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2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

COFFEEN ASH POND NO. 1, COFFEEN POWER STATION

RAMBOLL Bright ideas. Sustainable change.

2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
COFFEEN ASH POND NO. 1, COFFEEN POWER STATION

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ACRONYMS AND ABBREVIATIONS

AP1	Ash Pond No. 1
ASD	Alternate Source Demonstration
CCR	Coal Combustion Residuals
GWPS	Groundwater Protection Standard
SSL	Statistically Significant Level

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 Coffeen Ash Pond No. 1 (AP1) located at Coffeen Power Station near Coffeen, Illinois.

Groundwater is being monitored at Coffeen AP1 in accordance with the Assessment Monitoring Program requirements specified in 40 C.F.R. § 257.95.

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

The following Statistically Significant Levels (SSLs) of 40 C.F.R. Part 257 Appendix IV parameters were determined during one or more sampling events in 2019:

- Cobalt at well G307

Alternate Source Demonstrations (ASDs) were completed for the SSLs referenced above and Coffeen AP1 remains in the Assessment 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 the Coffeen AP1 located at Coffeen Power Station near Coffeen, 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 the Coffeen AP1 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 Coffeen AP1 remains in the Assessment Monitoring Program in accordance with 40 C.F.R. § 257.95.

3. KEY ACTIONS COMPLETED IN 2019

The Assessment 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 (NRT/OBG, 2017a). All monitoring data obtained under 40 C.F.R. §§ 257.90 through 257.98 (as applicable) in 2019 are presented in Tables 1 and 2. Analytical data were evaluated in accordance with the Statistical Analysis Plan (NRT/OBG, 2017b) to determine any SSLs of Appendix IV parameters over Groundwater Protection Standards (GWPSs).

Statistical background values are provided in Table 3 and GWPSs in Table 4.

Analytical results for the May and August 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. § 257.95(g)(3)(ii). 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] Exceptions include:

- G307 was not sampled during the January 23, 2019 sampling event for the reasons presented in Section 4

Table A – 2018-2019 Assessment Monitoring Program Summary

Sampling Dates	Analytical Data Receipt Date	Parameters Collected	SSL(s)	SSL(s) Determination Date	ASD Completion Date
May 11, 14, and 30, 2018	July 16, 2018	Appendix III Appendix IV	NA	NA	NA
August 3, 2018	October 8, 2018	Appendix III Appendix IV Detected [1]	Cobalt (G307)	January 7, 2019	April 8, 2019
January 23, 2019	April 15, 2019	Appendix III Appendix IV	Cobalt (G307)	July 15, 2019	October 14, 2019
August 13-19, 2019	October 15, 2019	Appendix III Appendix IV Detected [1]	TBD	TBD	TBD

Notes:

NA: Not Applicable
TBD: To Be Determined
1. Groundwater sample analysis was limited to Appendix IV parameters detected in previous events in accordance with 40 C.F.R. § 257.95(d)(1).

4. PROBLEMS ENCOUNTERED AND ACTIONS TO RESOLVE THE PROBLEMS

Well G307 was frozen during the January 2019 sampling event (A2); therefore, it was not sampled. A packer was placed inside the well to reduce the liklihood of freezing during future monitoring events.

5. KEY ACTIVITIES PLANNED FOR 2020

The following key activities are planned for 2020:

- Continuation of the Assessment 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 GWPSs to determine whether an SSL of Appendix IV parameters has occurred.
- If an SSL is identified, potential alternate sources (i.e., a source other than the CCR unit caused the SSL or that that SSL 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 SSL, a written demonstration will be completed within 90 days of SSL 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 SSL, the applicable requirements of 40 C.F.R. §§ 257.94 through 257.98 (e.g., assessment of corrective measures) as may apply in 2020 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, Coffeen Ash Pond No. 1, Coffeen Power Station, Coffeen, 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
COFFEEN POWER STATION
UNIT ID 101 - COFFEEN ASH POND NO. 1
COFFEEN, ILLINOIS
ASSESSMENT 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												
G281	39.065405	-89.399322	1/23/2019 12:16	8.17	618.19	0.013	130	85	0.299	7.0	380	880
			8/13/2019 13:29	6.20	620.16	<0.010	140	72	0.546	6.9	310	900
G306	39.056494	-89.39356162	1/23/2019 17:29	7.35	618.37	2.4	170	4.1	0.269	7.0	250	900
			8/19/2019 13:19	6.73	618.99	2.5	160	4.4	0.413	7.0	260	780
Downgradient Monitoring Wells												
G301	39.059502	-89.395415	1/23/2019 14:29	9.42	613.23	2.1	170	21	0.272	7.0	850	1500
			8/19/2019 10:50	8.83	613.82	2.0	110	12	0.351	6.9	570	950
G302	39.059537	-89.393192	1/23/2019 15:33	12.75	607.29	1.9	210	20	0.267	7.0	500	1400
			8/19/2019 11:35	10.09	609.95	1.8	120	5.9	0.381	7.0	280	800
G303	39.057137	-89.39172	1/23/2019 16:38	7.69	614.33	1.8	190	30	0.300	7.0	760	1800
			8/19/2019 12:32	4.65	617.37	1.8	190	32	0.334	7.0	730	1700
G307	39.057205	-89.395663	1/23/2019 NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
			8/19/2019 14:10	0.39	624.33	2.1	280	18	1.37	7.0	1100	1600

[O: RAB 12/9/19, C: KLT 12/10/19]

Notes:

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

ft = foot/feet

mg/L = milligrams per liter

NS = Not Sampled

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.
2019 ANALYTICAL RESULTS - APPENDIX IV PARAMETERS
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
COFFEEN POWER STATION
UNIT ID 101 - COFFEEN ASH POND NO. 1
COFFEEN, ILLINOIS
ASSESSMENT MONITORING PROGRAM

Well Identification Number	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Date & Time Sampled	40 C.F.R. Part 257 Appendix IV														
				Antimony, total (mg/L) 6020A[1]	Arsenic, total (mg/L) 6020A[1]	Barium, total (mg/L) 6020A[1]	Beryllium, total (mg/L) 6020A[1]	Cadmium, total (mg/L) 6020A[1]	Chromium, total (mg/L) 6020A[1]	Cobalt, total (mg/L) 6020A[1]	Fluoride, total (mg/L) 6020A[1]	Lead, total (mg/L) 6020A[1]	Lithium, total (mg/L) 6020A[1]	Mercury, total (mg/L) 7470A[1]	Molybdenum, total (mg/L) 6020A[1]	Radium 226/228, Combined (pCi/L) 903/904[1]	Selenium, total (mg/L) 6020A[1]	Thallium, total (mg/L) 6020A[1]
Background / Upgradient Monitoring Wells																		
G281	39.065405	-89.399322	1/23/2019 12:16	<0.0030	<0.0010	0.0720	<0.0010	<0.0010	<0.0040	<0.0020	0.299	<0.0010	<0.01	<0.00020	<0.0010	0.333	<0.0010	<0.0010
			8/13/2019 13:29[2]	NA	0.0015	0.091	<0.0010	<0.0010	0.0048	<0.0020	0.546	0.0016	0.014	NA	<0.0010	0.879	<0.0010	NA
G306	39.056494	-89.39356162	1/23/2019 17:29	<0.0030	0.020	0.28	0.0013	<0.0010	0.071	0.020	0.269	0.028	0.036	<0.00020	0.0037	2.61	0.0028	<0.0010
			8/19/2019 13:19[2]	NA	0.0025	0.088	<0.0010	<0.0010	0.013	0.0024	0.413	0.0031	0.015	NA	0.0016	0.533	<0.0010	NA
Downgradient Monitoring Wells																		
G301	39.059502	-89.395415	1/23/2019 14:29	<0.0030	0.0045	0.11	<0.0010	<0.0010	0.017	0.0084	0.272	0.0086	<0.01	<0.00020	<0.0010	0.943	<0.0010	<0.0010
			8/19/2019 10:50[2]	NA	<0.0010	0.020	<0.0010	<0.0010	<0.0040	<0.0020	0.351	<0.0010	0.014	NA	<0.0010	1.60	<0.0010	NA
G302	39.059537	-89.393192	1/23/2019 15:33	<0.0030	0.013	0.095	<0.0010	<0.0010	0.019	0.0084	0.267	0.011	0.028	<0.00020	0.0029	1.29	0.0011	<0.0010
			8/19/2019 11:35[2]	NA	<0.0010	0.028	<0.0010	<0.0010	<0.0040	0.0056	0.381	<0.0010	0.020	NA	<0.0010	1.89	<0.0010	NA
G303	39.057137	-89.39172	1/23/2019 16:38	<0.0030	0.0031	0.015	<0.0010	<0.0010	<0.0040	<0.0020	0.300	<0.0010	0.033	<0.00020	0.0022	0.884	<0.0010	<0.0010
			8/19/2019 12:32[2]	NA	0.0036	0.016	<0.0010	<0.0010	<0.0040	0.0024	0.334	<0.0010	0.058	NA	0.0021	1.14	<0.0010	NA
G307	39.057205	-89.395663	1/23/2019 NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
			8/19/2019 14:10[2]	NA	0.0049	0.1100	<0.0010	0.027	0.025	0.0072	1.37	0.010	0.030	NA	0.0020	1.06	0.0012	NA

[O: RAB 12/9/19, C: KLT 12/10/19]

Notes:

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

mg/L = milligrams per liter

NA = Not Analyzed

NS = Not Sampled

pCi/L = picoCuries per liter

< = concentration is less than 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 Levels (SSLs) over Groundwater Protection Standards.

[1]4-digit numbers represent SW-846 analytical methods and 3-digit numbers represent Clean Water Act analytical methods.

[2]Only the parameters detected during the previous sampling events were analyzed during this sampling event, in accordance with 40 C.F.R. § 257.95(d)(1).

TABLE 3.
STATISTICAL BACKGROUND VALUES
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
COFFEEN POWER STATION
UNIT ID 101 - ASH POND NO. 1
COFFEEN, ILLINOIS
ASSESSMENT MONITORING PROGRAM

Parameter	Statistical Background Value (UPL)
40 C.F.R. Part 257 Appendix III	
Boron (mg/L)	2.90
Calcium (mg/L)	151
Chloride (mg/L)	75
Fluoride (mg/L)	0.459
pH (S.U.)	6.5 / 7.1
Sulfate (mg/L)	700
Total Dissolved Solids (mg/L)	884

[O: KLT 12/11/19, C: RAB 12/12/19]

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

TABLE 4.
GROUNDWATER PROTECTION STANDARDS
2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
COFFEEN POWER STATION
UNIT ID 101 - ASH POND NO. 1
COFFEEN, ILLINOIS
ASSESSMENT MONITORING PROGRAM

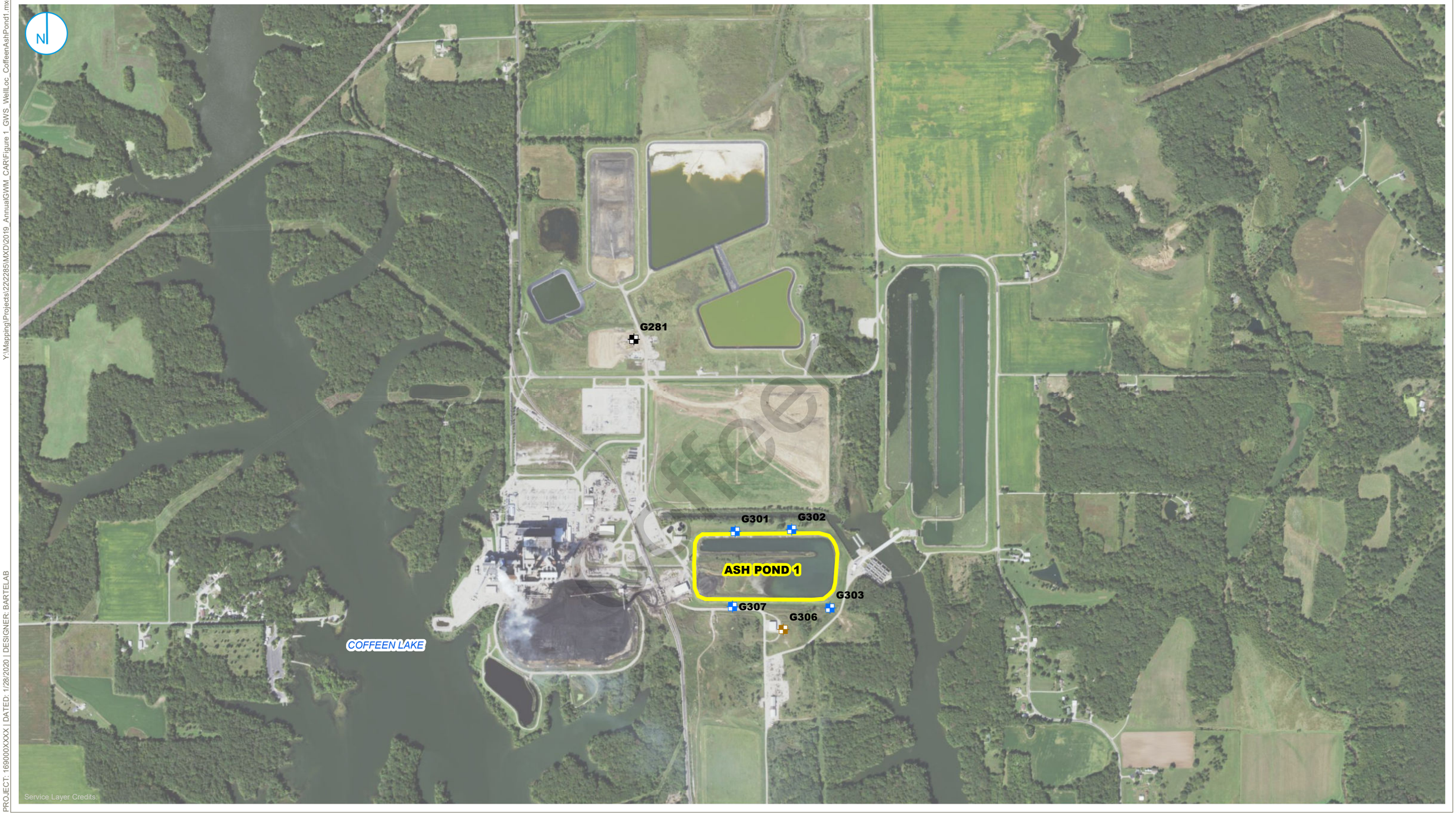
Parameter	Groundwater Protection Standard[1]
40 C.F.R. Part 257 Appendix IV	
Antimony (mg/L)	0.006
Arsenic (mg/L)	0.010
Barium (mg/L)	2
Beryllium (mg/L)	0.004
Cadmium (mg/L)	0.005
Chromium (mg/L)	0.10
Cobalt (mg/L)	0.006
Fluoride (mg/L)	4
Lead (mg/L)	0.015
Lithium (mg/L)	0.040
Mercury (mg/L)	0.002
Molybdenum (mg/L)	0.10
Radium 226+228 (pCi/L)	5
Selenium (mg/L)	0.05
Thallium (mg/L)	0.002

[O: KLT 12/11/19, C: RAB 12/12/19]

Notes:
40 C.F.R. = Title 40 of the Code of Federal Regulations
mg/L = milligrams per liter
pCi/L = picoCuries per liter
[1]Groundwater Protection Standard is the higher of the Maximum Contaminant Level / Health-Based Level or background.

FIGURES

Y:\Mapping\Projects\222285\MXD\2019_AnnualGWM_CAR\Figure 1_GWS_WellLoc_CoffeenAshPond1.mxd



PROJECT: 169000XXXX | DATED: 1/28/2020 | DESIGNER: BARTELAB

- UPGRADIENT MONITORING WELL LOCATION
- DOWNGRADIENT MONITORING WELL LOCATION
- BACKGROUND MONITORING WELL LOCATION
- CCR MONITORED UNIT

0 500 1,000 Feet

MONITORING WELL LOCATION MAP
COFFEEN ASH POND NO. 1
UNIT ID:101

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

FIGURE 1

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

RAMBOLL

APPENDIX A
ALTERNATE SOURCE DEMONSTRATIONS

40 C.F.R. § 257.95(g)(3)(ii): ALTERNATE SOURCE DEMONSTRATION
COFFEEN ASH POND NO. 1
APRIL 8, 2019

April 8, 2019

Title 40 of the Code of Federal Regulations (C.F.R.) § 257.95(g)(3)(ii) allows the owner or operator of a Coal Combustion Residuals (CCR) unit 90 days from the date of determination of Statistically Significant Levels (SSLs) over groundwater protection standards of groundwater constituents listed in Appendix IV of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSL(s), or that the SSL(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 Dynegy Midwest Generation, LLC (DMG), by OBG, part of Ramboll (OBG) to provide pertinent information pursuant to 40 C.F.R. § 257.95(g)(3)(ii) for the Coffeen Ash Pond No. 1 (AP1), located near Coffeen, Illinois.

Initial background groundwater monitoring, consisting of a minimum of eight samples, as required under 40 C.F.R. § 257.94(b), was initiated in December 2015 and completed prior to October 17, 2017. Comparison of background groundwater quality with concentrations of parameters in downgradient monitoring wells, observed during the November 2017 Detection Monitoring Program sampling event, identified a statistically significant increase (SSI) for one or more 40 C.F.R. Part 257 Appendix III parameters at AP1. Consequently, and in accordance with 40 C.F.R. § 257.94(e), an assessment monitoring program, in accordance with 40 C.F.R. § 257.95, was established by April 9, 2018, for AP1.

The first Assessment Monitoring sampling event was completed on May 29, 2018. In accordance with 40 C.F.R. § 257.95(d)(1), all wells were resampled on August 3, 2018, for all Appendix III parameters and Appendix IV parameters detected during the first Assessment Monitoring sampling event. Analytical data from the resampling event was evaluated in accordance with the statistical analysis plan[1] to determine any SSIs of Appendix III parameters over background concentrations or statistically significant levels (SSLs) of Appendix IV parameters over Groundwater Protection Standards (GWPSs). That evaluation identified SSLs at downgradient monitoring wells as follows:

- Cobalt at well G304/G307

G304 was replaced by G307 in July 2016; G307 is screened in the same geologic, unit and at a similar elevation, as G304. Data for samples collected from G304 from 2015-2016 is pooled for statistical purposes with data for samples collected subsequently from G307.

Pursuant to 40 C.F.R. § 257.95(g)(3)(ii), the following demonstrates that sources other than the AP1 were the cause of the SSL listed above. This alternate source demonstration (ASD) was completed within 90 days of determination of the SSLs (January 9, 2019), as required by 40 C.F.R. § 257.95(g)(3)(ii).

ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

This ASD is based on the following lines of evidence (LOE):

1. Cobalt is absent from AP1 source water.
2. AP1 is in close proximity to historic coal mining activity for Herrin (No. 6) Coal, which contains cobalt

[1] Natural Resource Technology, an OBG Company, 2017, Statistical Analysis Plan, Duck Creek Power Station, Edwards Power Station, Illinois Power Resources Generating, LLC, October 17, 2017.

These lines of evidence are described and supported in greater detail below. Monitoring wells and source water sample locations are shown in Attachment A.

LOE #1: COBALT IS ABSENT FROM AP1 SOURCE WATER.

Cobalt was not detected in source water samples from AP1, collected from multiple pond surface water locations (Attachment A). A time series for cobalt concentrations is provided in Figure 1.

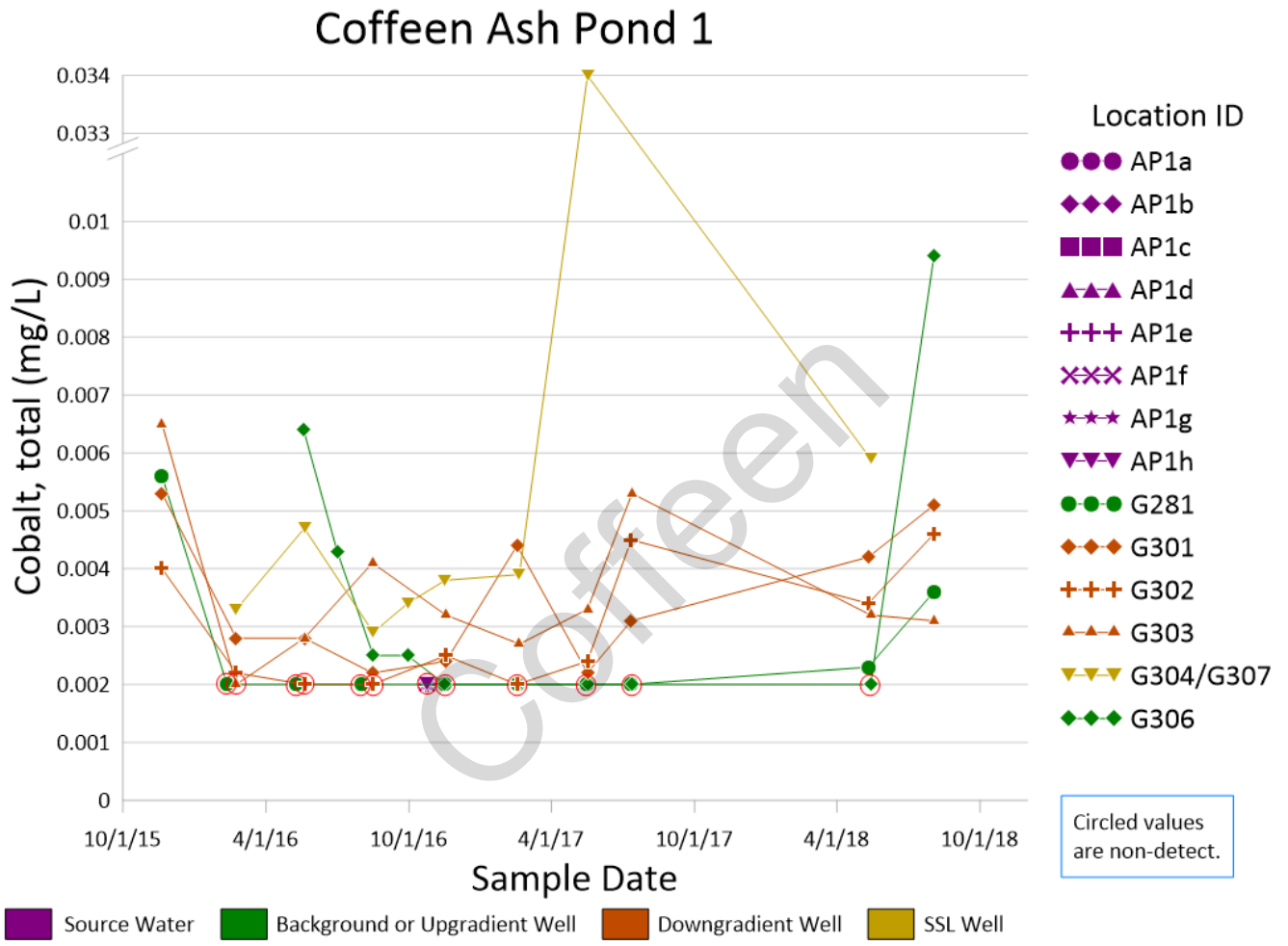


Figure 1. Time series showing cobalt concentrations in G307 compared to source water from AP1.

The following observations can be made from Figure 1:

- Cobalt was not detected in source water samples from AP1.
- Groundwater from background well G281 and upgradient well G306 has detections of cobalt (between 0.0023 and 0.02 mg/L) during multiple groundwater monitoring events.

For AP1 to be the source of cobalt in groundwater, cobalt would have to be present in AP1 source water, specifically at concentrations greater than those detected in the groundwater. Therefore, AP1 is not the source of the cobalt observed in groundwater, including G304/G307. Cobalt was also detected in background well G281 and upgradient well G306, indicating that cobalt concentrations are either naturally occurring due to geochemical variations within the Uppermost Aquifer or from upgradient anthropogenic sources.

LOE #2: AP1 IS IN CLOSE PROXIMITY TO HISTORIC COAL MINING ACTIVITY FOR HERRIN (NO. 6) COAL WHICH CONTAINS COBALT.

The area below and surrounding AP1 is associated with mined and unmined Herrin (No. 6) Coal, which was in production through 1983. Coal was mined at depths of approximately 500 feet below ground surface. The extent of the surrounding mine, and its associated features, are shown in Attachment B. Two shafts associated with the mine were located in close proximity to SSL well G304/G307 and background well G306.

Historic aerials are suggestive of coal storage in close proximity to G305, G306, and G307 (Figure 2), and upgradient of G307 with regard to groundwater flow (Figure 3). Small amounts of coal were observed to be mixed within the upper layers of soil in the boring for G306; associated boring logs are provided in Attachment C.

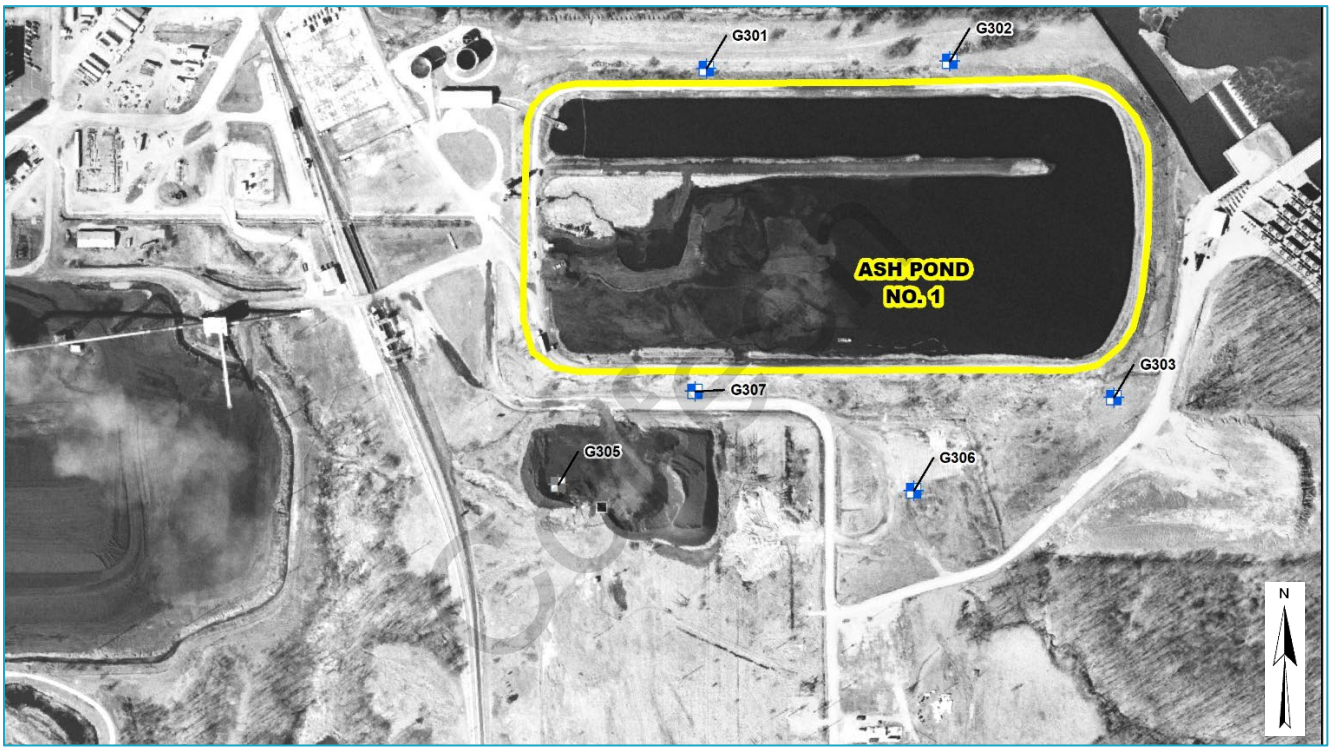


Figure 2. An aerial photograph from April 2005[2] shows potential coal storage near G307 and G306, and a mine shaft (black box) near G305. Groundwater generally flows from the southwest to the northeast across AP1.

A review by the Illinois State Geological Survey (ISGS) of coal quality in Montgomery County near AP1 indicated the presence of cobalt within the Herrin (No. 6) Coal at concentrations between 1.4 and 7.0 ppm[3]. Background well G306, for which small amounts of coal were observed in the associated soil boring, has demonstrated

[2] USGS, April 8, 2005. USGS EROS Archive – Aerial Photography – Digital Orthophoto Quadrangle (DOQs), 3.75-minute Quadrangle. https://www.usgs.gov/centers/eros/science/usgs-eros-archive-aerial-photography-digital-orthophoto-quadrangle-doqs?qt-science_center_objects=0#qt-science_center_objects. Accessed October 1, 2019.
[3] Illinois State Geological Survey (ISGS), 2019. Coal Quality Data: Coal Maps and Data, Prairie Research Institute, https://www.isgs.illinois.edu/sites/isgs/files/maps/coal-maps/strat-database/coal-quality-nonconf.xls.

elevated concentrations of cobalt. Background well G281, which is the monitoring well farthest outside of the historic coal mine footprint buffer, has the lowest detections of cobalt of AP1 monitoring wells.

Analytical samples collected by ISGS from Montgomery County also indicate a greater sulfur content in the Herrin (No. 6) Coal (median 4.6%) , which is considered a medium- to high-sulfur coal (3-5%).[4] A study of groundwater quality near surface coal mines, performed by the U.S. Geological Survey (USGS) provides data on the effects of mines on groundwater quality.[5] The study used Piper diagrams to evaluate regional differences in major ion composition of groundwater in areas mined for high-sulfur coal and unmined areas. Groundwater samples collected from wells downgradient of the reclaimed mine areas evaluated in the study have a broad range of carbonate-bicarbonate anions, as well as moderate to high concentrations of calcium cations in high-sulfur coal regions. Groundwater samples collected from AP1 monitoring wells reflect a broad distribution of carbonate-bicarbonate anions and moderate concentrations of calcium cations, similar to those from the USGS study. Piper diagrams in Figures 4 and 5 present this graphically.

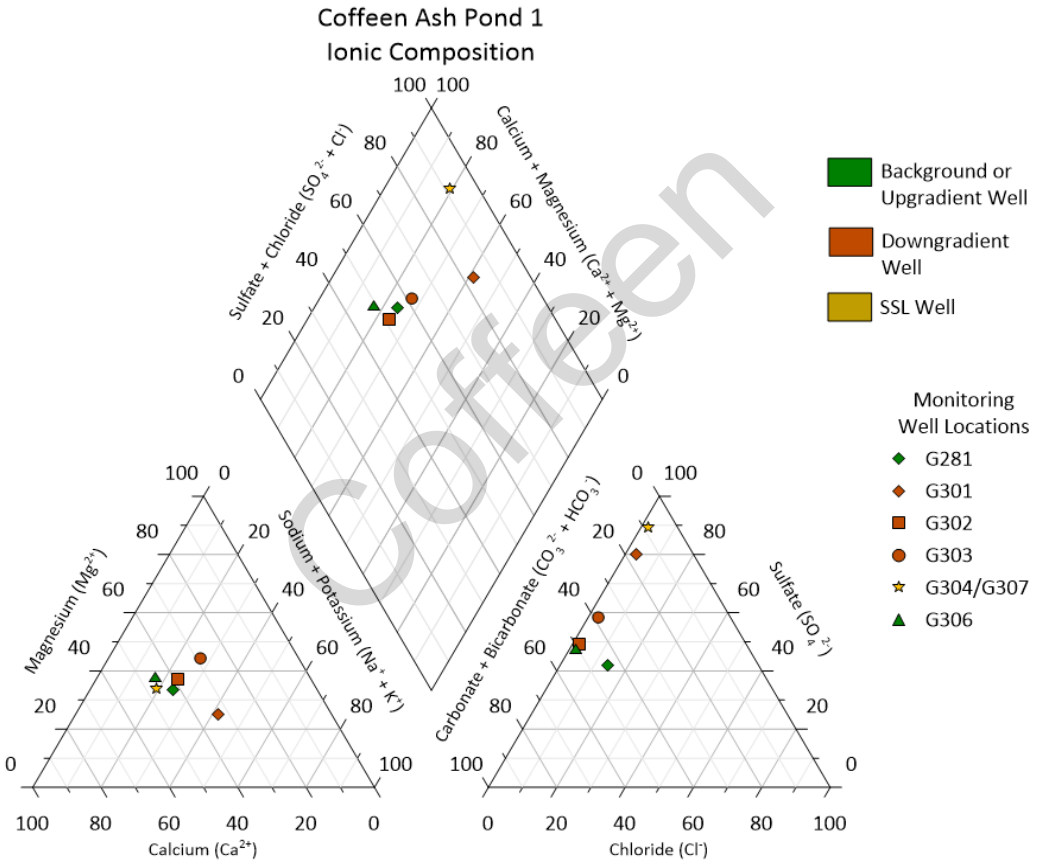


Figure 4. Piper diagram showing ionic composition of groundwater at AP1.

[4] Keystone Coal Industry Manual, 2010. New York: Mining Informational Services of the McGraw-Hill Mining Publications, pp. 456-468.
[5] "Ground-Water Quality in Unmined Areas and Near Reclaimed Surface Coal Mines in the Northern and Central Appalachian Coal Regions, Pennsylvania and West Virginia", Scientific Investigations Report 2006-5059, US Geological Survey, 2006.

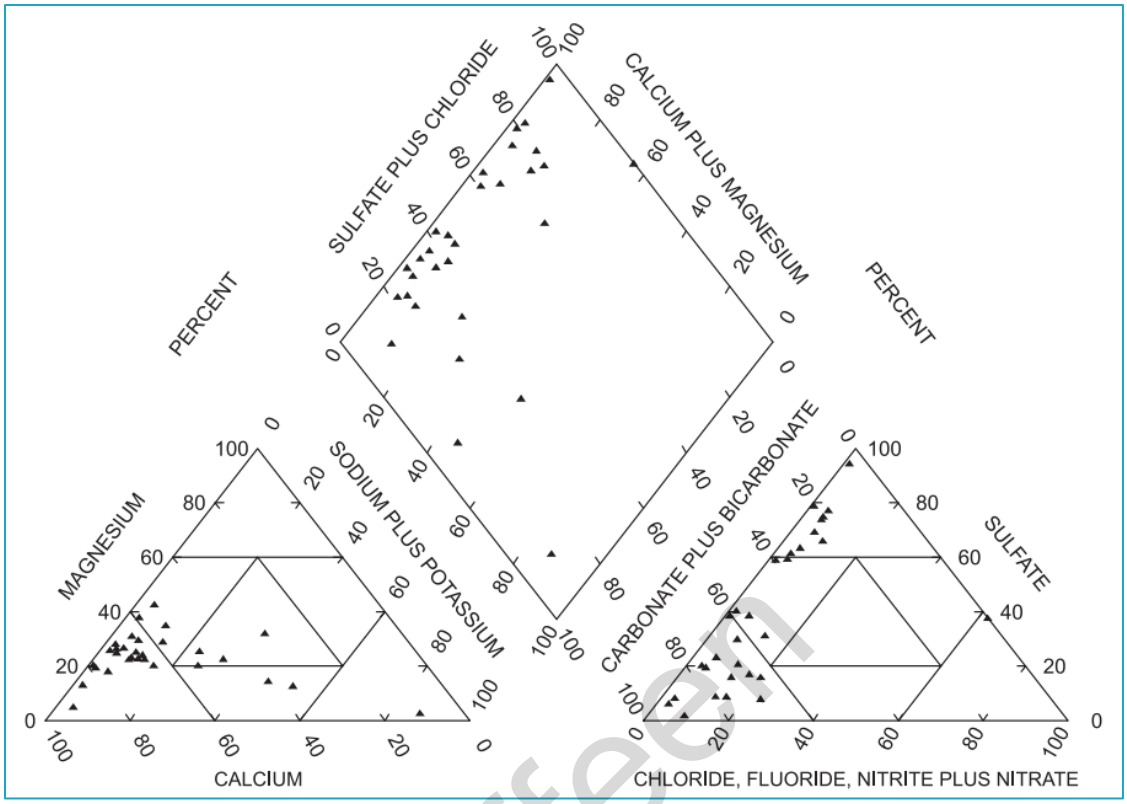


Figure 5. Piper diagram showing ionic composition of groundwater downgradient of reclaimed surface coal mines in high-sulfur coal regions (modified from USGS).

State of Illinois groundwater quality regulations (Illinois Administrative Code [IAC] Title 35 Part 620 Groundwater Quality) acknowledge that water quality is adversely affected in areas where coal mining activity has occurred, which are consistent with water quality exceedances at G307.

The absence of cobalt in the AP1 surface water, combined with the presence of cobalt in Herrin (No. 6) Coal, suggests that cobalt concentrations in AP1 monitoring wells are influenced by the surrounding coal mines and associated mining activity (e.g., storage on the ground surface).

Based on these two lines of evidence, it has been demonstrated that Coffeen Ash Pond No. 1 has not caused the SSL in G307.

This information serves as the written alternate source demonstration prepared in accordance with 40 C.F.R. § 257.95(g)(3)(ii) that the SSL observed during the assessment monitoring program was not due to the CCR unit, but was from a combination of naturally-occurring conditions and potential upgradient anthropogenic impacts. Therefore, a corrective measures assessment is not required and AP1 will remain in assessment monitoring.

Attachments:

Figure 3	Groundwater Elevation Contour Map
Attachment A	Sample Location Map
Attachment B	Herrin (No. 6) Coal Mine Extent Map
Attachment C	G305 and G306 Boring Logs

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: April 8, 2019

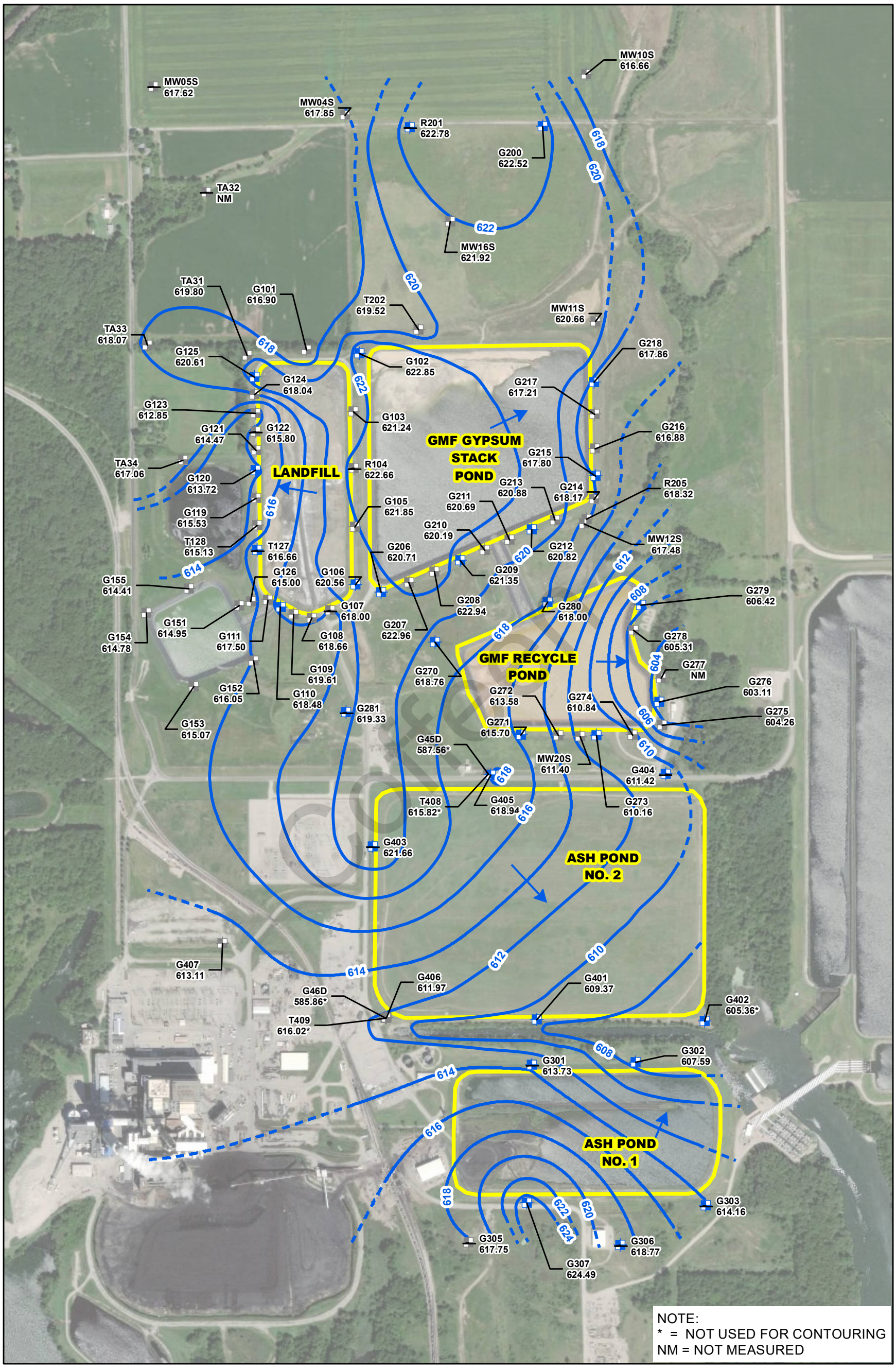
I, Nicole M. Pagano, a professional geologist in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used for other than its intended purpose and meaning, or for extrapolations beyond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

Nicole M. Pagano
Professional Geologist
196-000750
O'Brien & Gere Engineers, Inc., part of Ramboll
Date: April 8, 2019

Attachments

Figures

FIGURE 3



LEGEND

- CCR RULE MONITORING WELL LOCATION
- NON-CCR RULE MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- CCR MONITORED UNIT

COFFEEN ASH POND NO. 1 (UNIT ID: 101), COFFEEN ASH POND NO. 2 (UNIT ID: 102), COFFEEN GMF GYPSUM STACK POND (UNIT ID: 103), COFFEEN GMF RECYCLE POND (UNIT ID: 104) AND COFFEEN LANDFILL (UNIT ID: 105)
GROUNDWATER ELEVATION CONTOUR MAP
MAY 8, 2018

ALTERNATE SOURCE DEMONSTRATION
COFFEEN POWER STATION
COFFEEN, ILLINOIS

0 150 300 600
Feet

N

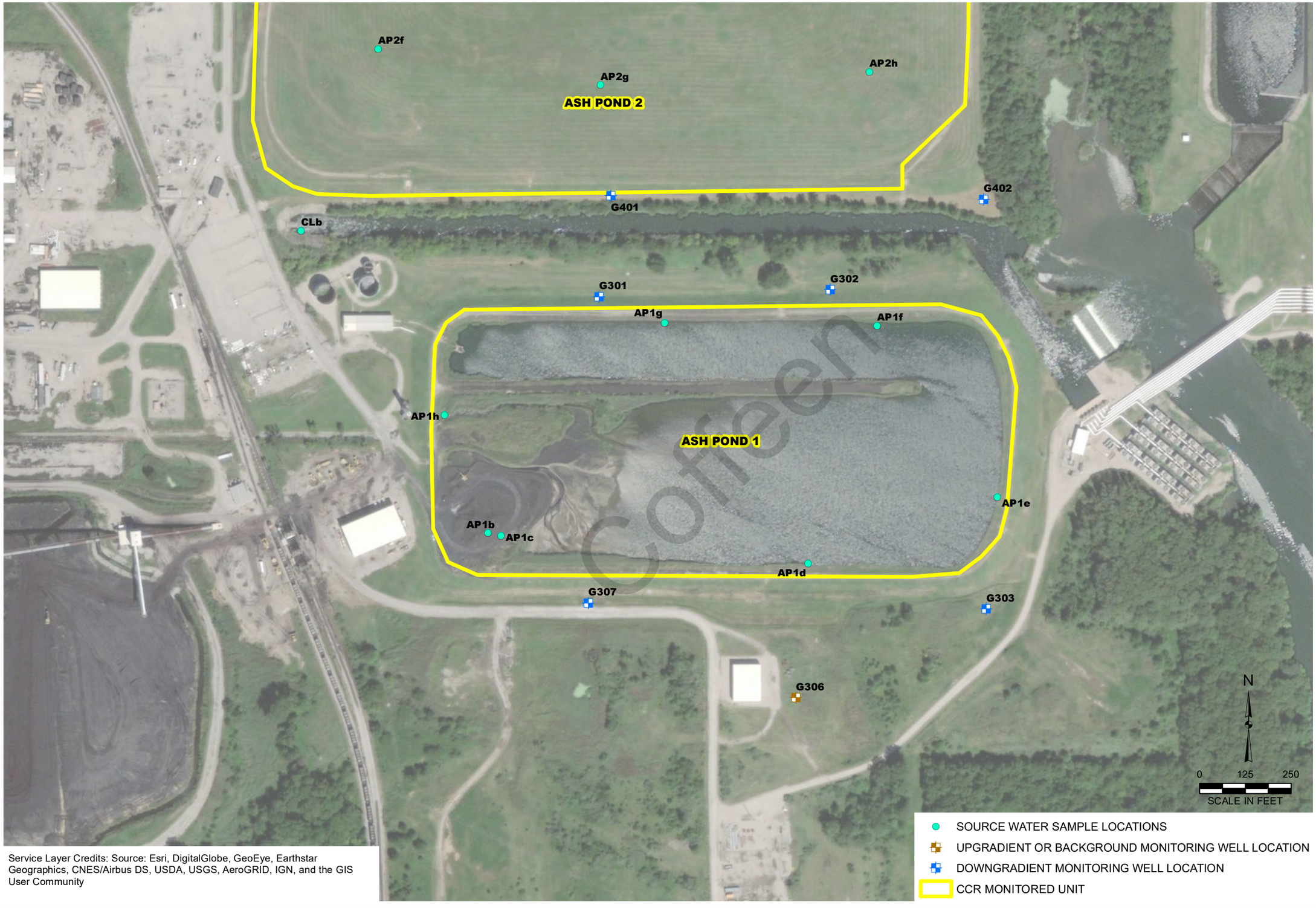
FILE_NO. 70099
DATE 8/1/2018

O'BRIEN & GERE ENGINEERS, INC.

Y:\Mapping\Projects\22\2285\MXD\GW_Contours\Round_2018_2Q\R2018_2Q_Coffeen_GW_Contours.mxd

Attachment A

Sample Location Map



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 4/8/19
REVIEWED BY/DATE: KLT 4/8/19
APPROVED BY/DATE: KLT 4/8/19

SAMPLE LOCATION MAP
COFFEEN ASH POND 1

ALTERNATE SOURCE DEMONSTRATION
COFFEEN POWER STATION
COFFEEN, ILLINOIS

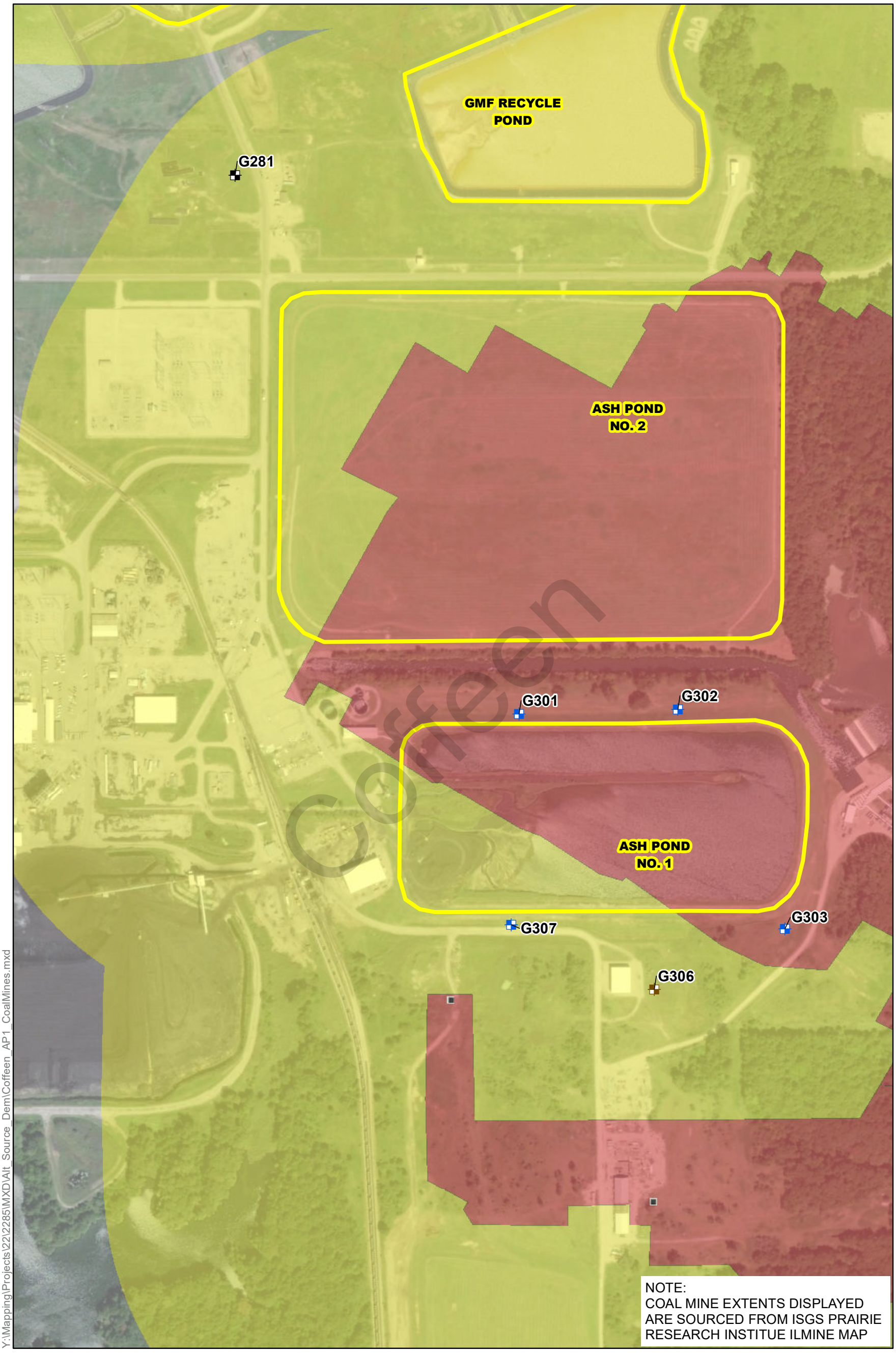
PROJECT NO: 72856

ATTACHMENT A

OBG
Part of Ramboll

Attachment B

Herrin (No. 6) Coal Mine Extent Map



CCR RULE MONITORING WELL
UPGRADIENT MONITORING WELL
BACKGROUND MONITORING WELL
CCR MONITORED UNIT
COAL MINE SHAFT
UNDERGROUND MINE BOUNDARY
UNDERGROUND MINE BUFFER REGION

HERRIN COAL MINE EXTENT MAP

40 CFR § 257.95(g)(3)(ii): ALTERNATE SOURCE DEMONSTRATION
COFFEEN ASH POND NO. 1
COFFEEN POWER STATION
COFFEEN, ILLINOIS

0 150 300 600
Feet

N

O'BRIEN & GERE ENGINEERS, INC.

Attachment C

G305 and G306 Boring Logs

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Coffeen Power Station
Location: Coffeen, Illinois
Project: 15E0030
DATES: **Start:** 5/3/2016
Finish: 5/3/2016
WEATHER: Cloudy, breezy, warm, lo 60s

CONTRACTOR: Ramsey Geotechnical Engineering LLC
Rig mfg/model: D-50 Turbo Tracked MST 800ATV
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: G305
Well ID: G305
Surface Elev: 622.54 ft. MSL
Completion: 18.45 ft. BGS
Station: 2,515,199.36N
871,156.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Coffeen, IL
Township: East Fork
Section 14, **Tier** 7N; **Range** 3W

WATER LEVEL INFORMATION:
▼ = 3.00 - 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
1A	14/24 58%	SS	2-2 5-7 N=7	12			0	FILL - Grayish brown (10YR5/2), moist, soft, silty CLAY with few small to coarse sand and few small to large gravel.	622	
							1	FILL - Black (10YR2/1), moist, loose, silty, fine- to coarse-grained SAND with little coal fragments.		
2A	17/24 71%	SS	6-7 7-6 N=14	19			2	Gray (10YR6/1) and light yellowish brown (10YR6/4), moist, very stiff, SILT with little clay.	620	
							3			
3A	18/24 75%	SS	3-3 6-4 N=9	28			4	Gray (10YR5/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, very stiff, silty CLAY with trace very fine-grained sand.	618	
							5			
4A	16/24 67%	SS	6-6 7-8 N=13	24			6	Gray (10YR5/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, stiff, silty CLAY with trace very fine- to coarse-grained sand.	616	
							7			
5A	23/24 96%	SS	1-3 5-6 N=8	21			8	Dark gray (10YR4/1) with 25% dark yellowish brown (10YR4/6) mottles, moist, very stiff, silty CLAY with few fine- to coarse-grained sand and trace small gravel.	614	
							9			
6A	21/24 88%	SS	3-4 6-6 N=10	21			10	Gray (10YR5/1) with 35% dark yellowish brown (10YR4/6) mottles, moist, very stiff, silty CLAY with few fine- to coarse-grained sand and trace small gravel.	612	
							11			
7A	24/24 100%	SS	8-8 9-9 N=17	18			12	Yellowish brown (10YR5/8) with 15% gray (10YR5/1) mottles, moist, very stiff, silty CLAY with few fine- to coarse-grained sand and trace small gravel.	610	
							13			
8A	19/24 79%	SS	3-3 4-4 N=7	18			14	Gray (10YR5/1) with 15% yellowish brown (10YR5/6) mottles, moist, stiff, silty CLAY with little fine- to coarse-grained sand and trace small gravel.	608	
							15	Gray (10YR5/1) with 15% yellowish brown (10YR5/6) mottles, moist, stiff, silty CLAY with some fine- to coarse-grained sand and trace small gravel.		
9A	22/24 92%	SS	1-3 7-14 N=10	19			16	Brown (10YR5/3), wet, loose, very silty, very fine- to coarse-grained SAND with trace small gravel.	606	
							17			
9B	0/5 0%	BD		15			18	Brown (10YR5/3) with 40% yellowish brown (10YR5/8) mottles, moist, very stiff, SILT with little clay and trace fine- to coarse-grained sand.		

End of boring = 18.45 feet

NOTE(S): G305 installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Coffeen Power Station
Location: Coffeen, Illinois
Project: 15E0030
DATES: **Start:** 5/3/2016
Finish: 5/3/2016
WEATHER: Sunny, calm, warm, lo 60s

CONTRACTOR: Ramsey Geotechnical Engineering LLC
Rig mfg/model: D-50 Turbo Tracked MST 800ATV
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: G306
Well ID: G306
Surface Elev: 622.84 ft. MSL
Completion: 18.00 ft. BGS
Station: 2,516,120.41N
871,140.98E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Coffeen, IL
Township: East Fork
Section 14, **Tier** 7N; **Range** 3W

WATER LEVEL INFORMATION:
▼ = 5.50 - 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	12/24 50%	ss	1-3 3-4 N=6	14			0	Very dark brown (10YR2/2), moist, medium, SILT with little clay and few very fine- to medium-grained sand, roots, trace coal fragments.		622	
2A	24/24 100%	ss	5-4 5-4 N=9	21			2	Dark gray (10YR4/1) with 5% dark yellowish brown (10YR3/6) mottles, moist, stiff, SILT with little clay and trace very fine- to medium-grained sand.		620	
2B				19			4	Gray (10YR6/1) with 10% yellowish brown (10YR5/6) mottles, moist, very stiff, SILT with little clay and trace very fine-grained sand.		618	
3A	22/24 92%	ss	2-2 3-3 N=5	30			6	Gray (10YR6/1) with 20% yellowish brown (10YR5/6) mottles, moist, very stiff, SILT with some clay and trace very fine-grained sand.		616	
4A	20/24 83%	ss	3-4 6-6 N=10	26			8	Gray (10YR5/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, very stiff, silty CLAY with trace very fine- to coarse-grained sand.		614	
5A	24/24 100%	ss	2-2 3-3 N=5	23			10			612	
6A	22/24 92%	ss	1-2 3-4 N=5	20			12	Gray (10YR5/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, stiff, silty CLAY with few very fine- to coarse-grained sand.		610	
7A	20/24 83%	ss	5-6 6-6 N=12	21			14	Yellowish brown (10YR5/6), wet, soft, very fine- to coarse-grained sandy CLAY with little silt.		608	
8A	20/24 83%	ss	2-2 8-14 N=10	15			16	Yellowish brown (10YR5/6), wet, medium dense, silty, very fine- to medium-grained SAND with trace coarse-grained sand.		606	
8B				12				Yellowish brown (10YR5/6), moist, dense, fine- to coarse-grained SAND with little silt, little very fine-grained sand, and trace small gravel.			
9A	23/24 96%	ss	14-17 28-50/5" N=45	10			18	Brown (10YR5/3) with 20% dark yellowish brown (10YR4/6) mottles, moist, hard, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel.			
9B				13				**End of boring = 18.0 feet**			

NOTE(S): G306 installed in borehole.

40 C.F.R. § 257.95(g)(3)(ii): ALTERNATE SOURCE DEMONSTRATION
COFFEEN ASH POND NO. 1
OCTOBER 14, 2019

October 14, 2019

Title 40 of the Code of Federal Regulations (C.F.R.) § 257.95(g)(3)(ii) allows the owner or operator of a Coal Combustion Residuals (CCR) unit 90 days from the date of determination of Statistically Significant Levels (SSLs) over groundwater protection standards (GWPSs) of groundwater constituents listed in Appendix IV of 40 C.F.R. Part 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSL(s), or that the SSL(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 Dynegy Midwest Generation, LLC (DMG), by O'Brien & Gere Engineers, Inc., part of Ramboll (OBG), to provide pertinent information pursuant to 40 C.F.R. § 257.95(g)(3)(ii) for the Coffeen Ash Pond No. 1 (AP1), located near Coffeen, Illinois.

The second Assessment Monitoring sampling event (A2) was completed on January 21-23, 2019, and analytical data were received on April 15, 2019. Analytical data from all sampling events, from December 2015 through A2, were evaluated in accordance with the Statistical Analysis Plan[1], to determine any Statistically Significant Increases (SSIs) of Appendix III parameters over background concentrations, or SSLs of Appendix IV parameters over Groundwater Protection Standards (GWPSs). That evaluation identified SSLs at downgradient monitoring wells as follows:

- Cobalt at well G304/G307

G304 was replaced by G307 in July 2016; G307 is screened in the same geologic, unit and at a similar elevation, as G304. Data for samples collected from G304 from 2015-2016 is pooled for statistical purposes with data for samples collected subsequently from G307.

Pursuant to 40 C.F.R. § 257.95(g)(3)(ii), the following lines of evidence demonstrate that sources other than the Baldwin Bottom Ash Pond were the cause of the SSLs listed above. This alternate source demonstration (ASD) was completed by October 14, 2019, within 90 days of determination of the SSLs (July 15, 2019), as required by 40 C.F.R. § 257.95(g)(3)(ii).

ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

As allowed by 40 C.F.R. § 257.94(g)(3), this ASD demonstrates that sources other than Coffeen AP1 (the CCR unit) caused the SSL. Lines of evidence supporting this ASD include the following:

1. Cobalt is absent from AP1 source water.
2. AP1 is in close proximity to historic coal mining activity for Herrin (No. 6) Coal, which contains cobalt

These lines of evidence are described and supported in greater detail below. Monitoring wells and source water sample locations are shown in Attachment A.

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

LOE #1: COBALT IS ABSENT FROM AP1 SOURCE WATER.

Cobalt was not detected in source water samples from AP1, collected from multiple pond surface water locations (Attachment A). A time series for cobalt concentrations is provided in Figure 1.

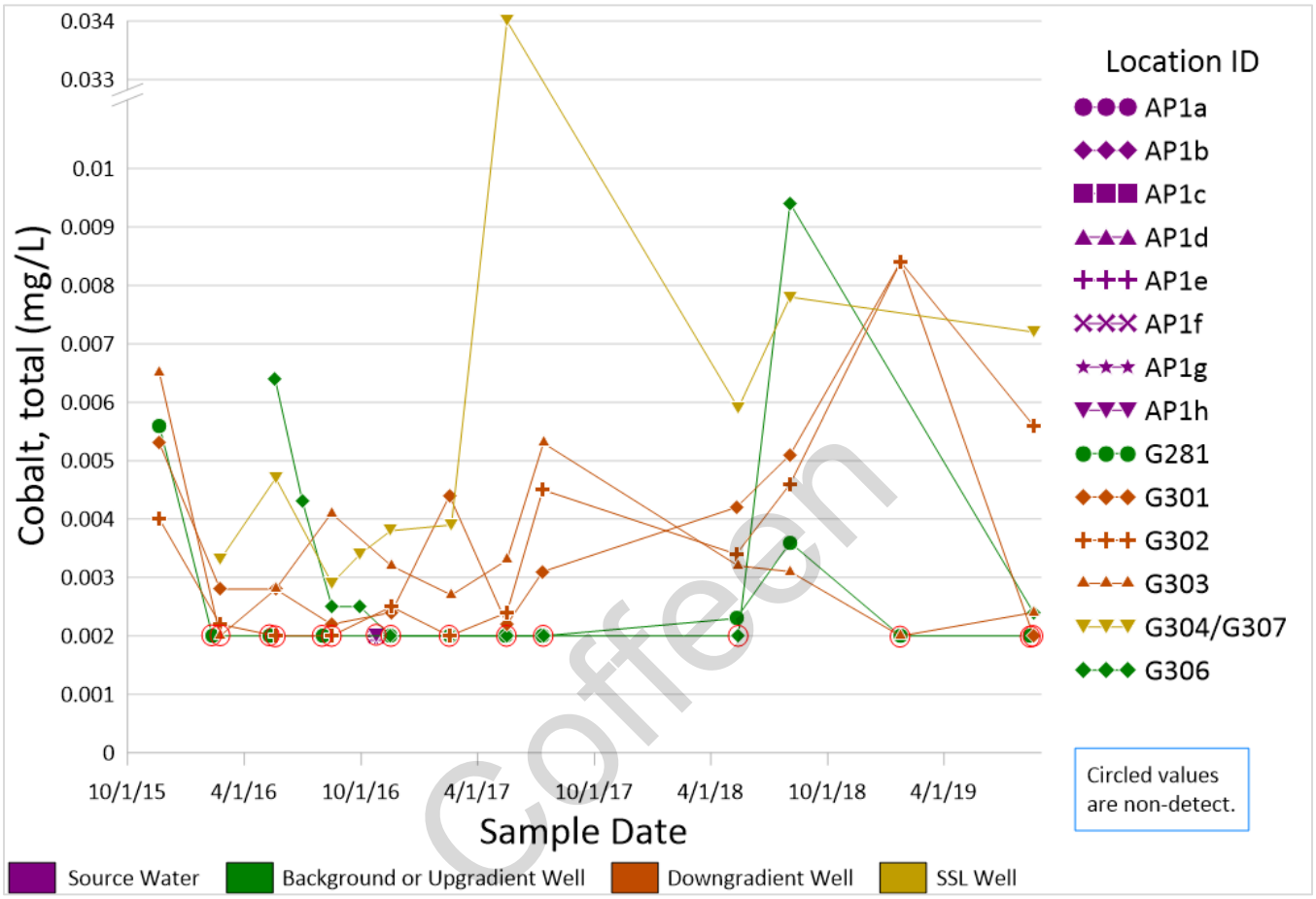


Figure 1. Time series showing cobalt concentrations in G307 compared to source water from AP1.

The following observations can be made from Figure 1:

- Cobalt was not detected in source water samples from AP1.
- Groundwater from background well G281 and upgradient well G306 has detections of cobalt (between 0.0023 and 0.02 mg/L) during multiple groundwater monitoring events.

For AP1 to be the source of cobalt in groundwater, cobalt would have to be present in AP1 source water, specifically at concentrations greater than those detected in the groundwater. Therefore, AP1 is not the source of the cobalt observed in groundwater, including G304/G307. Cobalt was also detected in background well G281 and upgradient well G306, indicating that cobalt concentrations are either naturally occurring due to geochemical variations within the Uppermost Aquifer or from upgradient anthropogenic sources.

LOE #2: AP1 IS IN CLOSE PROXIMITY TO HISTORIC COAL MINING ACTIVITY FOR HERRIN (NO. 6) COAL WHICH CONTAINS COBALT.

The area below and surrounding AP1 is associated with mined and unmined Herrin (No. 6) Coal, which was in production through 1983. Coal was mined at depths of approximately 500 feet below ground surface. The extent

of the surrounding mine, and its associated features, are shown in Attachment B. Two shafts associated with the mine were located in close proximity to SSL well G304/G307 and background well G306.

Historic aerials are suggestive of coal storage in proximity to G305, G306, and G307 (Figure 2), and upgradient of G307 with regard to groundwater flow (Figure 3; attached). Small amounts of coal were observed to be mixed within the upper layers of soil in the boring for G306; associated boring logs are provided in Attachment C.

Figure 2. An aerial photograph from April 2005[2] shows potential coal storage near G307 and G306, and a mine shaft (black box) near G305. Groundwater generally flows from the southwest to the northeast across AP1.

A review by the Illinois State Geological Survey (ISGS) of coal quality in Montgomery County near AP1 indicated the presence of cobalt within the Herrin (No. 6) Coal at concentrations between 1.4 and 7.0 ppm[3]. Background well G306, for which small amounts of coal were observed in the associated soil boring, has demonstrated elevated concentrations of cobalt. Background well G281, which is the monitoring well farthest outside of the historic coal mine footprint buffer, has the lowest detections of cobalt of AP1 monitoring wells.

Analytical samples collected by ISGS from Montgomery County also indicate a greater sulfur content in the Herrin (No. 6) Coal (median 4.6%) , which is considered a medium- to high-sulfur coal (3-5%).[4] A study of

[2] USGS, April 8, 2005. USGS EROS Archive – Aerial Photography – Digital Orthophoto Quadrangle (DOQs), 3.75-minute Quadrangle. https://www.usgs.gov/centers/eros/science/usgs-eros-archive-aerial-photography-digital-orthophoto-quadrangle-doqs?qt-science_center_objects=0#qt-science_center_objects. Accessed October 1, 2019.

[3] Illinois State Geological Survey (ISGS), 2019. Coal Quality Data: Coal Maps and Data, Prairie Research Institute, https://www.isgs.illinois.edu/sites/isgs/files/maps/coal-maps/strat-database/coal-quality-nonconf.xls.

[4] Keystone Coal Industry Manual, 2010. New York: Mining Informational Services of the McGraw-Hill Mining Publications, pp. 456-468.

groundwater quality near surface coal mines, performed by the U.S. Geological Survey (USGS) provides data on the effects of mines on groundwater quality.[5] The study used Piper diagrams to evaluate regional differences in major ion composition of groundwater in areas mined for high-sulfur coal and unmined areas. Groundwater samples collected from wells downgradient of the reclaimed mine areas evaluated in the study have a broad range of carbonate-bicarbonate anions, as well as moderate to high concentrations of calcium cations in high-sulfur coal regions. Groundwater samples collected from AP1 monitoring wells reflect a broad distribution of carbonate-bicarbonate anions and moderate concentrations of calcium cations, similar to those from the USGS study. Piper diagrams in Figures 4 and 5 present this graphically.

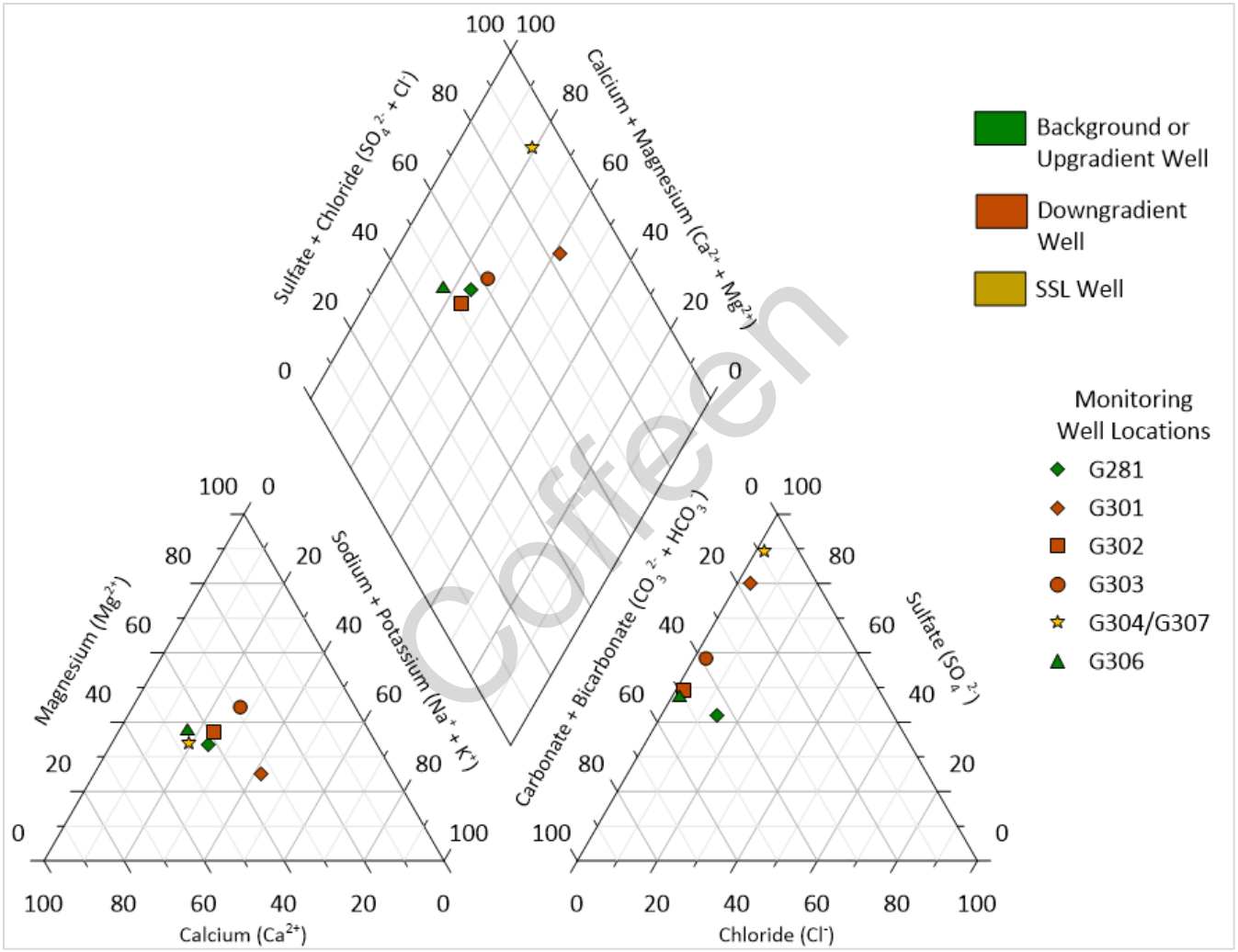


Figure 4. Piper diagram showing ionic composition of groundwater at AP1.

[5] "Ground-Water Quality in Unmined Areas and Near Reclaimed Surface Coal Mines in the Northern and Central Appalachian Coal Regions, Pennsylvania and West Virginia", Scientific Investigations Report 2006-5059, US Geological Survey, 2006.

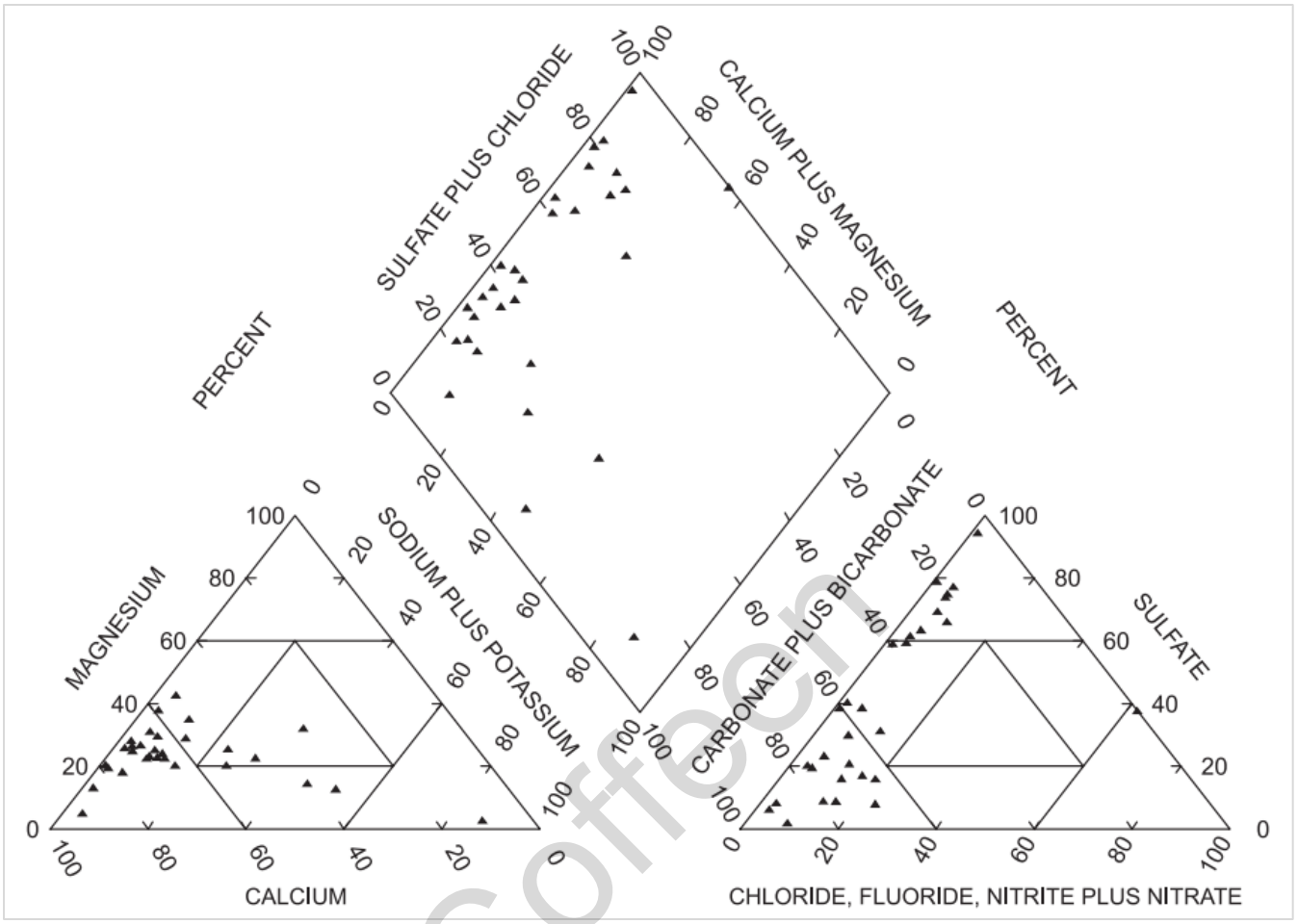


Figure 3. Piper diagram showing ionic composition of groundwater downgradient of reclaimed surface coal mines in high-sulfur coal regions (modified from USGS).

State of Illinois groundwater quality regulations (Illinois Administrative Code [IAC] Title 35 Part 620 Groundwater Quality) acknowledge that water quality is adversely affected in areas where coal mining activity has occurred, which would be consistent with water quality exceedances at G307.

The absence of cobalt in the AP1 surface water, combined with the presence of cobalt in Herrin (No. 6) Coal, suggests that cobalt concentrations in AP1 monitoring wells are influenced by the surrounding coal mines and associated mining activity (e.g., storage on the ground surface).

Based on these two lines of evidence, it has been demonstrated that Coffeen Ash Pond No. 1 has not caused the SSL in G307.

This information serves as the written alternate source demonstration prepared in accordance with 40 C.F.R. § 257.95(g)(3)(ii) that the SSL observed during the assessment monitoring program was not due to the CCR unit, but was from a combination of naturally-occurring conditions and potential upgradient anthropogenic impacts. Therefore, a corrective measures assessment is not required and AP1 will remain in assessment monitoring.

Attachments:

Figure 3	Groundwater Elevation Contour Map
Attachment A	Sample Location Map
Attachment B	Herrin (No. 6) Coal Mine Extent Map
Attachment C	G305 and G306 Boring Logs

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.

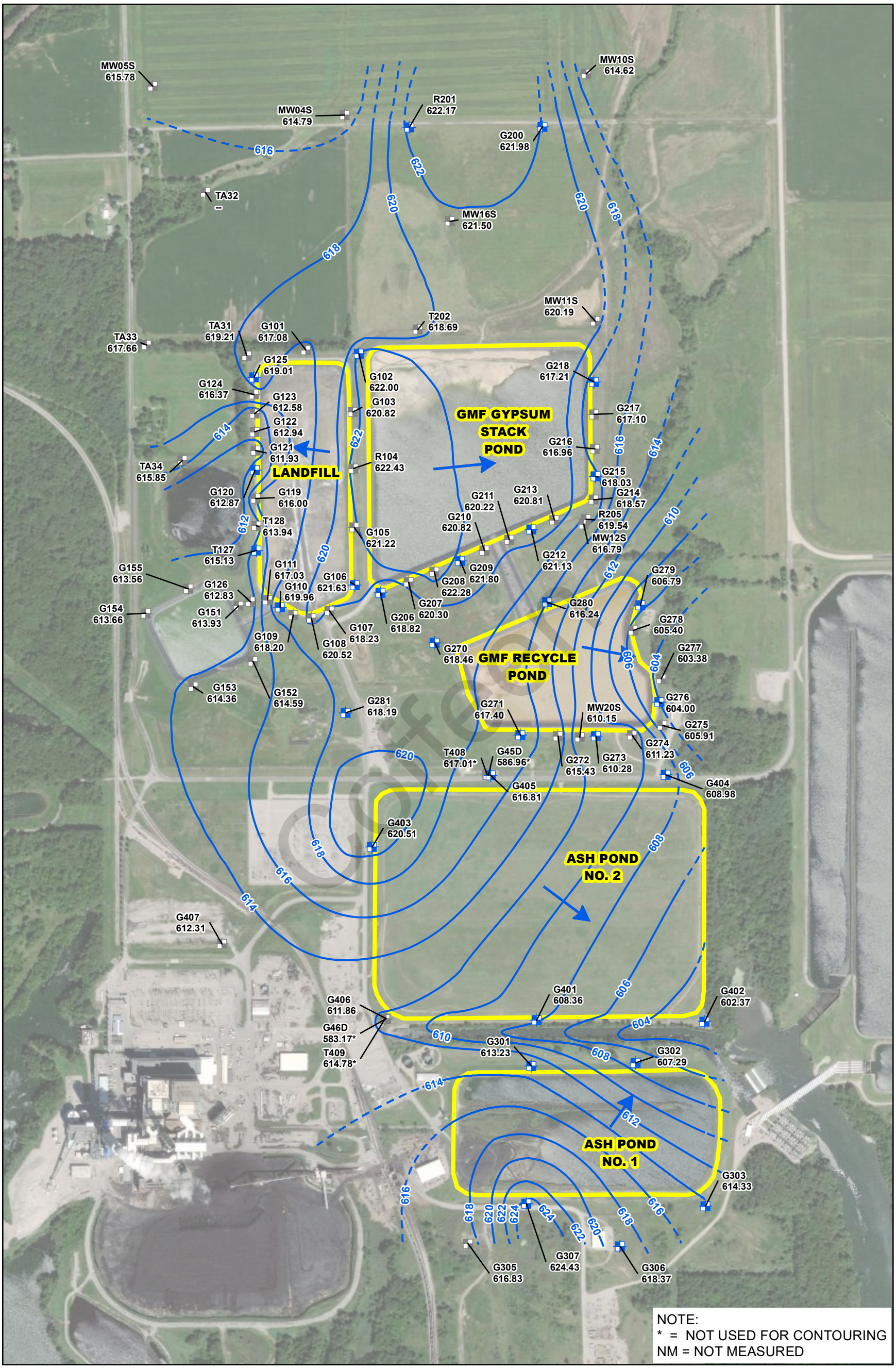
Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
O'Brien & Gere Engineers, Inc., a Ramboll Company
Date: October 14, 2019

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



NOTE:
* = NOT USED FOR CONTOURING
NM = NOT MEASURED

- CCR RULE MONITORING WELL LOCATION
- NON-CCR RULE MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- CCR MONITORED UNIT

COFFEEN ASH POND NO. 1 (UNIT ID: 101), COFFEEN ASH POND NO. 2 (UNIT ID: 102), COFFEEN GMF GYPSUM STACK POND (UNIT ID: 103), COFFEEN GMF RECYCLE POND (UNIT ID: 104) AND COFFEEN LANDFILL (UNIT ID: 105)
GROUNDWATER ELEVATION CONTOUR MAP
JANUARY 15, 2019

ALTERNATE SOURCE DEMONSTRATION
COFFEEN POWER STATION
COFFEEN, ILLINOIS

0 150 300 600
Feet

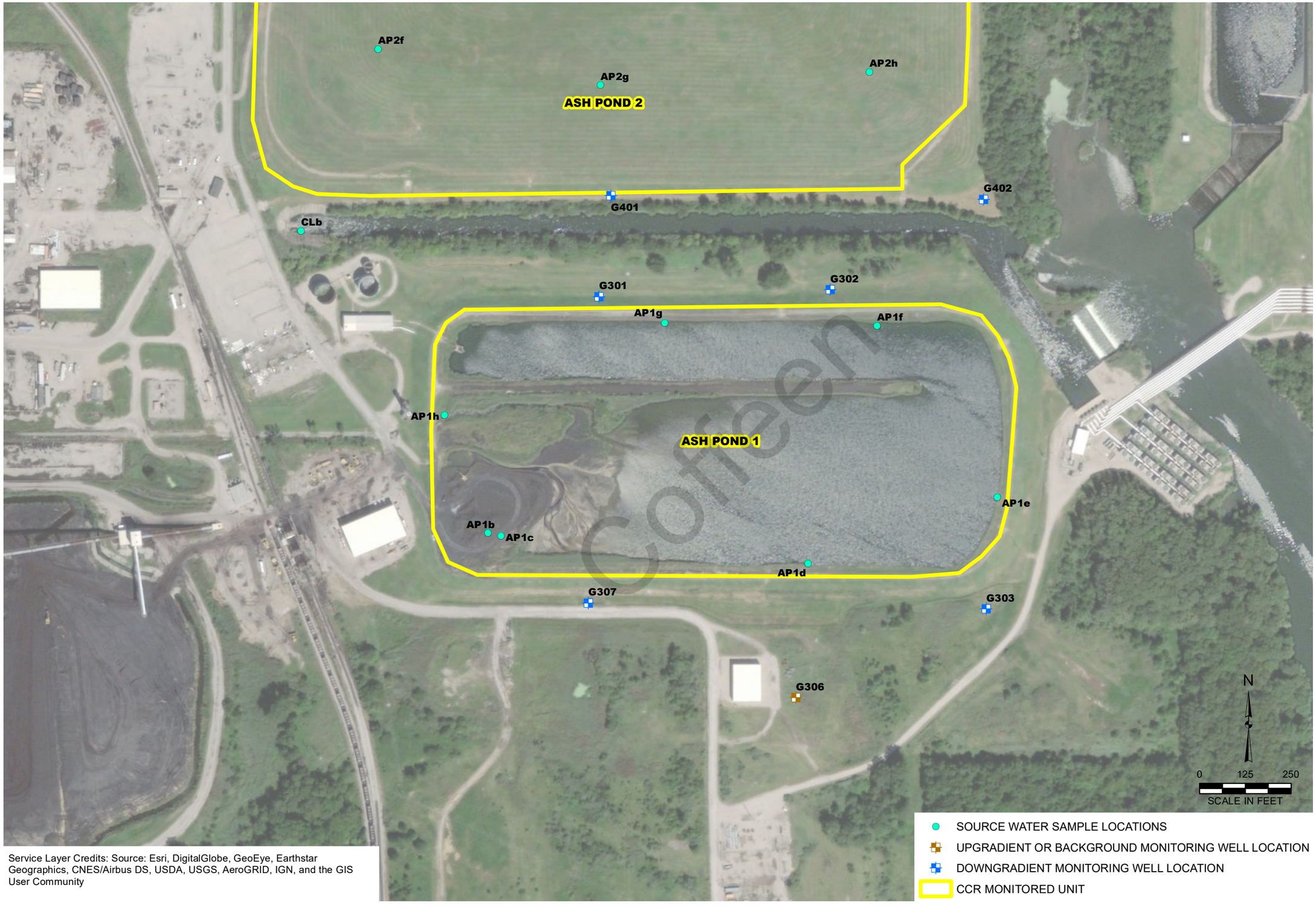
N

O'BRIEN & GERE ENGINEERS, INC.

Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Dem\Coffeen_GMF_GSP\R2019_1Q_Coffeen_GW_Contours.mxd

Attachment A

Sample Location Map



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 4/8/19
REVIEWED BY/DATE: KLT 4/8/19
APPROVED BY/DATE: KLT 4/8/19

SAMPLE LOCATION MAP
COFFEEN ASH POND 1

ALTERNATE SOURCE DEMONSTRATION
COFFEEN POWER STATION
COFFEEN, ILLINOIS

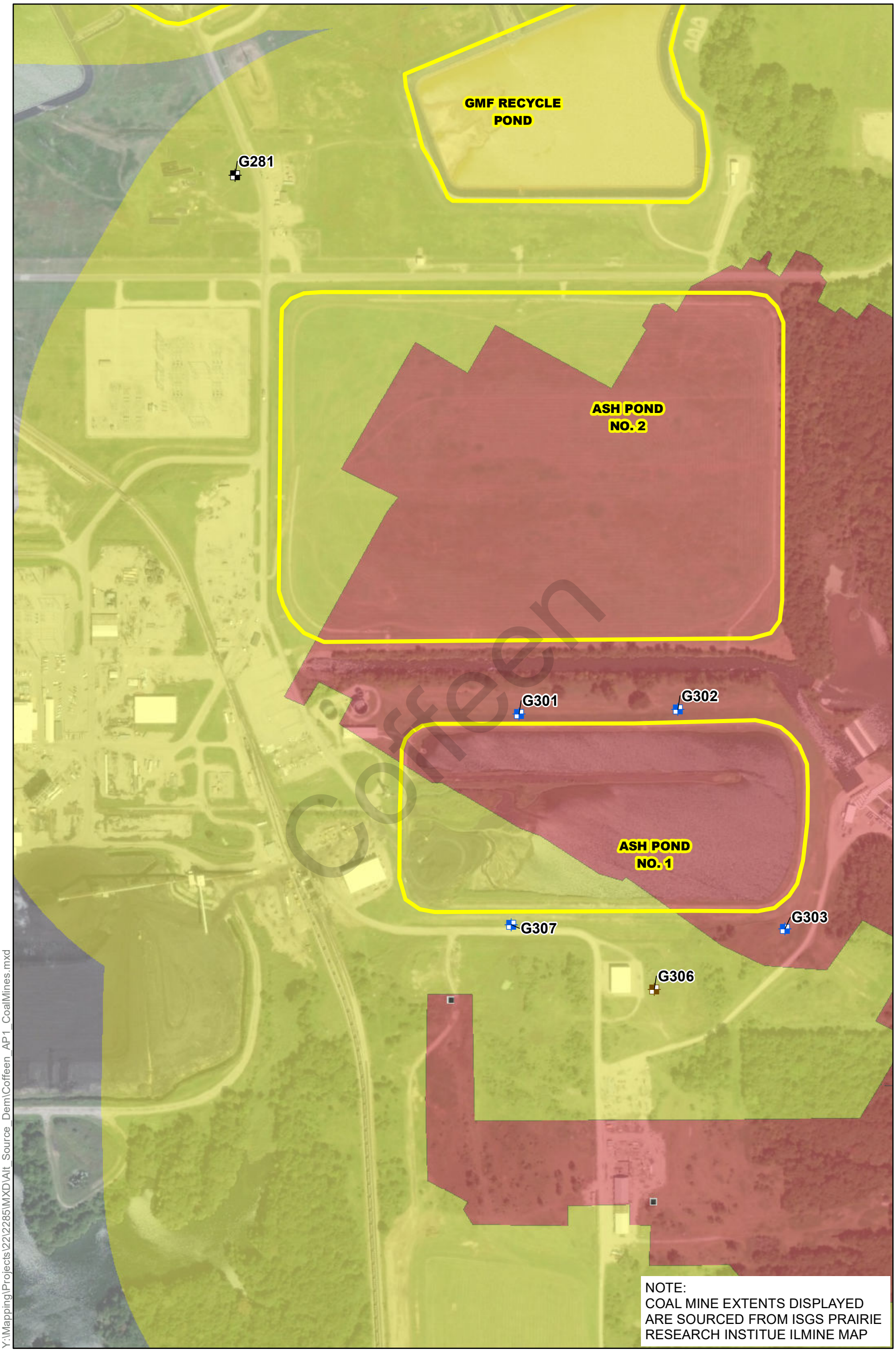
FIGURE 1

OBG
Part of Ramboll

Y:\Mapping\Projects\222285\MXD\Coffeen_CMA_Figs\AttachA_Coffeen AP1 Sample Locs.mxd Author: STOLZSD:

Attachment B

Herrin (No. 6) Coal Mine Extent Map



CCR RULE MONITORING WELL
UPGRADIENT MONITORING WELL
BACKGROUND MONITORING WELL
CCR MONITORED UNIT
COAL MINE SHAFT
UNDERGROUND MINE BOUNDARY
UNDERGROUND MINE BUFFER REGION

HERRIN COAL MINE EXTENT MAP

40 CFR § 257.95(g)(3)(ii): ALTERNATE SOURCE DEMONSTRATION
COFFEEN ASH POND NO. 1
COFFEEN POWER STATION
COFFEEN, ILLINOIS

0 150 300 600
Feet

N

O'BRIEN & GERE ENGINEERS, INC.

Attachment C

G305 and G306 Boring Logs

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Coffeen Power Station
Location: Coffeen, Illinois
Project: 15E0030
DATES: **Start:** 5/3/2016
Finish: 5/3/2016
WEATHER: Cloudy, breezy, warm, lo 60s

CONTRACTOR: Ramsey Geotechnical Engineering LLC
Rig mfg/model: D-50 Turbo Tracked MST 800ATV
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: G305
Well ID: G305
Surface Elev: 622.54 ft. MSL
Completion: 18.45 ft. BGS
Station: 2,515,199.36N
871,156.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Coffeen, IL
Township: East Fork
Section 14, **Tier** 7N; **Range** 3W

WATER LEVEL INFORMATION:
▼ = 3.00 - 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
1A	14/24 58%	SS	2-2 5-7 N=7	12			0	FILL - Grayish brown (10YR5/2), moist, soft, silty CLAY with few small to coarse sand and few small to large gravel.	622	
							1	FILL - Black (10YR2/1), moist, loose, silty, fine- to coarse-grained SAND with little coal fragments.		
2A	17/24 71%	SS	6-7 7-6 N=14	19			2	Gray (10YR6/1) and light yellowish brown (10YR6/4), moist, very stiff, SILT with little clay.	620	
							3			
3A	18/24 75%	SS	3-3 6-4 N=9	28			4	Gray (10YR5/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, very stiff, silty CLAY with trace very fine-grained sand.	618	
							5			
4A	16/24 67%	SS	6-6 7-8 N=13	24			6	Gray (10YR5/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, stiff, silty CLAY with trace very fine- to coarse-grained sand.	616	
							7			
5A	23/24 96%	SS	1-3 5-6 N=8	21			8	Dark gray (10YR4/1) with 25% dark yellowish brown (10YR4/6) mottles, moist, very stiff, silty CLAY with few fine- to coarse-grained sand and trace small gravel.	614	
							9			
6A	21/24 88%	SS	3-4 6-6 N=10	21			10	Gray (10YR5/1) with 35% dark yellowish brown (10YR4/6) mottles, moist, very stiff, silty CLAY with few fine- to coarse-grained sand and trace small gravel.	612	
							11			
7A	24/24 100%	SS	8-8 9-9 N=17	18			12	Yellowish brown (10YR5/8) with 15% gray (10YR5/1) mottles, moist, very stiff, silty CLAY with few fine- to coarse-grained sand and trace small gravel.	610	
							13			
8A	19/24 79%	SS	3-3 4-4 N=7	18			14	Gray (10YR5/1) with 15% yellowish brown (10YR5/6) mottles, moist, stiff, silty CLAY with little fine- to coarse-grained sand and trace small gravel.	608	
							15	Gray (10YR5/1) with 15% yellowish brown (10YR5/6) mottles, moist, stiff, silty CLAY with some fine- to coarse-grained sand and trace small gravel.		
9A	22/24 92%	SS	1-3 7-14 N=10	19			16	Brown (10YR5/3), wet, loose, very silty, very fine- to coarse-grained SAND with trace small gravel.	606	
							17			
9B	0/5 0%	BD		15			18	Brown (10YR5/3) with 40% yellowish brown (10YR5/8) mottles, moist, very stiff, SILT with little clay and trace fine- to coarse-grained sand.		

End of boring = 18.45 feet

NOTE(S): G305 installed in borehole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Coffeen Power Station
Location: Coffeen, Illinois
Project: 15E0030
DATES: **Start:** 5/3/2016
Finish: 5/3/2016
WEATHER: Sunny, calm, warm, lo 60s

CONTRACTOR: Ramsey Geotechnical Engineering LLC
Rig mfg/model: D-50 Turbo Tracked MST 800ATV
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: G306
Well ID: G306
Surface Elev: 622.84 ft. MSL
Completion: 18.00 ft. BGS
Station: 2,516,120.41N
871,140.98E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Coffeen, IL
Township: East Fork
Section 14, **Tier** 7N; **Range** 3W

WATER LEVEL INFORMATION:
▼ = 5.50 - 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	12/24 50%	ss	1-3 3-4 N=6	14			0	Very dark brown (10YR2/2), moist, medium, SILT with little clay and few very fine- to medium-grained sand, roots, trace coal fragments.		622	
2A	24/24 100%	ss	5-4 5-4 N=9	21			2	Dark gray (10YR4/1) with 5% dark yellowish brown (10YR3/6) mottles, moist, stiff, SILT with little clay and trace very fine- to medium-grained sand.		620	
2B				19			4	Gray (10YR6/1) with 10% yellowish brown (10YR5/6) mottles, moist, very stiff, SILT with little clay and trace very fine-grained sand.		618	
3A	22/24 92%	ss	2-2 3-3 N=5	30			6	Gray (10YR6/1) with 20% yellowish brown (10YR5/6) mottles, moist, very stiff, SILT with some clay and trace very fine-grained sand.		616	
4A	20/24 83%	ss	3-4 6-6 N=10	26			8	Gray (10YR5/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, very stiff, silty CLAY with trace very fine- to coarse-grained sand.		614	
5A	24/24 100%	ss	2-2 3-3 N=5	23			10			612	
6A	22/24 92%	ss	1-2 3-4 N=5	20			12	Gray (10YR5/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, stiff, silty CLAY with few very fine- to coarse-grained sand.		610	
7A	20/24 83%	ss	5-6 6-6 N=12	21			14	Yellowish brown (10YR5/6), wet, soft, very fine- to coarse-grained sandy CLAY with little silt.		608	
8A	20/24 83%	ss	2-2 8-14 N=10	15			16	Yellowish brown (10YR5/6), wet, medium dense, silty, very fine- to medium-grained SAND with trace coarse-grained sand.		606	
8B				12				Yellowish brown (10YR5/6), moist, dense, fine- to coarse-grained SAND with little silt, little very fine-grained sand, and trace small gravel.			
9A	23/24 96%	ss	14-17 28-50/5" N=45	10			18	Brown (10YR5/3) with 20% dark yellowish brown (10YR4/6) mottles, moist, hard, SILT with little clay, few very fine- to coarse-grained sand, and trace small gravel.			
9B				13				**End of boring = 18.0 feet**			

NOTE(S): G306 installed in borehole.