Prepared for
Illinois Power Generating Company

Date
January 31, 2021

Project No.
1940074915

2020 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

COFFEEN LANDFILL, COFFEEN POWER STATION

RAMBOLL Bright ideas. Sustainable change.

2020 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT COFFEEN LANDFILL, COFFEEN POWER STATION

Project name	**Coffeen Power Station**
Project no.	**1940074915**
Recipient	**Illinois Power Generating Company**
Document type	**Annual Groundwater Monitoring and Corrective Action Report**
Version	**FINAL**
Date	**January 31, 2021**
Prepared by	**Kristen L. Theesfeld**
Checked by	**Eric J. Tlachac, PE**
Approved by	**Lauren D. Cook**
Description	**Annual Report in Support of the CCR Rule Groundwater Monitoring Program**

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

T 414-837-3607
F 414-837-3608
https://ramboll.com

Kristen L. Theesfeld
Hydrogeologist

Eric J. Tlachac, PE
Managing Engineer

CONTENTS

TABLES (IN TEXT)

TABLES (ATTACHED)

FIGURES

APPENDICES

ACRONYMS AND ABBREVIATIONS

40 C.F.R.	Title 40 of the Code of Federal Regulations
ASD	Alternate Source Demonstration
CCR	Coal Combustion Residuals
CMA	Corrective Measures Assessment
LF	Landfill
SAP	Sampling and Analysis Plan
SSI	Statistically Significant Increase
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 Landfill (LF) located at Coffeen Power Station near Coffeen, Illinois.

Groundwater is being monitored at Coffeen LF 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 2020 (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 in 2020:

- Chloride at well G120
- Fluoride at well T127
- pH at well G125

Alternate Source Demonstrations (ASDs) were completed for the SSIs referenced above. Consequently, neither an Assessment Monitoring Program or Corrective Measures Assessment (CMA) are required, and Coffeen LF remains in the Detection Monitoring Program.

1. INTRODUCTION

This report has been prepared by Ramboll Americas Engineering Solutions Inc. (Ramboll) on behalf of Illinois Power Generating Company, to provide the information required by 40 C.F.R. § 257.90(e) for Coffeen LF 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 SSI relative to background levels).
5. Other information required to be included in the annual report as specified in §§ 257.90 through 257.98.
6. A section at the beginning of the annual report that provides an overview of the current status of groundwater monitoring and corrective action programs for the CCR unit. At a minimum, the summary must specify all of the following:
   i. At the start of the current annual reporting period, whether the CCR unit was operating under the detection monitoring program in §257.94 or the assessment monitoring program in §257.95.
   ii. At the end of the current annual reporting period, whether the CCR unit was operating under the detection monitoring program in §257.94 or the assessment monitoring program in §257.95.
   iii. If it was determined that there was a SSI over background for one or more constituents listed in Appendix III of §257 pursuant to §257.94(e):
      A. Identify those constituents listed in Appendix III of §257 and the names of the monitoring wells associated with the SSI(s).
      B. Provide the date when the assessment monitoring program was initiated for the CCR unit.

iv. If it was determined that there was a Statistically Significant Level (SSL) above the Groundwater Protection Standard (GWPS) for one or more constituents listed in Appendix IV of §257 pursuant to §257.95(g) include all of the following:

   A. Identify those constituents listed in Appendix IV of §257 and the names of the monitoring wells associated with the SSL(s).

   B. Provide the date when the CMA was initiated for the CCR unit.

   C. Provide the date when the public meeting was held for CMA for the CCR unit.

   D. Provide the date when the CMA was completed for the CCR unit.

v. Whether a remedy was selected pursuant to §257.97 during the current annual reporting period, and if so, the date of remedy selection.

vi. Whether remedial activities were initiated or are ongoing pursuant to §257.98 during the current annual reporting period.

This report provides the required information for Coffeen LF for calendar year 2020.

2. MONITORING AND CORRECTIVE ACTION PROGRAM STATUS

No changes have occurred to the monitoring program status in calendar year 2020, and Coffeen LF remains in the Detection Monitoring Program in accordance with 40 C.F.R. § 257.94.

3. KEY ACTIONS COMPLETED IN 2020

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 2020 (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 2020, and analytical results for the August 2019 sampling event, 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.

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 2020 are included in Appendix A.

1 Sampling was limited to G120, G125, and T127 during the May 2020 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 – 2019–2020 Detection Monitoring Program Summary

Sampling Date	Analytical Data Receipt Date	Parameters Collected	SSI(s)	SSI(s) Determination Date	ASD Completion Date
August 12-13, 2019	October 15, 2019	Appendix III	Fluoride (T127)	January 13, 2020	April 13, 2020
January 21, 2020	April 15, 2020	Appendix III	Chloride (G120) pH (G125)	July 14, 2020	October 12, 2020
May 5, 2020 [1]	May 28, 2020	Appendix III Greater than Background [2]			
August 11, 2020	October 15, 2020	Appendix III	TBD	TBD	TBD

Notes:

NA: Not Applicable

TBD: To Be Determined

1. Sampling was limited to G120, G125, and T127 during the May 2020 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.

2. 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 2020. Groundwater samples were collected and analyzed in accordance with the Sampling and Analysis Plan, and all data were accepted.

5. KEY ACTIVITIES PLANNED FOR 2021

The following key activities are planned for 2021:

- Continuation of the Detection Monitoring Program with semi-annual sampling scheduled for the first and third quarters of 2021.
- 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 2021 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 2021 (*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, Coffeen Landfill, 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.
ANALYTICAL RESULTS - GROUNDWATER ELEVATION AND APPENDIX III PARAMETERS
2020 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
COFFEEN POWER STATION
105 - LANDFILL
COFFEEN, IL

Well ID	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Date	Depth to Groundwater (ft) 6020A	Groundwater Elevation (ft NAVD88) 6020A	Boron, total (mg/L) 6020A	Calcium, total (mg/L) 6020A	Chloride, total (mg/L) 9251	Fluoride, total (mg/L) 9214	pH (field) (STD) SM4500 H+B	Sulfate, total (mg/L) 9036	Total Dissolved Solids (mg/L) SM 2540C
G102 Background	39.0713873	-89.3989908	8/5/2019	8.19	622.77							
			8/12/2019			0.022	93	22	0.402	7.2	86	420
			1/20/2020	3.84	627.12							
			1/21/2020			0.015	56	3.4	0.388	7.6	49	330
			8/10/2020	9.24	621.72							
			8/11/2020			<0.01	75	30	0.265	7.4	120	470
G106 Downgradient	39.06753	-89.3990973	8/5/2019	10.57	620.58							
			8/13/2019			0.029	94	44	0.468	6.9	36	520
			1/20/2020	8.55	622.6							
			1/21/2020			0.04	100	48	0.398	7.3	98	560
			8/10/2020	10.67	620.48							
			8/11/2020			0.016	87	39	0.36	7.0	69	490
G110 Downgradient	39.0671717	-89.4007039	8/5/2019	9	620.65							
			8/13/2019			<0.01	98	47	0.476	7.2	85	530
			1/20/2020	10.35	619.3							
			1/21/2020			<0.01	100	46	0.415	7.2	82	580
			8/10/2020	13.51	616.14							
			8/11/2020			<0.01	91	51	0.363	7.0	90	500
G120 Downgradient	39.0694787	-89.401214	8/5/2019	17.6	614.27							
			8/13/2019			0.028	120	95	0.426	7.1	36	520
			1/20/2020	14.18	617.69							
			1/21/2020			0.015	110	110	0.382	7.3	39	590
			5/5/2020	13.64	618.23			110		7.3		
			8/10/2020	16.65	615.22							
			8/11/2020			<0.01	83	98	0.323	7.2	37	440
G125 Downgradient	39.0710026	-89.4012211	8/5/2019	14.65	618.86							
			8/13/2019			<0.01	76	89	0.472	7.1	70	540
			1/20/2020	10.55	622.96							
			1/21/2020			<0.01	78	95	0.379	7.6	77	590
			5/5/2020	10.12	623.39					7.5		
			8/10/2020	18.13	615.38							

RAMBOLL

TABLE 1.
ANALYTICAL RESULTS - GROUNDWATER ELEVATION AND APPENDIX III PARAMETERS
2020 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
COFFEEN POWER STATION
105 - LANDFILL
COFFEEN, IL

Well ID	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Date	Depth to Groundwater (ft) 6020A	Groundwater Elevation (ft NAVD88) 6020A	Boron, total (mg/L) 6020A	Calcium, total (mg/L) 6020A	Chloride, total (mg/L) 9251	Fluoride, total (mg/L) 9214	pH (field) (STD) SM4500 H+B	Sulfate, total (mg/L) 9036	Total Dissolved Solids (mg/L) SM 2540C
	39.0710026	-89.4012211	8/11/2020			<0.01	66	90	0.369	7.2	73	470
G200 Background	39.0751386	-89.3950088	8/5/2019	3.9	622.04							
			8/12/2019			<0.01	92	58	0.405	7.0	110	540
			1/20/2020	3.22	622.72							
			1/21/2020			<0.01	110	100	0.302	7.2	120	520
			8/10/2020	7.78	618.16							
			8/11/2020			<0.01	85	63	0.427	7.2	110	530
R201 Background	39.0751423	-89.3978553	8/5/2019	3.99	622.35							
			8/12/2019			<0.01	120	71	0.466	7.1	220	760
			1/20/2020	3.46	622.88							
			1/21/2020			0.01	130	66	0.309	7.2	210	770
			8/10/2020	7.45	618.89							
			8/11/2020			<0.01	120	87	0.364	6.9	240	790
T127 Downgradient	39.0681189	-89.4012104	8/5/2019	15.81	615.15							
			8/13/2019			0.015	78	40	0.525	7.0	92	520
			1/20/2020	13.91	617.05							
			1/21/2020			0.02	71	26	0.535	7.3	100	510
			5/5/2020	13.94	617.02				0.402	7.3		
			8/10/2020	15.06	615.9							
			8/11/2020			<0.01	66	41	0.443	7.2	87	480

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.
4-digit numbers below parameter represent SW-846 analytical methods and alpha-numeric values that begin with SM represent Standard Methods for the Examination of Water and Wastewater.

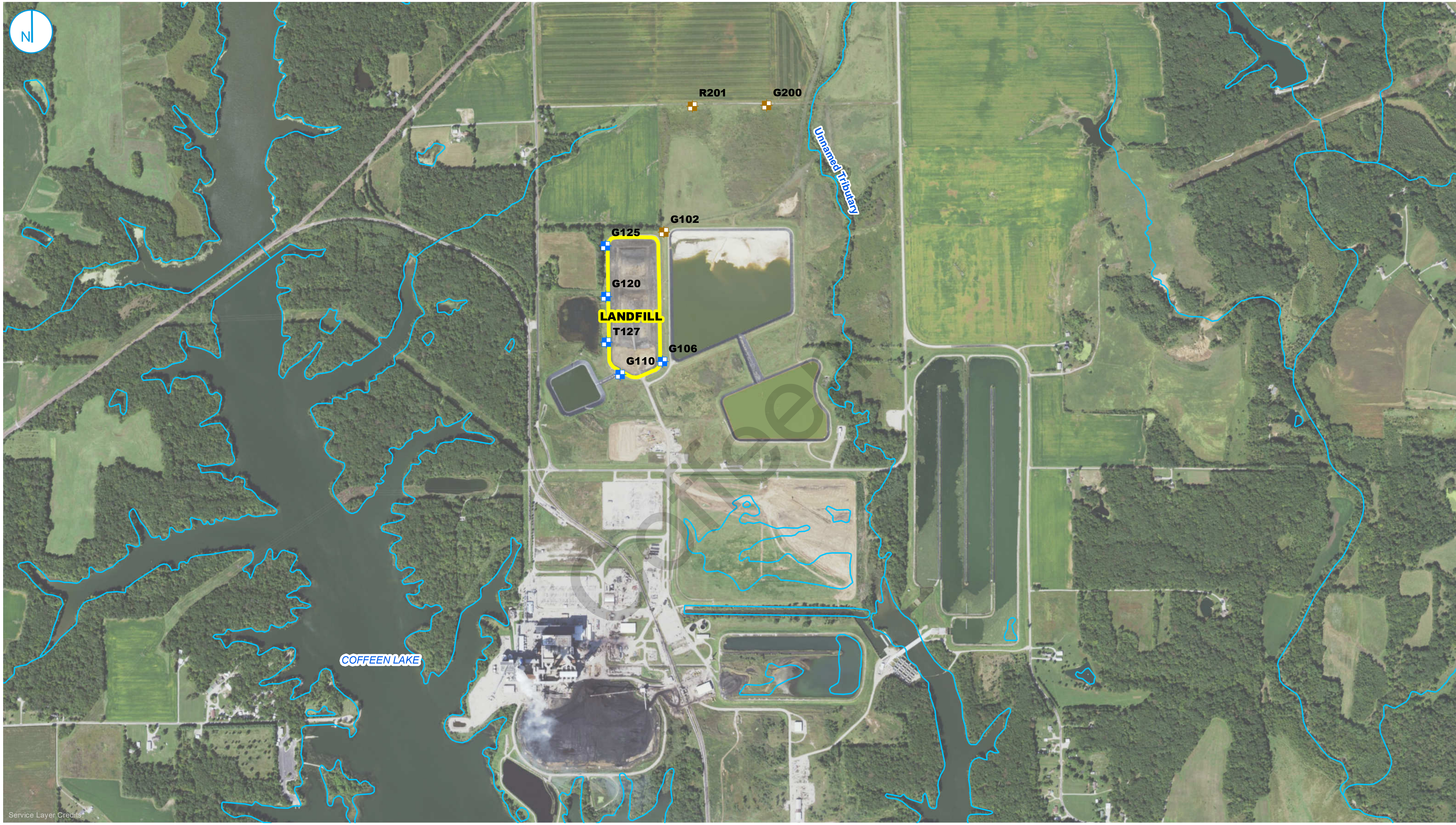
TABLE 2.
STATISTICAL BACKGROUND VALUES
2020 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
COFFEEN POWER STATION
105 - LANDFILL
COFFEEN, ILLINOIS
DETECTION MONITORING PROGRAM

Parameter	Statistical Background Value (UPL)
40 C.F.R. Part 257 Appendix III	
Boron (mg/L)	0.39
Calcium (mg/L)	140
Chloride (mg/L)	96
Fluoride (mg/L)	0.5
pH (S.U.)	6.9 / 7.4
Sulfate (mg/L)	329.4
Total Dissolved Solids (mg/L)	891

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

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



Y:\Mapping\Projects\22\2285\MXD\2020_AnnualGWM_CAR\Figure 1_GWS_WellLoc_CoffeenLandfill.mxd

PROJECT: 169000XXXX | DATED: 1/25/2021 | DESIGNER: galarnmc

BACKGROUND MONITORING WELL LOCATION

DOWNGRADIENT MONITORING WELL LOCATION

CCR MONITORED UNIT

SURFACE WATER FEATURE

0 500 1,000 Feet

MONITORING WELL LOCATION MAP
COFFEEN LANDFILL
UNIT ID:105

2020 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
CCR RULE GROUNDWATER MONITORING
COFFEEN POWER STATION
COFFEEN, ILLINOIS

FIGURE 1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

APPENDICES

Intended for
Illinois Power Generating Company

Date
April 13, 2020

Project No.
74915

40 C.F.R. § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION

COFFEEN LANDFILL

CERTIFICATIONS

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
Illinois
O'Brien & Gere Engineers, Inc., a Ramboll Company
Date: April 13, 2020

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: April 13, 2020

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA
T 414-837-3607
F 414-837-3608
https://ramboll.com

CONTENTS

TABLES (IN TEXT)

FIGURES (IN TEXT)

FIGURES (ATTACHED)

ACRONYMS AND ABBREVIATIONS

40 C.F.R.	Title 40 of the Code of Federal Regulations
ASD	Alternate Source Demonstration
CCR	Coal Combustion Residuals
cm/s	centimeters per second
CV	coefficient of variation
GMF	Gypsum Management Facility
HDPE	high-density polyethylene
IEPA	Illinois Environmental Protection Agency
LOE	Line of Evidence
mg/L	milligrams per liter
msl	mean sea level
NRT/OBG	Natural Resource Technology, an OBG Company
OBG	O'Brien & Gere Engineers, Inc., part of Ramboll
Site	Coffeen Power Station
SSI	Statistically Significant Increase
UPL	Upper Prediction Limit

1. INTRODUCTION

Title 40 of the Code of Federal Regulations (40 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 a Statistically Significant Increase (SSI) 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., a Ramboll Company (Ramboll), to provide pertinent information pursuant to 40 C.F.R. § 257.95(g)(3)(ii) for the Coffeen Landfill, located near Coffeen, Illinois.

The fifth Detection Monitoring sampling event (D5) was completed on August 12-13, 2019, and analytical data were received on October 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 January 13, 2020, within 90 days of receipt of the analytical data. The statistical determination identified the following SSI at a downgradient monitoring well:

- Fluoride at well T127

Pursuant to 40 C.F.R. § 257. 94(e)(2), the following lines of evidence demonstrate that sources other than Coffeen Landfill were the cause of the SSI listed above. This ASD was completed by April 13, 2020, within 90 days of determination of the SSI, as required by 40 C.F.R. § 257.94(e)(2).

2. BACKGROUND

2.1 Site Location and Description

The Coffeen Power Station (Site) is located in Montgomery County, in central Illinois, approximately 2 miles south of the city of Coffeen. Coffeen Lake was built by damming the McDavid Branch of the East Fork of Shoal Creek in 1963 for use as an artificial cooling lake for the Coffeen Power Station. The Site is located between two lobes of the Coffeen Lake (identified as "Coffeen Lake" and "Unnamed Tributary" on Figures 1 and 2) to the west, east, and south, and is bordered by agricultural land to the north. Several underground coal mines were historically operated both beneath and in the vicinity of the Site.

2.2 Description of Landfill CCR Unit

Fly ash is managed in an approximately 15-acre composite lined landfill constructed in 2010. At the time of the October 2019 annual inspection, the Landfill contained approximately 611,000 cubic yards of CCR (Vistra, 2019).

2.3 Geology and Hydrogeology

The Site geologic and hydrogeologic setting summarized below is from the Coffeen Hydrogeologic Monitoring Plan (NRT/OBG, 2017).

Pleistocene deposits of unlithified glacial diamictons, lacustrine/alluvial deposits, and windblown loess overlie Pennsylvanian-age bedrock throughout central Illinois. The most extensive glacial deposits are those from the Illinoian Stage which cover much of the state and are present at the Site. Windblown (aeolian) deposits, the Peoria and Roxana Silts, cover the glacial deposits over a majority of the state. These units are fine-grained deposits blown from river valleys by prevailing winds.

Till members of the Glasford Formation include the Smithboro Member, the Mulberry Grove Member, the Vandalia Member, and the Hagarstown Member (oldest to youngest). The Smithboro Member is described as a gray, compact, silty till. The Smithboro is bounded below by the Yarmouth Soil. The Mulberry Grove Member is intermittent at the Site, and is described as a calcareous gray silt and fine sand containing some fossil mollusks. The Vandalia Member is a sandy till with thin lenticular bodies of silt, sand, and gravel. It is calcareous, except where weathered, generally gray, and moderately compact. The Hagarstown Member is bounded at the top by the Sangamon Soil. The member consists of gravelly till, poorly sorted gravel, well sorted gravel, and sand.

Bedrock consists of the Pennsylvanian-age McLeansboro, Kewanee, and McCormick Groups, which are characterized by limestone and calcareous clays and shales. The Bond and Modesto Formations of the McLeansboro Group contain multiple thin (typically less than 2 feet) intermittent coal beds. The upper formation of the Kewanee Group is the top of the Carbondale Formation which contains multiple coal beds, including the Herrin (No. 6) Coal, of varying thicknesses (up to 7 feet). The Bond Formation is characterized by limestone and calcareous clays and shales, and contains thin (typically less than 2 feet) intermittent coal beds including the Witt and Flat Creek Coals. The top of the Carbondale Formation is the Herrin (No. 6) Coal.

The Quaternary deposits in the Coffeen area consist mainly of diamictons and intercalated outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations. The unconsolidated deposits and bedrock which occur at the Site include the following units (beginning at the ground surface):

- Ash Fill Unit – Ash is present within the Landfill.
- Upper Confining Unit – Low permeability clays and silts, including the Roxana Silt and Peoria Silt (Loess Unit) and the upper clayey till portion of the Hagarstown Member.
- Uppermost Aquifer – Thin (generally less than 3 feet), moderate to high permeability sand, silty sand, and sandy silt/clay units which include the Hagarstown Member (also referred to as the Hagarstown Beds) and the upper Vandalia Till Member (where weathered). The uppermost aquifer thins to less than 1.0 feet surrounding the Landfill.
- Lower Confining Unit – Thick (generally greater than 15 feet), very low permeability sandy, silt till, or clay till that includes the unweathered Vandalia Member, Mulberry Grove Member (discontinuous), and Smithboro Member.

Coffeen Lake was built by damming the McDavid Branch of the East Fork of Shoal Creek in 1963 for use as an artificial cooling lake for the Coffeen Power Station. The Site is located between the two lobes of the lake (identified as "Coffeen Lake" and "Unnamed Tributary" on Figure 1), which results in a north/south trending groundwater divide observed beneath the CCR units. Groundwater flow is to the southeast or southwest, downgradient of the divide, converging on the tributary valleys leading to Coffeen Lake on the east and west sides of the property.

Groundwater elevations were obtained from measurements in monitoring wells on August 5, 2019 prior to a sampling event for the five CCR units at Coffeen Power Station. As noted above, groundwater sampling for D5 occurred on August 12-13, 2019. Water levels in the landfill area ranged from approximately 613 to 623 feet msl (Figure 1). The groundwater elevations and flow direction for the Coffeen Power Station during the D5 sampling event are shown in Figure 1, and generally follow the flow patterns established by the groundwater divide beneath the CCR units.

2.4 Groundwater Monitoring

Figure 1 shows all monitoring wells present at the site, including those in the groundwater monitoring systems established in accordance with 40 C.F.R. § 257.91 at Ash Pond No. 1, Ash Pond No. 2, the GMF Recycle Pond, the Landfill and the Gypsum Stack Pond. Figure 2 shows the monitoring system for the Landfill including background wells R201 and G200, located north of the Landfill, and downgradient monitoring wells G106, G210, G220, G125, and T127. Details on the procedures and techniques used to fulfill the groundwater sampling and analysis program requirements are found in the Sampling and Analysis Plan (NRT/OBG, 2017a) for the Landfill.

3. ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

As allowed by 40 C.F.R. § 257.94(e)(2), this ASD demonstrates that sources other than Coffeen Landfill (the CCR unit) caused the SSI. Lines of evidence supporting this ASD include the following:

1. Landfill liner design.
2. The ionic composition of landfill leachate is different from the ionic composition of groundwater.
3. Concentrations of boron and sulfate, common indicators for CCR impacts to groundwater, are below background concentrations and are stable in the downgradient wells.

These lines of evidence are described and supported in greater detail below. Monitoring wells and source water sample locations are shown in Figure 2.

3.1 LOE #1: Landfill Liner Design

The Coffeen Landfill was constructed in 2010. The constructed landfill liner includes the following design components:

- A 60-mil high-density polyethylene (HDPE) geomembrane
- A three-foot-thick layer of recompacted, low-permeability soil having a maximum hydraulic conductivity of 1 x 10^{-7} centimeters per second (cm/s)

The Illinois Environmental Protection Agency (IEPA)-approved Coffeen Landfill liner system exceeds the design criteria for a composite liner for new CCR landfills established by 40 C.F.R. § 257.70. The composite liner design criteria were established to help prevent contaminants in CCR from leaching from the CCR unit and contaminating groundwater. Therefore, the presence of the composite liner suggests that the Landfill is not the source of the observed SSIs.

3.2 LOE #2: The Ionic Composition of Landfill Leachate 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 on the two lower triangular portions of the diagram, providing the information which, when combined on the central diamond-shaped portion of the diagram, identifies the compositional categories or groupings (hydrochemical facies).

Groundwater samples from Landfill monitoring wells were most recently collected and analyzed for ionic composition (major ions) on July 12-14, 2017 for comparison against the ionic composition of Landfill leachate. Figure 2 also shows leachate wells L201, L202 and L203 that are used to collect leachate samples from the landfill. Leachate samples were most recently collected and analyzed for major ion concentrations on November 18, 2016 at L202; August 8, 2017 at L203; and October 24, 2017 at L201. Groundwater and leachate samples will be collected semi-annually for analysis of major ions.

Figure A, below, is a Piper diagram that displays the ionic composition of groundwater samples from the background and downgradient monitoring wells associated with the Landfill and leachate samples collected from the Landfill. The ionic compositional groupings identified are shown in the black and green ellipses on the diamond portion of the Piper diagram. These are discussed in more detail below.

It is evident from the Piper diagrams that the background and downgradient groundwater (enclosed within the black ellipse) are tightly clustered within the calcium-bicarbonate facies and that the Landfill leachate (enclosed within the green ellipse) is in the sodium-chloride facies. The differences in ionic composition between the groundwater and Landfill leachate indicate that the Landfill is not the source of CCR constituents detected in groundwater.

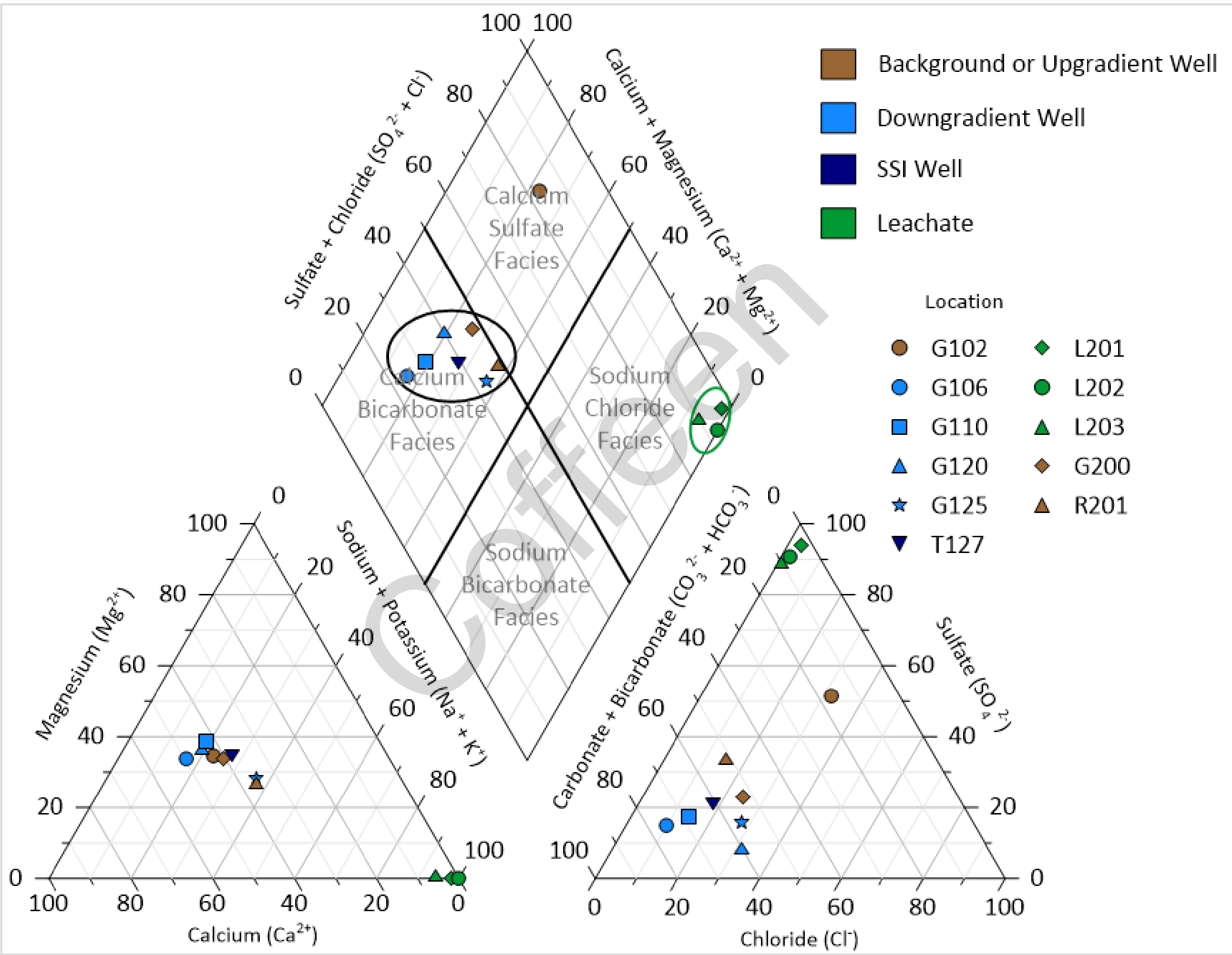


Figure A. Piper Diagram. The piper diagram above shows the ionic composition of samples of background and downgradient groundwater and landfill leachate.

3.3 LOE #3: Concentrations of Boron and Sulfate, Common Indicators for CCR Impacts to Groundwater, are Below Background Concentrations and are Stable in the Downgradient Wells

Boron and sulfate are common indicators of CCR impacts to groundwater due to their leachability from CCR and mobility in groundwater. Downgradient concentrations of both boron and sulfate are near or below concentrations in background wells as described below.

3.3.1 Boron

During the D5 monitoring event, boron concentrations are near or below analytical method reporting limits. All downgradient monitoring well boron concentrations were below the background Upper Prediction Limit (UPL) of 0.39 mg/L (Table A). Boron is consistently below the reporting limit (0.01 mg/L) in the majority of the wells, precluding trend analysis.

Table A – Summary Statistics for Boron in Groundwater.

Monitoring Well	% Non-Detects	Boron (mg/L)		
		Minimum	Maximum	Median
Background/Upgradient Wells				
G102	31	<0.010	0.022	0.014
G200	46	<0.010	0.390	0.010
R201	69	<0.010	0.017	0.010
Downgradient Wells				
G106	69	<0.010	0.058	0.010
G110	85	<0.010	0.025	0.010
G120	69	<0.010	0.028	0.010
G125	92	<0.010	0.018	0.010
T127	69	<0.010	0.033	0.010

Notes:

B = Background, D = Downgradient, U = Upgradient

3.3.2 Sulfate

Sulfate concentrations in downgradient wells and background wells are shown on Figure B. All sulfate concentrations in downgradient wells are below the background UPL of 329.4 mg/L. The background UPL was determined from concentrations in background monitoring wells G102, G200, and R201. Maximum sulfate concentrations measured in downgradient groundwater between 2015 and 2019 ranged from 47 mg/L to 110 mg/L, indicating that sulfate concentrations in downgradient wells are below background concentrations.

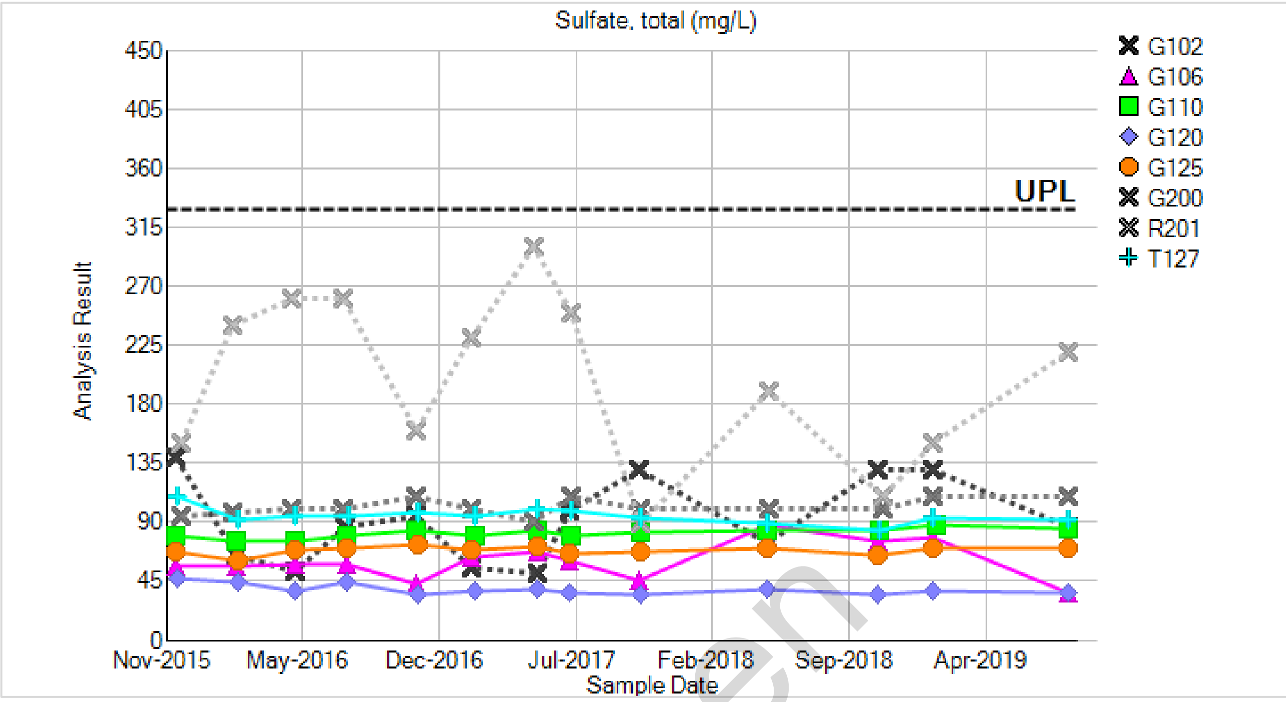


Figure B. Sulfate Time Series.

Mann-Kendall trend tests were performed to determine if sulfate concentrations at each well are 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 A) 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 low-magnitude trend.

Sulfate concentrations were stable in background wells G102 and R201 and downgradient wells G106 and G125. A statistically significant downward trend was identified in downgradient wells G120 and T127. Statistically significant upward trends were identified in background wells G200 and downgradient well G110. Although the sulfate trends at G110, G120, G200, and T127 were determined to be significant based on the Mann-Kendall tests, the concentrations demonstrated low variability (CV less than or equal to 1), suggesting low-magnitude trends. Table B provides summary statistics, including CV and trend per well. The CV for the downgradient well exhibiting an upward trend (G110) was very low (0.04) and the remaining downgradient wells exhibited stability or a slight downward trend, indicating that the concentrations of sulfate in downgradient wells are stable.

Table B – Summary Statistics, Trend, and Coefficient of Variation of Sulfate in Groundwater.

Monitoring Well	Sulfate (mg/L)					
	Minimum	Maximum	Median	Standard Deviation	Trend	CV
Background/Upgradient Wells						
G102	51	140	86	32.2	None	0.35
G200	90	110	100	6.5	Upward	0.06
R201	89	300	220	64.4	None	0.32
Downgradient Wells						
G106	36	88	58	14.5	None	0.24
G110	76	88	82	3.5	Upward	0.04
G120	34	47	37	4.1	Downward	0.11
G125	61	73	69	3.2	None	0.05
T127	84	110	95	6.1	Downward	0.06

Notes:

B = Background, D = Downgradient, U = Upgradient

As evidenced by the information presented above, the boron and sulfate concentrations are near or below background levels and are generally stable, indicating that the groundwater in the vicinity of the Landfill is not impacted by CCR constituents.

4. CONCLUSIONS

Based on these three lines of evidence, it has been demonstrated that Coffeen Landfill has not caused the SSI in T127.

1. Landfill liner design.
2. The ionic composition of landfill leachate is different from the ionic composition of groundwater.
3. Concentrations of boron and sulfate, common indicators for CCR impacts to groundwater, are below background concentrations and are stable in the downgradient wells.

This information serves as the written Alternate Source Demonstration prepared in accordance with 40 C.F.R. § 257.95(e)(2) that the SSI observed during the Detection Monitoring Program was not due to the CCR unit. Therefore, an Assessment Monitoring Program is not required and Coffeen Landfill will remain in detection monitoring.

5. REFERENCES

Natural Resource Technology, an OBG Company (NRT/OBG), 2017b. Hydrogeologic Monitoring Plan. Coffeen Ash Pond No. 1 – CCR Unit ID 101, Coffeen Ash Pond No. 2 – CCR Unit ID 102, Coffeen GMF Gypsum Stack Pond – CCR Unit ID 103, Coffeen GMF Recycle Pond – CCR Unit ID 104, Coffeen Landfill – CCR Unit ID 105. Coffeen Power Station, Coffeen, Illinois. Illinois Power Generating Company, October 17, 2017

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

Vistra, 2019. Annual Landfill Inspection Certificate Report, October 18, 2019. https://www.luminant.com/ccr/#coffeen (accessed March 20, 2020).

FIGURES

BACKGROUND MONITORING WELL
DOWNGRADIENT MONITORING WELL
CCR RULE MONITORING WELL
NON-CCR RULE MONITORING WELL
ABANDONED MONITORING WELL
CCR UNIT BOUNDARY, SUBJECT SITE
CCR UNIT BOUNDARY
SURFACE WATER FEATURE

GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION

0 200 400 Feet

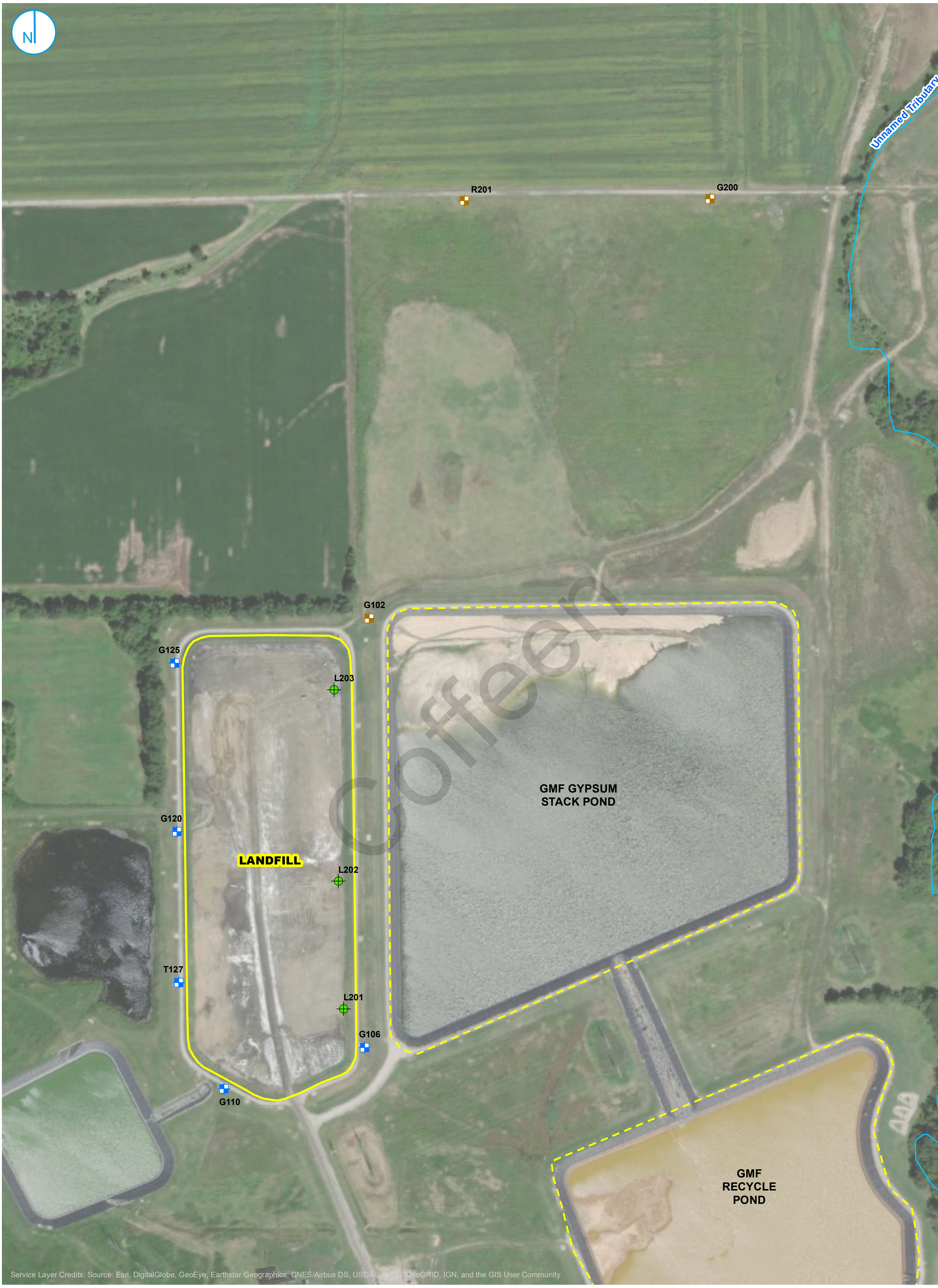
GROUNDWATER ELEVATION CONTOUR MAP
AUGUST 5, 2019

40 C.F.R. § 257.95(e)(2): ALTERNATE SOURCE DEMONSTRATION
COFFEEN LANDFILL
COFFEEN POWER STATION
COFFEEN, ILLINOIS

FIGURE 1

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL



BACKGROUND MONITORING WELL
DOWNGRADIENT MONITORING WELL
LEACHATE WELL LOCATION
CCR UNIT BOUNDARY, SUBJECT SITE
CCR UNIT BOUNDARY
SURFACE WATER FEATURE

0 150 300 Feet

SAMPLE LOCATION MAP

FIGURE 2

40 C.F.R. § 257.95(e)(2): ALTERNATE SOURCE DEMONSTRATION
COFFEEN LANDFILL
COFFEEN POWER STATION
COFFEEN, ILLINOIS

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

Intended for
Illinois Power Generating Company

Date
October 12, 2020

Project No.
1940074915

40 C.F.R. § 257.94(e)(2): ALTERNATE SOURCE DEMONSTRATION

COFFEEN LANDFILL

CERTIFICATIONS

I, Brian G. Hennings, 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.

LICENSED PROFESSIONAL GEOLOGIST
BRIAN G. HENNINGS
196.001482
ILLINOIS

Brian G. Hennings
Professional Geologist
196-001482
Illinois
Ramboll Americas Engineering Solutions, Inc., f/k/a O'Brien & Gere Engineers, Inc.
Date: October 12, 2020

I, Anne Frances Ackerman, 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.

LICENSED PROFESSIONAL ENGINEER
ANNE FRANCES
ACKERMAN
062.060586
OF ILLINOIS

Anne Frances Ackerman
Qualified Professional Engineer
062-060586
Illinois
Ramboll Americas Engineering Solutions, Inc., f/k/a O'Brien & Gere Engineers, Inc.
Date: October 12, 2020

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA
T 414-837-3607
F 414-837-3608
https://ramboll.com

CONTENTS

TABLES (IN TEXT)

FIGURES (IN TEXT)

FIGURES (ATTACHED)

ACRONYMS AND ABBREVIATIONS

<	less than
40 C.F.R.	Title 40 of the Code of Federal Regulations
ASD	Alternate Source Demonstration
CCR	Coal Combustion Residuals
cm/s	centimeters per second
CV	coefficient of variation
f/k/a	formerly known as
GMF	Gypsum Management Facility
HDPE	high-density polyethylene
IEPA	Illinois Environmental Protection Agency
LOE	Line of Evidence
mg/L	milligrams per liter
NAV88	North American Vertical Datum of 1988
NRT/OBG	Natural Resource Technology, an OBG Company
Site	Coffeen Power Station
SSI	Statistically Significant Increase
UPL	Upper Prediction Limit

1. INTRODUCTION

Title 40 of the Code of Federal Regulations (40 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 a Statistically Significant Increase (SSI) 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 Ramboll Americas Engineering Solutions, Inc., formerly known as (f/k/a) O'Brien & Gere Engineers, Inc. (Ramboll), to provide pertinent information pursuant to 40 C.F.R. § 257.95(g)(3)(ii) for the Coffeen Landfill, located near Coffeen, Illinois.

The sixth Detection Monitoring sampling event (D6) was completed on January 21, 2020, and analytical data were received on April 15, 2020. 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 14, 2020, within 90 days of receipt of the analytical data. The statistical determination identified the following SSIs at downgradient monitoring wells:

- Chloride at well G120
- Fluoride at well T127
- pH at well G125

In accordance with the Statistical Analysis Plan, G120, G125, and T127 were resampled on May 5, 2020 and analyzed only for the SSI parameters to confirm the SSIs. Following evaluation of analytical data from the resample event, the following SSIs were confirmed:

- Chloride at well G120
- pH at well G125

Pursuant to 40 C.F.R. § 257. 94(e)(2), the following lines of evidence (LOE) demonstrate that sources other than Coffeen Landfill were the cause of the SSIs listed above. This ASD was completed by October 12, 2020, within 90 days of determination of the SSIs, as required by 40 C.F.R. § 257.94(e)(2).

2. BACKGROUND

2.1 Site Location and Description

The Coffeen Power Station (Site) is located in Montgomery County, in central Illinois, approximately 2 miles south of the city of Coffeen. Coffeen Lake was built by damming the McDavid Branch of the East Fork of Shoal Creek in 1963 for use as an artificial cooling lake for the Coffeen Power Station. The Site is located between two lobes of the Coffeen Lake (identified as "Coffeen Lake" and "Unnamed Tributary" on Figures 1 and 2) to the west, east, and south, and is bordered by agricultural land to the north. Several underground coal mines were historically operated both beneath and in the vicinity of the Site.

2.2 Description of Landfill CCR Unit

Fly ash is managed in an approximately 15-acre composite lined landfill constructed in 2010. At the time of the October 2019 annual inspection, the Landfill contained approximately 611,000 cubic yards of CCR (Vistra, 2019).

2.3 Geology and Hydrogeology

The Site geologic and hydrogeologic setting summarized below is from the Coffeen Hydrogeologic Monitoring Plan (Natural Resource Technology, an OBG Company [NRT/OBG], 2017).

Pleistocene deposits of unlithified glacial diamictons, lacustrine/alluvial deposits, and windblown loess overlie Pennsylvanian-age bedrock throughout central Illinois. The most extensive glacial deposits are those from the Illinoian Stage which cover much of the state and are present at the Site. Windblown (aeolian) deposits, the Peoria and Roxana Silts, cover the glacial deposits over a majority of the state. These units are fine-grained deposits blown from river valleys by prevailing winds.

Till members of the Glasford Formation include the Smithboro Member, the Mulberry Grove Member, the Vandalia Member, and the Hagarstown Member (oldest to youngest). The Smithboro Member is described as a gray, compact, silty till. The Smithboro is bounded below by the Yarmouth Soil. The Mulberry Grove Member is intermittent at the Site, and is described as a calcareous gray silt and fine sand containing some fossil mollusks. The Vandalia Member is a sandy till with thin lenticular bodies of silt, sand, and gravel. It is calcareous, except where weathered, generally gray, and moderately compact. The Hagarstown Member is bounded at the top by the Sangamon Soil. The member consists of gravelly till, poorly sorted gravel, well sorted gravel, and sand.

Bedrock consists of the Pennsylvanian-age McLeansboro, Kewanee, and McCormick Groups, which are characterized by limestone and calcareous clays and shales. The Bond and Modesto Formations of the McLeansboro Group contain multiple thin (typically less than 2 feet) intermittent coal beds. The upper formation of the Kewanee Group is the top of the Carbondale Formation which contains multiple coal beds, including the Herrin (No. 6) Coal, of varying thicknesses (up to 7 feet). The Bond Formation is characterized by limestone and calcareous clays and shales, and contains thin (typically less than 2 feet) intermittent coal beds including the Witt and Flat Creek Coals. The top of the Carbondale Formation is the Herrin (No. 6) Coal.

The Quaternary deposits in the Coffeen area consist mainly of diamictons and intercalated outwash deposits that were deposited during Illinoian and Pre-Illinoian glaciations. The unconsolidated deposits and bedrock which occur at the Site include the following units (beginning at the ground surface):

- Upper Confining Unit – Low permeability clays and silts, including the Roxana Silt and Peoria Silt (Loess Unit) and the upper clayey till portion of the Hagarstown Member.
- Uppermost Aquifer – Thin (generally less than 3 feet), moderate to high permeability sand, silty sand, and sandy silt/clay units which include the Hagarstown Member (also referred to as the Hagarstown Beds) and the upper Vandalia Till Member (where weathered). The uppermost aquifer thins to less than 1.0 foot surrounding the Landfill.
- Lower Confining Unit – Thick (generally greater than 15 feet), very low permeability sandy, silt till, or clay till that includes the unweathered Vandalia Member, Mulberry Grove Member (discontinuous), and Smithboro Member.

Coffeen Lake was built by damming the McDavid Branch of the East Fork of Shoal Creek in 1963 for use as an artificial cooling lake for the Coffeen Power Station. The Site is located between the two lobes of the lake (identified as "Coffeen Lake" and "Unnamed Tributary" on Figure 1), which results in a north/south trending groundwater divide observed beneath the CCR units. Groundwater flow is to the southeast or southwest, downgradient of the divide, converging on the tributary valleys leading to Coffeen Lake on the east and west sides of the property.

Groundwater elevations (referenced to North American Vertical Datum of 1988 [NAV88]) were obtained from measurements in monitoring wells on January 20, 2020 prior to a sampling event for the five CCR units at Coffeen Power Station. As noted above, groundwater sampling for D6 was completed on January 21, 2020. Water levels in the Landfill area ranged from approximately 617 to 627 feet (Figure 1). The groundwater elevations and flow direction for the Coffeen Power Station during the D6 sampling event are shown in Figure 1, and generally follow the flow patterns established by the groundwater divide beneath the CCR units with groundwater flowing from east to west beneath the Landfill.

2.4 Groundwater Monitoring

Figure 1 shows all monitoring wells present at the site, including those in the groundwater monitoring systems established in accordance with 40 C.F.R. § 257.91 at Ash Pond No. 1, Ash Pond No. 2, the Gypsum Management Facility (GMF) Recycle Pond, the Landfill and the Gypsum Stack Pond. Figure 2 shows the monitoring system for the Landfill including background wells G012, R201 and G200, located north of the Landfill, and downgradient monitoring wells G106, G210, G220, G125 and T127. Details on the procedures and techniques used to fulfill the groundwater sampling and analysis program requirements are found in the Sampling and Analysis Plan (NRT/OBG, 2017a) for the Landfill.

3. ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

As allowed by 40 C.F.R. § 257.94(e)(2), this ASD demonstrates that sources other than Coffeen Landfill (the CCR unit) caused the SSIs. LOEs supporting this ASD include the following:

1. Landfill liner design.
2. The ionic composition of Landfill leachate is different from the ionic composition of groundwater.
3. Concentrations of boron and sulfate, common indicators for CCR impacts to groundwater, are near or below background concentrations and are stable in the downgradient wells.

These LOEs are described and supported in greater detail below. Monitoring wells and leachate sample locations are shown in Figure 2.

3.1 LOE #1: Landfill Liner Design

The Coffeen Landfill was constructed in 2010. The constructed Landfill liner includes the following design components:

- A 60-mil high-density polyethylene (HDPE) geomembrane.
- A three-foot-thick layer of recompacted, low-permeability soil having a maximum hydraulic conductivity of 1 x 10^{-7} centimeters per second (cm/s).

The Illinois Environmental Protection Agency (IEPA)-approved Coffeen Landfill liner system exceeds the design criteria for a composite liner for new CCR landfills established by 40 C.F.R. § 257.70. The composite liner design criteria were established to help prevent contaminants in CCR from leaching from the CCR unit and contaminating groundwater. Therefore, the presence of the composite liner suggests that the Landfill is not the source of the observed SSIs.

3.2 LOE #2: The Ionic Composition of Landfill Leachate 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 on the two lower triangular portions of the diagram, providing the information which, when combined on the central diamond-shaped portion of the diagram, identifies the compositional categories or groupings (hydrochemical facies).

Groundwater samples collected from Landfill monitoring wells on January 21, 2020 and Landfill leachate samples collected from leachate wells on May 7, 2020 were analyzed for ionic composition (major ions).

Figure A, below, is a Piper diagram that displays the ionic composition of groundwater and leachate. The ionic compositional groupings identified are shown in the black and green ellipses on the diamond portion of the Piper diagram. These are discussed in more detail below.

It is evident from the Piper diagrams that the background and downgradient groundwater (enclosed within the black ellipse) are clustered within the calcium-bicarbonate facies and that the Landfill leachate (enclosed within the green ellipse) is in the sodium-chloride facies. The differences in ionic composition between the groundwater and Landfill leachate indicate that the Landfill is not the source of CCR constituents detected in groundwater.

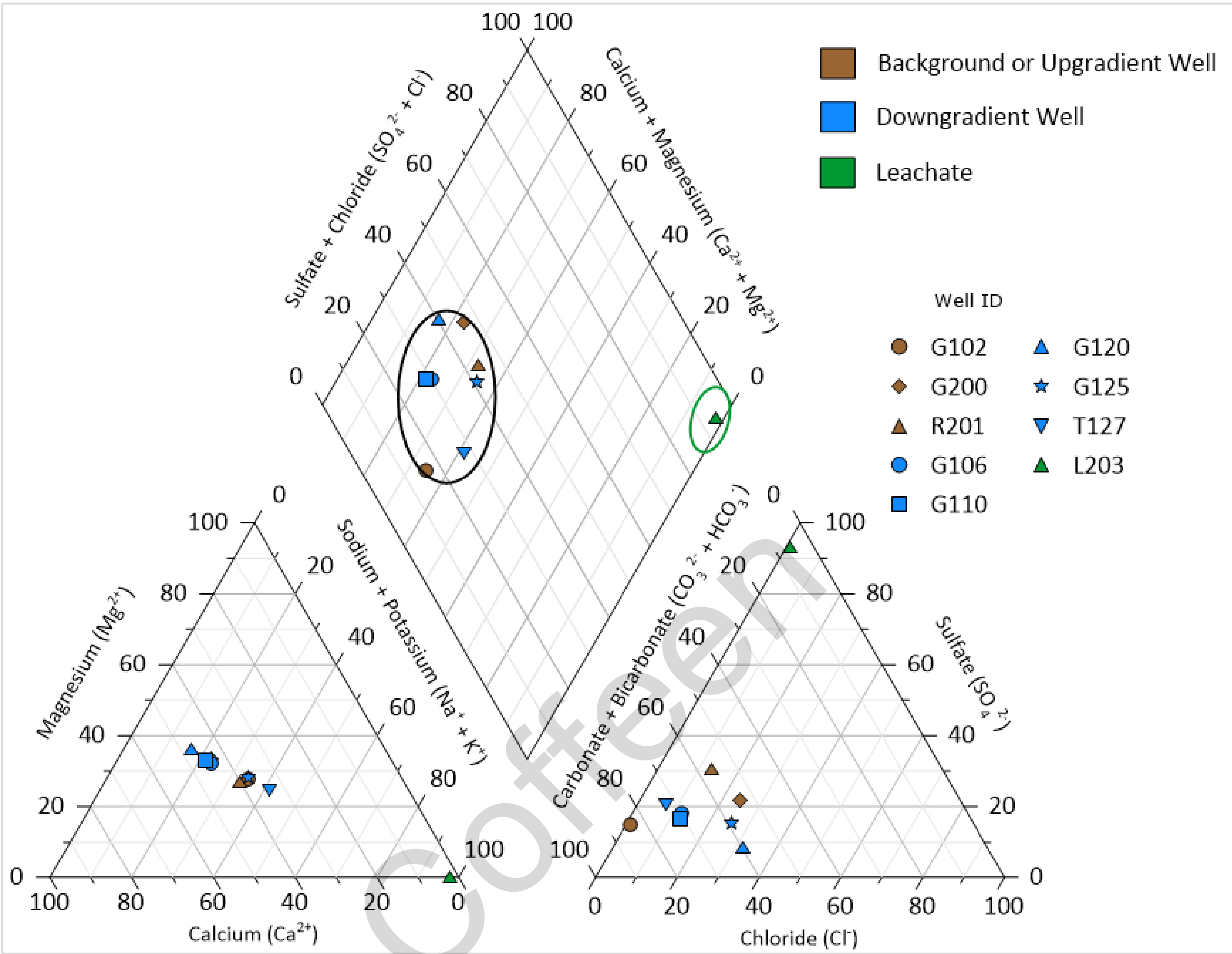


Figure A. Piper Diagram. The piper diagram above shows the ionic composition of samples of background and downgradient groundwater and Landfill leachate.

3.3 LOE #3: Concentrations of Boron and Sulfate, Common Indicators for CCR Impacts to Groundwater, are Near or Below Background Concentrations and are Stable in the Downgradient Wells

Boron and sulfate are common indicators of CCR impacts to groundwater due to their leachability from CCR and mobility in groundwater. Downgradient concentrations of both boron and sulfate are near or below concentrations in background wells as described below.

3.3.1 Boron

All downgradient monitoring well boron concentrations were below the background Upper Prediction Limit (UPL) of 0.39 milligrams per liter (mg/L) (Table A). Boron has been consistently below the reporting limit (i.e., not detected) in the majority of the wells. The high percentage of non-detects indicate boron concentrations are generally stable at very low concentrations.

Table A – Summary Statistics for Boron in Groundwater (from November 2015 to January 2020).

Monitoring Well	Percent Non-Detects	Detected Boron Concentrations (mg/L)		
		Minimum	Maximum	Median
Background/Upgradient Wells				
G102	29	<0.010	0.022	0.014
G200	50	<0.010	0.390	0.010
R201	64	<0.010	0.017	0.010
Downgradient Wells				
G106	64	<0.010	0.058	0.010
G110	86	<0.010	0.025	0.010
G120	64	<0.010	0.028	0.010
G125	93	<0.010	0.018	0.010
T127	64	<0.010	0.033	0.010

3.3.2 Sulfate

Sulfate concentrations in downgradient wells and background wells are shown on Figure B. All sulfate concentrations in downgradient wells are below the background UPL of 329.4 mg/L. The background UPL was determined from concentrations in background monitoring wells G102, G200 and R201. Maximum sulfate concentrations measured in downgradient groundwater between 2015 and 2020 ranged from 47 mg/L to 110 mg/L, indicating that sulfate concentrations in downgradient wells are below background concentrations.

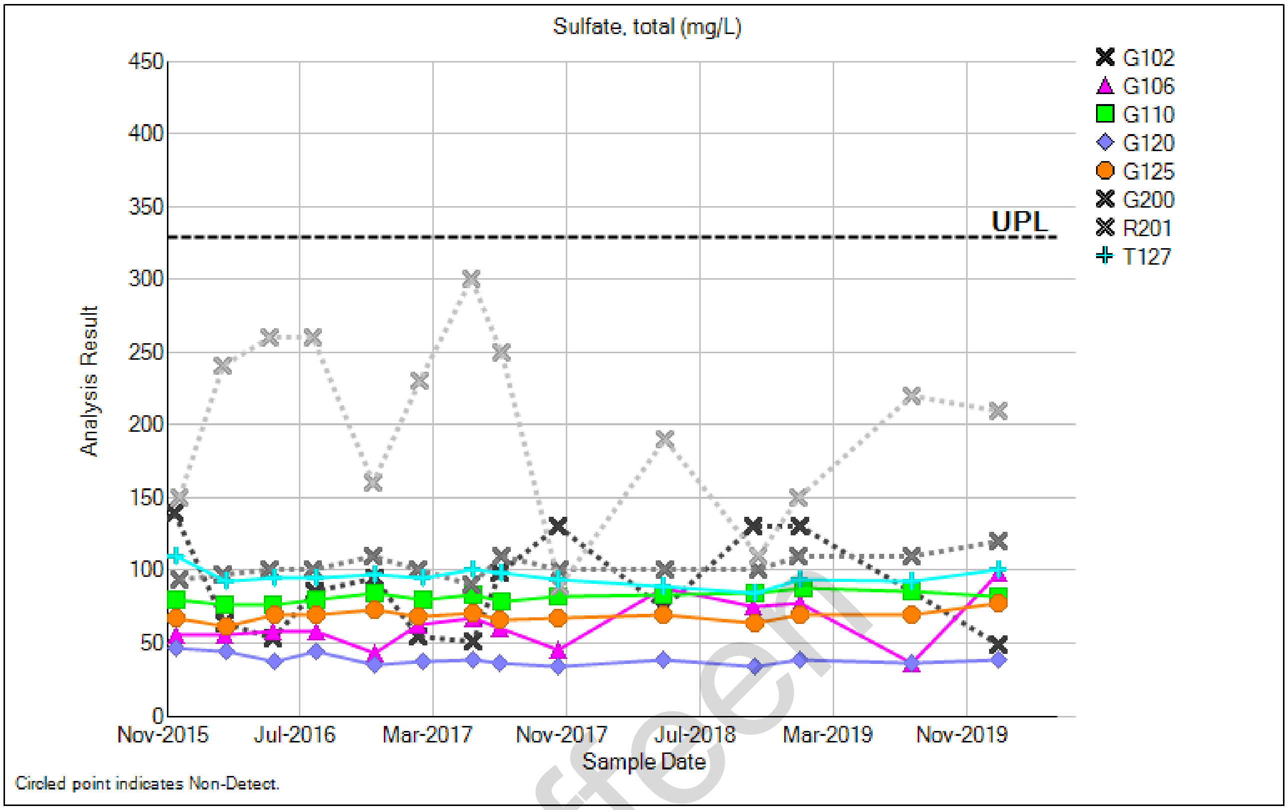


Figure B. Sulfate Time Series.

Mann-Kendall trend tests were performed to determine if sulfate concentrations at each well are 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 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 low-magnitude trend.

Sulfate concentrations were stable in background wells G102 and R201 and downgradient wells G120, G125 and T127. Statistically significant upward trends were identified in background well G200 and downgradient wells G106 and G110. Although the sulfate trends at G106, G110 and G200 were determined to be significant based on the Mann-Kendall tests, the concentrations demonstrated low variability (CV less than or equal to 1), suggesting low-magnitude trends. Table B provides summary statistics, including CV and trend per well. The CV for the downgradient wells exhibiting upward trends (G106 and G110) were low (0.27) and very low (0.04), respectively, and the remaining downgradient wells exhibited stability, indicating that the concentrations of sulfate in downgradient wells are stable.

Table B – Summary Statistics, Trend, and Coefficient of Variation of Sulfate in Groundwater.

Monitoring Well	Sulfate (mg/L)					
	Minimum	Maximum	Median	Standard Deviation	Trend	CV
Background/Upgradient Wells						
G102	49	140	86	33.0	None	0.37
G200	90	120	100	8.0	Upward	0.08
R201	89	300	215	61.9	None	0.31
Downgradient Wells						
G106	36	98	59	17.2	Upward	0.27
G110	76	88	82	3.3	Upward	0.04
G120	34	47	38	4.0	None	0.10
G125	61	77	70	3.9	None	0.06
T127	84	110	95	6.0	None	0.06

As evidenced by the information presented above, the boron and sulfate concentrations are near or below background levels, and are generally stable, indicating that the groundwater in the vicinity of the Landfill is not impacted by CCR constituents.

4. CONCLUSIONS

Based on these three LOE, it has been demonstrated that Coffeen Landfill has not caused the SSIs in G120 and G125.

1. Landfill liner design.
2. The ionic composition of Landfill leachate is different from the ionic composition of groundwater.
3. Concentrations of boron and sulfate, common indicators for CCR impacts to groundwater, are near or below background concentrations and are stable in the downgradient wells.

This information serves as the written ASD prepared in accordance with 40 C.F.R. § 257.95(e)(2) that the SSIs observed during the Detection Monitoring Program D6 sampling event were not due to the CCR unit. Therefore, an Assessment Monitoring Program is not required and Coffeen Landfill will remain in detection monitoring.

5. REFERENCES

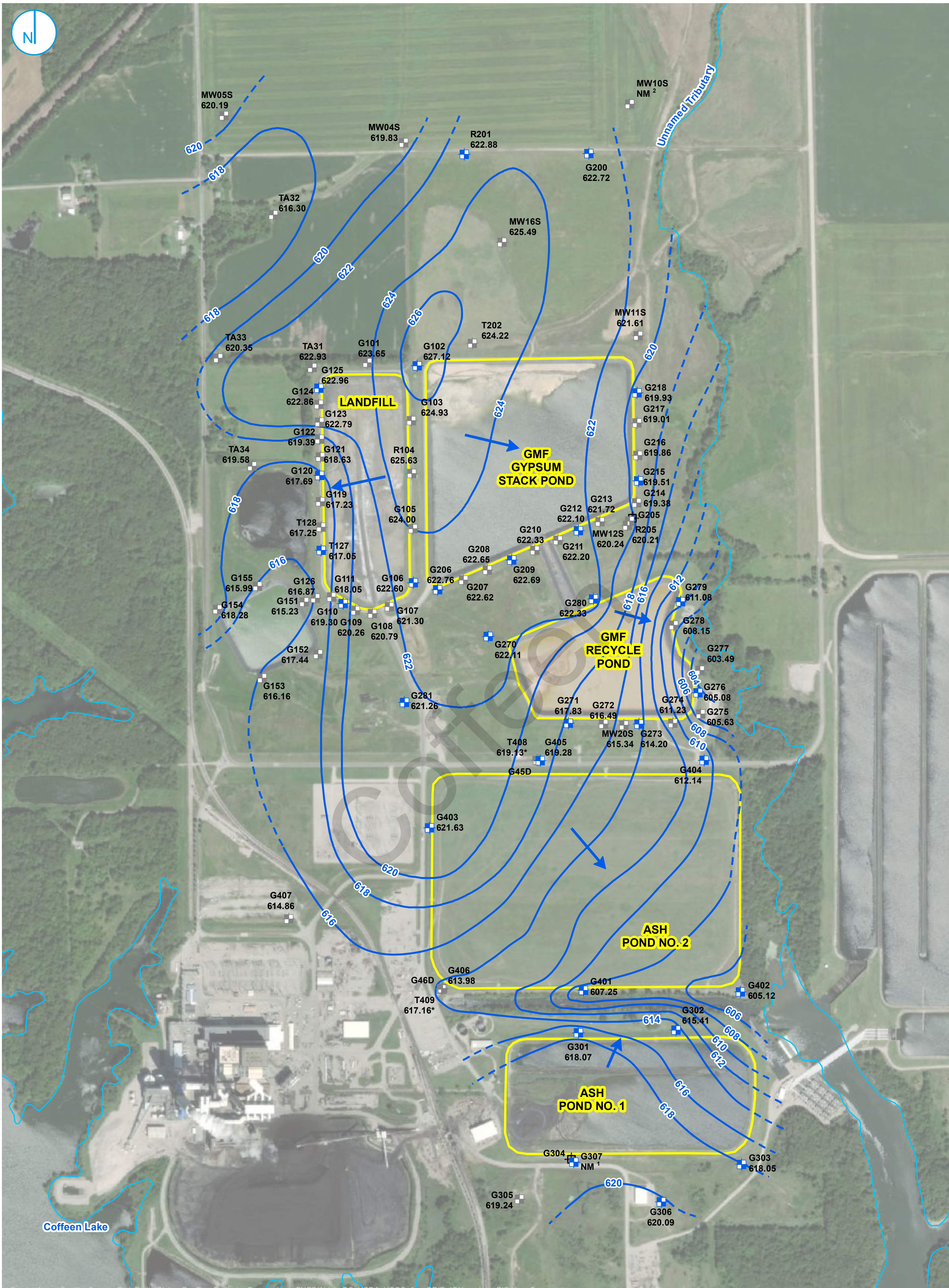
Natural Resource Technology, an OBG Company (NRT/OBG), October 17, 2017a. *Statistical Analysis Plan. Coffeen Power Station, Newton Power Station. Illinois Power Generating Company*.

Natural Resource Technology, an OBG Company (NRT/OBG), October 17, 2017b. *Hydrogeologic Monitoring Plan. Coffeen Ash Pond No. 1 – CCR Unit ID 101, Coffeen Ash Pond No. 2 – CCR Unit ID 102, Coffeen GMF Gypsum Stack Pond – CCR Unit ID 103, Coffeen GMF Recycle Pond – CCR Unit ID 104, Coffeen Landfill – CCR Unit ID 105.* Coffeen Power Station, Coffeen, Illinois. Illinois Power Generating Company.

Vistra, 2019. *Annual Landfill Inspection Certificate Report*, October 18, 2019. https://www.luminant.com/ccr/#coffeen (accessed March 20, 2020).

FIGURES

PROJECT: 169000XXXX | DATED: 6/18/2020 | DESIGNER: STOLZSD   Y:\Mapping\Projects\22\2285\MXD\GW_Contours\Round_2020_1Q\R2020_1Q_Coffeen_GW_Contours.mxd



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

CCR UNIT BOUNDARY
SURFACE WATER FEATURE

NOTE:
* = NOT USED FOR CONTOURING
NM = NOT MEASURED
[1] G307 WAS FROZEN DURING THE JANUARY 20, 2020 SAMPLING EVENT AND WATER LEVEL COULD NOT BE COLLECTED.
[2] MW10S WAS DAMAGED PRIOR TO THE JANUARY 20, 2020 SAMPLING EVENT AND WATER LEVEL COULD NOT BE COLLECTED.

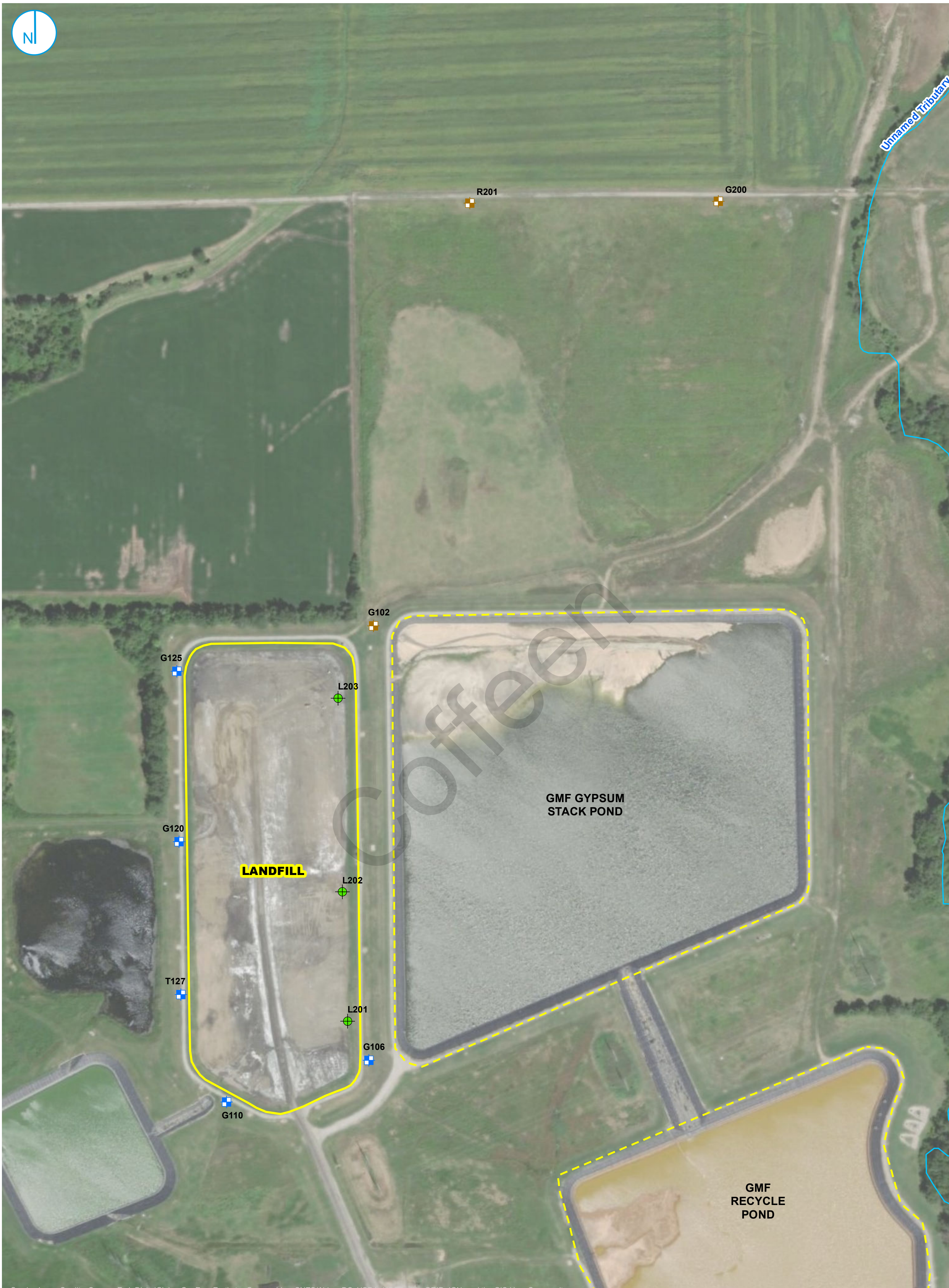
0 300 600 Feet

GROUNDWATER ELEVATION CONTOUR MAP
JANUARY 20, 2020

CCR RULE GROUNDWATER MONITORING
COFFEEN POWER STATION
COFFEEN, ILLINOIS

FIGURE 1

RAMBOLL US CORPORATION
A RAMBOLL COMPANY



BACKGROUND MONITORING WELL
DOWNGRADIENT MONITORING WELL
LEACHATE WELL LOCATION
CCR UNIT BOUNDARY, SUBJECT SITE
CCR UNIT BOUNDARY
SURFACE WATER FEATURE

0 150 300 Feet

SAMPLE LOCATION MAP

FIGURE 2

40 C.F.R. § 257.95(e)(2): ALTERNATE SOURCE DEMONSTRATION
COFFEEN LANDFILL
COFFEEN POWER STATION
COFFEEN, ILLINOIS

RAMBOLL US CORPORATION
A RAMBOLL COMPANY