Sandy Silty Clay

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,400 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Brn Silty Clay

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,800 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Yel Brn Gry VF Sandy Silt

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,000 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gray Clayey Shale

Model: Mohr-Coulomb

Resp. to 4th RTP
CWLP - 29821

Electronic Filing: Received, Clerk's Office 02/13/2020

Unit Weight: 130 pcf
Cohesion': 2,000 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Ash

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion': 0 psf
Phi': 15 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (-16, 535) ft
Left-Zone Right Coordinate: (24, 544) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (70, 565) ft
Right-Zone Right Coordinate: (139, 565) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (-20, 535) ft
Right Coordinate: (145, 565) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
Coordinate 1	-20	533
Coordinate 2	15	535
Coordinate 3	22	542
Coordinate 4	70	557
Coordinate 5	75	560
Coordinate 6	80	565
Coordinate 7	145	565

Electronic Filing: Received, Clerk's Office 02/13/2020

Seismic Coefficients

Horz Seismic Coef.: 0.1

Vert Seismic Coef.: 0

Points

	X (ft)	Y (ft)
Point 1	15	535
Point 2	35	555
Point 3	50	555
Point 4	60	545
Point 5	70	535
Point 6	70	565
Point 7	80	565
Point 8	95	550
Point 9	145	565
Point 10	-20	535
Point 11	145	535
Point 12	-20	532
Point 13	145	532
Point 14	-20	525
Point 15	145	525
Point 16	-20	515
Point 17	145	515

Regions

	Material	Points	Area (ft²)
Region 1	Brn Gry Sandy Silty Clay	1,2,3,4,5	700
Region 2	Brn Gry Sandy Silty Clay	3,6,7,8,4	550
Region 3	Brn Silty Clay	10,1,5,11,13,12	495
Region 4	Yel Brn Gry VF Sandy Silt	12,14,15,13	1,155
Region 5	Ash	8,4,5,11,9,7	2,000
Region 6	Gray Clayey Shale	14,16,17,15	1,650

Current Slip Surface

Slip Surface: 63

F of S: 1.260

Volume: 1,901.9136 ft³

Weight: 220,860.5 lbs

Resisting Moment: 7,130,465.7 lbs-ft

Activating Moment: 5,657,637.6 lbs-ft

Resisting Force: 85,224.85 lbs

Activating Force: 67,622.745 lbs

F of S Rank: 1

Resp. to 4th RTP
CWLP - 29823

Electronic Filing: Received, Clerk's Office 02/13/2020

Exit: (5.863961, 535) ft
Entry: (104.5, 565) ft
Radius: 79.109148 ft
Center: (37.720356, 607.41151) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	6.3985031	534.76952	-16.235239	666.78022	0	1,800
Slice 2	8.6540842	533.85892	48.417777	824.15224	0	1,800
Slice 3	12.096162	532.5894	139.61124	1,052.2735	0	1,800
Slice 4	14.408601	531.81762	195.83209	915.79274	0	1,000
Slice 5	16.75	531.15401	349.18995	1,237.5437	0	1,000
Slice 6	20.25	530.27641	622.35204	1,804.3101	0	1,000
Slice 7	23.625	529.58574	734.59908	2,313.1757	0	1,000
Slice 8	26.875	529.06648	821.85486	2,760.4465	0	1,000
Slice 9	30.125	528.68475	901.29201	3,161.9008	0	1,000
Slice 10	33.375	528.43857	973.0241	3,515.7678	0	1,000
Slice 11	36.5	528.32601	1,034.9389	3,637.264	0	1,000
Slice 12	39.5	528.33662	1,087.631	3,541.0214	0	1,000
Slice 13	42.5	528.46119	1,133.8449	3,421.4585	0	1,000
Slice 14	45.5	528.70025	1,173.5497	3,282.3533	0	1,000
Slice 15	48.5	529.05487	1,206.6858	3,127.2166	0	1,000
Slice 16	51.619048	529.55023	1,233.9353	3,039.0174	0	1,000
Slice 17	54.928571	530.21608	1,254.8771	3,014.6722	0	1,000
Slice 18	58.309524	531.04871	1,267.6066	2,974.7747	0	1,000
Slice 19	60.811756	531.75225	1,272.0639	2,922.9997	0	1,000
Slice 20	63.611822	532.68895	1,268.5574	2,836.2034	0	1,800
Slice 21	67.588442	534.18895	1,253.9299	2,627.4289	0	1,800
Slice 22	69.723473	535.0649	1,242.0626	2,534.1139	0	1,400
Slice 23	69.935097	535.15874	1,240.4874	2,588.738	361.26267	0
Slice 24	71.25	535.77273	1,008.3689	2,514.1676	403.47755	0
Slice 25	73.75	536.99738	1,021.0026	2,378.8723	363.8401	0
Slice 26	76.25	538.3342	714.97294	2,233.9803	407.0168	0

Resp. to 4th RTP
CWLP - 29824

Electronic Filing: Received, Clerk's Office 02/13/2020

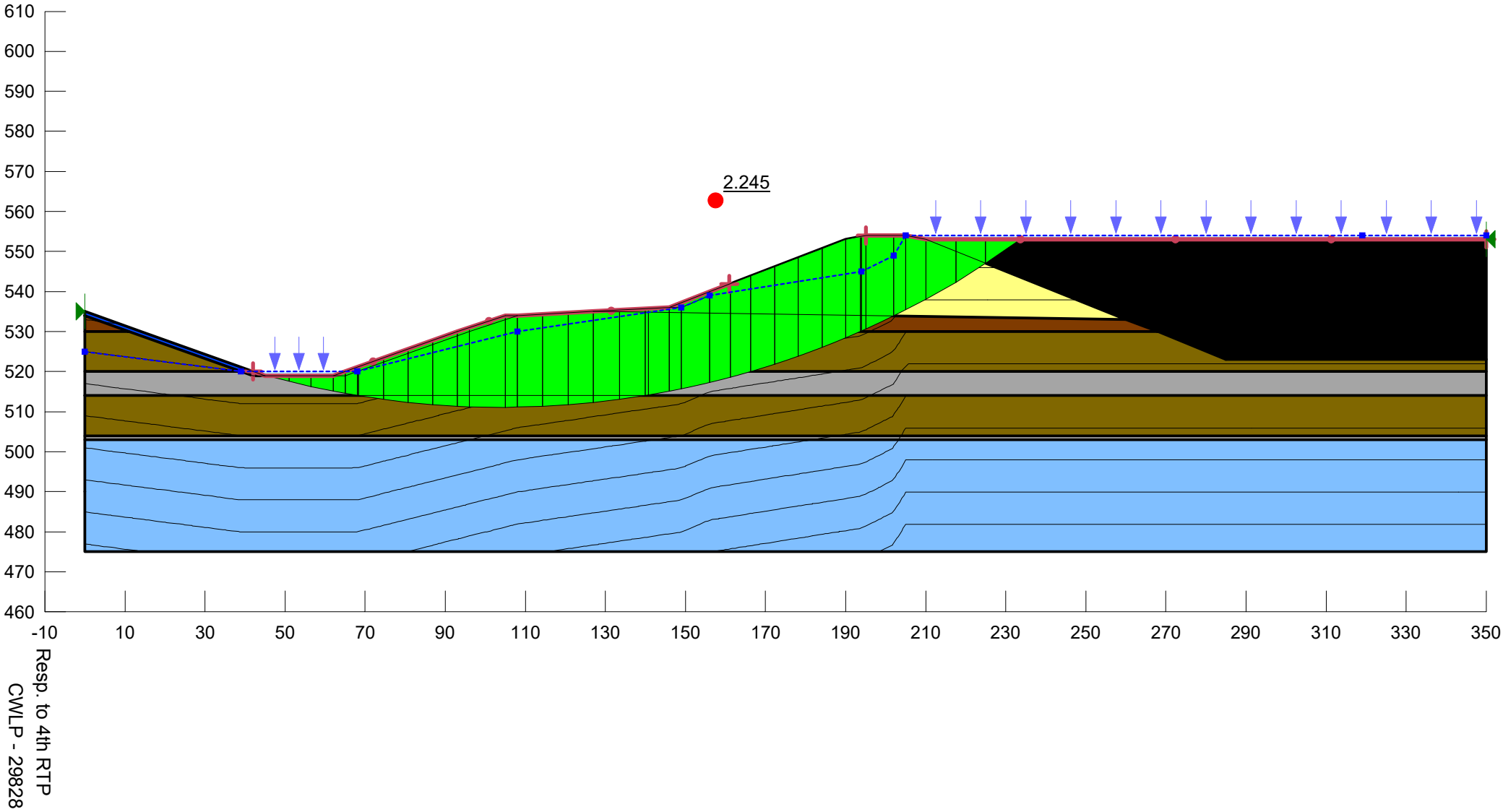
Slice 27	78.75	539.78986	747.55632	2,103.0434	363.20167	0
Slice 28	81.454318	541.51348	1,465.559	1,988.8949	140.22742	0
Slice 29	84.362954	543.54069	1,339.0611	1,797.0107	122.70723	0
Slice 30	87.27159	545.77183	1,199.8378	1,598.0888	106.71104	0
Slice 31	90.180226	548.23008	1,046.4432	1,386.8062	91.199981	0
Slice 32	92.613771	550.46311	907.10183	416.08203	-0	1,400
Slice 33	95.410831	553.34674	727.16315	925.16796	53.055228	0
Slice 34	99.046499	557.52099	466.69001	618.90263	40.785248	0
Slice 35	102.68217	562.37775	163.62838	227.05533	16.995201	0

APPENDIX G

Dallman Ash Pond Slope Stability Analysis

APPENDIX G-1

Long-Term Static Slope Stability Analysis


2.245
610
600
590
580
570
560
550
540
530
520
510
500
490
480
470
460
-10
10
30
50
70
90
110
130
150
170
190
210
230
250
270
290
310
330
350
Resp. to 4th RTP
CWLP - 29828

Electronic Filing: Received, Clerk's Office 02/13/2020

Dallman Long Term Static

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File Information

File Version: 8.14
Created By: Karl Finke
Last Edited By: Karl Finke
Revision Number: 45
Date: 10/3/2016
Time: 2:45:37 PM
Tool Version: 8.14.1.10087
File Name: CWLP Dallman Long Term Static.gsz
Directory: J:\CWLP Factor of Safety Report\SlopeW\
Last Solved Date: 10/3/2016
Last Solved Time: 2:45:42 PM

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

Dallman Long Term Static

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
    Side Function
        Interslice force function option: Half-Sine
    PWP Conditions Source: Piezometric Line
    Apply Phreatic Correction: No
    Use Staged Rapid Drawdown: No
Slip Surface
    Direction of movement: Right to Left
    Use Passive Mode: No
    Slip Surface Option: Entry and Exit
    Critical slip surfaces saved: 1
    Resisting Side Maximum Convex Angle: 1 °

Resp. to 4th RTP
CWLP - 29829

Electronic Filing: Received, Clerk's Office 02/13/2020

Driving Side Maximum Convex Angle: 5 °
Optimize Critical Slip Surface Location: No
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 30
F of S Tolerance: 0.001
Minimum Slip Surface Depth: 0.1 ft
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Embankment

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 145 psf
Phi': 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dk Brn Silty Clay

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 190 psf
Phi': 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Clayey Silt

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 190 psf
Phi': 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gry Snd Silty Clay

Model: Mohr-Coulomb
Unit Weight: 120 pcf

Resp. to 4th RTP
CWLP - 29830

Electronic Filing: Received, Clerk's Office 02/13/2020

Cohesion': 190 psf
Phi': 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gry Sand w/Silt

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Shale

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 2,000 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Rip-Rap

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 0 psf
Phi': 40 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Ash

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion': 0 psf
Phi': 25 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (42, 520) ft
Left-Zone Right Coordinate: (161, 541.91176) ft
Left-Zone Increment: 4

Resp. to 4th RTP
CWLP - 29831

Electronic Filing: Received, Clerk's Office 02/13/2020

Right Projection: Range
Right-Zone Left Coordinate: (195, 554) ft
Right-Zone Right Coordinate: (350, 553) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 535) ft
Right Coordinate: (350, 553) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
Coordinate 1	0	525
Coordinate 2	39	520
Coordinate 3	68	520
Coordinate 4	108	530
Coordinate 5	149	536
Coordinate 6	156	539
Coordinate 7	194	545
Coordinate 8	202	549
Coordinate 9	205	554
Coordinate 10	319	554
Coordinate 11	350	554

Seismic Coefficients

Horz Seismic Coef.: 0
Vert Seismic Coef.: 0

Points

	X (ft)	Y (ft)
Point 1	0	535
Point 2	105	534
Point 3	146	536
Point 4	190	553
Point 5	195	554
Point 6	205	554
Point 7	210	553
Point 8	260	533
Point 9	285	523

Electronic Filing: Received, Clerk's Office 02/13/2020

Point 10	319	523
Point 11	108	534
Point 12	149	536
Point 13	156	539
Point 14	156	540
Point 15	127	535
Point 16	0	534
Point 17	0	530
Point 18	0	520
Point 19	0	514
Point 20	0	504
Point 21	0	503
Point 22	0	490
Point 23	319	490
Point 24	319	503
Point 25	319	504
Point 26	319	514
Point 27	319	520
Point 28	268	530
Point 29	96	530
Point 30	93	530
Point 31	68	520
Point 32	65	520
Point 33	65	519
Point 34	62	519
Point 35	45	519
Point 36	42	519
Point 37	42	520
Point 38	39	520
Point 39	14	530
Point 40	11	530
Point 41	319	553
Point 42	319	554
Point 43	0	475
Point 44	319	475
Point 45	350	475
Point 46	350	503
Point 47	350	504
Point 48	350	514
Point 49	350	520
Point 50	350	523
Point 51	350	553
Point 52	350	554

Regions

	Material	Points	Area (ft²)
Region 1	Embankment	15,3,12,13,14,4,5,6,7,8	1,329

Resp. to 4th RTP
CWLP - 29833

Electronic Filing: Received, Clerk's Office 02/13/2020

Region 2	Dk Brn Silty Clay	8,28,29,11,15	859.5
Region 3	Dk Brn Silty Clay	16,17,40	22
Region 4	Clayey Silt	17,18,38,40	250
Region 5	Clayey Silt	31,29,28,9,50,49	2,165.5
Region 6	Gry Snd Silty Clay	18,19,48,49,31,33,34,35,36,38	2,074
Region 7	Clayey Silt	19,20,47,48	3,500
Region 8	Gry Sand w/Silt	20,21,46,47	350
Region 9	Shale	21,22,43,45,46	9,800
Region 10	Rip-Rap	14,13,12,3	9.5
Region 11	Rip-Rap	11,2,30,32,34,33,31,29	45
Region 12	Rip-Rap	1,16,40,38,36,35,37,39	46
Region 13	Ash	50,9,28,8,7,51	3,072.5

Current Slip Surface

Slip Surface: 7
F of S: 2.245
Volume: 3,200.3592 ft³
Weight: 383,171.01 lbs
Resisting Moment: 36,423,187 lbs-ft
Activating Moment: 16,221,979 lbs-ft
Resisting Force: 158,991.47 lbs
Activating Force: 70,815.407 lbs
F of S Rank: 1
Exit: (45.522783, 519) ft
Entry: (233.67574, 553) ft
Radius: 221.12319 ft
Center: (104.14305, 732.21147) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	48.268985	518.28274	107.15674	178.87139	44.812287	190
Slice 2	53.761391	516.92283	192.01571	353.71493	101.04088	190
Slice 3	59.253797	515.71076	267.64836	511.69752	152.49884	190
Slice 4	63.5	514.86088	320.68133	660.9906	212.64883	190
Slice 5	66.5	514.32124	354.35436	839.15316	302.93591	190
Slice 6	68.188424	514.03105	375.40183	956.76282	363.27466	190
Slice 7	71.454742	513.5399	457.00431	1,171.6028	446.53067	190
Slice 8	77.61053	512.70776	604.96029	1,562.4615	598.31313	190
Slice 9	83.766318	512.05084	741.98189	1,926.5541	740.20288	190
Slice 10	89.922106	511.5676	868.16684	2,261.6771	870.76189	190
Slice 11	94.5	511.30374	956.04651	2,488.3181	957.46953	190
Slice 12	100.5	511.1641	1,058.3602	2,738.6197	1,049.9427	190
Slice 13	106.5	511.10593	1,155.5902	2,901.8597	1,091.1903	190

Resp. to 4th RTP
CWLP - 29834

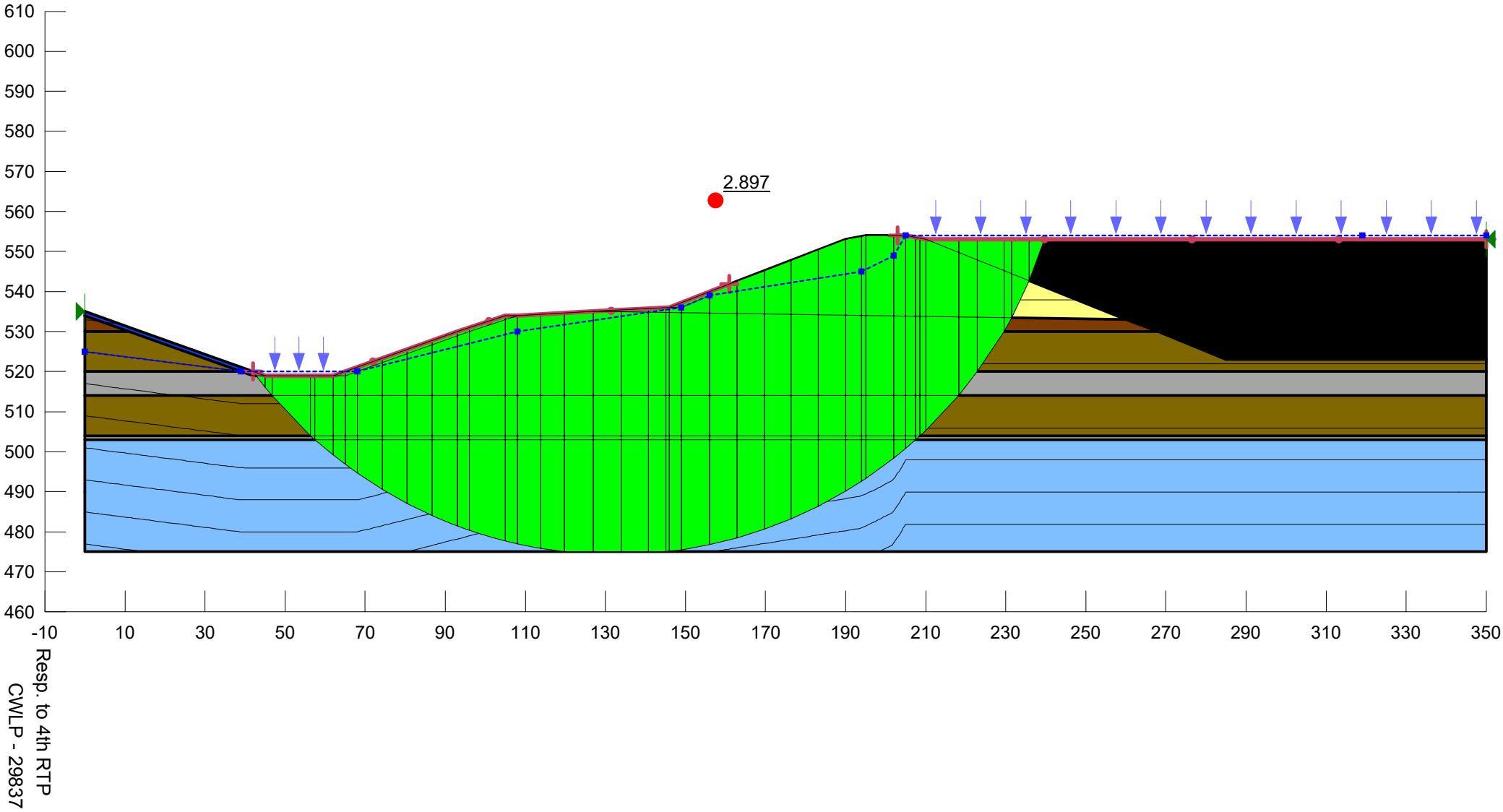
Electronic Filing: Received, Clerk's Office 02/13/2020

Slice 14	111.16667	511.22256	1,200.6293	2,877.0302	1,047.5315	190
Slice 15	117.5	511.51486	1,240.2241	2,843.683	1,001.9523	190
Slice 16	123.83333	511.98965	1,268.4315	2,784.2952	947.21677	190
Slice 17	130.22731	512.6562	1,285.2263	2,699.9685	884.02907	190
Slice 18	136.68194	513.51981	1,290.2789	2,592.4107	813.66226	190
Slice 19	140.33133	514.07002	1,289.2711	2,525.18	772.28159	190
Slice 20	143.3767	514.61303	1,283.1968	2,460.0575	735.38418	190
Slice 21	147.5	515.38596	1,272.6186	2,435.0091	726.34218	190
Slice 22	152.5	516.4704	1,312.2468	2,513.0909	750.37068	190
Slice 23	158.57153	517.90802	1,341.4759	2,572.8352	769.43867	190
Slice 24	163.71458	519.28057	1,306.5016	2,609.0957	813.95114	190
Slice 25	169.25034	520.91337	1,259.1564	2,631.83	857.74164	190
Slice 26	175.17882	522.83241	1,197.8192	2,639.2275	900.69184	190
Slice 27	181.10729	524.93876	1,124.7941	2,628.7031	939.74661	190
Slice 28	187.03576	527.2382	1,039.7203	2,600.2125	975.10375	190
Slice 29	191.80962	529.21848	963.18591	2,530.9234	979.63114	190
Slice 30	193.80962	530.08446	928.85427	2,475.0325	966.15936	190
Slice 31	194.5	530.39277	927.09136	2,455.6885	955.17346	190
Slice 32	198.5	532.26834	934.8556	2,265.3266	831.37054	190
Slice 33	203.5	534.67452	1,049.9097	2,031.1828	613.16748	145
Slice 34	207.5	536.75096	1,076.3401	1,798.7329	451.40109	145
Slice 35	213.74088	540.20827	860.60409	1,381.2735	325.35038	145
Slice 36	221.22264	544.6791	581.62409	853.3867	169.81613	145
Slice 37	229.31963	550.0073	249.14466	341.52741	43.078784	0

APPENDIX G-2

Short-Term Static Slope Stability Analysis

Electronic Filing: Received, Clerk's Office 02/13/2020



Electronic Filing: Received, Clerk's Office 02/13/2020

Dallman Short Term Static

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File Information

File Version: 8.14
Created By: Karl Finke
Last Edited By: Karl Finke
Revision Number: 40
Date: 10/3/2016
Time: 1:54:59 PM
Tool Version: 8.14.1.10087
File Name: CWLP Dallman Short Term Static.gsz
Directory: J:\CWLP Factor of Safety Report\SlopeW\
Last Solved Date: 10/3/2016
Last Solved Time: 1:55:04 PM

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

Dallman Short Term Static

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
    Side Function
        Interslice force function option: Half-Sine
    PWP Conditions Source: Piezometric Line
    Apply Phreatic Correction: No
    Use Staged Rapid Drawdown: No
Slip Surface
    Direction of movement: Right to Left
    Use Passive Mode: No
    Slip Surface Option: Entry and Exit
    Critical slip surfaces saved: 1
    Resisting Side Maximum Convex Angle: 1 °

Resp. to 4th RTP
CWLP - 29838

Electronic Filing: Received, Clerk's Office 02/13/2020

Driving Side Maximum Convex Angle: 5
Optimize Critical Slip Surface Location: No
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 30
F of S Tolerance: 0.001
Minimum Slip Surface Depth: 0.1 ft
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Embankment

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,400 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dk Brn Silty Clay

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,800 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Clayey Silt

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,400 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gry Snd Silty Clay

Model: Mohr-Coulomb
Unit Weight: 120 pcf

Resp. to 4th RTP
CWLP - 29839

Electronic Filing: Received, Clerk's Office 02/13/2020

Cohesion': 1,000 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gry Sand w/Silt

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Shale

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 2,000 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Rip-Rap

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 0 psf
Phi': 40 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Ash

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion': 0 psf
Phi': 15 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (42, 520) ft
Left-Zone Right Coordinate: (161, 541.91176) ft
Left-Zone Increment: 4

Resp. to 4th RTP
CWLP - 29840

Electronic Filing: Received, Clerk's Office 02/13/2020

Right Projection: Range
Right-Zone Left Coordinate: (203, 554) ft
Right-Zone Right Coordinate: (350, 553) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 535) ft
Right Coordinate: (350, 553) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
Coordinate 1	0	525
Coordinate 2	39	520
Coordinate 3	68	520
Coordinate 4	108	530
Coordinate 5	149	536
Coordinate 6	156	539
Coordinate 7	194	545
Coordinate 8	202	549
Coordinate 9	205	554
Coordinate 10	319	554
Coordinate 11	350	554

Seismic Coefficients

Horz Seismic Coef.: 0
Vert Seismic Coef.: 0

Points

	X (ft)	Y (ft)
Point 1	0	535
Point 2	105	534
Point 3	146	536
Point 4	190	553
Point 5	195	554
Point 6	205	554
Point 7	210	553
Point 8	260	533
Point 9	285	523

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Point 10	319	523
Point 11	108	534
Point 12	149	536
Point 13	156	539
Point 14	156	540
Point 15	127	535
Point 16	0	534
Point 17	0	530
Point 18	0	520
Point 19	0	514
Point 20	0	504
Point 21	0	503
Point 22	0	490
Point 23	319	490
Point 24	319	503
Point 25	319	504
Point 26	319	514
Point 27	319	520
Point 28	268	530
Point 29	96	530
Point 30	93	530
Point 31	68	520
Point 32	65	520
Point 33	65	519
Point 34	62	519
Point 35	45	519
Point 36	42	519
Point 37	42	520
Point 38	39	520
Point 39	14	530
Point 40	11	530
Point 41	319	553
Point 42	319	554
Point 43	0	475
Point 44	319	475
Point 45	350	475
Point 46	350	503
Point 47	350	504
Point 48	350	514
Point 49	350	520
Point 50	350	523
Point 51	350	553
Point 52	350	554

Regions

	Material	Points	Area (ft²)
Region 1	Embankment	15,3,12,13,14,4,5,6,7,8	1,329

Electronic Filing: Received, Clerk's Office 02/13/2020

Region 2	Dk Brn Silty Clay	8,28,29,11,15	859.5
Region 3	Dk Brn Silty Clay	16,17,40	22
Region 4	Clayey Silt	17,18,38,40	250
Region 5	Clayey Silt	31,29,28,9,50,49	2,165.5
Region 6	Gry Snd Silty Clay	18,19,48,49,31,33,34,35,36,38	2,074
Region 7	Clayey Silt	19,20,47,48	3,500
Region 8	Gry Sand w/Silt	20,21,46,47	350
Region 9	Shale	21,22,43,45,46	9,800
Region 10	Rip-Rap	14,13,12,3	9.5
Region 11	Rip-Rap	11,2,30,32,34,33,31,29	45
Region 12	Rip-Rap	1,16,40,38,36,35,37,39	46
Region 13	Ash	50,9,28,8,7,51	3,072.5

Current Slip Surface

Slip Surface: 9
F of S: 2.897
Volume: 9,136.4623 ft³
Weight: 1,093,861.8 lbs
Resisting Moment: 47,499,602 lbs-ft
Activating Moment: 16,395,280 lbs-ft
Resisting Force: 357,222.23 lbs
Activating Force: 123,292.08 lbs
F of S Rank: 1
Exit: (42, 520) ft
Entry: (239.67574, 553) ft
Radius: 112.36371 ft
Center: (132.46693, 586.64336) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	42.372628	519.5	31.2	73.027936	35.097806	0
Slice 2	43.872628	517.55435	152.60873	711.94304	0	1,000
Slice 3	45.871637	515.05435	308.60873	974.73547	0	1,000
Slice 4	51.540427	509	686.4	1,850.0351	0	1,400
Slice 5	56.88762	503.5	1,029.6	2,336.2148	881.32283	0
Slice 6	59.71883	501.06093	1,181.7983	3,000.1174	0	2,000
Slice 7	63.5	497.9554	1,375.5833	3,409.4613	0	2,000
Slice 8	66.5	495.70089	1,516.2646	3,784.4612	0	2,000
Slice 9	71.125	492.57502	1,760.0687	4,370.811	0	2,000
Slice 10	77.375	488.77803	2,094.5006	5,106.8708	0	2,000
Slice 11	83.625	485.50966	2,395.9473	5,767.5331	0	2,000
Slice 12	89.875	482.71971	2,667.54	6,353.5021	0	2,000
Slice 13	94.5	480.90039	2,853.2155	6,740.4066	0	2,000

Resp. to 4th RTP
CWLP - 29843

Electronic Filing: Received, Clerk's Office 02/13/2020

Slice 14	100.5	479.02514	3,063.8314	7,152.3338	0	2,000
Slice 15	106.5	477.33213	3,263.075	7,458.84	0	2,000
Slice 16	110.94101	476.40154	3,371.4003	7,514.7108	0	2,000
Slice 17	116.82303	475.41364	3,486.7583	7,567.0138	0	2,000
Slice 18	123.38202	475	3,572.4641	7,392.9072	0	2,000
Slice 19	130.43835	475	3,636.9005	7,390.4633	0	2,000
Slice 20	137.31506	475	3,699.6965	7,383.8323	0	2,000
Slice 21	142.96161	475	3,751.2592	7,375.7445	0	2,000
Slice 22	145.58491	475.04879	3,772.1697	7,172.558	0	2,000
Slice 23	147.5	475.30011	3,773.9755	7,179.3671	0	2,000
Slice 24	152.5	476.13713	3,829.0431	7,210.3691	0	2,000
Slice 25	159.4	477.61149	3,864.1417	7,194.7724	0	2,000
Slice 26	166.2	479.52204	3,811.9215	7,137.3757	0	2,000
Slice 27	173	481.90854	3,730.0017	7,036.0639	0	2,000
Slice 28	179.8	484.80463	3,616.2836	6,889.9686	0	2,000
Slice 29	186.6	488.25558	3,467.9422	6,695.9509	0	2,000
Slice 30	192	491.37608	3,326.4275	6,468.2458	0	2,000
Slice 31	194.5	492.95696	3,263.0859	6,318.1096	0	2,000
Slice 32	198.5	495.83306	3,208.4168	5,963.0255	0	2,000
Slice 33	203.5	499.60223	3,238.4207	5,489.861	0	2,000
Slice 34	206.2481	501.91318	3,250.2175	5,189.8481	0	2,000
Slice 35	208.04624	503.5	3,151.2	5,153.528	1,350.5873	0
Slice 36	209.29814	504.65773	3,078.9575	4,990.2829	0	1,400
Slice 37	214.09529	509.65773	2,766.9575	4,364.4456	0	1,400
Slice 38	220.56223	517	2,308.8	3,606.2371	0	1,000
Slice 39	226.22135	525	1,809.6	2,420.3273	0	1,400

Electronic Filing: Received, Clerk's Office 02/13/2020

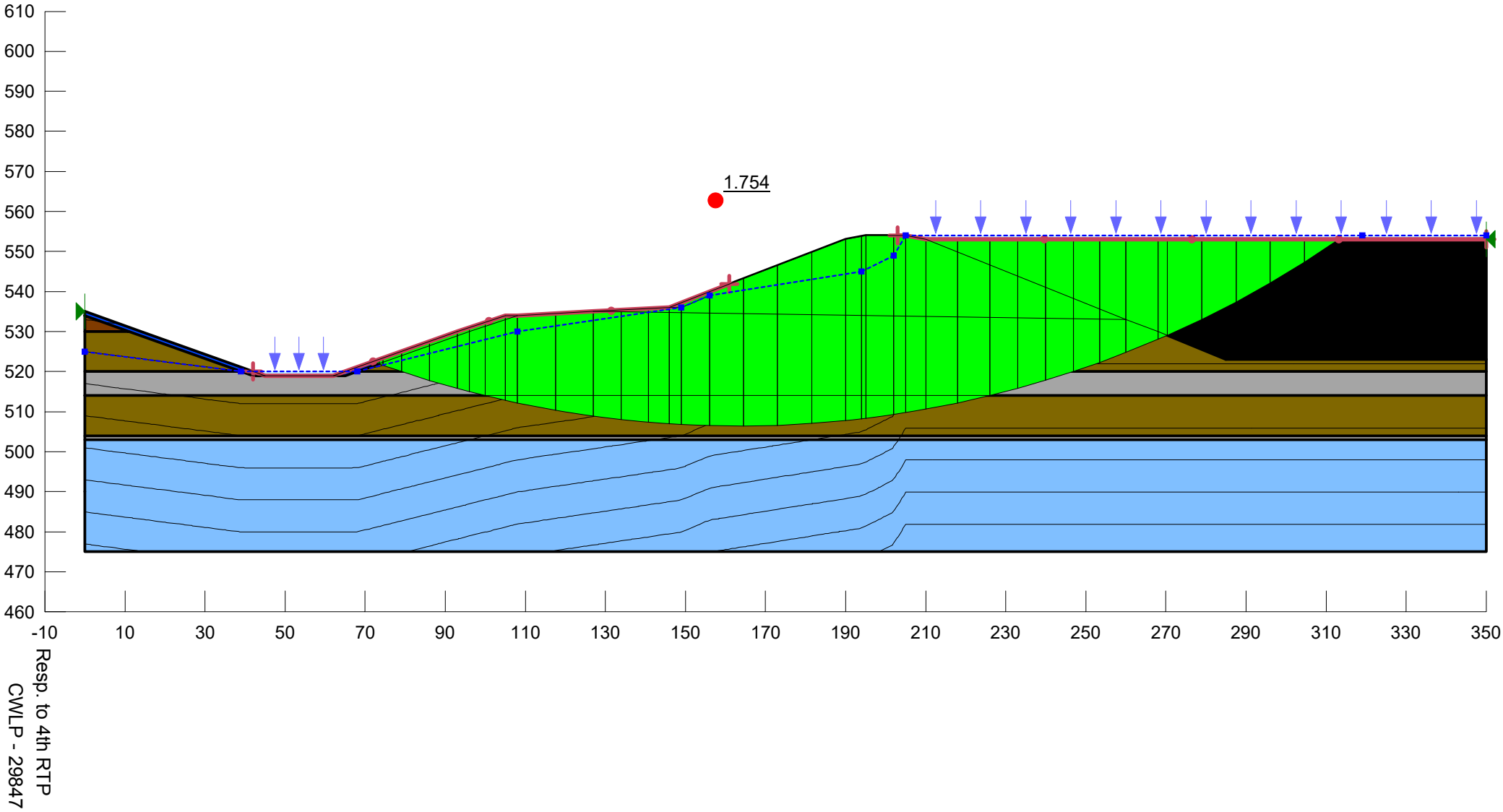
Slice 40	230.46996	531.7148	1,390.5962	1,289.2997	-0	1,800
Slice 41	233.64675	538.04232	995.7594	636.10168	-0	1,400
Slice 42	237.76908	547.82751	385.16317	531.44729	39.196713	0

Resp. to 4th RTP
CWLP - 29845

APPENDIX G-3

Seismic Slope Stability Analysis

Electronic Filing: Received, Clerk's Office 02/13/2020



Electronic Filing: Received, Clerk's Office 02/13/2020

Dallman Short Term Seismic

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File Information

File Version: 8.14
Created By: Karl Finke
Last Edited By: Karl Finke
Revision Number: 39
Date: 10/3/2016
Time: 2:01:36 PM
Tool Version: 8.14.1.10087
File Name: CWLP Dallman Short Term Seismic.gsz
Directory: J:\CWLP Factor of Safety Report\SlopeW\
Last Solved Date: 10/3/2016
Last Solved Time: 2:01:42 PM

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

Dallman Short Term Seismic

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- PWP Conditions Source: Piezometric Line
- Apply Phreatic Correction: No
- Use Staged Rapid Drawdown: No

Slip Surface
- Direction of movement: Right to Left
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Resisting Side Maximum Convex Angle: 1 °

Resp. to 4th RTP
CWLP - 29848

Electronic Filing: Received, Clerk's Office 02/13/2020

Driving Side Maximum Convex Angle: 5
Optimize Critical Slip Surface Location: No
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 30
F of S Tolerance: 0.001
Minimum Slip Surface Depth: 0.1 ft
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Embankment

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,400 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Dk Brn Silty Clay

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,800 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Clayey Silt

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,400 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gry Snd Silty Clay

Model: Mohr-Coulomb
Unit Weight: 120 pcf

Resp. to 4th RTP
CWLP - 29849

Electronic Filing: Received, Clerk's Office 02/13/2020

Cohesion': 1,000 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Gry Sand w/Silt

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 34 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Shale

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 2,000 psf
Phi': 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Rip-Rap

Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 0 psf
Phi': 40 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Ash

Model: Mohr-Coulomb
Unit Weight: 100 pcf
Cohesion': 0 psf
Phi': 15 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Line: 1

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (42, 520) ft
Left-Zone Right Coordinate: (161, 541.91176) ft
Left-Zone Increment: 4

Resp. to 4th RTP
CWLP - 29850

Electronic Filing: Received, Clerk's Office 02/13/2020

Right Projection: Range
Right-Zone Left Coordinate: (203, 554) ft
Right-Zone Right Coordinate: (350, 553) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 535) ft
Right Coordinate: (350, 553) ft

Piezometric Lines

Piezometric Line 1

Coordinates

	X (ft)	Y (ft)
Coordinate 1	0	525
Coordinate 2	39	520
Coordinate 3	68	520
Coordinate 4	108	530
Coordinate 5	149	536
Coordinate 6	156	539
Coordinate 7	194	545
Coordinate 8	202	549
Coordinate 9	205	554
Coordinate 10	319	554
Coordinate 11	350	554

Seismic Coefficients

Horz Seismic Coef.: 0.1
Vert Seismic Coef.: 0

Points

	X (ft)	Y (ft)
Point 1	0	535
Point 2	105	534
Point 3	146	536
Point 4	190	553
Point 5	195	554
Point 6	205	554
Point 7	210	553
Point 8	260	533
Point 9	285	523

Electronic Filing: Received, Clerk's Office 02/13/2020

Point 10	319	523
Point 11	108	534
Point 12	149	536
Point 13	156	539
Point 14	156	540
Point 15	127	535
Point 16	0	534
Point 17	0	530
Point 18	0	520
Point 19	0	514
Point 20	0	504
Point 21	0	503
Point 22	0	490
Point 23	319	490
Point 24	319	503
Point 25	319	504
Point 26	319	514
Point 27	319	520
Point 28	268	530
Point 29	96	530
Point 30	93	530
Point 31	68	520
Point 32	65	520
Point 33	65	519
Point 34	62	519
Point 35	45	519
Point 36	42	519
Point 37	42	520
Point 38	39	520
Point 39	14	530
Point 40	11	530
Point 41	319	553
Point 42	319	554
Point 43	0	475
Point 44	319	475
Point 45	350	475
Point 46	350	503
Point 47	350	504
Point 48	350	514
Point 49	350	520
Point 50	350	523
Point 51	350	553
Point 52	350	554

Regions

	Material	Points	Area (ft²)
Region 1	Embankment	15,3,12,13,14,4,5,6,7,8	1,329

Resp. to 4th RTP
CWLP - 29852

Electronic Filing: Received, Clerk's Office 02/13/2020

Region 2	Dk Brn Silty Clay	8,28,29,11,15	859.5
Region 3	Dk Brn Silty Clay	16,17,40	22
Region 4	Clayey Silt	17,18,38,40	250
Region 5	Clayey Silt	31,29,28,9,50,49	2,165.5
Region 6	Gry Snd Silty Clay	18,19,48,49,31,33,34,35,36,38	2,074
Region 7	Clayey Silt	19,20,47,48	3,500
Region 8	Gry Sand w/Silt	20,21,46,47	350
Region 9	Shale	21,22,43,45,46	9,800
Region 10	Rip-Rap	14,13,12,3	9.5
Region 11	Rip-Rap	11,2,30,32,34,33,31,29	45
Region 12	Rip-Rap	1,16,40,38,36,35,37,39	46
Region 13	Ash	50,9,28,8,7,51	3,072.5

Current Slip Surface

Slip Surface: 42
F of S: 1.754
Volume: 6,598.2566 ft³
Weight: 766,725.5 lbs
Resisting Moment: 71,665,768 lbs-ft
Activating Moment: 40,847,042 lbs-ft
Resisting Force: 263,139.9 lbs
Activating Force: 149,983.87 lbs
F of S Rank: 1
Exit: (71.965012, 522.4875) ft
Entry: (313.22525, 553) ft
Radius: 265.53272 ft
Center: (162.97654, 771.93595) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	72.710494	522.21803	-64.921586	84.576094	70.967769	0
Slice 2	73.938352	521.77687	-18.238546	472.45788	0	1,400
Slice 3	76.758491	520.80259	86.550781	718.90818	0	1,400
Slice 4	82.57219	518.89551	296.24629	1,134.4225	0	1,000
Slice 5	89.524063	516.79035	536.05734	1,710.1262	0	1,000
Slice 6	94.5	515.38931	701.10704	2,105.3764	0	1,000
Slice 7	97.957845	514.49447	810.88759	2,362.8992	0	1,000
Slice 8	102.45784	513.40492	949.07567	2,767.0697	0	1,400
Slice 9	106.5	512.48332	1,069.641	2,986.2009	0	1,400
Slice 10	112.75	511.24165	1,213.8969	3,170.3135	0	1,400
Slice 11	122.25	509.5891	1,403.7668	3,429.6314	0	1,400
Slice 12	130.43835	508.42715	1,551.0464	3,605.8766	0	1,400
Slice 13	137.31506	507.6687	1,661.1696	3,715.8515	0	1,400

Resp. to 4th RTP
CWLP - 29853

Electronic Filing: Received, Clerk's Office 02/13/2020

Slice 14	143.3767	507.14065	1,749.4733	3,787.6752	0	1,400
Slice 15	147.5	506.8589	1,804.7072	3,890.9901	0	1,400
Slice 16	152.5	506.63311	1,926.094	4,125.6573	0	1,400
Slice 17	160.25	506.45125	2,072.9157	4,430.4254	0	1,400
Slice 18	168.75	506.50004	2,153.6184	4,724.8943	0	1,400
Slice 19	177.25	506.8213	2,217.3194	4,975.4526	0	1,400
Slice 20	185.75	507.41601	2,263.9567	5,186.2206	0	1,400
Slice 21	192	508.00184	2,288.98	5,279.8551	0	1,400
Slice 22	194.5	508.28155	2,306.8313	5,276.83	0	1,400
Slice 23	198.5	508.81386	2,398.4152	5,183.9269	0	1,400
Slice 24	203.5	509.51802	2,619.6756	5,051.391	0	1,400
Slice 25	207.5	510.17489	2,734.6872	4,909.4629	0	1,400
Slice 26	214.00935	511.38541	2,659.1506	4,657.9989	0	1,400
Slice 27	222.02804	513.08535	2,553.0742	4,341.2089	0	1,400
Slice 28	229.50729	514.89814	2,439.9562	4,038.4685	0	1,000
Slice 29	236.4471	516.79547	2,321.5624	3,744.462	0	1,000
Slice 30	243.38691	518.89734	2,190.4062	3,435.4115	0	1,000
Slice 31	250.14261	521.14201	2,050.3384	3,081.8957	0	1,400
Slice 32	256.7142	523.52391	1,901.7079	2,742.488	0	1,400
Slice 33	264	526.40963	1,721.6393	2,341.8376	0	1,400
Slice 34	269.14655	528.55562	1,587.7296	2,046.5904	0	1,400
Slice 35	274.58632	531.04491	1,432.3974	2,013.5709	155.72496	0
Slice 36	283.17275	535.21394	1,172.2503	1,660.0611	130.7085	0
Slice 37	291.75918	539.77533	887.61932	1,267.4716	101.78111	0
Slice 38	300.3456	544.75278	577.02659	827.27814	67.054701	0
Slice 39	308.93203	550.17436	238.71985	329.37161	24.290066	0