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2019 Annual Groundwater Monitoring and Corrective Action Report

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2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

NEWTON PRIMARY ASH POND, NEWTON POWER STATION

RAMBOLL Bright ideas. Sustainable change.

2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
NEWTON PRIMARY ASH POND, NEWTON POWER STATION

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Checked by	**Nicole M. Pagano**
Approved by	**Eric J. Tlachac**
Description	**Annual Report in Support of the CCR Rule Groundwater Monitoring Program**

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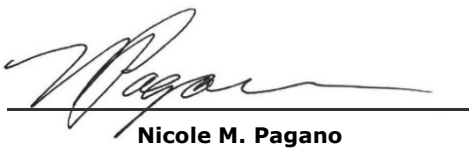

Nicole M. Pagano
Senior Managing Engineer

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ACRONYMS AND ABBREVIATIONS

ASD	Alternate Source Demonstration
CCR	Coal Combustion Residuals
PAP	Primary Ash Pond
SAP	Sampling and Analysis Plan
SSI	Statistically Significant Increase

EXECUTIVE SUMMARY

This report has been prepared to provide the information required by Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.90(e) for the Newton Primary Ash Pond (PAP) located at Newton Power Station near Newton, Illinois.

Groundwater is being monitored at Newton PAP in accordance with the Detection Monitoring Program requirements specified in 40 C.F.R. § 257.94.

No changes were made to the monitoring system in 2019 (no wells were installed or decommissioned).

The following Statistically Significant Increases (SSIs) of 40 C.F.R. Part 257 Appendix III parameter concentrations greater than background concentrations were determined during one or more sampling events in 2019:

- Calcium at wells APW7, APW8, APW9, and APW10
- Chloride at wells APW7 and APW9
- Fluoride at wells APW7 and APW9
- Sulfate at wells APW7, APW8, APW9, and APW10

Alternate Source Demonstrations (ASDs) were completed for the SSIs referenced above and Newton PAP remains in the Detection Monitoring Program.

1. INTRODUCTION

This report has been prepared by Ramboll on behalf of Illinois Power Generating Company, to provide the information required by 40 C.F.R. § 257.90(e) for Newton PAP located at Newton Power Station near Newton, Illinois.

In accordance with 40 C.F.R. § 257.90(e), the owner or operator of a Coal Combustion Residuals (CCR) unit must prepare an Annual Groundwater Monitoring and Corrective Action Report for the preceding calendar year that documents the status of the Groundwater Monitoring and Corrective Action Program for the CCR unit, summarizes key actions completed, describes any problems encountered, discusses actions to resolve the problems, and projects key activities for the upcoming year. At a minimum, the Annual Report must contain the following information, to the extent available:

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.
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.
3. In addition to all the monitoring data obtained under §§ 257.90 through 257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the Detection Monitoring or Assessment Monitoring Programs.
4. A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from Detection Monitoring to Assessment Monitoring in addition to identifying the constituent(s) detected at a Statistically Significant Increase relative to background levels).
5. Other information required to be included in the Annual Report as specified in §§ 257.90 through 257.98.

This report provides the required information for Newton PAP for calendar year 2019.

2. MONITORING AND CORRECTIVE ACTION PROGRAM STATUS

No changes have occurred to the monitoring program status in calendar year 2019, and Newton PAP remains in the Detection Monitoring Program in accordance with 40 C.F.R. § 257.94.

3. KEY ACTIONS COMPLETED IN 2019

The Detection Monitoring Program is summarized in Table A. The groundwater monitoring system, including the CCR unit and all background and downgradient monitoring wells, is presented in Figure 1. No changes were made to the monitoring system in 2019 (no wells were installed or decommissioned). In general, one groundwater sample was collected from each background and downgradient well during each monitoring event.[1] All samples were collected and analyzed in accordance with the Sampling and Analysis Plan (SAP) (NRT/OBG, 2017a). All monitoring data obtained under 40 C.F.R. §§ 257.90 through 257.98 (as applicable) in 2019 are presented in Table 1. Analytical data were evaluated in accordance with the Statistical Analysis Plan (NRT/OBG, 2017b) to determine any SSIs of Appendix III parameters relative to background concentrations.

Statistical background values are provided in Table 2.

Analytical results for the May, August, and November 2018 sampling events were provided in the 2018 Annual Groundwater Monitoring and Corrective Action Report.

Potential alternate sources were evaluated as outlined in the 40 C.F.R. § 257.94(e)(2). ASDs were completed and certified by a qualified professional engineer. The dates the ASDs were completed are provided in Table A. The ASDs completed in 2019 are included in Appendix A.

[1] Sampling was limited to APW7, APW8, APW9, and APW10 during the August 2018 sampling event to confirm Appendix III parameters initially detected at concentrations greater than statistical background values in the preceding sampling event to confirm SSIs, as allowed by the Statistical Analysis Plan.

Table A – 2018–2019 Detection Monitoring Program Summary

Sampling Date	Analytical Data Receipt Date	Parameters Collected	SSI(s)	SSI(s) Determination Date	ASD Completion Date
May 18, 2018	July 9, 2018	Appendix III	Calcium (APW7, APW8, APW9, APW10) Chloride (APW7, APW9) Sulfate (APW8, APW10)	October 7, 2018	January 7, 2019
August 17-18, 2018	July 9, 2018	Appendix III Greater than Background [1]	NA	NA	NA
November 9, 2018	January 16, 2019	Appendix III	Calcium (APW8, APW10) Fluoride (APW9) Sulfate (APW8, APW9, APW10)	April 15, 2019	July 15, 2019
February 22, 2019	April 15, 2019	Appendix III	Calcium (APW8, APW10) Fluoride (APW7, APW9) Sulfate (APW7, APW8, APW9, APW10)	July 15, 2019	October 14, 2019
August 22-23, 2019	October 28, 2019	Appendix III	TBD	TBD	TBD

Notes:

NA: Not Applicable
TBD: To Be Determined
1. To confirm SSIs, as allowed by the Statistical Analysis Plan, groundwater samples were collected and analyzed for Appendix III parameters initially detected at concentrations greater than statistical background values in the preceding sampling event.

4. PROBLEMS ENCOUNTERED AND ACTIONS TO RESOLVE THE PROBLEMS

No problems were encountered with the Groundwater Monitoring Program during 2019. Groundwater samples were collected and analyzed in accordance with the SAP (NRT/OBG, 2017a), and all data were accepted.

5. KEY ACTIVITIES PLANNED FOR 2020

The following key activities are planned for 2020:

- Continuation of the Detection Monitoring Program with semi-annual sampling scheduled for the first and third quarters of 2020.
- Complete evaluation of analytical data from the downgradient wells, using background data to determine whether an SSI of Appendix III parameters detected at concentrations greater than background concentrations has occurred.
- If an SSI is identified, potential alternate sources (i.e., a source other than the CCR unit caused the SSI or that that SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality) will be evaluated.
  - If an alternate source is demonstrated to be the cause of the SSI, a written demonstration will be completed within 90 days of SSI determination and included in the 2020 Annual Groundwater Monitoring and Corrective Action Report.
  - If an alternate source(s) is not identified to be the cause of the SSI, the applicable requirements of 40 C.F.R. §§ 257.94 through 257.98 as may apply in 2020 (e.g., Assessment Monitoring) will be met, including associated recordkeeping/notifications required by 40 C.F.R. §§ 257.105 through 257.108.

6. REFERENCES

Natural Resource Technology, an OBG Company (NRT/OBG), 2017a. Sampling and Analysis Plan, Newton Primary Ash Pond, Newton Power Station, Newton, Illinois, Project No. 2285, Revision 0, October 17, 2017.

Natural Resource Technology, an OBG Company (NRT/OBG), 2017b. Statistical Analysis Plan, Coffeen Power Station, Newton Power Station, Illinois Power Generating Company, October 17, 2017.

TABLES

TABLE 1.
2019 ANALYTICAL RESULTS - GROUNDWATER ELEVATION AND APPENDIX III PARAMETERS
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
NEWTON POWER STATION
UNIT ID 501 - NEWTON PRIMARY ASH POND
NEWTON, ILLINOIS
DETECTION MONITORING PROGRAM

Well Identification Number	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Date & Time Sampled	Depth to Groundwater (ft)[1]	Groundwater Elevation (ft NAVD88)	40 C.F.R. Part 257 Appendix III						
						Boron, total (mg/L) 6020A[2]	Calcium, total (mg/L) 6020A[2]	Chloride, total (mg/L) 9251[2]	Fluoride, total (mg/L) 9214[2]	pH (field) (S.U.) SM 4500 H+B[2]	Sulfate, total (mg/L) 9036[2]	Total Dissolved Solids (mg/L) SM 2540C[2]
Background / Upgradient Monitoring Wells												
APW5	38.933964	-88.280989	2/22/2019 10:00	15.00	529.07	0.11	50	48	0.374	6.9	3.5	600
			8/22/2019 16:46	16.04	528.03	0.12	49	50	<0.250	7.0	2.3	530
APW6	38.933753	-88.286281	2/22/2019 11:07	15.49	530.58	0.09	45	24	0.386	7.3	1.7	480
			8/23/2019 8:14	16.39	529.68	0.11	55	26	0.314	7.3	5.8	500
Downgradient Monitoring Wells												
APW7	38.928239	-88.292081	2/22/2019 15:38	42.18	496.19	0.060	45	43	0.734	7.2	66	340
			8/23/2019 11:30	43.00	495.37	0.075	58	46	0.632	7.1	62	350
APW8	38.923161	-88.292292	2/22/2019 13:12	35.06	493.91	0.10	80	56	0.393	7.2	46	600
			8/23/2019 9:01	34.20	494.77	0.10	82	59	0.337	7.2	48	570
APW9	38.922325	-88.281036	2/22/2019 13:56	20.77	510.75	0.054	38	47	0.714	7.5	61	320
			8/23/2019 9:50	22.09	509.43	0.055	41	51	0.621	7.4	51	360
APW10	38.927442	-88.273133	2/22/2019 14:42	14.85	509.40	0.079	110	50	0.276	6.9	420	990
			8/23/2019 10:42	16.08	508.17	0.10	130	50	0.359	7.0	390	1000

[O: RAB 12/23/19, C: KLT 12/26/19]

Notes:

40 C.F.R. = Title 40 of the Code of Federal Regulations

ft = foot/feet

mg/L = milligrams per liter

NAVD88 = North American Vertical Datum of 1988

S.U. = Standard Units

< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method; estimated concentrations below the reporting limit and associated qualifiers are not provided since not utilized in statistics to determine Statistically Significant Increases (SSIs) over background.

[1]All depths to groundwater were measured on the first day of the sampling event.

[2]4-digit numbers represent SW-846 analytical methods.

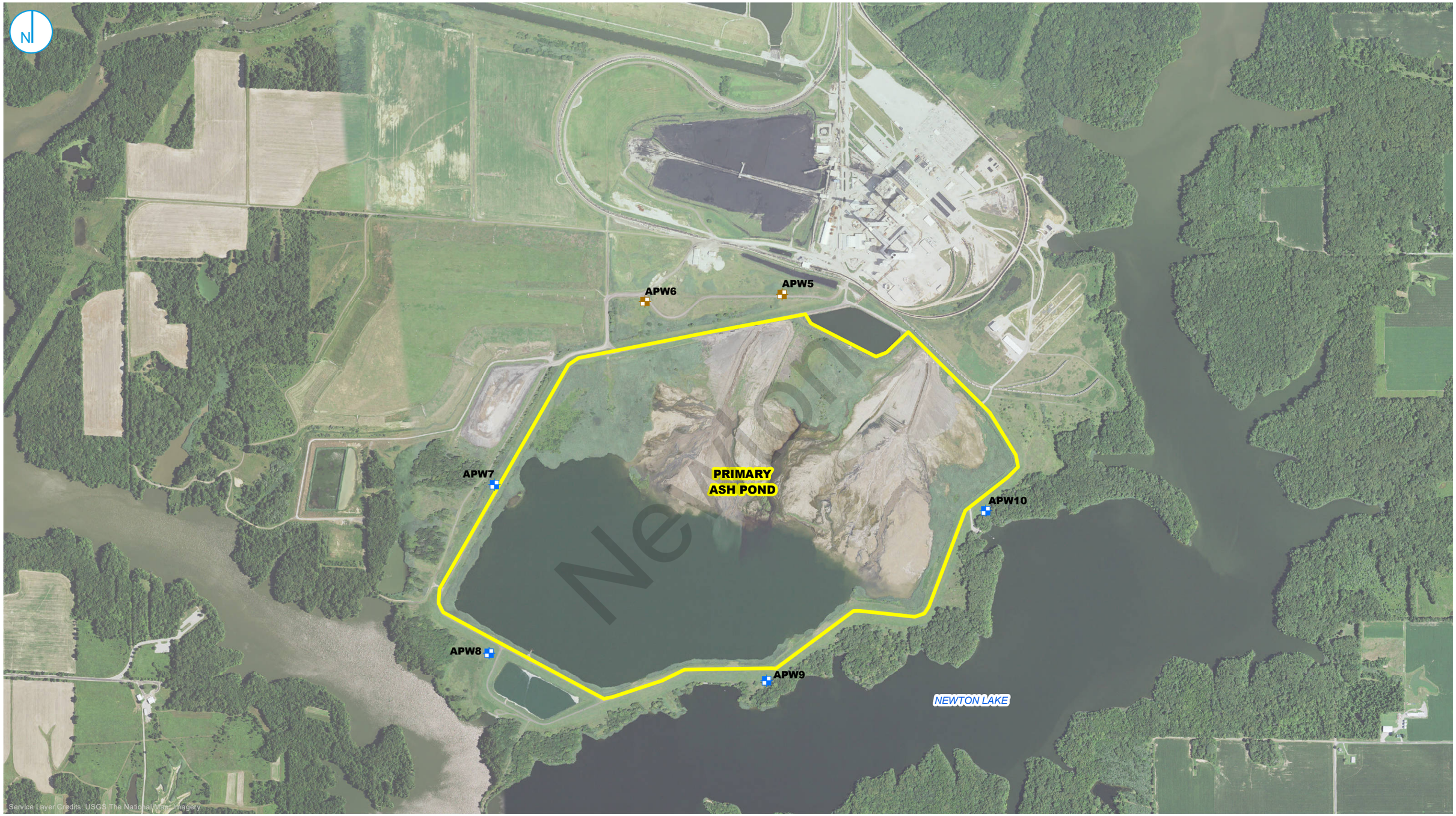
TABLE 2.
STATISTICAL BACKGROUND VALUES
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
NEWTON POWER STATION
UNIT ID 501 - NEWTON PRIMARY ASH POND
NEWTON, ILLINOIS
DETECTION MONITORING PROGRAM

Parameter	Statistical Background Value (UPL)
40 C.F.R. Part 257 Appendix III	
Boron (mg/L)	0.14
Calcium (mg/L)	65
Chloride (mg/L)	58
Fluoride (mg/L)	0.692
pH (S.U.)	6.6 / 8.0
Sulfate (mg/L)	15
Total Dissolved Solids (mg/L)	1000

[O: RAB 12/23/19, C: KLT 12/26/19]

Notes:
40 C.F.R. = Title 40 of the Code of Federal Regulations
mg/L = milligrams per liter
S.U. = Standard Units
UPL = Upper Prediction Limit

FIGURES



UPGRADIENT MONITORING WELL LOCATION
DOWNGRADIENT MONITORING WELL LOCATION
CCR MONITORED UNIT

0 500 1,000 Feet

MONITORING WELL LOCATION MAP
NEWTON PRIMARY ASH POND
UNIT ID:501

2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
VISTRA CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

FIGURE 1

O'BRIEN & GERE ENGINEERS, INC.
A RAMBOLL COMPANY

APPENDIX A
ALTERNATE SOURCE DEMONSTRATIONS

40 C.F.R. § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION
NEWTON PRIMARY ASH POND
JANUARY 7, 2019

January 7, 2019

Title 40 of the Code of Federal Regulations (C.F.R.) § 257.94(e)(2) allows the owner or operator of a coal combustion residuals (CCR) unit 90 days from the date of determination of statistically significant increases (SSIs) over background for groundwater constituents listed in Appendix III of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSI(s), or that the SSI(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (alternate source demonstration [ASD]).

This ASD has been prepared on behalf of Illinois Power Generating Company by O'Brien & Gere Engineers, Inc., part of Ramboll (OBG) to provide pertinent information pursuant to 40 C.F.R. § 257.94(e)(2) for the Newton Primary Ash Pond (PAP) located near Newton, Illinois.

The second semi-annual detection monitoring samples (Detection Monitoring Round 2 [D2]) were collected on May 18, 2018 and analytical data were received on July 9, 2018. In accordance with 40 C.F.R. § 257.93(h)(2), statistical analysis of the data to identify SSIs of 40 C.F.R. Part 257 Appendix III parameters over background concentrations was completed by October 7, 2018, within 90 days of receipt of the analytical data. The statistical determination identified the following SSIs at downgradient monitoring wells:

- Calcium at wells APW7, APW8, APW9, and APW10
- Chloride at wells APW7 and APW9
- Sulfate at wells APW8 and APW10

In accordance with the Statistical Analysis Plan[1], to confirm the SSIs, wells APW7, APW8, APW9, and APW10 were resampled on August 17-18, 2018 and analyzed only for the SSI parameters at each well. Following evaluation of analytical data from the resample, the following SSIs were confirmed:

- Calcium at wells APW7, APW8, APW9, and APW10
- Chloride at wells APW7 and APW9
- Sulfate at wells APW8 and APW10

Pursuant to 40 C.F.R. § 257.94(e)(2), the following demonstrates that sources other than the Newton PAP were the cause of the SSIs listed above. This ASD was completed by January 7, 2019, within 90 days of determination of the SSIs, as required by 40 C.F.R. § 257.94(e)(2).

ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

Lines of evidence supporting these ASDs include the following:

1. The ionic composition of Newton PAP water is different from the ionic composition of groundwater.
2. Concentrations of calcium in the Newton PAP are lower than those observed in the groundwater.
3. Concentrations of chloride in the Newton PAP are lower than those observed in the groundwater.

[1] Natural Resource Technology, an OBG Company, 2017, *Statistical Analysis Plan, Coffeen Power Station, Newton Power Station*, Illinois Power Generating Company, October 17, 2017.

4. Concentrations of sulfate in the Newton PAP are lower than those observed in the groundwater.
5. Concentrations of boron, a common indicator for CCR impacts to groundwater, in downgradient wells are stable and at or below concentrations in the background wells.

These lines of evidence are described and supported in greater detail below. Monitoring wells and leachate sample locations are shown on Figure 1.

LINE OF EVIDENCE #1: THE IONIC COMPOSITION OF NEWTON PAP WATER IS DIFFERENT FROM THE IONIC COMPOSITION OF GROUNDWATER

Piper diagrams graphically represent ionic composition of aqueous solutions. A Piper diagram displays the position of water samples relative to their major cation and anion content, providing the information needed to identify compositional categories or groupings. Figure 2 is a Piper diagram that displays the ionic composition of groundwater samples from the background and downgradient monitoring wells associated with the Phase I Landfill (LF1), Phase II Landfill (LF2), and Primary Ash Pond (PAP) and LF1 leachate and PAP water based on Quarter 2 2017 and Quarter 3 2018 samples. The ionic compositional groupings identified are shown in the green, blue, purple, brown, and turquoise ellipses on the diamond portion of the Piper diagram. These are discussed in more detail below.

The results show that there are three distinct groups. Groundwater samples from the PAP background and downgradient wells (enclosed within a green ellipse) and LF2 groundwater samples (enclosed within a blue ellipse) have a very high percentage of carbonate-bicarbonate cations and no dominant cation. Groundwater samples from the LF1 wells (enclosed within a turquoise ellipse) also have no dominant cation, but these waters have a high percentage of sulfate. Surface water samples from the PAP (enclosed within a purple ellipse) and the landfill leachate (enclosed within a brown ellipse) have a very high percentage of sodium-potassium and no dominant anion and a high percentage of sulfate, respectively.

The groundwater samples for both the PAP and LF2 (enclosed within the green and blue ellipses, respectively) are tightly clustered on the Piper diagram. This tight grouping indicates either an apparent lack of outside influences on the groundwater or the apparent influence of a constant, steady-state source, such as LF1, that is influencing all the wells equally and simultaneously.

The potential presence of a mixing zone between LF2 groundwater, PAP groundwater, and LF1 groundwater suggests that LF1 is an alternate source of the elevated major anion chloride.

Neither PAP groundwater nor LF2 groundwater is trending towards, or mixing with, the PAP leachate. The apparent lack of mixing between the PAP leachate and underlying groundwater in the Uppermost Aquifer demonstrates that there is no impact to groundwater from the PAP. However, the presence of a potential mixing zone between PAP groundwater and LF1 groundwater suggests that LF1 is a source of the elevated major cation calcium and elevated major anions chloride and sulfate.

The ionic characteristics of these samples are provided in Table 1 below.

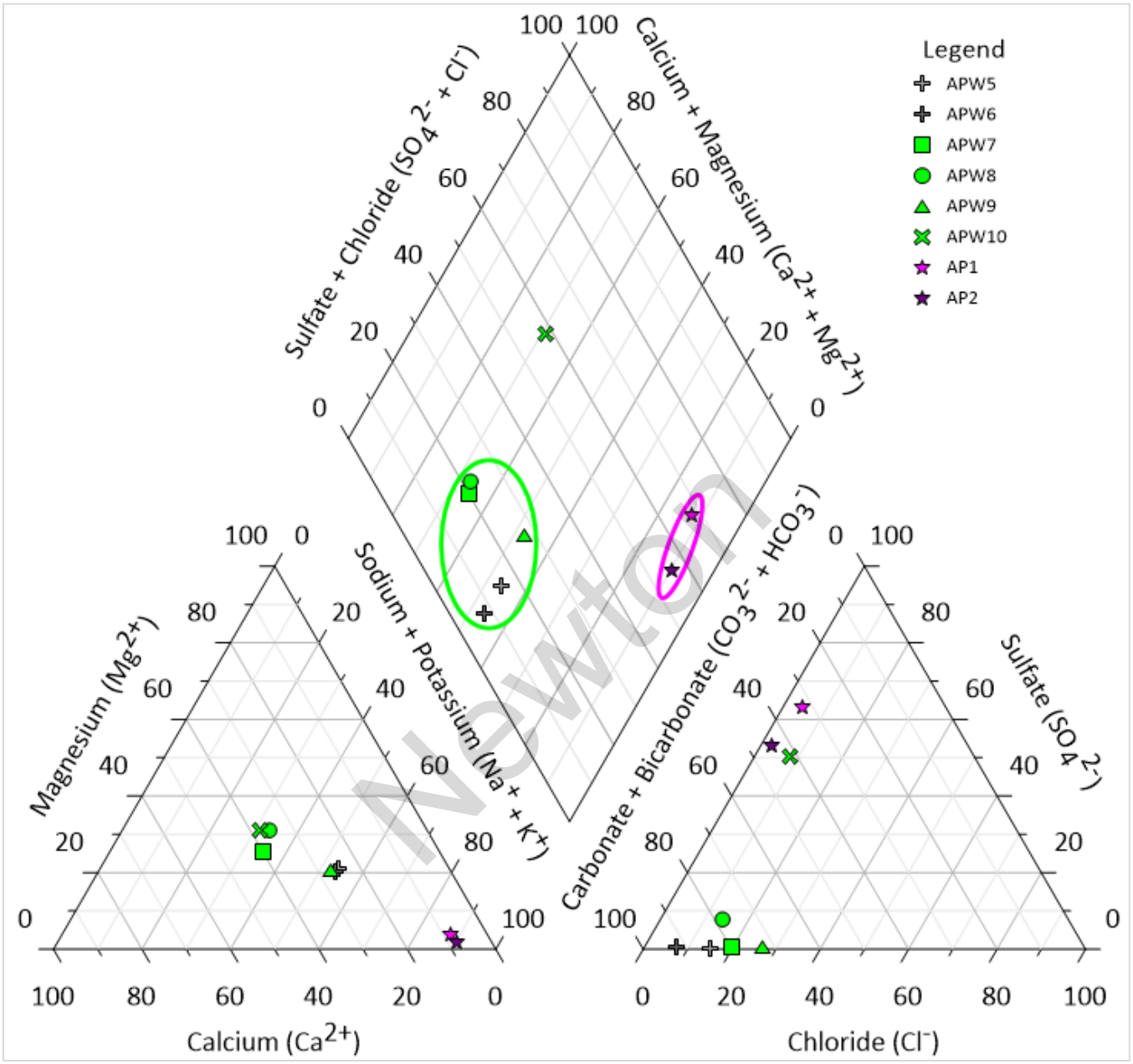


Figure 2 Piper Diagram Showing Ionic Composition of Samples of Background and Downgradient Groundwater Associated with LF1, LF2, and PAP.

Grouping	Green	Blue	Purple	Brown	Turquoise
Locations	PAP Wells Groundwater	LF2 Wells Groundwater	PAP Surface Water	LF1 Leachate	LF1 Wells Groundwater
Dominant Cation	No dominant cation	No dominant cation	**Very High Sodium-Potassium**	**Very High Sodium-Potassium**	No dominant cation
Dominant Anion	**Very High Carbonate-Bicarbonate**	**Very High Carbonate-Bicarbonate**	**No dominant anion**	**High Sulfate**	**High Sulfate**

Table 1. Summary of Ionic Classification

LINE OF EVIDENCE #2: CONCENTRATIONS OF CALCIUM IN THE NEWTON PRIMARY ASH POND ARE LOWER THAN THOSE OBSERVED IN THE GROUNDWATER

Calcium concentrations in water sampled from the PAP are lower than calcium concentrations in all groundwater samples from downgradient ash pond wells from 2015 through 2018. A time series for calcium concentrations is provided in Figure 3 below.

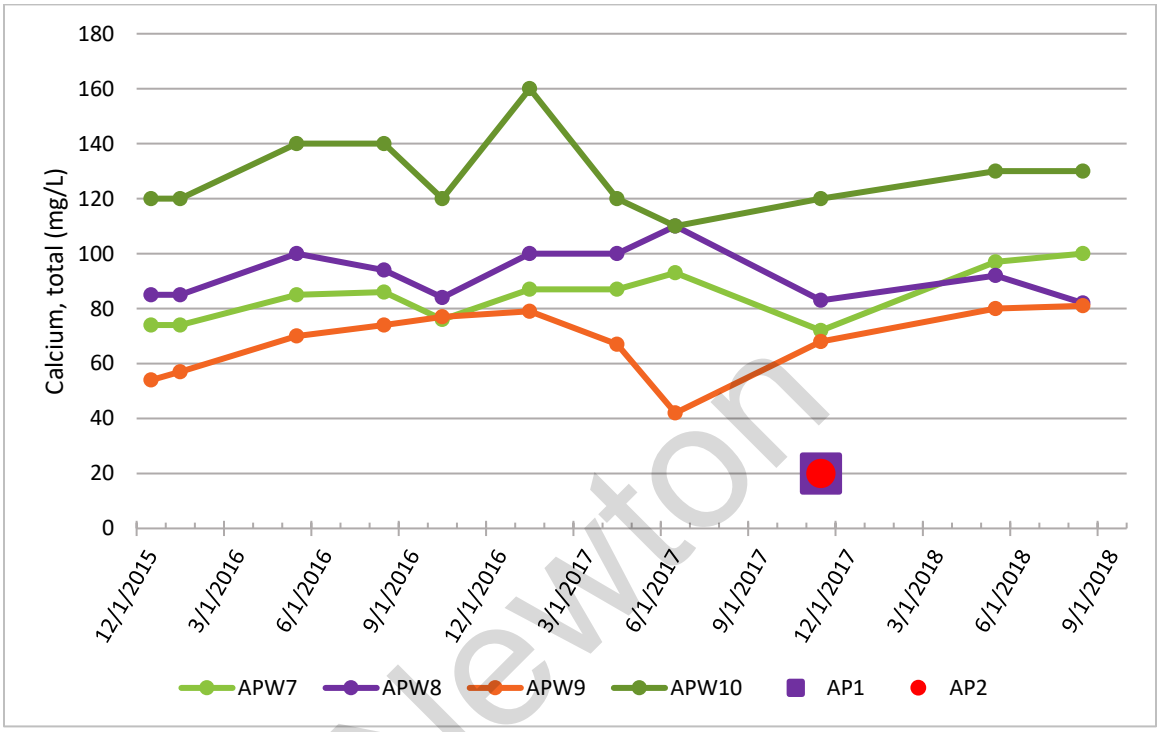


Figure 3. Calcium time series

The following observations can be made from Figure 3:

- PAP water samples AP1 and AP2 each contain 20 mg/L of calcium.
- Groundwater samples from wells APW7, APW8, APW9, and APW10 have two to eight times greater concentrations than the PAP water.

If the PAP were the source of calcium in groundwater, calcium concentrations in downgradient monitoring wells would be lower than calcium concentrations in the water in the pond; therefore, the PAP is not the source of the calcium observed in the Uppermost Aquifer. Elevated concentrations of calcium are most likely naturally occurring due to geochemical variations within the Uppermost Aquifer, although some level of impacts from upgradient anthropogenic sources (i.e. Phase I Landfill) may also be present.

LINE OF EVIDENCE #3: CONCENTRATIONS OF CHLORIDE IN THE NEWTON PRIMARY ASH POND ARE LOWER THAN THOSE OBSERVED IN THE GROUNDWATER

Chloride concentrations in water sampled from the PAP are lower than chloride concentrations in all groundwater samples from downgradient ash pond wells from 2015 through 2018, inclusive of wells APW7 and APW9. A time series for chloride concentrations is provided in Figure 4 below.

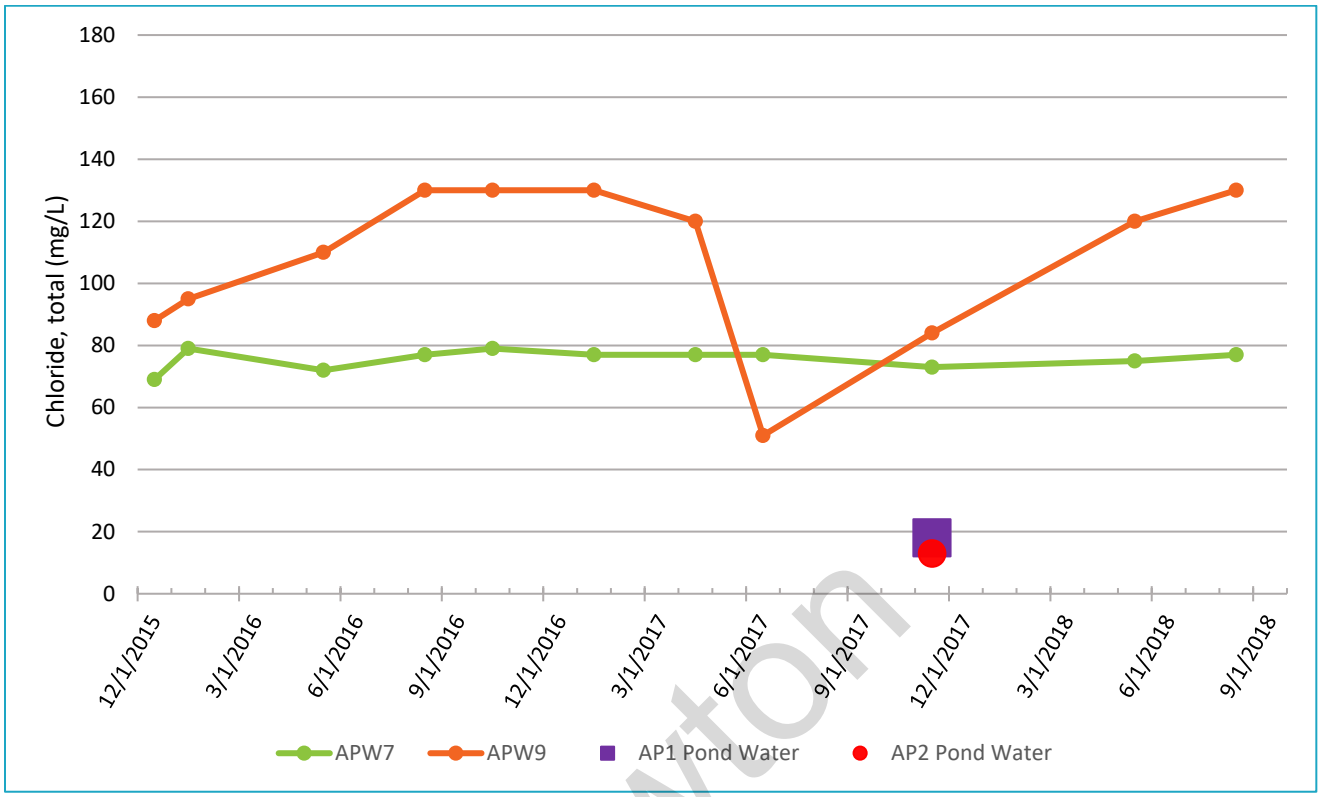


Figure 4. Chloride time series

The following observations can be made from Figure 4:

- PAP water samples AP1 and AP2 contain 18 and 13 mg/L of chloride, respectively.
- Groundwater samples from wells APW7 and APW9 have two-and-a-half to seven times greater concentrations than the PAP water.

If the PAP was the source of chloride observed in groundwater, chloride concentrations in downgradient monitoring wells APW7 and APW9 would be lower than chloride concentrations in the water in the pond; therefore, the PAP is not the source of the chloride observed in the Uppermost Aquifer. Elevated chloride concentrations are most likely naturally occurring due to geochemical variations within the Uppermost Aquifer, although some level of impacts from upgradient anthropogenic sources (i.e. Phase I Landfill) may also be present.

LINE OF EVIDENCE #4: CONCENTRATIONS OF SULFATE IN THE NEWTON PRIMARY ASH POND ARE LOWER THAN THOSE OBSERVED IN THE GROUNDWATER

Sulfate concentrations in water sampled from the PAP are lower than sulfate concentrations in all groundwater samples from downgradient ash pond well APW10 from 2015 through 2018. A time series for sulfate concentrations is provided in Figure 5 below.

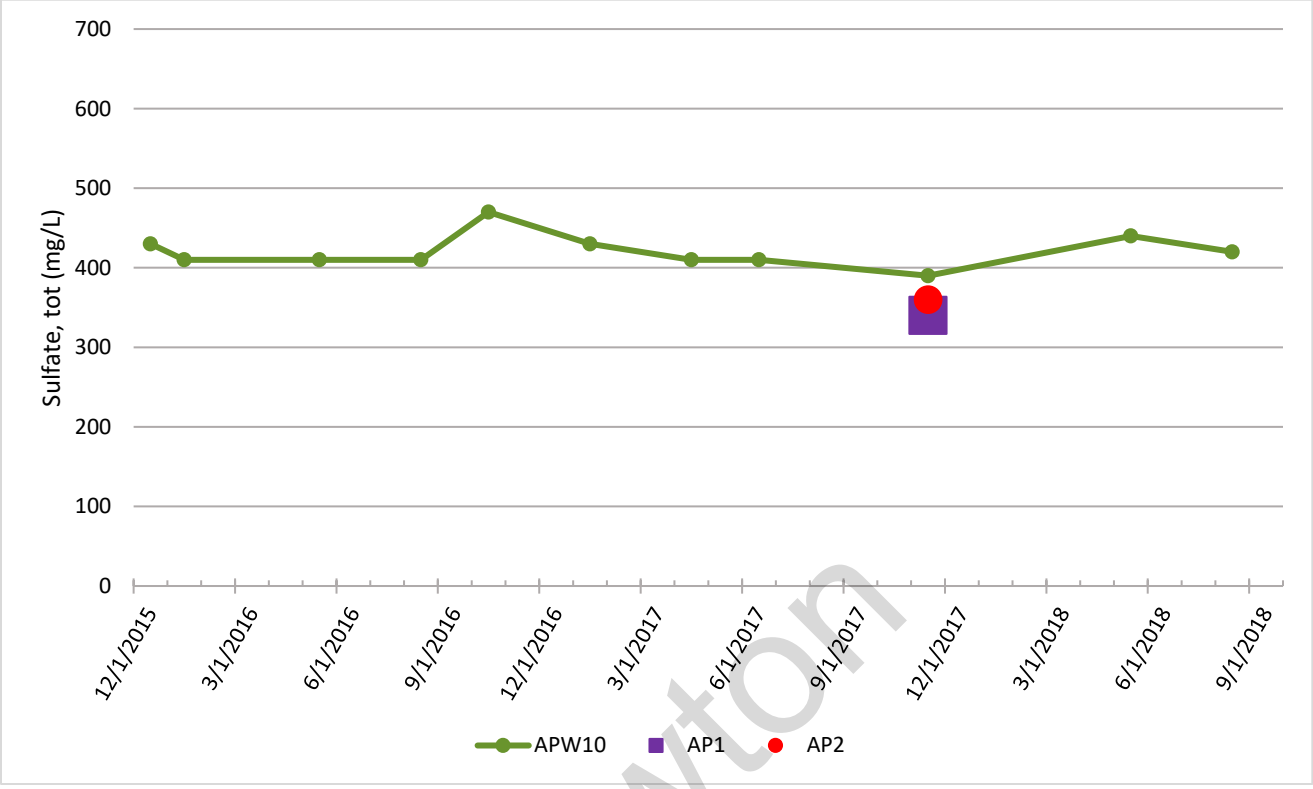


Figure 5. Sulfate time series

The following observations can be made from Figure 5:

- PAP water samples AP1 and AP2 contain 340 and 360 mg/L of sulfate, respectively.
- Groundwater samples from well APW10 have higher sulfate concentrations than the PAP water, ranging from 390 to 470 mg/L from 2015 through 2018.

If the PAP were the source of sulfate observed in groundwater samples from APW10, the sulfate concentrations in downgradient monitoring well APW10 would be lower than sulfate concentrations in the water in the pond; therefore, the PAP is not the source of the sulfate observed in the Uppermost Aquifer. Alternate sources of sulfate are most likely present from upgradient anthropogenic sources, principally the Phase I Landfill, although naturally occurring geochemical variations within the Uppermost Aquifer may also be affecting sulfate concentrations.

LINE OF EVIDENCE #5: CONCENTRATIONS OF BORON, A COMMON INDICATOR FOR CCR IMPACTS TO GROUNDWATER, IN DOWNGRADIENT WELLS ARE STABLE AND AT OR BELOW CONCENTRATIONS IN THE BACKGROUND WELLS

Boron is a primary indicator of CCR impacts to groundwater. Concentrations of boron in all downgradient monitoring wells are below upper prediction limits established using background monitoring wells (i.e. thresholds for SSIs) and are lower than median concentrations observed in background wells APW5 and APW6 from 2015 through 2018, as shown on Figure 6.

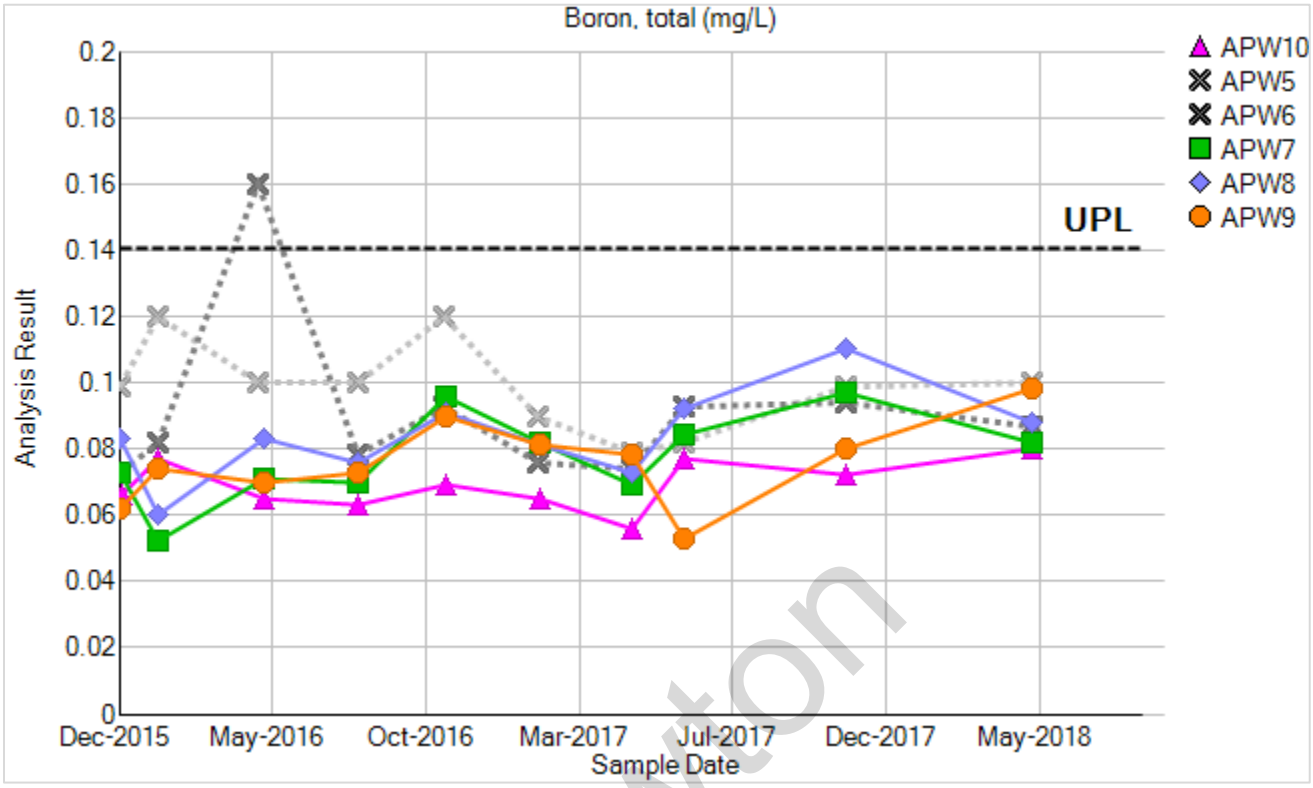


Figure 6. Boron time series showing boron concentrations in groundwater samples from background wells (gray "X"s) are higher or similar to concentrations in groundwater samples from downgradient wells.

From Figure 6 the following observations can be made:

- Boron is stable. A Mann-Kendall trend analysis (Attachment A) was performed to determine whether the concentration trend for each downgradient well is statistically significant. None were determined to be statistically significant using the Mann-Kendall test.
  - If a Mann-Kendall test did not identify a trend, the coefficient of variation (CV) was calculated (Attachment B) to determine if the concentrations are stable (i.e., CV less than or equal to 1), or if there is too much data variability to draw a conclusion. All calculated CVs were less than 1, indicating concentrations are stable.
- Boron concentrations in groundwater samples from downgradient monitoring wells range from 0.052 to 0.11 mg/L and 0.073 to 0.16 mg/L in groundwater samples from background wells. The overall median boron concentration in groundwater samples collected from downgradient wells from 2015 through 2018 is 0.077 mg/L and 0.093 mg/L in groundwater samples collected from background wells.

Elevated boron concentrations are most likely naturally occurring due to geochemical variations within the Uppermost Aquifer, although some level of impacts from upgradient anthropogenic sources may also be present.

Based on these five lines of evidence, it has been demonstrated that the Newton Primary Ash Pond has not caused the SSIs in APW7, APW8, APW9, and APW10.

This information serves as the written alternate source demonstration prepared in accordance with 40 C.F.R. § 257.94(e)(2) that SSIs observed during the detection monitoring program were not due to the CCR unit but were from a combination of naturally occurring conditions and potential anthropogenic impacts from the closed Phase I Landfill. Therefore, an assessment monitoring program is not required and the Newton Primary Ash Pond will remain in detection monitoring.

Attachments:

Figure 1	Monitoring Well and Source Water Location Map Newton Primary Ash Pond
Attachment A	Boron Mann-Kendall Trend Analyses
Attachment B	Coefficient of Variation Evaluation

I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

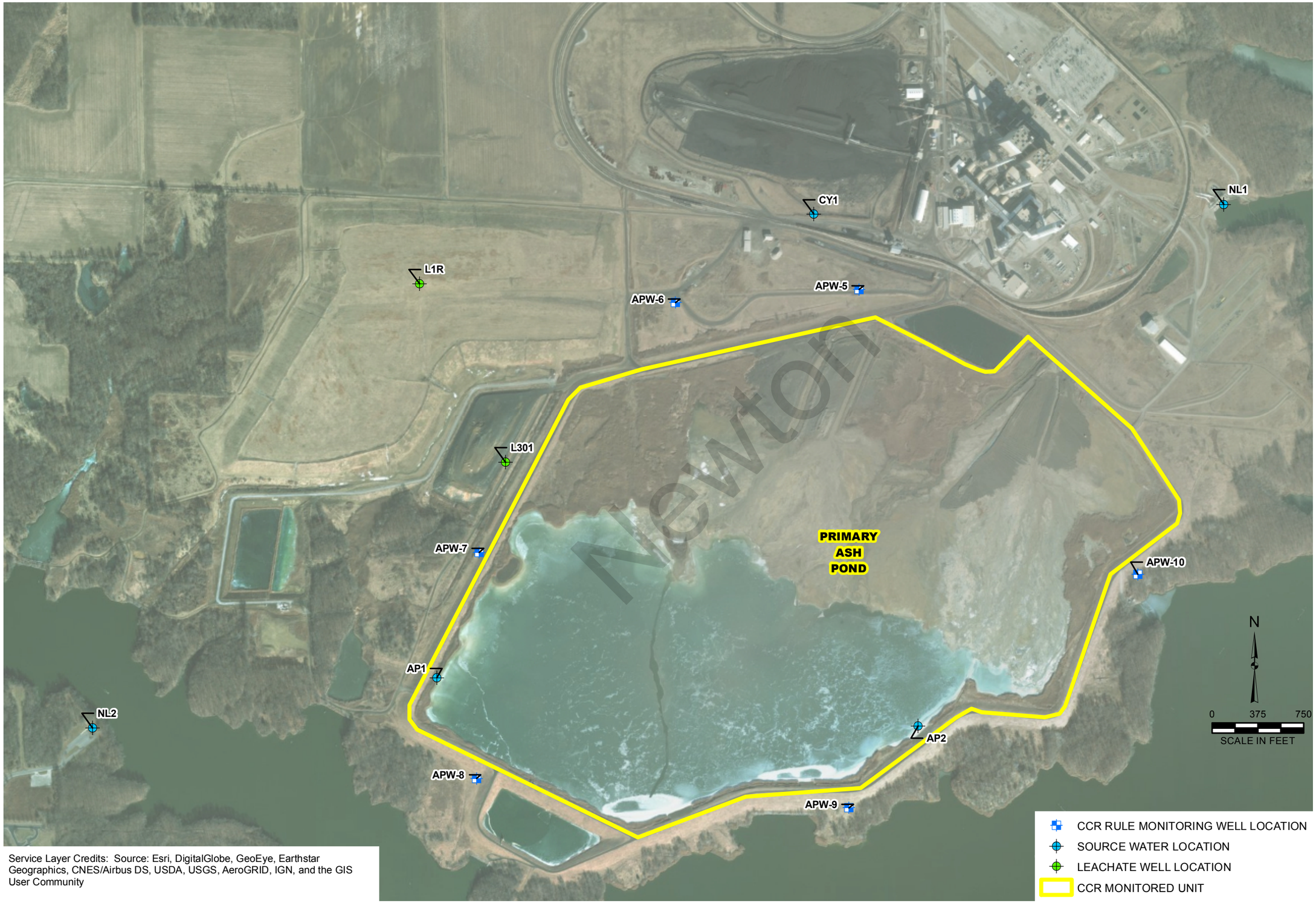
Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
O'Brien & Gere Engineers, Inc., part of Ramboll
Date: January 7, 2019

I, Nicole M. Pagano, a professional geologist in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Nicole M. Pagano
Professional Geologist
196-000750
O'Brien & Gere Engineers, Inc., part of Ramboll
Date: January 7, 2019

Attachments

Figures



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SDS 3/28/18
REVIEWED BY/DATE:
JJW 3/28/18
APPROVED BY/DATE:
NMP 3/30/18

MONITORING WELL AND SOURCE WATER LOCATION MAP
NEWTON PRIMARY ASH POND

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 67719

FIGURE NO: 1

Y:\Mapping\Projects\222285\MXD\Alt_Source_Dem\Figure 1_Newton Landfill Phases_PAP.mxd Author: stolzsd:

Attachment A

Boron Mann-Kendall Trend Analyses

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW7**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 08/31/2018		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line		
Slope (fitted to data):	0.000028	mg/L per day
R-Squared error of fit:	0.350024	
Sen's Non-parametric estimate of the slope (One-Sided Test)		
Median Slope:	0.000032	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000005	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000061	mg/L per day
Non-parametric Mann-Kendall Test for Trend		
S Statistic:	1.347	
Z test:	1.645	
At the 95.0 % Confidence Level (One-Sided Test):	None	

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW8**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 08/31/2018		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line		
Slope (fitted to data):	0.000027	mg/L per day
R-Squared error of fit:	0.338419	
Sen's Non-parametric estimate of the slope (One-Sided Test)		
Median Slope:	0.000025	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000005	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000055	mg/L per day
Non-parametric Mann-Kendall Test for Trend		
S Statistic:	1.347	
Z test:	1.645	
At the 95.0 % Confidence Level (One-Sided Test):	None	

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW9**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 08/31/2018		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line

Slope (fitted to data):	0.000021	mg/L per day
R-Squared error of fit:	0.226829	

Sen's Non-parametric estimate of the slope (One-Sided Test)

Median Slope:	0.000022	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000005	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000044	mg/L per day

Non-parametric Mann-Kendall Test for Trend

S Statistic:	1.431
Z test:	1.645
At the 95.0 % Confidence Level (One-Sided Test):	None

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW10**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 08/31/2018		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line

Slope (fitted to data):	0.000009	mg/L per day
R-Squared error of fit:	0.110910	

Sen's Non-parametric estimate of the slope (One-Sided Test)

Median Slope:	0.000009	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000017	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000023	mg/L per day

Non-parametric Mann-Kendall Test for Trend

S Statistic:	0.721
Z test:	1.645
At the 95.0 % Confidence Level (One-Sided Test):	None

Attachment B

Coefficient of Variation Evaluation

Newton

Coefficient of Variation
Date Range: 12/14/2015 to 8/31/2018

Boron, total (mg/L)

Location	Count	Mean	Std Dev	% Non-Detects	CV
APW5	10	0.099	0.014	0.00	0.14
APW6	10	0.091	0.026	0.00	0.29
APW7	10	0.078	0.014	0.00	0.18
APW8	10	0.084	0.013	0.00	0.15
APW9	10	0.076	0.013	0.00	0.17
APW10	10	0.069	0.007	0.00	0.10

CV=Std Dev/ Mean

Newton

Coefficient of Variation
Date Range: 12/14/2015 to 8/31/2018

Boron, total (mg/L)

Location	Count	Mean	Std Dev	% Non-Detects	CV
APW5	10	0.099	0.014	0.00	0.14
APW6	10	0.091	0.026	0.00	0.29
APW7	10	0.078	0.014	0.00	0.18
APW8	10	0.084	0.013	0.00	0.15
APW9	10	0.076	0.013	0.00	0.17
APW10	10	0.069	0.007	0.00	0.10

CV=Std Dev/ Mean

40 C.F.R. § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION
NEWTON PRIMARY ASH POND
JULY 15, 2019

July 15, 2019

Title 40 of the Code of Federal Regulations (C.F.R.) § 257.94(e)(2) allows the owner or operator of a Coal Combustion Residuals (CCR) unit 90 days from the date of determination of Statistically Significant Increases (SSIs) over background for groundwater constituents listed in Appendix III of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSI(s), or that the SSI(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (Alternate Source Demonstration [ASD]).

This ASD has been prepared on behalf of Illinois Power Generating Company by O'Brien & Gere Engineers, Inc., part of Ramboll (OBG), to provide pertinent information pursuant to 40 C.F.R. § 257.94(e)(2) for the Newton Primary Ash Pond (PAP) located near Newton, Illinois.

The third round of semi-annual detection monitoring samples (Detection Monitoring Round 3 [D3]) were collected on November 9, 2018 and analytical data were received on January 16, 2019. In accordance with 40 C.F.R. Section 257.93(h)(2), statistical analysis of the data to identify SSIs of 40 C.F.R. Part 257 Appendix III parameters over background concentrations was completed by April 16, 2019 within 90 days of receipt of the analytical data. The statistical determination identified the following SSIs at downgradient monitoring wells:

- Calcium at wells APW7, APW8, and APW10
- Chloride at APW7
- Fluoride at well APW9
- Sulfate at wells APW8, APW9, and APW10

Because the Detection Monitoring Round 4 (D4) was completed on February 22, 2019, prior to SSIs referenced above being determined for D3, results from D4 were used to verify the D3 SSIs in accordance with the Statistical Analysis Plan[1]. Following evaluation of analytical data from D4, the following SSIs were confirmed:

- Calcium at wells APW8 and APW10
- Fluoride at well APW9
- Sulfate at wells APW8, APW9, and APW10

Pursuant to 40 C.F.R. § 257.94(e)(2), the following demonstrates that sources other than the PAP were the cause of the SSIs listed above. This ASD was completed by July 15, 2019, within 90 days of determination of the SSIs, as required by 40 C.F.R. § 257.94(e)(2).

SITE LOCATION AND DESCRIPTION

The Newton Power Station (Site) is located in Jasper County, in the southeastern part of central Illinois, approximately 7 miles southwest of the town of Newton. The area is surrounded by Newton Lake. Beyond the lake is agricultural land.

GEOLOGY AND HYDROGEOLOGY

The site geology and hydrogeology are summarized below from the Hydrogeologic Monitoring Plan (NRT/OBG, 2017a)[2].

[1] Natural Resource Technology, an OBG Company, *Statistical Analysis Plan, Coffeen Power Station, Newton Power Station*, Illinois Power Generating Company, October 17, 2017.

GEOLOGY

Quaternary deposits in the Newton area consist mainly of diamictons and outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations. The unconsolidated deposits occurring at Newton Power Station include the following units (beginning at the ground surface):

- Ash/Fill Units – CCR and fill within the various CCR Units
- Upper Confining Unit – Low permeability clays and silts, including: the Peoria Silt (Loess Unit) in upland areas and the Cahokia Formation in the flood plain and channel areas to the south and east; underlain by the Sangamon Soil, and the predominantly clay diamictons of the Hagarstown (Till) and Vandalia (Till) Members of the Glasford Formation
- Uppermost Aquifer (Groundwater Monitoring Zone) – Thin to moderately thick (3 to 17 ft), moderate to high permeability sand, silty sand, and sandy silt/clay units of the Mulberry Grove Member of the Glasford Formation
- Lower Confining Unit – Thick, very low permeability silty clay diamictons of the Smithboro (Till) Member of the Glasford Formation and the silty clay diamictons of the Banner Formation

The bedrock beneath the unconsolidated deposits consists of Pennsylvanian-age Mattoon Formation that is mostly shale near the bedrock surface, but is characterized at depth by a complex sequence of shales, thin limestones, coals, underclays, and several sandstones. The erosional surface of the Pennsylvanian-age Mattoon Formation bedrock ranges widely in depth in the vicinity of the site, but is typically encountered at 90 to 120 ft below ground surface (bgs).

HYDROGEOLOGY

The information used to describe the hydrogeology is based on the local geology obtained from published sources, hydrogeologic investigation data, and boring data collected during monitoring well installation. CCR monitoring well locations are shown in Figure 1.

Uppermost Aquifer

The Uppermost Aquifer, the Mulberry Grove Member, typically consists of fine to coarse sand with varying amounts of clay, silt, and fine to coarse gravel. The portion of the Mulberry Grove Member at the site that is defined as a sand layer ranges in thickness from 3 to 17 ft with an average thickness of 8 ft. With only a few exceptions, the sand layer occurs between depths of 55 to 88 ft bgs.

Lower Limit of Aquifer

The lower hydrostratigaphic units, which comprise the lower limit of the Uppermost Aquifer, consist of the Smithboro Member and the Banner Formation, both of which are predominantly low permeability clay diamictons with varying amounts of silt, sand, and gravel. The lower hydrostratigraphic units are 30 ft to more than 50 ft thick above the underlying bedrock.

Groundwater Elevation and Flow Direction

Groundwater elevations across PAP ranged from approximately 495 to 530 ft MSL (NAVD88) during D3 (Figure 2). The groundwater elevation contours shown on Figure 2 were measured on November 8, 2018, the first day of a combined sampling event at the Site for LF2 and the Primary Ash Pond and for multiple monitoring programs required by both federal and state regulatory agencies. Overall groundwater flow within the Uppermost Aquifer in this area is southward toward Newton Lake, but with a predominantly southwesterly flow under the PAP.

[2] Natural Resource Technology, an OBG Company (NRT), October 17, 2017. *Hydrogeologic Monitoring Plan. Newton Primary Ash Pond – CCR Unit ID 501, Newton Landfill 2 – CCR Unit ID 502*. Newton Power Station, Canton, Illinois. Illinois Power Generating Company.

GROUNDWATER AND PAP WATER MONITORING

The Uppermost Aquifer monitoring system for the PAP is shown on Figure 1. Monitoring wells APW5 and APW6 are used to monitor background water quality for the PAP. These wells are located north of the PAP. The downgradient monitoring wells are APW7, APW8, APW9, and APW10.

PAP water samples have been collected from locations AP1 in the southwest corner of the PAP and AP2 in the southeast corner of the PAP.

ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

As allowed by 40 C.F.R. § 257.94(e)(2), this ASD demonstrates that sources other than the PAP caused the SSIs, or that the SSIs were a result of natural variation in groundwater quality. Lines of evidence supporting this ASD include the following:

1. The ionic composition of Newton PAP water is different from the ionic composition of groundwater.
2. The Newton PAP is not hydraulically connected to the Uppermost Aquifer.
3. Concentrations of calcium in the Newton PAP are lower than those observed in the groundwater.
4. Boron, a primary indicator parameter for CCR impacts to groundwater, has concentrations in downgradient wells that are near, or below, concentrations observed in background monitoring wells.

These lines of evidence are described and supported in greater detail below. Monitoring wells and leachate sample locations are shown on Figure 1.

LINE OF EVIDENCE #1: THE IONIC COMPOSITION OF NEWTON PAP WATER IS DIFFERENT FROM THE IONIC COMPOSITION OF GROUNDWATER

Piper diagrams graphically represent ionic composition of aqueous solutions. A Piper diagram displays the position of water samples relative to their major cation and anion content, providing the information needed to identify compositional categories or groupings. Figure 2, below, is a Piper diagram that displays the ionic composition of groundwater samples from the background and downgradient monitoring wells associated with the PAP and PAP water based on Quarter 2 2017 and Quarter 3 2018 samples.

Groundwater samples from the PAP downgradient wells (enclosed within a green ellipse) have a very high percentage of carbonate-bicarbonate anions and no dominant cation. Surface water samples from the PAP (enclosed within a purple ellipse) have a very high percentage of sodium-potassium cations and no dominant anion. The dissimilar ionic compositions of the PAP downgradient groundwater and the PAP surface water indicates that the PAP is not the source of CCR constituents detected in PAP groundwater.

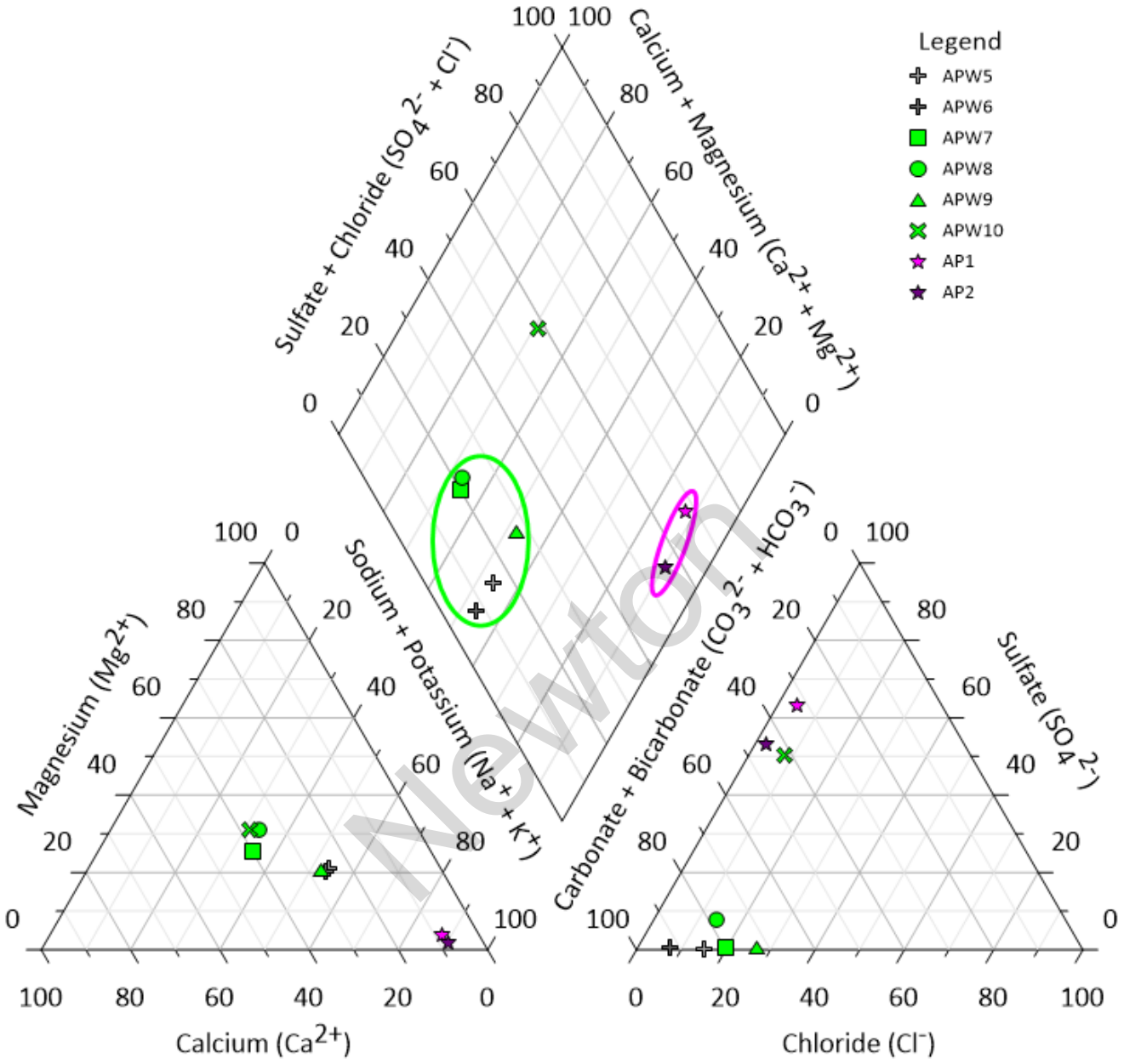


Figure 2 Piper Diagram Showing Ionic Composition of Samples of Background and Downgradient Groundwater Associated with PAP and Samples of PAP Surface Water.

LINE OF EVIDENCE #2: THE NEWTON PRIMARY ASH POND IS NOT HYDRAULICALLY CONNECTED TO THE UPPERMOST AQUIFER

As noted above, the Uppermost Aquifer at the Site is the Mulberry Grove Member of the Glasford Formation. Based on boring logs for monitoring wells installed around the perimeter of the site, the Uppermost Aquifer is confined and the top of this unit ranges from 461.8 ft msl in APW-8 to 482.8 ft msl in APW-10 (Attachment A). The bottom elevation of the PAP is within the Hagarstown Member of the Glasford Formation at 508 ft msl, approximately 25 ft above the top of the Uppermost Aquifer (Attachment B). The Hagarstown Member functions as an aquitard, with hydraulic conductivity ranging from 2.4 x 10^{-6} to 6.1 x 10^{-5} centimeters per second (cm/s). Based upon these hydraulic conductivity values and the fact that the Uppermost Aquifer is confined, the PAP is not hydraulically connected to the Uppermost Aquifer. The lack of connection between the PAP and the

Uppermost Aquifer demonstrates that there is no complete pathway for transport of CCR constituents in groundwater beneath the PAP, thus the PAP is not the source of CCR constituents in the Uppermost Aquifer.

LINE OF EVIDENCE #3: CONCENTRATIONS OF CALCIUM IN THE NEWTON PRIMARY ASH POND ARE LOWER THAN THOSE OBSERVED IN THE GROUNDWATER

Calcium concentrations are lower in PAP water samples than in all downgradient groundwater samples collected between 2015 and 2019. A time series for calcium concentrations is provided in Figure 3 below.

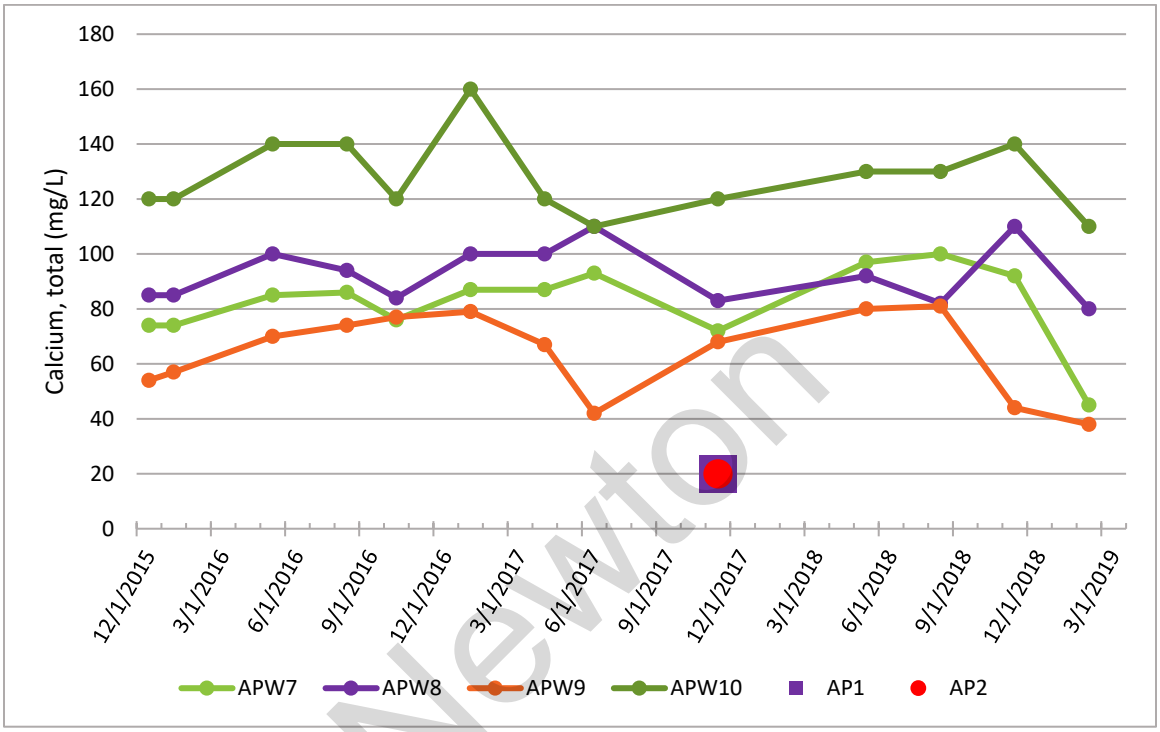


Figure 3. Calcium time series

The following observations can be made from Figure 3:

- PAP water samples AP1 and AP2 each contained 20 mg/L of calcium.
- Groundwater from downgradient wells APW7, APW8, APW9, and APW10 had higher calcium concentrations than the PAP water.

If the PAP were the source of calcium in groundwater, groundwater concentrations in PAP water would be higher than the downgradient groundwater; therefore, the PAP is not likely the source of the calcium observed in the Uppermost Aquifer.

LINE OF EVIDENCE #4: BORON, A PRIMARY INDICATOR PARAMETER OF CCR IMPACTS TO GROUNDWATER, HAS CONCENTRATIONS IN DOWNGRADIENT WELLS THAT ARE STABLE AND NEAR, OR BELOW, CONCENTRATIONS OBSERVED IN BACKGROUND MONITORING WELLS

Boron is a primary indicator of CCR impacts to groundwater. If the source of the SSIs in the downgradient monitoring wells were the PAP, boron would be anticipated to be present at elevated concentrations, as well. Concentrations of boron in all downgradient monitoring wells are below upper prediction limits established using background monitoring wells (i.e. SSI limits) and are lower than median concentrations observed in background wells APW5 and APW6 from 2015 through 2019, as shown on Figure 4.

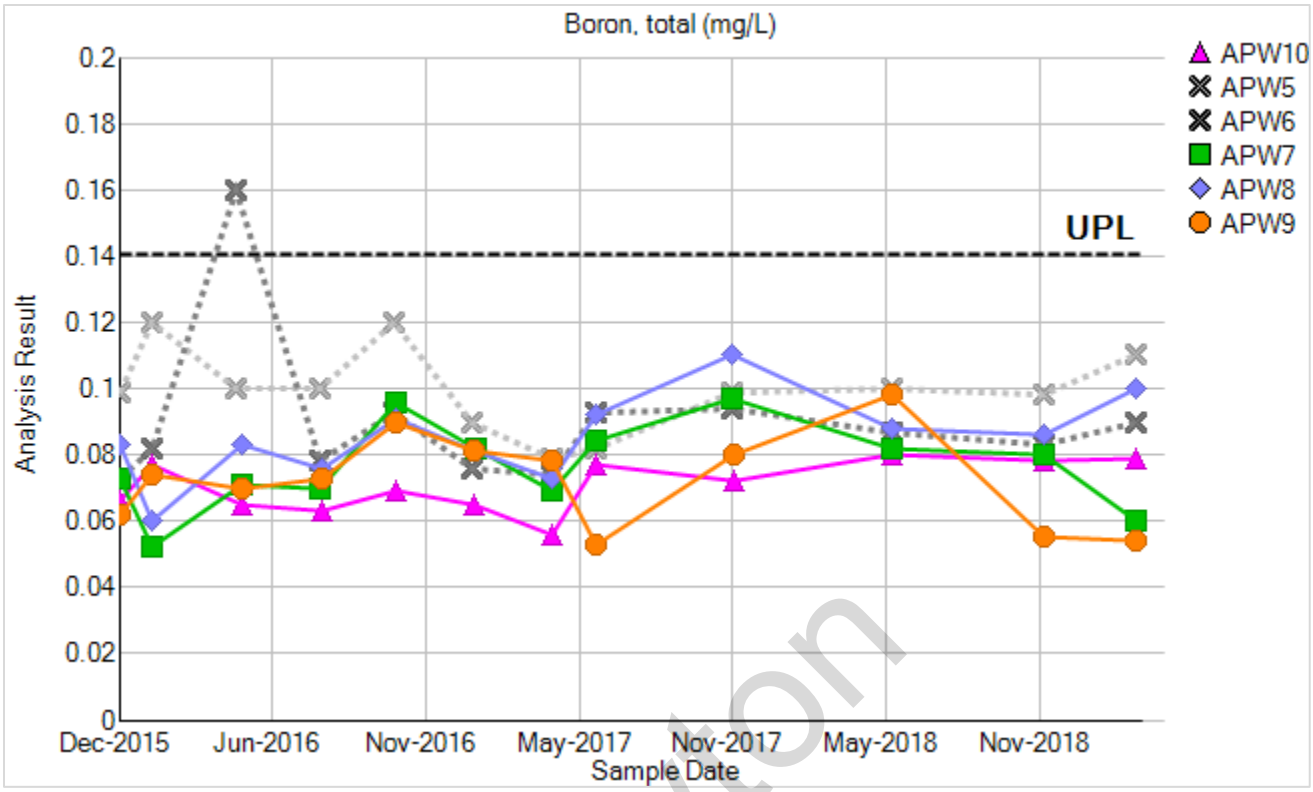


Figure 4. Boron time series showing boron concentrations in background wells (gray "X"s) are higher or similar to concentrations in downgradient wells.

From Figure 4 the following observations can be made:

- Boron concentrations in downgradient monitoring wells range from 0.052 mg/L to 0.11 mg/L, versus 0.073 mg/L to 0.16 mg/L in background wells.
- Overall median boron concentration in downgradient wells from 2015 through 2019 is 0.077 mg/L versus 0.093 mg/L in background wells.

Mann-Kendall trend analysis tests were performed (Attachment C) to determine if boron concentrations at each well were increasing, decreasing or stable (i.e., no statistically significant upward or downward trend). If the Mann-Kendall test did not identify a trend, the coefficient of variation (CV) was calculated (Attachment D) to determine if the concentrations were too variable to identify a trend (i.e. CV greater than or equal to 1). If a trend was identified, the CV was calculated to indicate whether data used to establish the trend were suggestive of a low or high magnitude trend. Data with a CV less than or equal to 1 suggest a lower magnitude trend. Boron concentrations are stable in background wells and downgradient wells APW7 and APW9. Upward trends were identified at APW8 and APW10, however, coefficient of variation evaluations identified minimal variation at all wells, suggesting a low-magnitude trend. Table 2 provides summary statistics, including variability and trend per well.

The low concentrations of boron in downgradient monitoring wells, relative to background concentrations, and the relatively stable boron concentrations in both background and downgradient monitoring wells suggests that the source of the of the SSIs in those wells is not the PAP.

Monitoring Well	Boron (mg/L)					
	Minimum	Maximum	Median	Standard Deviation	Trend	CV
APW5	0.079	0.12	0.100	0.0127	stable	0.13
APW6	0.073	0.16	0.085	0.0232	stable	0.26
APW7	0.052	0.097	0.077	0.0133	stable	0.17
APW8	0.060	0.11	0.085	0.0129	upward	0.15
APW9	0.053	0.098	0.074	0.0143	stable	0.20
APW10	0.056	0.08	0.071	0.0077	upward	0.11

Table 2. Minimum, maximum, median, standard deviation, trend, and coefficient of variation of boron concentrations in groundwater

Based on these four lines of evidence, it has been demonstrated that the Newton Primary Ash Pond has not caused the SSIs in APW7, APW8, APW9, and APW10.

This information serves as the written alternate source demonstration prepared in accordance with 40 C.F.R. § 257.94(e)(2) that SSIs observed during the detection monitoring program were not due to the PAP. Therefore, an assessment monitoring program is not required and the PAP will remain in detection monitoring.

Attachments

Figure 1 Monitoring Well and Source Water Location Map Newton Primary Ash Pond
Figure 2 Groundwater Elevation Contour Map – November 8, 2018
Attachment A Boring Logs for Monitoring Wells APW8 and APW10
Attachment B Geologic Cross Section B-B'
Attachment C Mann-Kendall Trend Analysis
Attachment D Coefficient of Variation Evaluation
.

I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

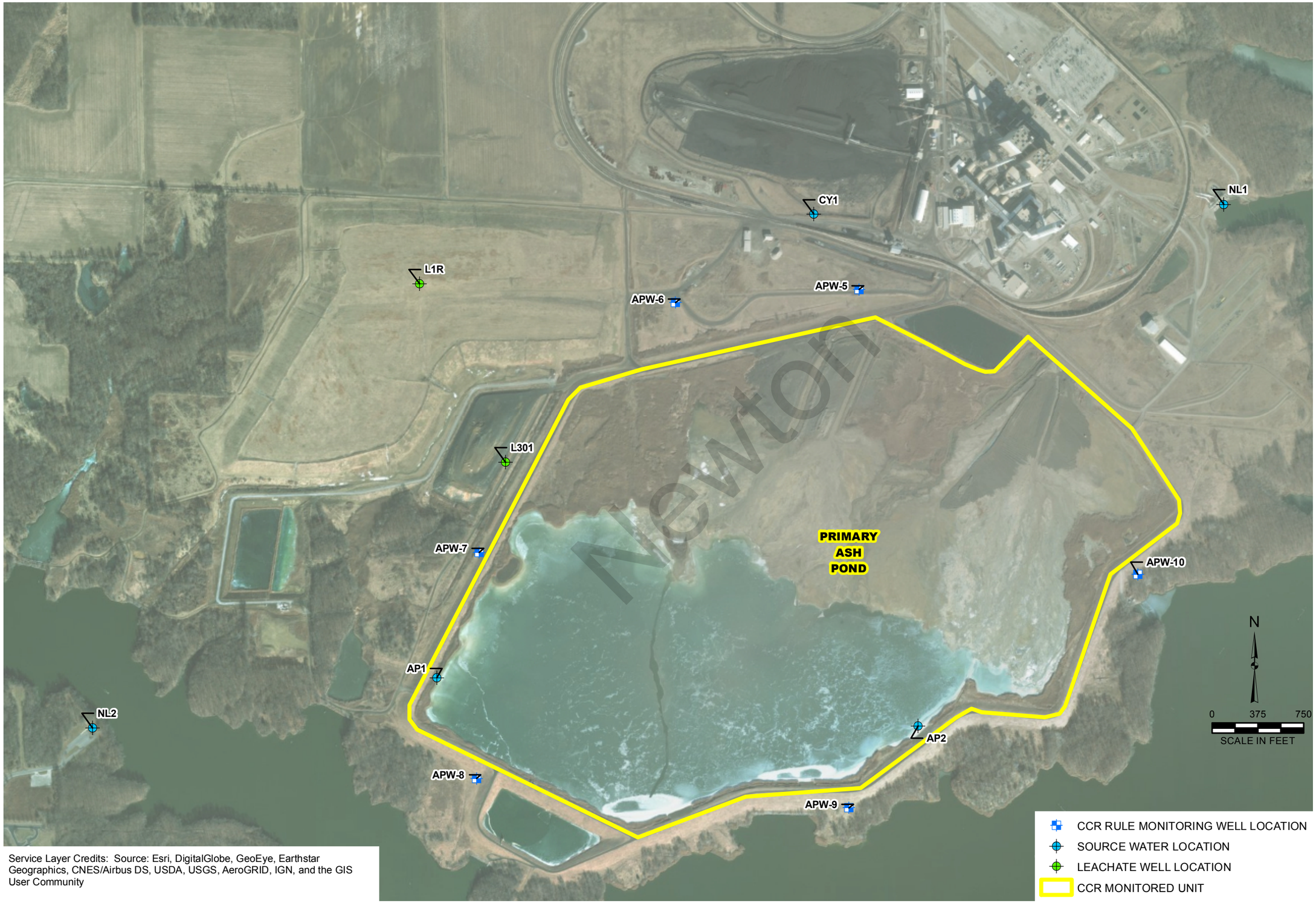
Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
O'Brien & Gere Engineers, Inc., a Ramboll Company
Date: July 15, 2019

I, Nicole M. Pagano, a professional geologist in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Nicole M. Pagano
Professional Geologist
196-000750
O'Brien & Gere Engineers, Inc., a Ramboll Company
Date: July 15, 2019

Attachments

Figures



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DRAWN BY/DATE:
SDS 3/28/18
REVIEWED BY/DATE:
JJW 3/28/18
APPROVED BY/DATE:
NMP 3/30/18

MONITORING WELL AND SOURCE WATER LOCATION MAP
NEWTON PRIMARY ASH POND

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 67719

FIGURE NO: 1

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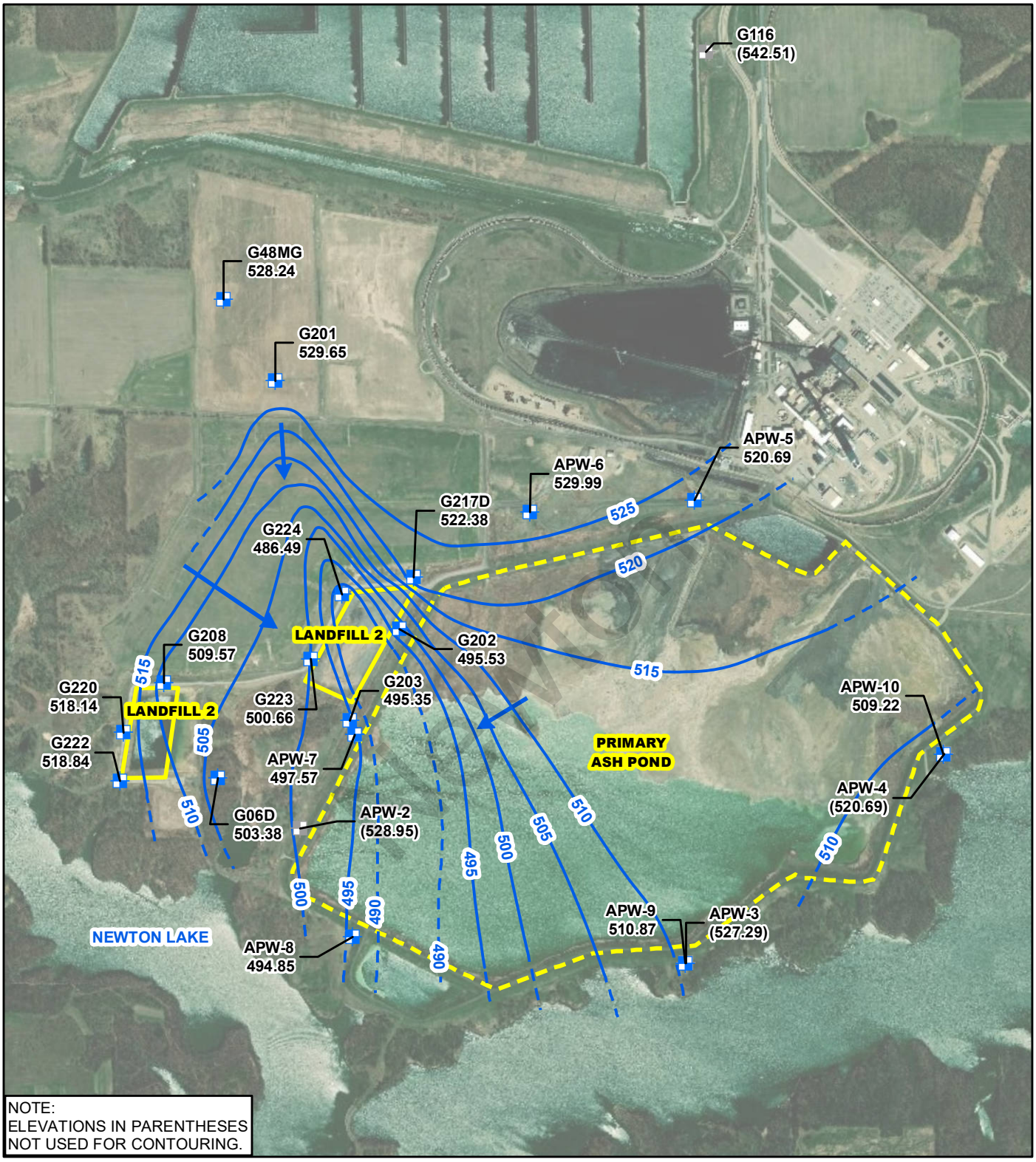

CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT INTERVAL)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

LANDFILL 2 CCR MONITORED UNIT

PRIMARY ASH POND CCR MONITORED UNIT

NEWTON PRIMARY ASH POND (UNIT ID: 501)
GROUNDWATER ELEVATION CONTOUR MAP
NOVEMBER 8, 2018

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

0 325 650 1,300
Feet

N

O'BRIEN & GERE ENGINEERS, INC.

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Attachment A

Boring Logs for Monitoring Wells APW8 and APW10

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: **Start:** 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: **Driller:** C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
1A				13		4.50	0	Black (10YR2/1), moist, very stiff, SILT with little clay and trace very fine- to medium-grained sand, roots.		526	
	60/60 100%	DP					2	Yellowish brown (10YR5/4) with 30% light gray (10YR7/2) mottles, dry, hard, SILT with little clay and trace very fine- to medium-grained sand.		524	
1B				21		3.00	4	Grayish brown (10YR5/2) with 15% dark yellowish brown (10YR4/6) and 10% black (10YR2/1) mottles, moist, very stiff, silty CLAY with few very fine- to coarse-grained sand and trace small gravel.		522	
2A				18		2.50	6			520	
	60/60 100%	DP					8	Grayish brown (10YR5/2) with 15% dark yellowish brown mottles, moist, stiff, silty CLAY with few very fine- to coarse-grained sand and trace small gravel.		518	
2B				28		2.00	10			516	
	20/24 83%	DP					12	Brown (10YR5/3) with 20% dark yellowish brown (10YR5/6) mottles, dry, stiff, SILT with little clay and trace very fine- to coarse-grained sand.		514	Rock in shoe of sampler.
3A				8		2.00	14			512	
4A	0/17 0%	SS	23-43 50/5"				16			510	
5A	21/24 88%	SS	13-20 24-28 N=44	10		4.50	18	Dark gray (10YR4/1), moist, hard, SILT with little clay, trace very fine- to coarse-grained sand and small gravel.		508	
6A	24/24 100%	SS	7-14 20-48 N=34	11		4.50	20				
7A	24/24 100%	SS	14-21 26-32 N=47	10							

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: **Start:** 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: **Driller:** C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
8A	24/24 100%	ss	7-13 19-23 N=32	11		4.50	22			506	
9A	24/24 100%	ss	7-14 19-27 N=33	11		4.50	24	Dark gray (10YR4/1), moist, hard, SILT with little clay, trace very fine- to coarse-grained sand and small gravel. *[Continued from previous page]*		504	
10A	24/24 100%	ss	8-15 30-37 N=45	11		4.50	26			502	
11A	24/24 100%	ss	8-16 24-33 N=40	11		4.50	28			500	
12A	24/24 100%	ss	9-31 33-30 N=64	11			30	Gray (10YR5/1), moist, dense, silty, very fine- to medium-grained SAND.		498	
12B				12		4.50					
13A	24/24 100%	ss	10-23 40-35 N=63	11		4.50	32	Dark gray (10YR4/1), moist, hard SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel.		496	
14A	21/24 88%	ss	16-16 29-50 N=45	10		4.50	▼ 34			494	
15A	20/24 83%	ss	9-24 34-41 N=58	13			36	Dark gray (10YR4/1), wet, very dense, silty, very fine- to coarse-grained SAND with trace small gravel.		492	
16A	22/24 92%	ss	16-18 29-35 N=47	11		4.50	38	Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel.		490	
17A	21/24 88%	ss	10-17 21-31 N=38	11		4.50	40			488	

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: **Start:** 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: **Driller:** C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
18A	24/24 100%	ss	9-16 26-32 N=42	11		4.50	42			486	
19A	24/24 100%	ss	10-16 23-34 N=39	12		4.50	44			484	
20A	24/24 100%	ss	10-15 26-44 N=41	13		4.50	46			482	
21A	24/24 100%	ss	12-21 32-48 N=53	12		4.50	48			480	
22A	24/24 100%	ss	11-17 22-31 N=39	13		4.50	50	Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel. *[Continued from previous page]*		478	
23A	24/24 100%	ss	10-13 21-32 N=34	13		4.50	52			476	
24A	24/24 100%	ss	8-13 50-26 N=63	13		4.50	54			474	
25A	24/24 100%	ss	8-11 19-28 N=30	14		4.25	56			472	
26A	24/24 100%	ss	10-12 18-26 N=30	13		4.50	58			470	
27A	22/24 92%	ss	7-10 15-22 N=25	21		4.50	60	Olive gray (5Y4/2), moist, hard, silty CLAY with few very fine- to coarse-grained sand and trace small gravel.		468	

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: **Start:** 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: **Driller:** C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
28A	20/24 83%	ss	7-15 19-20 N=34	14		4.50	62	Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand and trace small gravel.	466	
29A	21/24 88%	ss	7-8 11-16 N=19	11		3.75	64	Dark gray (10YR4/1), moist, very stiff, SILT with little clay, few very fine- to coarse-grained sand and trace small gravel.	464	
30A	21/24 88%	ss	6-13 14-11 N=27	14		4.00	66	Gray (10YR6/1), wet, medium dense, silty, very fine- to coarse-grained SAND with trace small to large gravel.	462	
30B				10				Dark gray (10YR4/1), moist, very stiff, SILT with little clay and few very fine- to coarse-grained sand.		
31A	18/24 75%	ss	4-3 4-3 N=7	28				Dark gray (10YR4/1), wet, loose, silty, very fine- to coarse-grained SAND with trace small gravel and trace wood fragments.	460	
31B				15		3.25	68	Dark gray (10YR4/1), moist, very stiff, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel, trace wood fragments.		
32A	20/24 83%	ss	1-3 3-2 N=6	17				Dark gray (10YR4/1), wet, loose, SILT with little very fine- to fine-grained sand.	458	
32B				28				Dark gray (10YR4/1), wet, loose, silty, very fine- to coarse-grained SAND.		
33A	15/24 63%	ss	woh-2 6-6 N=8	17			70	Dark gray (10YR4/1), wet, loose, SILT with little very fine- to fine-grained sand, trace wood fragments.	456	
34A	16/24 67%	ss	9-11 15-20 N=26	9			72	Dark gray (10YR4/1), wet, loose, silty, very fine- to coarse-grained SAND, trace wood fragments.	454	
35A	15/24 63%	ss	16-21 23-24 N=44	9			74	Dark gray (10YR4/1), wet, medium dense, silty, very fine- to coarse-grained SAND with trace small gravel.	452	
36A	14/24 58%	ss	11-20 25-24 N=45	11			76	Dark gray (10YR4/1), wet, medium dense, silty, very fine- to coarse-grained SAND with few small to large gravel.	450	
37A	15/24 63%	ss	20-25 24-25 N=49	10			78	Dark gray (10YR4/1), wet, dense, silty, very fine- to coarse-grained SAND with few small to large gravel.	448	
							80	Dark gray (10YR4/1), wet, dense, silty, very fine- to coarse-grained SAND with trace small gravel.		

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: **Start:** 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: **Driller:** C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
38A	18/24	ss	*26-26*	8				Dark gray (10YR4/1), wet, dense, silty, very fine- to coarse-grained SAND with trace small gravel. *[Continued from previous page]*		446	
38B	*75%*		*26-31* N=52	11		*4.50*	82	Dark gray (10YR4/1), moist, hard, SILT with little clay and few very fine- to coarse-grained sand.			

End of boring = 82.0 feet

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: **Start:** 10/27/2015
Finish: 10/27/2015
WEATHER: Cool, rainy, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: **Driller:** C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW10a
Well ID: APW10
Surface Elev: 521.98 ft. MSL
Completion: 45.94 ft. BGS
Station: 5,371.32N
11,541.23E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 25, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 36.00 - During Drilling
▼ =
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail / Elevation ft. MSL / Remarks

Blind drill - see APW4 boring log for lithology, sample, and testing data

NOTE(S): APW10 installed in borehole.
Lithology, sample, and testing data can be found on APW-4 Field Boring Log.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: **Start:** 10/27/2015
Finish: 10/27/2015
WEATHER: Cool, rainy, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: **Driller:** C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW10a
Well ID: APW10
Surface Elev: 521.98 ft. MSL
Completion: 45.94 ft. BGS
Station: 5,371.32N
11,541.23E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 25, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 36.00 - During Drilling
▼ =
▽ =

SAMPLE Number	SAMPLE Recov / Total (in) % *Recovery*	SAMPLE Type	TESTING *Blows / 6 in* N - Value **RQD**	TESTING Moisture (%)	TESTING Dry Den. (lb/ft³)	TESTING Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							22	Yellowish brown (10YR5/6) with 5% gray (N6/1) mottles, moist, hard, SILT with little clay, few very fine-grained sand, and trace small gravel.		500	
							24			498	
							26			496	
							28	Yellowish brown (10YR5/4) with 5% dark yellowish brown (10YR4/6) and 5% gray (N6/1) mottles, moist, hard, SILT with little clay, few very fine-grained sand, and trace small gravel.		494	
							30			492	
							32			490	
							34			488	
							▼ 36	Brown (10YR5/3) with 5% gray (N6/1) mottles, moist, hard, SILT with little clay, few very fine-grained sand, and trace small gravel.		486	
							38			484	
							40	Brown (10YR5/3), wet, very dense, silty, very fine- to medium-grained SAND with trace small gravel.		482	

NOTE(S): APW10 installed in borehole.
Lithology, sample, and testing data can be found on APW-4 Field Boring Log.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: **Start:** 10/27/2015
Finish: 10/27/2015
WEATHER: Cool, rainy, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: **Driller:** C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW10a
Well ID: APW10
Surface Elev: 521.98 ft. MSL
Completion: 45.94 ft. BGS
Station: 5,371.32N
11,541.23E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 25, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 36.00 - During Drilling
▼ =
▽ =

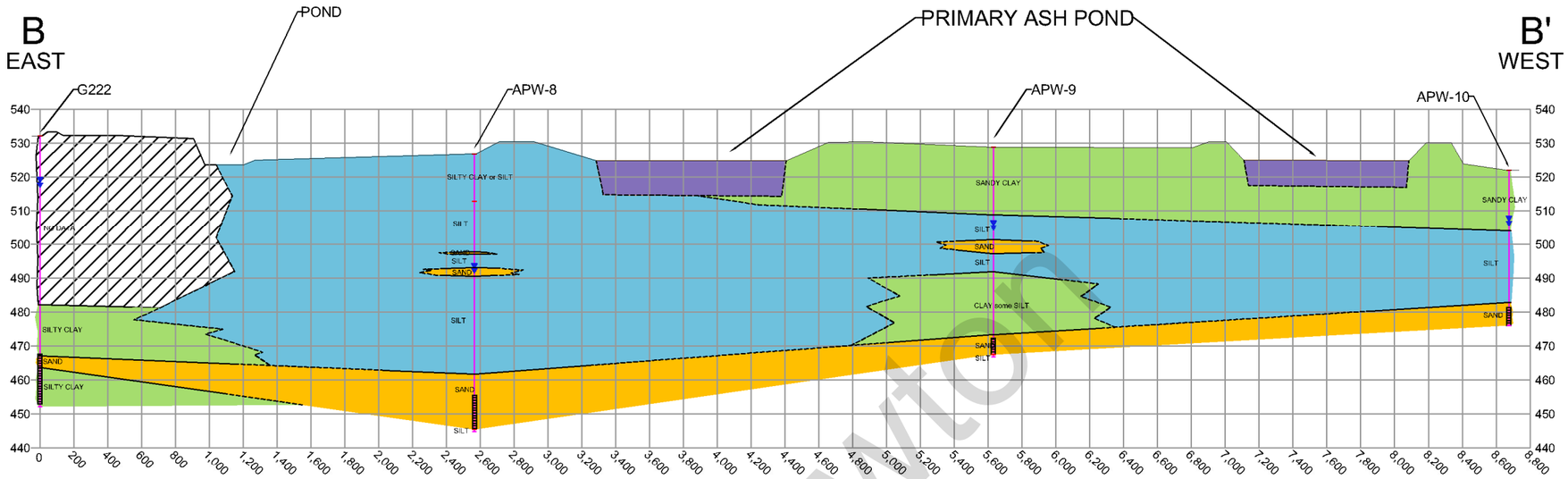
SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail / Elevation ft. MSL / Remarks
							42	Brown (10YR5/3), wet, very dense, silty, very fine- to medium-grained SAND with trace small gravel. *[Continued from previous page]*	480
							44		478

End of boring = 45.94 feet

NOTE(S): APW10 installed in borehole.
Lithology, sample, and testing data can be found on APW-4 Field Boring Log.

Attachment B

Geologic Cross Section B-B'

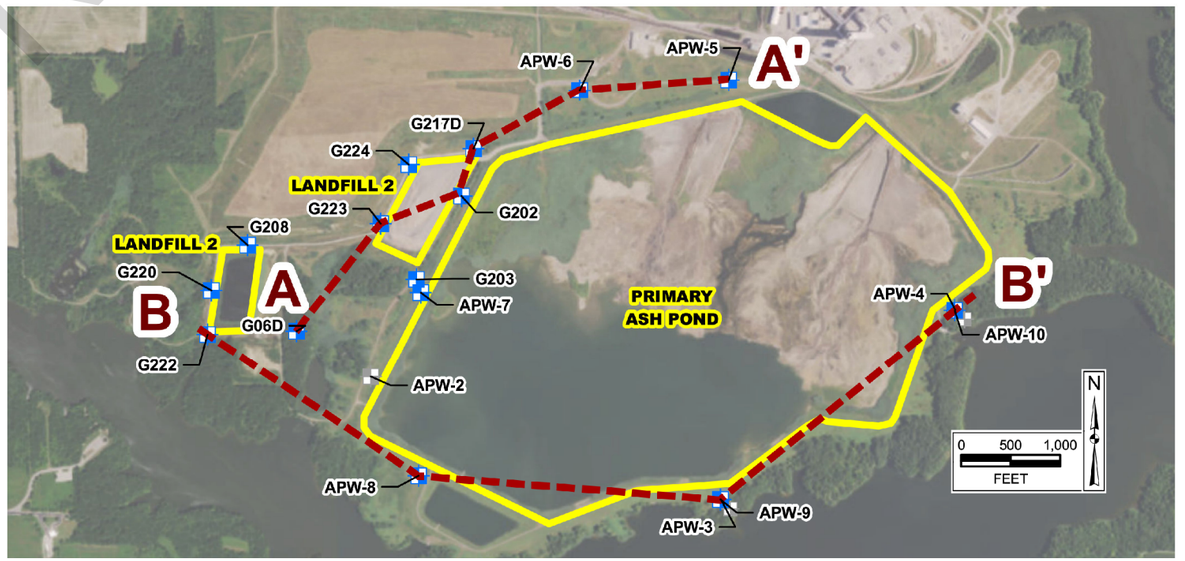


NO DATA
ASH
CLAY
SILT
SAND
WELL SCREEN
GROUNDWATER ELEVATION

NOTE THAT THE DEPTH OF THE ASH IN THE ASH POND IS APPROXIMATE.

VERTICAL SCALE IN FEET: 40
HORIZONTAL SCALE IN FEET: 800

VERTICAL EXAGGERATION =20



DRAWN BY: JMO DATE: 08/29/2017
CHECKED BY: TBN DATE: 10/2/2017
APPROVED BY: SJC DATE: 10/2/2017
DRAWING NO: Fig X_Geologic Cross-Section A-A'
REFERENCE: .

GEOLOGIC CROSS-SECTION B-B'

HYDROGEOLOGIC MONITORING PLAN

NEWTON POWER STATION
NEWTON, ILLINOIS

Natural Resource Technology
AN OBG COMPANY

PROJECT NO.
2285

FIGURE NO.
APPENDIX A-2

Attachment C

Mann-Kendall Trend Analysis

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW5**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line		
Slope (fitted to data):	-0.000004	mg/L per day
R-Squared error of fit:	0.016425	
Sen's Non-parametric estimate of the slope (One-Sided Test)		
Median Slope:	-0.000001	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000031	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000011	mg/L per day
Non-parametric Mann-Kendall Test for Trend		
S Statistic:	-0.417	
Z test:	1.645	
At the 95.0 % Confidence Level (One-Sided Test):	None	

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW6**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line		
Slope (fitted to data):	-0.000008	mg/L per day
R-Squared error of fit:	0.018309	
Sen's Non-parametric estimate of the slope (One-Sided Test)		
Median Slope:	0.000006	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000015	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000018	mg/L per day
Non-parametric Mann-Kendall Test for Trend		
S Statistic:	0.687	
Z test:	1.645	
At the 95.0 % Confidence Level (One-Sided Test):	None	

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW7**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line		
Slope (fitted to data):	0.000006	mg/L per day
R-Squared error of fit:	0.033439	
Sen's Non-parametric estimate of the slope (One-Sided Test)		
Median Slope:	0.000008	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000011	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000034	mg/L per day
Non-parametric Mann-Kendall Test for Trend		
S Statistic:	0.412	
Z test:	1.645	
At the 95.0 % Confidence Level (One-Sided Test):	None	

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW8**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line

Slope (fitted to data):	0.000019	mg/L per day
R-Squared error of fit:	0.342389	

Sen's Non-parametric estimate of the slope (One-Sided Test)

Median Slope:	0.000017	mg/L per day
Lower Confidence Limit of Slope, M1:	0.000003	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000039	mg/L per day

Non-parametric Mann-Kendall Test for Trend

S Statistic:	1.787
Z test:	1.645
At the 95.0 % Confidence Level (One-Sided Test):	Upward

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW9**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line		
Slope (fitted to data):	-0.000006	mg/L per day
R-Squared error of fit:	0.028627	
Sen's Non-parametric estimate of the slope (One-Sided Test)		
Median Slope:	-0.000001	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000026	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000028	mg/L per day
Non-parametric Mann-Kendall Test for Trend		
S Statistic:	0.000	
Z test:	1.645	
At the 95.0 % Confidence Level (One-Sided Test):	None	

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW10**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line

Slope (fitted to data):	0.000011	mg/L per day
R-Squared error of fit:	0.304448	

Sen's Non-parametric estimate of the slope (One-Sided Test)

Median Slope:	0.000011	mg/L per day
Lower Confidence Limit of Slope, M1:	0.000000	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000019	mg/L per day

Non-parametric Mann-Kendall Test for Trend

S Statistic:	1.722
Z test:	1.645
At the 95.0 % Confidence Level (One-Sided Test):	Upward

Attachment D

Coefficient of Variation Evaluation

Newton

Coefficient of Variation
Date Range: 12/14/2015 to 3/31/2019

Boron, total (mg/L)

Location	Count	Mean	Std Dev	% Non-Detects	CV
APW5	12	0.100	0.013	0.00	0.13
APW6	12	0.090	0.023	0.00	0.26
APW7	12	0.076	0.013	0.00	0.17
APW8	12	0.085	0.013	0.00	0.15
APW9	12	0.072	0.014	0.00	0.20
APW10	12	0.071	0.008	0.00	0.11

CV=Std Dev/ Mean

40 C.F.R. § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION
NEWTON PRIMARY ASH POND
OCTOBER 14, 2019

October 14, 2019

Title 40 of the Code of Federal Regulations (C.F.R.) § 257.94(e)(2) allows the owner or operator of a Coal Combustion Residuals (CCR) unit 90 days from the date of determination of Statistically Significant Increases (SSIs) over background for groundwater constituents listed in Appendix III of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSI(s), or that the SSI(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality (Alternate Source Demonstration [ASD]).

This ASD has been prepared on behalf of Illinois Power Generating Company by O'Brien & Gere Engineers, Inc., part of Ramboll (OBG) to provide pertinent information pursuant to 40 C.F.R. § 257.94(e)(2) for the Newton Primary Ash Pond (PAP) located near Newton, Illinois.

The fourth semi-annual detection monitoring samples (Detection Monitoring Round 4 [D4]) were collected on February 22, 2019 and analytical data were received on April 15, 2019. In accordance with 40 C.F.R. § 257.93(h)(2), statistical analysis of the data to identify SSIs of 40 C.F.R. Part 257 Appendix III parameters over background concentrations was completed by July 15, 2019, within 90 days of receipt of the analytical data. The statistical determination identified the following SSIs at downgradient monitoring wells:

- Calcium at wells APW8 and APW10
- Fluoride at wells APW7 and APW9
- Sulfate at wells APW7, APW8, APW9, and APW10

Pursuant to 40 C.F.R. § 257.94(e)(2), the following demonstrates that sources other than the Newton PAP were the cause of the SSIs listed above. This ASD was completed by October 14, 2019, within 90 days of determination of the SSIs, as required by 40 C.F.R. § 257.94(e)(2).

SITE LOCATION AND DESCRIPTION

The Newton Power Station (Site) is located in Jasper County, in the southeastern part of central Illinois, approximately 7 miles southwest of the town of Newton. The area is surrounded by Newton Lake. Beyond the lake is agricultural land.

GEOLOGY AND HYDROGEOLOGY

The site geology and hydrogeology are summarized below from the Hydrogeologic Monitoring Plan (NRT/OBG, 2017a)[1].

GEOLOGY

Quaternary deposits in the Newton area consist mainly of diamictons and outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations. The unconsolidated deposits occurring at Newton Power Station include the following units (beginning at the ground surface):

- Ash/Fill Units – CCR and fill within the various CCR Units

[1] Natural Resource Technology, an OBG Company (NRT), October 17, 2017. *Hydrogeologic Monitoring Plan. Newton Primary Ash Pond – CCR Unit ID 501, Newton Landfill 2 – CCR Unit ID 502*. Newton Power Station, Canton, Illinois. Illinois Power Generating Company.

- Upper Confining Unit – Low permeability clays and silts, including: the Peoria Silt (Loess Unit) in upland areas and the Cahokia Formation in the flood plain and channel areas to the south and east; underlain by the Sangamon Soil, and the predominantly clay diamictons of the Hagarstown (Till) and Vandalia (Till) Members of the Glasford Formation
- Uppermost Aquifer (Groundwater Monitoring Zone) – Thin to moderately thick (3 to 17 ft), moderate to high permeability sand, silty sand, and sandy silt/clay units of the Mulberry Grove Member of the Glasford Formation
- Lower Confining Unit – Thick, very low permeability silty clay diamicton of the Smithboro (Till) Member of the Glasford Formation and the silty clay diamictons of the Banner Formation

The bedrock beneath the unconsolidated deposits consists of Pennsylvanian-age Mattoon Formation that is mostly shale near the bedrock surface, but is characterized at depth by a complex sequence of shales, thin limestones, coals, underclays, and several sandstones. The erosional surface of the Pennsylvanian-age Mattoon Formation bedrock ranges widely in depth in the vicinity of the site, but is typically encountered at 90 to 120 ft below ground surface (bgs).

HYDROGEOLOGY

The information used to describe the hydrogeology is based on the local geology obtained from published sources, hydrogeologic investigation data, and boring data collected during monitoring well installation. CCR monitoring well locations are shown in Figure 1.

Uppermost Aquifer

The Uppermost Aquifer is the Mulberry Grove Member, typically consisting of fine to coarse sand with varying amounts of clay, silt, and fine to coarse gravel. The portion of the Mulberry Grove Member at the site that is defined as a sand layer ranges in thickness from 3 to 17 ft with an average thickness of 8 ft. With only a few exceptions, the sand layer occurs between depths of 55 to 88 ft bgs.

Lower Limit of Aquifer

The lower hydrostratigraphic units, which comprise the lower limit of the Uppermost Aquifer, consist of the Smithboro Member and the Banner Formation, both of which are predominantly low permeability clay diamictons with varying amounts of silt, sand, and gravel. The lower hydrostratigraphic units are 30 to more than 50 ft thick above the underlying bedrock.

Groundwater Elevation and Flow Direction

Groundwater elevations across PAP ranged from approximately 494 to 531 ft MSL (NAVD88) during D4 (Figure 2). The groundwater elevation contours shown on Figure 2 were measured on February 18, 2019, the first day of a combined sampling event at the Site for LF2 and the Primary Ash Pond and for multiple monitoring programs required by both federal and state regulatory agencies. Overall groundwater flow within the Uppermost Aquifer in this area is southward toward Newton Lake, but with a predominantly southwesterly flow under the PAP.

GROUNDWATER AND PAP WATER MONITORING

The Uppermost Aquifer monitoring system for the PAP is shown on Figure 1. Monitoring wells APW5 and APW6 are used to monitor background water quality for the PAP. These wells are located north of the PAP. The downgradient monitoring wells are APW7, APW8, APW9, and APW10.

PAP water samples have been collected from locations AP1 in the southwest corner of the PAP and AP2 in the southeast corner of the PAP.

ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

Lines of evidence supporting these ASDs include the following:

1. The ionic composition of Newton PAP water is different from the ionic composition of groundwater.
2. The Newton PAP is not hydraulically connected to the Uppermost Aquifer.
3. Concentrations of calcium in the Newton PAP are lower than those observed in the groundwater.
4. Boron, a primary indicator parameter for CCR impacts to groundwater, has concentrations in downgradient wells that are near, or below, concentrations observed in background monitoring wells.

These lines of evidence are described and supported in greater detail below. Monitoring wells and leachate sample locations are shown on Figure 1.

LINE OF EVIDENCE #1: THE IONIC COMPOSITION OF NEWTON PAP WATER IS DIFFERENT FROM THE IONIC COMPOSITION OF GROUNDWATER

Piper diagrams graphically represent ionic composition of aqueous solutions. A Piper diagram displays the position of water samples relative to their major cation and anion content, providing the information needed to identify compositional categories or groupings. Figure 2 is a Piper diagram that displays the ionic composition of groundwater samples from the background and downgradient monitoring wells associated with the Phase I Landfill (LF1), Phase II Landfill (LF2), and Primary Ash Pond (PAP) and LF1 leachate and PAP water based on Quarter 2 2017 and Quarter 3 2018 samples.

Groundwater samples from the PAP downgradient wells (enclosed within a green ellipse) have a very high percentage of carbonate-bicarbonate cations and no dominant cation. Surface water samples from the PAP (enclosed within a purple ellipse) have a very high percentage of sodium-potassium cations and no dominant anion. The dissimilar ionic compositions of the PAP downgradient groundwater and the PAP surface water indicates that the PAP is not the source of CCR constituents detected in PAP groundwater.

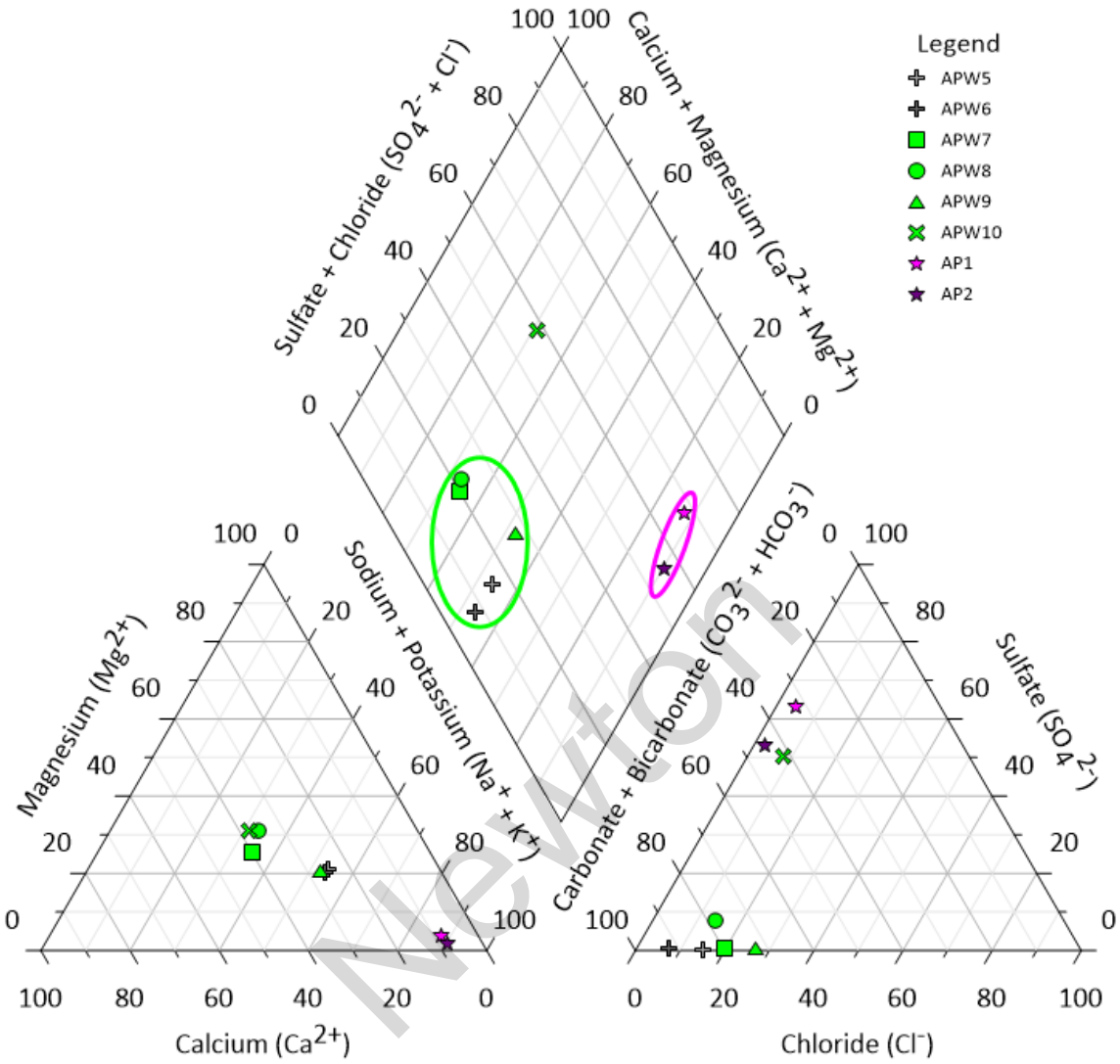


Figure 2 Piper Diagram Showing Ionic Composition of Samples of Background and Downgradient Groundwater Associated with LF1, LF2, and PAP and Samples of LF1 Leachate and PAP Surface Water.

LINE OF EVIDENCE #2: THE NEWTON PRIMARY ASH POND IS NOT HYDRAULICALLY CONNECTED TO THE UPPERMOST AQUIFER

As noted above, the Uppermost Aquifer at the Site is the Mulberry Grove Member of the Glasford Formation. Based on boring logs for monitoring wells installed around the perimeter of the site, the Uppermost Aquifer is confined and the top of this unit ranges from 461.8 ft msl in APW-8 to 482.8 ft msl in APW-10 (Attachment A). The bottom elevation of the PAP is, situated within the Hagarstown Member of the Glasford Formation at 508 ft msl, approximately 25 ft above the top of the Uppermost Aquifer (Attachment B). The Hagarstown Member functions as an aquitard with hydraulic conductivities ranging from 2.4 x 10^{-6} to 6.1 x 10^{-5} centimeters per

second (cm/s)[2]. Based upon these hydraulic conductivity values and the fact that the Uppermost Aquifer is confined, the PAP is not hydraulically connected to the Uppermost Aquifer. The lack of connection between the PAP and the Uppermost Aquifer demonstrates that there is no complete pathway for transport of CCR constituents in groundwater beneath the PAP, thus the PAP is not the source of CCR constituents in the Uppermost Aquifer.

LINE OF EVIDENCE #3: CONCENTRATIONS OF CALCIUM IN THE NEWTON PRIMARY ASH POND ARE LOWER THAN THOSE OBSERVED IN THE GROUNDWATER

Calcium concentrations are lower in PAP water samples than in all downgradient groundwater samples collected between 2015 and 2019. A time series for calcium concentrations is provided in Figure 3 below.

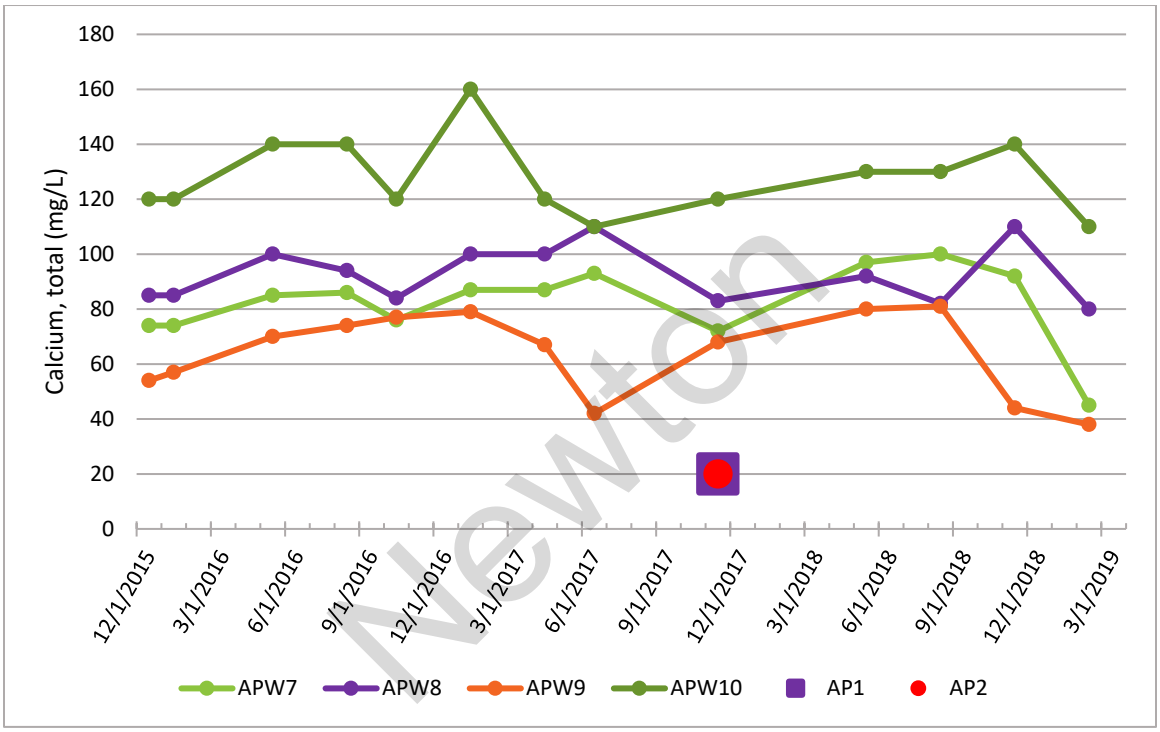


Figure 3. Calcium time series

The following observations can be made from Figure 3:

- PAP water samples AP1 and AP2 each contained 20 mg/L of calcium.
- Groundwater from downgradient wells APW7, APW8, APW9, and APW10 had higher calcium concentrations than the PAP water.

[2] Natural Resource Technology, an OBG Company (NRT), October 17, 2017. *Hydrogeologic Monitoring Plan. Newton Primary Ash Pond – CCR Unit ID 501, Newton Landfill 2 – CCR Unit ID 502*. Newton Power Station, Canton, Illinois. Illinois Power Generating Company.

If the PAP were the source of calcium in groundwater, groundwater concentrations in PAP water would be higher than the downgradient groundwater; therefore, the PAP is not likely the source of the calcium observed in the Uppermost Aquifer.

LINE OF EVIDENCE #4: BORON, A PRIMARY INDICATOR PARAMETER OF CCR IMPACTS TO GROUNDWATER, HAS CONCENTRATIONS IN DOWNGRADIENT WELLS THAT ARE STABLE AND NEAR, OR BELOW, CONCENTRATIONS OBSERVED IN BACKGROUND MONITORING WELLS

Boron is a primary indicator of CCR impacts to groundwater. If the source of the SSIs in the downgradient monitoring wells were the PAP, boron would be anticipated to be present at elevated concentrations, as well. Concentrations of boron in all downgradient monitoring wells are below upper prediction limits established using background monitoring wells (i.e. SSI limits) and are lower than median concentrations observed in background wells APW5 and APW6 from 2015 through 2019, as shown on Figure 4.

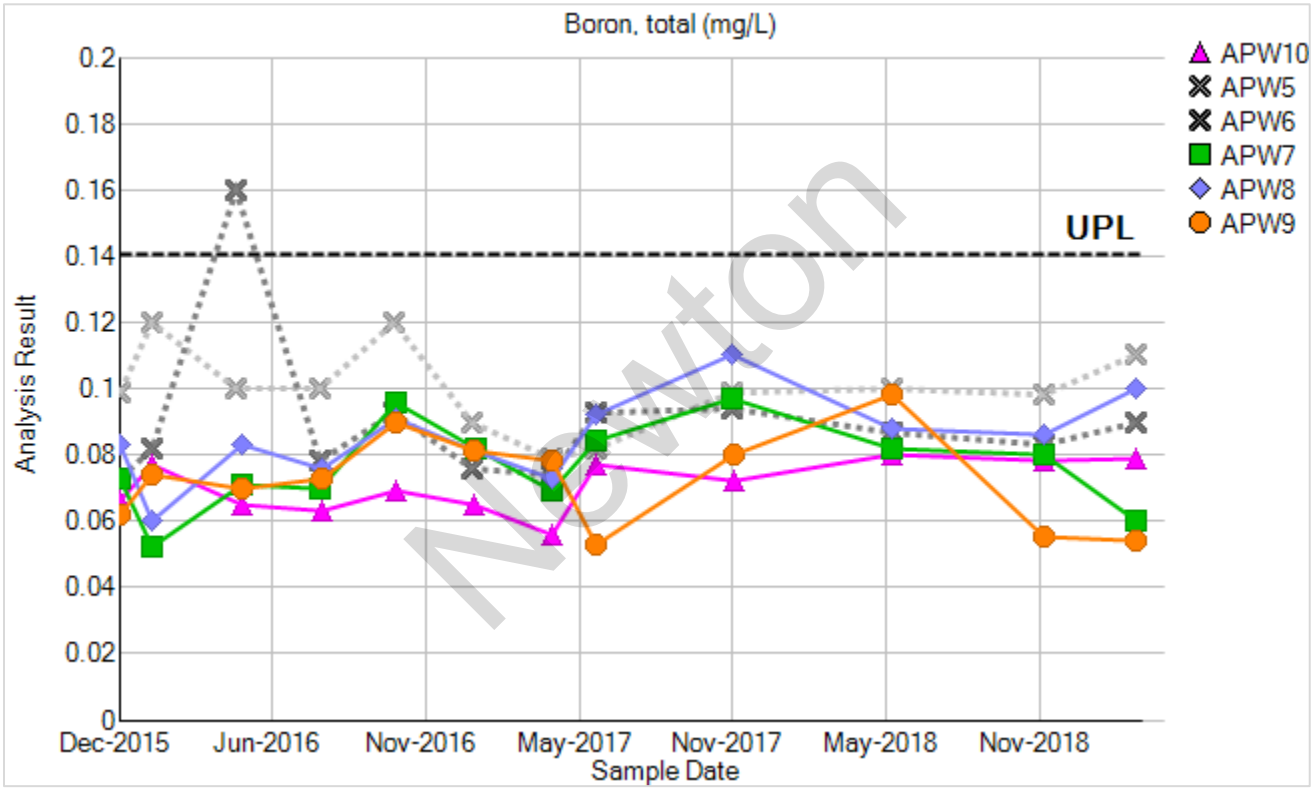


Figure 4. Boron time series showing boron concentrations in background wells (gray "X"s) are higher or similar to concentrations in downgradient wells.

From Figure 6 the following observations can be made:

- Boron concentrations in downgradient monitoring wells range from 0.052 to 0.11 mg/L versus 0.073 to 0.16 mg/L in background wells.
- Overall median boron concentration in downgradient wells from 2015 through 2019 is 0.077 mg/L versus 0.093 mg/L in background wells.

Mann-Kendall trend analysis tests were performed (Attachment D) to determine if concentrations at each well were increasing, decreasing or stable (i.e., no statistically significant upward or downward trend). If the Mann-Kendall test did not identify a trend the coefficient of variation (CV) was calculated (Attachment E) to determine if the concentrations are too variable to identify a trend (i.e. CV greater than or equal to 1). If a trend was identified, the CV was calculated to indicate whether data used to establish the trend are suggestive of a low or high magnitude trend. Data with a CV less than or equal to 1 suggest a lower magnitude trend. Boron

concentrations are stable in background wells and downgradient wells APW7 and APW9. Upward trends were identified at APW8 and APW10, however, coefficient of variation evaluations identified minimal variation at all wells, suggesting a low-magnitude trend. Table 2 provides summary statistics, including variability and trend per well.

Monitoring Well	Boron (mg/L)					
	Minimum	Maximum	Median	Standard Deviation	Trend	CV
APW5	0.079	0.12	0.100	0.0127	stable	0.13
APW6	0.073	0.16	0.085	0.0232	stable	0.26
APW7	0.052	0.097	0.077	0.0133	stable	0.17
APW8	0.060	0.11	0.085	0.0129	upward	0.15
APW9	0.053	0.098	0.074	0.0143	stable	0.20
APW10	0.056	0.08	0.071	0.0077	upward	0.11

Table 2. Maximum, minimum, median, variance and trend of boron in groundwater

The low concentrations of boron in downgradient monitoring wells, relative to background concentrations, and the relatively stable boron concentrations in both background and downgradient monitoring wells suggests that the source of the of the SSIs in those wells is not the PAP.

Based on these four lines of evidence, it has been demonstrated that the Newton Primary Ash Pond has not caused the SSIs in APW7, APW8, APW9, and APW10.

This information serves as the written alternate source demonstration prepared in accordance with 40 C.F.R. § 257.94(e)(2) that SSIs observed during the detection monitoring program were not due to the PAP. Therefore, an assessment monitoring program is not required and the Newton Primary Ash Pond will remain in detection monitoring.

Attachments

Figure 1 Monitoring Well and Source Water Location Map Newton Primary Ash Pond
Figure 2 Groundwater Elevation Contour Map – February 18, 2019
Attachment A Boring Logs for Monitoring Wells APW8 and APW10
Attachment B Geologic Cross Section B-B'
Attachment C Boron Trend Analysis for APW7, APW8, APW9, and APW10
Attachment D Coefficient of Variation Evaluation

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I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

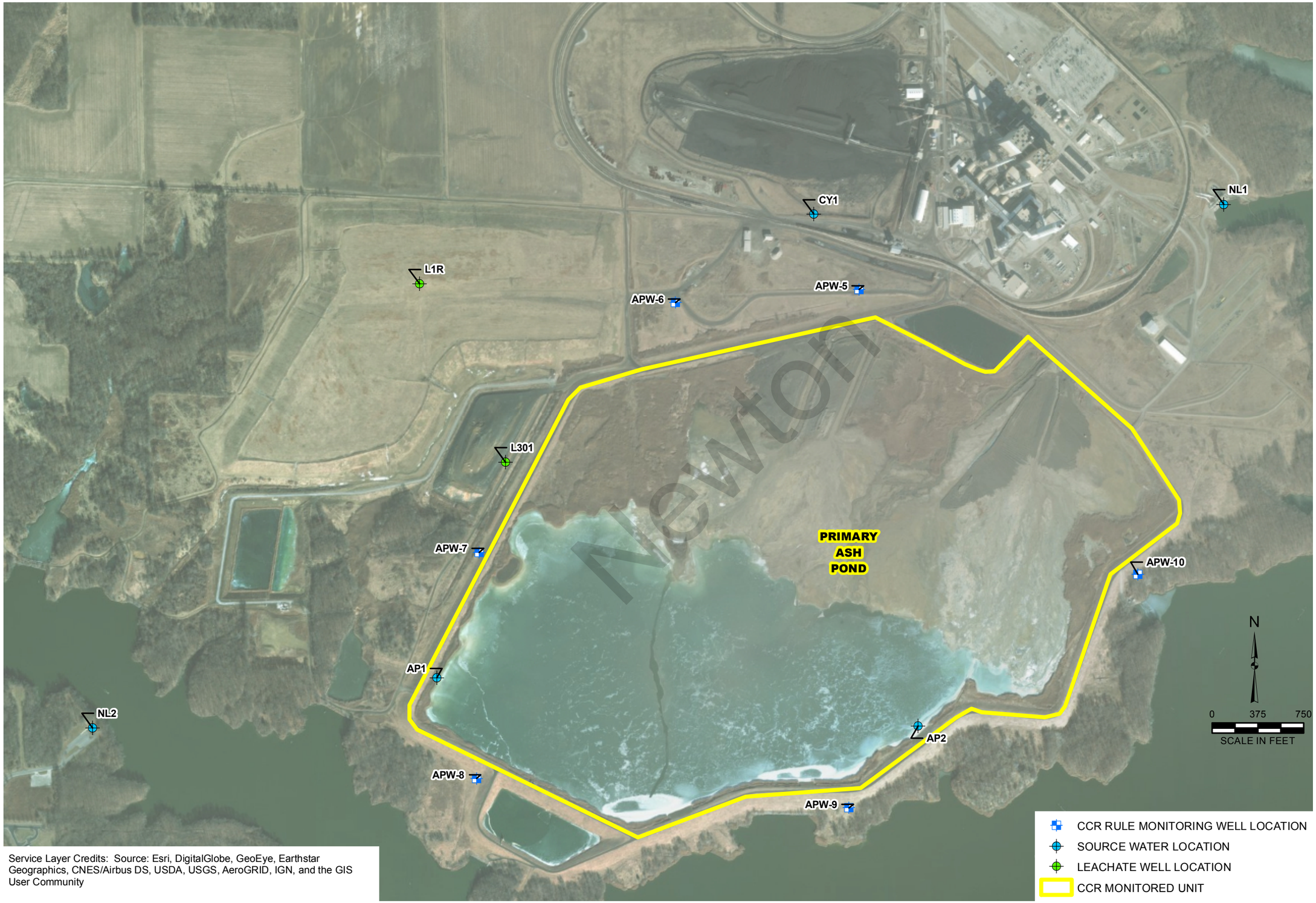
Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
O'Brien & Gere Engineers, Inc., a Ramboll Company
Date: October 14, 2019

I, Nicole M. Pagano, a professional geologist in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Nicole M. Pagano
Professional Geologist
196-000750
O'Brien & Gere Engineers, Inc., a Ramboll Company
Date: October 14, 2019

Attachments

Figures



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DRAWN BY/DATE:
SDS 3/28/18
REVIEWED BY/DATE:
JJW 3/28/18
APPROVED BY/DATE:
NMP 3/30/18

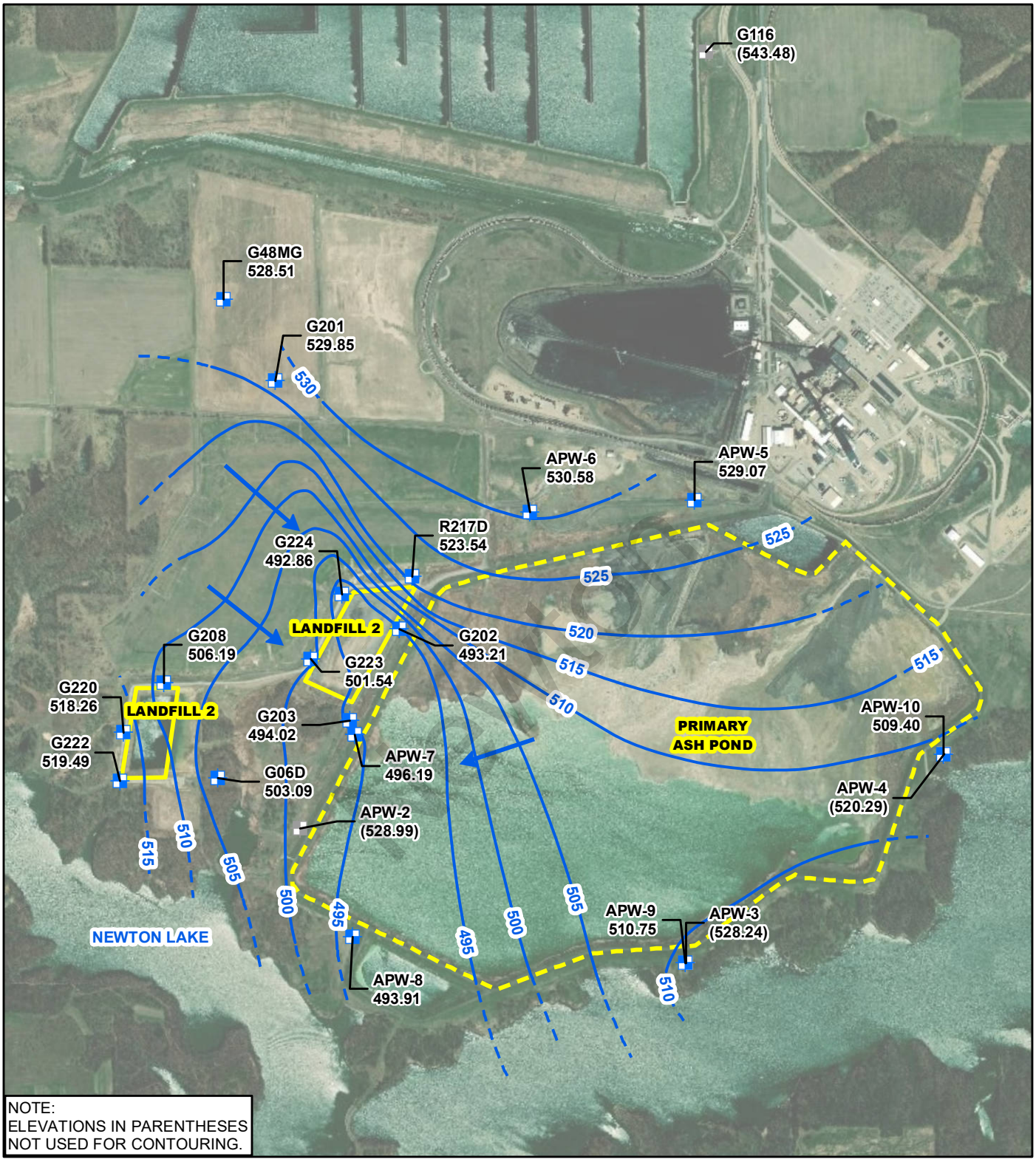
MONITORING WELL AND SOURCE WATER LOCATION MAP
NEWTON PRIMARY ASH POND

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 67719

FIGURE NO: 1

Y:\Mapping\Projects\222285\MXD\Alt_Source_Dem\Figure 1_Newton Landfill Phases_PAP.mxd Author: stolzsd:



CCR RULE MONITORING WELL LOCATION

NON-CCR RULE MONITORING WELL LOCATION

GROUNDWATER ELEVATION CONTOUR (5-FOOT INTERVAL)

INFERRED GROUNDWATER ELEVATION CONTOUR

GROUNDWATER FLOW DIRECTION

LANDFILL 2 CCR MONITORED UNIT

PRIMARY ASH POND CCR MONITORED UNIT

NEWTON PRIMARY ASH POND (UNIT ID: 501)
GROUNDWATER ELEVATION CONTOUR MAP
FEBRUARY 18, 2019

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

0 325 650 1,300
Feet

N

O'BRIEN & GERE ENGINEERS, INC.

Y:\Mapping\Projects\221285\MXD\Alt_Source_Dem\Figure 2_D4 Newton GW Contours.mxd

Attachment A

Boring Logs for Monitoring Wells APW8 and APW10

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: **Start:** 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: **Driller:** C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
1A				13		4.50	0	Black (10YR2/1), moist, very stiff, SILT with little clay and trace very fine- to medium-grained sand, roots.		526	
	60/60 100%	DP					2	Yellowish brown (10YR5/4) with 30% light gray (10YR7/2) mottles, dry, hard, SILT with little clay and trace very fine- to medium-grained sand.		524	
1B				21		3.00	4	Grayish brown (10YR5/2) with 15% dark yellowish brown (10YR4/6) and 10% black (10YR2/1) mottles, moist, very stiff, silty CLAY with few very fine- to coarse-grained sand and trace small gravel.		522	
2A				18		2.50	6			520	
	60/60 100%	DP					8	Grayish brown (10YR5/2) with 15% dark yellowish brown mottles, moist, stiff, silty CLAY with few very fine- to coarse-grained sand and trace small gravel.		518	
2B				28		2.00	10			516	
	20/24 83%	DP					12	Brown (10YR5/3) with 20% dark yellowish brown (10YR5/6) mottles, dry, stiff, SILT with little clay and trace very fine- to coarse-grained sand.		514	Rock in shoe of sampler.
3A				8		2.00	14			512	
4A	0/17 0%	SS	23-43 50/5"				16			510	
5A	21/24 88%	SS	13-20 24-28 N=44	10		4.50	18	Dark gray (10YR4/1), moist, hard, SILT with little clay, trace very fine- to coarse-grained sand and small gravel.		508	
6A	24/24 100%	SS	7-14 20-48 N=34	11		4.50	20				
7A	24/24 100%	SS	14-21 26-32 N=47	10							

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: **Start:** 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: **Driller:** C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
8A	24/24 100%	ss	7-13 19-23 N=32	11		4.50	22			506	
9A	24/24 100%	ss	7-14 19-27 N=33	11		4.50	24	Dark gray (10YR4/1), moist, hard, SILT with little clay, trace very fine- to coarse-grained sand and small gravel. *[Continued from previous page]*		504	
10A	24/24 100%	ss	8-15 30-37 N=45	11		4.50	26			502	
11A	24/24 100%	ss	8-16 24-33 N=40	11		4.50	28			500	
12A	24/24 100%	ss	9-31 33-30 N=64	11			30	Gray (10YR5/1), moist, dense, silty, very fine- to medium-grained SAND.		498	
12B				12		4.50					
13A	24/24 100%	ss	10-23 40-35 N=63	11		4.50	32	Dark gray (10YR4/1), moist, hard SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel.		496	
14A	21/24 88%	ss	16-16 29-50 N=45	10		4.50	▼ 34			494	
15A	20/24 83%	ss	9-24 34-41 N=58	13			36	Dark gray (10YR4/1), wet, very dense, silty, very fine- to coarse-grained SAND with trace small gravel.		492	
16A	22/24 92%	ss	16-18 29-35 N=47	11		4.50	38	Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel.		490	
17A	21/24 88%	ss	10-17 21-31 N=38	11		4.50	40			488	

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: **Start:** 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: **Driller:** C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
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6,082.37E

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WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
18A	24/24 100%	ss	9-16 26-32 N=42	11		4.50	42			486	
19A	24/24 100%	ss	10-16 23-34 N=39	12		4.50	44			484	
20A	24/24 100%	ss	10-15 26-44 N=41	13		4.50	46			482	
21A	24/24 100%	ss	12-21 32-48 N=53	12		4.50	48			480	
22A	24/24 100%	ss	11-17 22-31 N=39	13		4.50	50	Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel. *[Continued from previous page]*		478	
23A	24/24 100%	ss	10-13 21-32 N=34	13		4.50	52			476	
24A	24/24 100%	ss	8-13 50-26 N=63	13		4.50	54			474	
25A	24/24 100%	ss	8-11 19-28 N=30	14		4.25	56			472	
26A	24/24 100%	ss	10-12 18-26 N=30	13		4.50	58			470	
27A	22/24 92%	ss	7-10 15-22 N=25	21		4.50	60	Olive gray (5Y4/2), moist, hard, silty CLAY with few very fine- to coarse-grained sand and trace small gravel.		468	

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: **Start:** 10/27/2015
Finish: 10/28/2015
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SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
28A	20/24 83%	ss	7-15 19-20 N=34	14		4.50	62	Dark gray (10YR4/1), moist, hard, SILT with little clay, few very fine- to coarse-grained sand and trace small gravel.	466	
29A	21/24 88%	ss	7-8 11-16 N=19	11		3.75	64	Dark gray (10YR4/1), moist, very stiff, SILT with little clay, few very fine- to coarse-grained sand and trace small gravel.	464	
30A	21/24 88%	ss	6-13 14-11 N=27	14		4.00	66	Gray (10YR6/1), wet, medium dense, silty, very fine- to coarse-grained SAND with trace small to large gravel.	462	
30B				10				Dark gray (10YR4/1), moist, very stiff, SILT with little clay and few very fine- to coarse-grained sand.		
31A	18/24 75%	ss	4-3 4-3 N=7	28				Dark gray (10YR4/1), wet, loose, silty, very fine- to coarse-grained SAND with trace small gravel and trace wood fragments.	460	
31B				15		3.25	68	Dark gray (10YR4/1), moist, very stiff, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel, trace wood fragments.		
32A	20/24 83%	ss	1-3 3-2 N=6	17				Dark gray (10YR4/1), wet, loose, SILT with little very fine- to fine-grained sand.	458	
32B				28				Dark gray (10YR4/1), wet, loose, silty, very fine- to coarse-grained SAND.		
33A	15/24 63%	ss	woh-2 6-6 N=8	17			70	Dark gray (10YR4/1), wet, loose, SILT with little very fine- to fine-grained sand, trace wood fragments.	456	
34A	16/24 67%	ss	9-11 15-20 N=26	9			72	Dark gray (10YR4/1), wet, loose, silty, very fine- to coarse-grained SAND, trace wood fragments.	454	
35A	15/24 63%	ss	16-21 23-24 N=44	9			74	Dark gray (10YR4/1), wet, medium dense, silty, very fine- to coarse-grained SAND with trace small gravel.	452	
36A	14/24 58%	ss	11-20 25-24 N=45	11			76	Dark gray (10YR4/1), wet, medium dense, silty, very fine- to coarse-grained SAND with few small to large gravel.	450	
37A	15/24 63%	ss	20-25 24-25 N=49	10			78	Dark gray (10YR4/1), wet, dense, silty, very fine- to coarse-grained SAND with few small to large gravel.	448	
							80	Dark gray (10YR4/1), wet, dense, silty, very fine- to coarse-grained SAND with trace small gravel.		

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: **Start:** 10/27/2015
Finish: 10/28/2015
WEATHER: Sunny, breezy, warm, lo-80s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA, macro-core sampler, split spoon sampler
FIELD STAFF: **Driller:** C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW8
Well ID: APW8
Surface Elev: 526.75 ft. MSL
Completion: 82.00 ft. BGS
Station: 3,839.59N
6,082.37E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 26, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 33.70 - During Drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
38A	18/24	ss	*26-26*	8				Dark gray (10YR4/1), wet, dense, silty, very fine- to coarse-grained SAND with trace small gravel. *[Continued from previous page]*		446	
38B	*75%*		*26-31* N=52	11		*4.50*	82	Dark gray (10YR4/1), moist, hard, SILT with little clay and few very fine- to coarse-grained sand.			

End of boring = 82.0 feet

NOTE(S): APW8 installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: **Start:** 10/27/2015
Finish: 10/27/2015
WEATHER: Cool, rainy, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: **Driller:** C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW10a
Well ID: APW10
Surface Elev: 521.98 ft. MSL
Completion: 45.94 ft. BGS
Station: 5,371.32N
11,541.23E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 25, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 36.00 - During Drilling
▼ =
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail / Elevation ft. MSL / Remarks

Blind drill - see APW4 boring log for lithology, sample, and testing data

NOTE(S): APW10 installed in borehole.
Lithology, sample, and testing data can be found on APW-4 Field Boring Log.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: **Start:** 10/27/2015
Finish: 10/27/2015
WEATHER: Cool, rainy, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: **Driller:** C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW10a
Well ID: APW10
Surface Elev: 521.98 ft. MSL
Completion: 45.94 ft. BGS
Station: 5,371.32N
11,541.23E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 25, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 36.00 - During Drilling
▼ =
▽ =

SAMPLE Number	SAMPLE Recov / Total (in) % *Recovery*	SAMPLE Type	TESTING *Blows / 6 in* N - Value **RQD**	TESTING Moisture (%)	TESTING Dry Den. (lb/ft³)	TESTING Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
							22	Yellowish brown (10YR5/6) with 5% gray (N6/1) mottles, moist, hard, SILT with little clay, few very fine-grained sand, and trace small gravel.		500	
							24			498	
							26			496	
							28	Yellowish brown (10YR5/4) with 5% dark yellowish brown (10YR4/6) and 5% gray (N6/1) mottles, moist, hard, SILT with little clay, few very fine-grained sand, and trace small gravel.		494	
							30			492	
							32			490	
							34			488	
							▼ 36	Brown (10YR5/3) with 5% gray (N6/1) mottles, moist, hard, SILT with little clay, few very fine-grained sand, and trace small gravel.		486	
							38			484	
							40	Brown (10YR5/3), wet, very dense, silty, very fine- to medium-grained SAND with trace small gravel.		482	

NOTE(S): APW10 installed in borehole.
Lithology, sample, and testing data can be found on APW-4 Field Boring Log.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Newton Energy Center
Location: Newton, Illinois
Project: 15E0030
DATES: **Start:** 10/27/2015
Finish: 10/27/2015
WEATHER: Cool, rainy, lo-50s

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" HSA

FIELD STAFF: **Driller:** C. Dutton
Helper: C. Jones
Eng/Geo: S. Keim

BOREHOLE ID: APW10a
Well ID: APW10
Surface Elev: 521.98 ft. MSL
Completion: 45.94 ft. BGS
Station: 5,371.32N
11,541.23E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Latona
Township: North Muddy
Section 25, **Tier** 6N; **Range** 8E

WATER LEVEL INFORMATION:
▼ = 36.00 - During Drilling
▼ =
▽ =

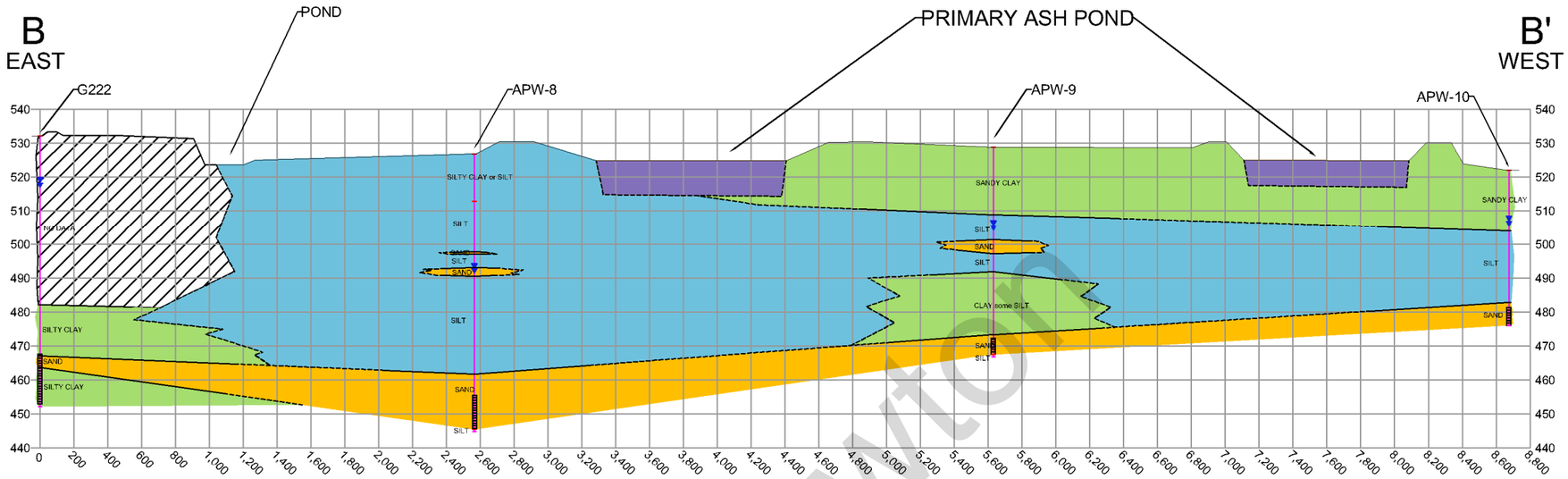
SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail / Elevation ft. MSL / Remarks
							42	Brown (10YR5/3), wet, very dense, silty, very fine- to medium-grained SAND with trace small gravel. *[Continued from previous page]*	480
							44		478

End of boring = 45.94 feet

NOTE(S): APW10 installed in borehole.
Lithology, sample, and testing data can be found on APW-4 Field Boring Log.

Attachment B

Geologic Cross Section B-B'

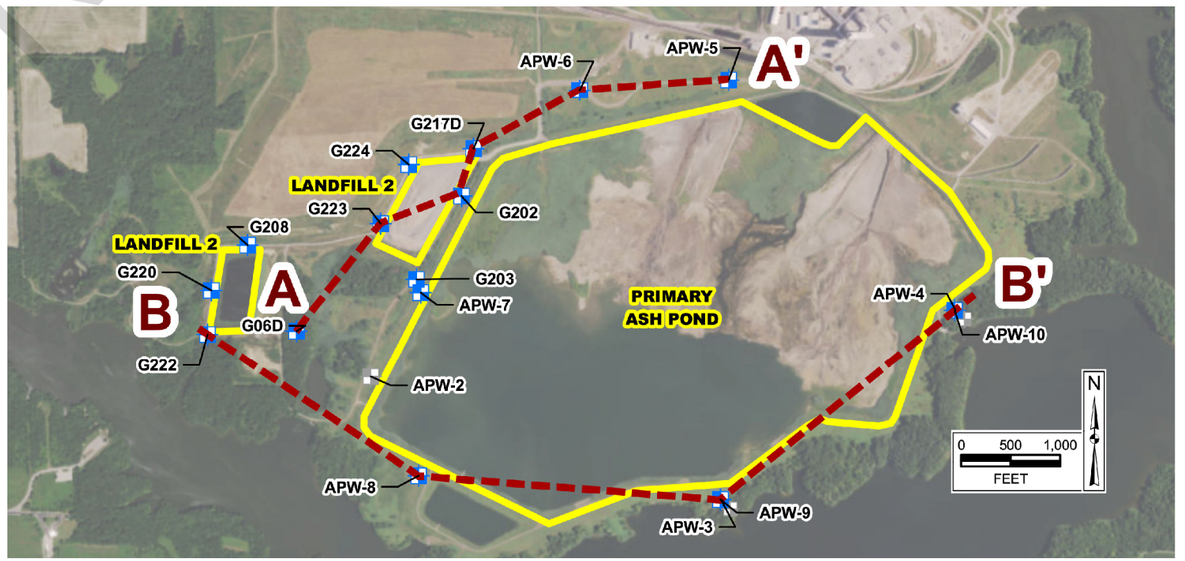


NO DATA
ASH
CLAY
SILT
SAND
WELL SCREEN
GROUNDWATER ELEVATION

NOTE THAT THE DEPTH OF THE ASH IN THE ASH POND IS APPROXIMATE.

VERTICAL SCALE IN FEET: 40
HORIZONTAL SCALE IN FEET: 800

VERTICAL EXAGGERATION =20



DRAWN BY: JMO DATE: 08/29/2017
CHECKED BY: TBN DATE: 10/2/2017
APPROVED BY: SJC DATE: 10/2/2017
DRAWING NO: Fig X_Geologic Cross-Section A-A'
REFERENCE: .

GEOLOGIC CROSS-SECTION B-B'

HYDROGEOLOGIC MONITORING PLAN

NEWTON POWER STATION
NEWTON, ILLINOIS

Natural Resource Technology
AN OBG COMPANY

PROJECT NO.
2285

FIGURE NO.
APPENDIX A-2

Attachment C

Mann-Kendall Trend Analysis

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW5**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line		
Slope (fitted to data):	-0.000004	mg/L per day
R-Squared error of fit:	0.016425	
Sen's Non-parametric estimate of the slope (One-Sided Test)		
Median Slope:	-0.000001	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000031	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000011	mg/L per day
Non-parametric Mann-Kendall Test for Trend		
S Statistic:	-0.417	
Z test:	1.645	
At the 95.0 % Confidence Level (One-Sided Test):	None	

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW6**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line		
Slope (fitted to data):	-0.000008	mg/L per day
R-Squared error of fit:	0.018309	
Sen's Non-parametric estimate of the slope (One-Sided Test)		
Median Slope:	0.000006	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000015	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000018	mg/L per day
Non-parametric Mann-Kendall Test for Trend		
S Statistic:	0.687	
Z test:	1.645	
At the 95.0 % Confidence Level (One-Sided Test):	None	

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW7**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line		
Slope (fitted to data):	0.000006	mg/L per day
R-Squared error of fit:	0.033439	
Sen's Non-parametric estimate of the slope (One-Sided Test)		
Median Slope:	0.000008	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000011	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000034	mg/L per day
Non-parametric Mann-Kendall Test for Trend		
S Statistic:	0.412	
Z test:	1.645	
At the 95.0 % Confidence Level (One-Sided Test):	None	

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW8**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line

Slope (fitted to data):	0.000019	mg/L per day
R-Squared error of fit:	0.342389	

Sen's Non-parametric estimate of the slope (One-Sided Test)

Median Slope:	0.000017	mg/L per day
Lower Confidence Limit of Slope, M1:	0.000003	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000039	mg/L per day

Non-parametric Mann-Kendall Test for Trend

S Statistic:	1.787
Z test:	1.645
At the 95.0 % Confidence Level (One-Sided Test):	Upward

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW9**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line		
Slope (fitted to data):	-0.000006	mg/L per day
R-Squared error of fit:	0.028627	
Sen's Non-parametric estimate of the slope (One-Sided Test)		
Median Slope:	-0.000001	mg/L per day
Lower Confidence Limit of Slope, M1:	-0.000026	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000028	mg/L per day
Non-parametric Mann-Kendall Test for Trend		
S Statistic:	0.000	
Z test:	1.645	
At the 95.0 % Confidence Level (One-Sided Test):	None	

Newton
Mann-Kendall Trend Analysis

User Supplied Information

Location ID:	**APW10**	**Parameter Code:**	**01022**
Location Class:		**Parameter:**	**B, tot**
Location Type:		**Units:**	**mg/L**
Confidence Level:	**95.00%**	**Period Length:**	**1 month(s)**
Date Range: 12/14/2015 to 03/31/2019		**Limit Name:**	
		Averaged:	**No**

Trend Analysis

Trend of the least squares straight line

Slope (fitted to data):	0.000011	mg/L per day
R-Squared error of fit:	0.304448	

Sen's Non-parametric estimate of the slope (One-Sided Test)

Median Slope:	0.000011	mg/L per day
Lower Confidence Limit of Slope, M1:	0.000000	mg/L per day
Upper Confidence Limit of Slope, M2+1:	0.000019	mg/L per day

Non-parametric Mann-Kendall Test for Trend

S Statistic:	1.722
Z test:	1.645
At the 95.0 % Confidence Level (One-Sided Test):	Upward

Attachment D

Coefficient of Variation Evaluation

Newton

Coefficient of Variation
Date Range: 12/14/2015 to 3/31/2019

Boron, total (mg/L)

Location	Count	Mean	Std Dev	% Non-Detects	CV
APW5	12	0.100	0.013	0.00	0.13
APW6	12	0.090	0.023	0.00	0.26
APW7	12	0.076	0.013	0.00	0.17
APW8	12	0.085	0.013	0.00	0.15
APW9	12	0.072	0.014	0.00	0.20
APW10	12	0.071	0.008	0.00	0.11

CV=Std Dev/ Mean