2018 Annual Groundwater Monitoring and Corrective Action Report

Newton Landfill 2 – CCR Unit ID 502
Newton Power Station
6725 North 500th Street
Newton, Illinois 62448

Illinois Power Generating Company

January 31, 2019

OBG
Part of Ramboll

JANUARY 31, 2019 | PROJECT #70092

2018 Annual Groundwater Monitoring and Corrective Action Report

Newton Landfill 2 – CCR Unit ID 502
Newton Power Station
Newton, Illinois

Prepared for:
Illinois Power Generating Company

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ACRONYMS AND ABBREVIATIONS

ASD	Alternate Source Demonstration
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
mg/L	milligrams per liter
NRT/OBG	Natural Resource Technology, an OBG Company
OBG	O'Brien & Gere Engineers, part of Ramnboll
SSI	Statistically Significant Increase
S.U.	Standard Units
TDS	Total Dissolved Solids

SECTION 1: INTRODUCTION

This report has been prepared on behalf of Illinois Power Generating Company by O'Brien & Gere Engineers, part of Ramboll (OBG), to provide the information required by the Code of Federal Regulations (CFR) found in 40 CFR 257.90(e) for the Newton Landfill 2 located at Newton Power Station near Newton, Illinois.

In accordance with 40 CFR § 257.90(e), the owner or operator of an existing 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 over background levels).
5. Other information required to be included in the annual report as specified in §§ 257.90 through 257.98[1].

This report provides the required information for the Newton Landfill 2 for calendar year 2018.

[1] For calendar year 2018, corrective action and other information required to be included in the annual report as specified in §§ 257.96 through 257.98 is not applicable.

SECTION 2: MONITORING AND CORRECTIVE ACTION PROGRAM STATUS

Detection Monitoring Program sampling event dates and parameters collected are provided in the detection monitoring program summary table below. One sample was collected from each background and downgradient well in the monitoring system during the sampling events in November 2017, May 2018, and November 2018. Resampling was conducted in August 2018 on a subset of the Appendix III parameters. Analytical data was evaluated after each event in accordance with the Statistical Analysis Plan, Newton Power Station, Illinois Power Generating Company (NRT/OBG, 2017a) to identify any statistically significant increases (SSIs) of Appendix III parameters over background concentrations. The dates the SSIs were evaluated are provided in the detection monitoring program summary table below.

Detection Monitoring Program Summary

Sampling Dates	Parameters Collected	SSIs	ASD Completion
November 15, 17, 28, and 29, 2017	Appendix III	Yes	April 9, 2018
May 21, 22, and 23, 2018	Appendix III	Yes	To Be Determined
August 15, 16, 20, 21, 22, and 23, 2018	SSI Parameters only	Not Applicable	Not Applicable
November 12, 13, 14, 15, and 16, 2018	Appendix III	To Be Determined	To Be Determined

Potential alternate sources were evaluated as outlined in the 40 CFR § 257.94(e)(2). An alternate source demonstration (ASD) was completed and certified by a qualified professional engineer. The date the ASD was completed is provided in the detection monitoring program summary table. The ASD is included in Appendix A.

Statistical background values are provided in Table 1. Analytical results from the events summarized in the detection monitoring program summary table above are included in Table 2.

The Newton Landfill 2 remains in the Detection Monitoring Program in accordance with 40 CFR § 257.94.

SECTION 3: KEY ACTIONS COMPLETED IN 2018

Three groundwater monitoring events were completed in 2018 under the Detection Monitoring Program. These events occurred in May, August, and November, and are detailed in Section 2. One sample was collected from each background and downgradient well in the monitoring system during the sampling events in May 2018 and November 2018. Resampling was conducted in August 2018 on a subset of the Appendix III parameters. All samples were collected and analyzed in accordance with the Sampling and Analysis Plan (NRT/OBG, 2017b). All monitoring data obtained under 40 CFR §§ 257.90 through 257.98 (as applicable) in 2018 are presented in Table 2.

The groundwater monitoring system, including the CCR unit and all background and downgradient monitoring wells, is presented in Figure 1.

SECTION 4: PROBLEMS ENCOUNTERED AND ACTIONS TO RESOLVE THE PROBLEMS

No problems were encountered with the groundwater monitoring program during 2018. Groundwater samples were collected and analyzed in accordance with the Sampling and Analysis Plan (NRT/OBG, 2017b), and all data was accepted.

SECTION 5: KEY ACTIVITIES PLANNED FOR 2019

The following key activities are planned for 2019:

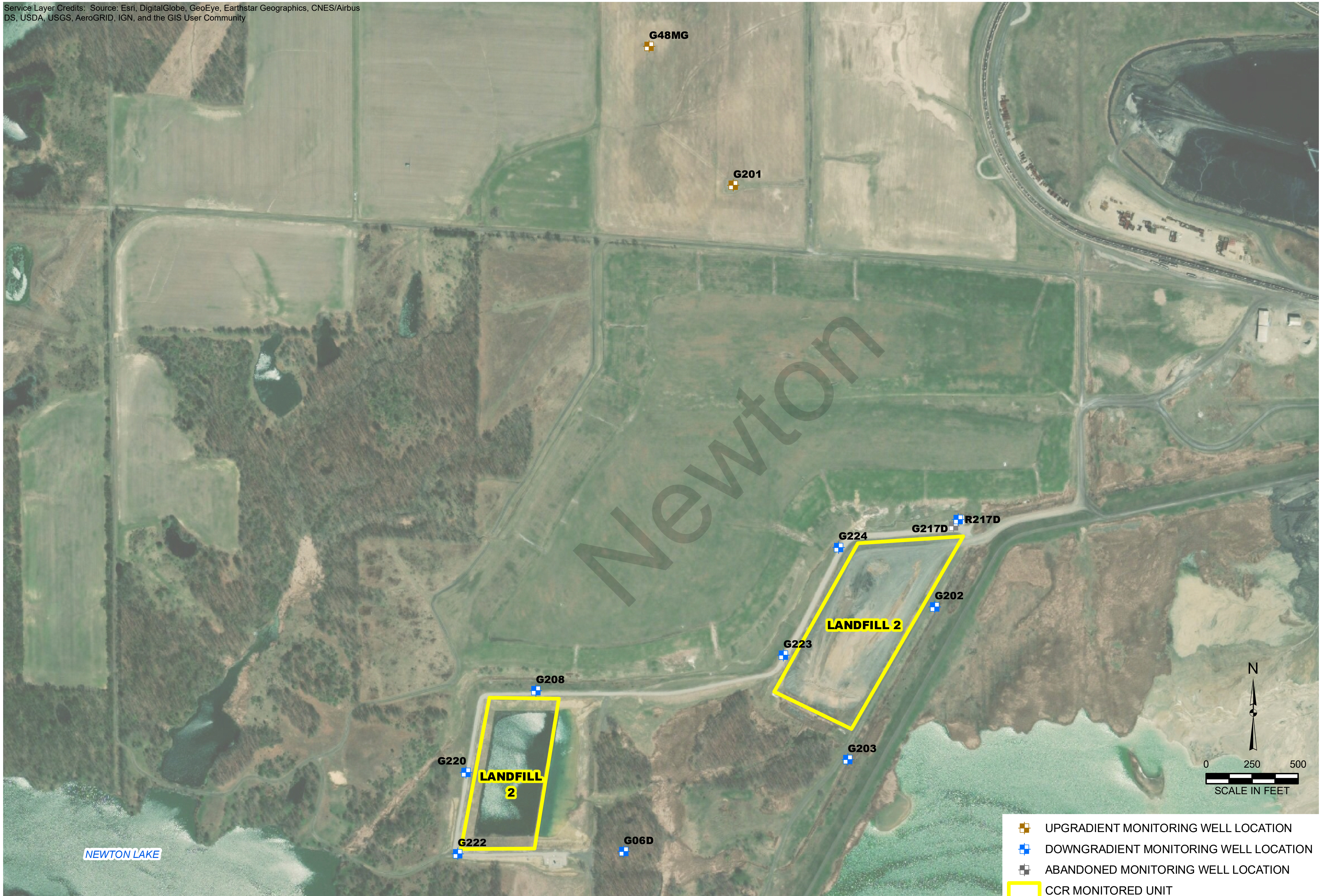
- Continuation of the Detection Monitoring Program with semi-annual sampling scheduled for the first and third quarters of 2019.
- Complete evaluation of analytical data from the downgradient wells, using background data to determine whether an SSI of Appendix III parameters over background concentrations has occurred.
- If an SSI is identified, potential alternate sources (i.e., a source other than the CCR unit caused the SSI or that 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 annual groundwater monitoring and corrective action report for 2019.
    - If an alternate source(s) is not identified to be the cause of the SSI, the applicable requirements of 40 CFR §§ 257.94 through 257.98 (e.g., assessment monitoring) as may apply in 2019 will be met, including associated recordkeeping/notifications required by 40 CFR §§ 257.105 through 257.108.

REFERENCES

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

Natural Resource Technology, an OBG Company, 2017b, Sampling and Analysis Plan, Newton Landfill 2, Newton Power Station, Newton, Illinois, Project No. 2285, Revision 0, October 17, 2017.

Figures



DRAWN BY/DATE: SDS 11/28/18
REVIEWED BY/DATE: AJB 1/24/19
APPROVED BY/DATE: NMP 1/28/19

GROUNDWATER SAMPLING WELL LOCATION MAP
NEWTON LANDFILL 2
UNIT ID: 502

2018 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT
VISTRA CCR RULE GROUNDWATER MONITORING
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 70092

FIGURE NO: 1

OBG Part of Ramboll

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Tables

Table 1. Statistical Background Values

2018 Annual Groundwater Monitoring and Corrective Action Report

Newton Power Station

Unit ID 502 - Newton Landfill 2

Parameter	Statistical Background Value
Appendix III	
Boron (mg/L)	0.181
Calcium (mg/L)	160
Chloride (mg/L)	34
Fluoride (mg/L)	1.037
pH (S.U.)	6.6 / 8.1
Sulfate (mg/L)	760
TDS (mg/L)	1005

[O: KLS 8/29/18, C: RAB 8/30/18]

Notes:

mg/L = milligrams per liter

S.U. = Standard Units

TDS = Total Dissolved Solids

Table 2. Appendix III Analytical Results

2018 Annual Groundwater Monitoring and Corrective Action Report
Newton Power Station
Unit ID 502 - Newton Landfill 2

Sample Location	Date Sampled	B, total (mg/L)	Ca, total (mg/L)	Cl, total (mg/L)	F, total (mg/L)	pH (field) (S.U.)	SO4, total (mg/L)	TDS (mg/L)
Background / Upgradient Monitoring Wells								
G48MG	11/28/2017	0.11	36	31	0.682	6.9	2.5	460
	5/21/2018	0.045	63	22	0.366	7.0	70	450
	8/23/2018	NA	110	47	NA	7.0	190	NA
	11/15/2018	0.053	72	13	0.334	7.0	54	380
G201	11/28/2017	0.10	150	4.7	0.748	7.3	530	790
	5/21/2018	0.093	130	4.2	0.774	7.2	530	770
	8/15/2018	NA	150	3.8	NA	7.3	530	NA
	11/12/2018	0.098	160	4.2	0.724	7.3	550	810
Downgradient Monitoring Wells								
G06D	11/15/2017	0.18	88	56	0.709	7.5	9.6	760
	5/21/2018	0.17	94	57	0.696	7.4	13	780
	8/16/2018	NA	110	54	NA	7.7	6.5	NA
	11/12/2018	0.17	120	58	0.681	7.3	3.0	770
G202	11/15/2017	0.10	180	55	0.618	7.2	150	720
	5/23/2018	0.11	150	58	0.526	7.3	160	660
	8/21/2018	NA	120	64	NA	7.3	73	NA
	11/14/2018	0.10	130	56	0.421	7.2	95	590
G203	11/15/2017	0.070	110	49	0.504	6.8	170	720
	5/23/2018	0.095	200	49	0.438	6.8	150	640
	8/21/2018	NA	140	55	NA	7.0	120	NA
	11/14/2018	0.082	160	47	0.344	6.8	170	650
G208	11/17/2017	0.18	110	48	1.11	7.5	110	820
	5/23/2018	0.19	110	42	1.30	7.3	91	780
	8/20/2018	0.18	120	47	0.966	7.5	88	NA
	11/13/2018	0.18	120	44	1.07	7.4	45	620
G220	11/17/2017	0.26	100	37	1.37	7.0	24	610
	5/22/2018	0.49	100	31	1.46	7.1	81	770
	8/16/2018	0.39	120	36	1.34	7.1	64	NA
	11/13/2018	0.31	110	35	1.28	7.0	45	660
G222	11/15/2017	0.21	110	67	1.09	7.0	200	1100
	5/22/2018	0.21	120	67	1.30	7.1	170	1000
	8/16/2018	0.22	140	70	1.08	7.1	160	NA
	11/12/2018	0.21	140	68	0.956	7.1	150	990
G223	11/29/2017	0.23	110	100	0.781	7.2	6.0	840
	5/23/2018	0.23	98	100	0.975	7.2	7.5	820
	8/21/2018	0.092	130	51	NA	7.2	130	NA
	11/13/2018	0.24	120	100	0.671	7.2	7.3	780
G224	11/15/2017	0.093	100	50	0.526	7.3	140	680
	5/23/2018	0.093	120	49	0.449	7.4	140	630
	8/21/2018	NA	130	52	NA	7.4	140	NA
	11/15/2018	0.086	120	49	0.369	7.3	130	640
R217D	11/28/2017	0.081	72	25	0.721	6.8	47	470
	5/23/2018	0.057	54	28	0.694	7.0	66	320
	8/22/2018	NA	120	110	NA	7.0	1.5	NA
	11/16/2018	0.10	92	29	0.609	7.0	110	560

[O: RAB 12/27/18, C: JQW 12/27/18][U: RAB 1/26/19]

Notes:
mg/L = milligrams per liter
S.U. = Standard Units
TDS = Total Dissolved Solids
NA = Not Analyzed
< = concentration is less than the reporting limit

Appendix A

Alternate Source Demonstration

40 CFR § 257.94(E)(2): Alternate Source Demonstration
Newton Landfill 2

Newton Power Station
Newton, Illinois

Illinois Power Generating Company

April 9, 2018

APRIL 9, 2018 | PROJECT #70092

40 CFR § 257.94(E)(2): Alternate Source Demonstration Newton Landfill 2

Newton Power Station
Newton, Illinois

Prepared for:
Illinois Power Generating Company

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Included in the text.

LIST OF FIGURES

Figures 1 and 2 are attached, Figures 3-10 are included in the text.

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

ASD	alternate source demonstration
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulation
IEPA	Illinois Environmental Protection Agency
LF1	Newton Power Station Phase I Landfill
LF2	Newton Power Station Phase II Landfill
mg/L	milligrams per liter
msl	mean sea level
NPDES	National Pollutant Discharge Elimination System
OBG	O'Brien & Gere Engineers, Inc.
PAP	Newton Power Station Primary Ash Pond
SSI	statistically significant increase

1 INTRODUCTION

1.1 OVERVIEW

This alternate source demonstration (ASD) has been prepared on behalf of Illinois Power Generating Company by O'Brien & Gere Engineers, Inc. (OBG) to provide pertinent information pursuant to 40 CFR § 257.94(e)(2) for the Newton Power Station Landfill 2 (Phase II Landfill) near Newton, Illinois.

Initial background groundwater monitoring consisting of a minimum of eight samples as required under 40 CFR § 257.94(b) was initiated in December 2015 and completed prior to October 17, 2017. The first semi-annual detection monitoring samples were collected on November 15 to 29, 2017. Evaluation of analytical data from the first detection monitoring sample for statistically significant increases (SSIs) of 40 CFR Part 257 Appendix III parameters over background concentrations was completed within 90 days of collection and analysis of the sample (January 9, 2018). That evaluation identified SSIs at downgradient monitoring wells as follows:

- Boron at wells G220, G222 and G223
- Calcium at well G202
- Chloride at wells G06D, G202, G203, G208, G220, G222, G223 and G224
- Fluoride at wells G208, G220 and G222
- Total dissolved solids at wells G222

40 CFR 257.94(e)(2) allows the owner or operator 90 days from the date of an SSI determination to complete a written demonstration that a source other than the CCR unit caused the SSI or that the SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality ("alternate source demonstration"). Pursuant to 40 CFR § 257.94(e)(2), the following demonstrates that sources other than the Phase II Landfill, including anthropogenic sources and natural variation in groundwater quality, were the cause of the SSIs listed above. This alternate source demonstration (ASD) was completed within 90 days of determination of the SSIs (April 9, 2018) as required by 40 CFR § 257.94(e)(2).

1.2 SITE LOCATION AND DESCRIPTION

The Newton Power Station is located in Jasper County in the southeastern part of central Illinois, approximately 7 miles southwest of the town of Newton (Figure 1). The area is surrounded by Newton Lake. Beyond the lake is agricultural land.

1.3 DESCRIPTION OF CCR MANAGEMENT UNITS

The CCR management units at the Newton Power Station include the Phase I Landfill, Primary Ash Pond (CCR Unit ID 501), and the Phase II Landfill (CCR Unit ID 502).

1.3.1 Phase I Landfill (LF1)

The Phase I Landfill (LF1) is an unlined landfill built around 1977 and permitted to start receiving CCRs in 1979. LF1was closed in 1999 with a 40-mil thick geomembrane cap, and is consequently not subject to the USEPA CCR Rule (40 CFR Part 257).

1.3.2 Phase II Landfill (LF2)

The Phase II Landfill (LF2) includes three cells. Cells 1 and 2, encompassing approximately 46 acres, are adjacent to each other and located south and east of LF1. Cell 3 has a footprint of approximately 12 acres and is approximately 1,100 feet west of Cells 1 and 2 and south of the southwestern portion of LF1. All three cells of LF2 are constructed with composite liners with leachate collection systems that meet or exceed the landfill liner performance standards of 40 CFR § 257.70. More details on the liner construction of LF2 are provided in Section 3.1.

Cell 3 is currently inactive and has not received CCR since constructed in 2011.

1.3.3 Primary Ash Pond (PAP)

The Newton Power Station's sole CCR surface impoundment, the Primary Ash Pond (PAP), was constructed in 1977 and has a design capacity of approximately 9,715 acre-feet. The PAP has a surface area of 400 acres and a height of approximately 71 feet above grade. The PAP currently receives bottom ash, fly ash, and low-volume wastewater (LVW) from the plant's two coal-fired boilers, and is operated per NPDES Permit IL0049191, Outfall 001. The PAP was not excavated during construction except for native materials used to build the containment berms.

1.4 GEOLOGY AND HYDROGEOLOGY

The results of the site characterization activities previously performed at the Site are discussed below.

1.4.1 Geology

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

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

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

1.4.2 Hydrogeology

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

1.4.2.1 Uppermost Aquifer

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

1.4.2.2 Lower Limit of Aquifer

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

1.4.2.3 Groundwater Elevations, Flow Direction, and Velocity

Groundwater elevations across LF2 ranged from approximately 441 to 520 ft MSL (NAVD88) from 2015 to 2017. Figure 2 is the potentiometric surface from the November 2017 detection monitoring event. Overall groundwater flow beneath LF2, within the uppermost aquifer, is southward toward Newton Lake, but with a south component of flow under Areas 1 and 2, and a predominantly eastward flow under Cell 3. Horizontal hydraulic gradients are moderate at 0.016 ft/ft. Calculated groundwater flow velocity based on the January and June 2017 groundwater contour maps was 1.42 ft per day (ft/day).

2 GROUNDWATER AND LEACHATE MONITORING

The uppermost aquifer monitoring well network for Cells 1/2 and Cell 3 is shown on Figure 1 and described below.

2.1 BACKGROUND GROUNDWATER MONITORING

Monitoring wells G201 and G48MG are used to monitor background water quality for LF2. These wells are located north of LF1 and LF2.

2.2 DOWNGRADIENT GROUNDWATER MONITORING

LF2 Cells 1 and 2 are monitored using wells G202, G203, G223, G224, and R217D. LF1 borders these two cells on the north and west sides; the PAP borders them to the east. LF2 Cell 3 is located 1,500 feet to the southwest. The undeveloped area between Cells 1/2, and Cell 3, has been reserved for future landfill expansion, if needed.

LF2 Cell 3 is monitored using wells G06D, G208, G220 and G222. LF2 Cell 3 is bounded to the north by the southern end of LF1. The land bordering the cell to the east, west and south is undeveloped. The lake is 1,000 feet to the southwest. Cell 3 does not contain CCR.

2.3 LEACHATE MONITORING

Leachate generated by LF1 is monitored at location L1R and leachate from LF Cells 1 and 2 is monitored at L301; both locations are shown on Figure 1. Leachate is not generated at Cell 3 since it does not contain CCR.

3 LINES OF EVIDENCE SUPPORTING ASD

As allowed by 40 CFR § 257.94(e)(2), this ASD demonstrates that sources other than LF2 caused the SSI or that the SSI was a result of natural variation in groundwater quality. This ASD is based on the following lines of evidence (LOE) as discussed below.

3.1 LANDFILL DESIGN AND OPERATION

The LF2 includes three cells. Cells 1 and 2 are adjacent to each other and located south and east of LF1. Cells 1 and 2, encompassing approximately 46 acres, were constructed in 1997 and began receiving CCRs that same year. A portion of Cell 2 is still operational. Cell 3 was constructed in 2011 and its footprint is approximately 12 acres. It is currently inactive and has not received CCR since constructed in 2011.

The constructed landfill components for Cells 1, 2, and 3 include the following features from top to bottom:

- Soil cover for frost protection
- 10-ounce/sy geotextile for separation of the leachate management system from the frost protection soil cover
- 1-foot thick sand drainage layer for the leachate collection system
- 60-mil high-density polyethylene (HDPE) geomembrane
- Three feet of compacted, low-permeability soil with a maximum hydraulic conductivity of 1.0 x 10-7 centimeters per second (cm/sec)

All three cells of LF2 are constructed with composite liners with leachate collection systems that meet or exceed the landfill liner performance standards of 40 CFR § 257.70.

3.2 GROUNDWATER QUALITY SIGNATURE

Piper diagrams graphically represent ionic composition of aqueous solutions. A Piper diagram displays the position of water samples with respect to their major cation and anion content, providing the information needed to identify composition categories or groupings. Figure 3 is a Piper diagram that displays the ionic composition of samples from the background and downgradient monitoring wells associated with LF1, LF2, and PAP versus landfill leachate and PAP water. The groupings identified are shown in the green, brown, blue, and purple ellipses on the Piper diagram. These are discussed in more detail below.

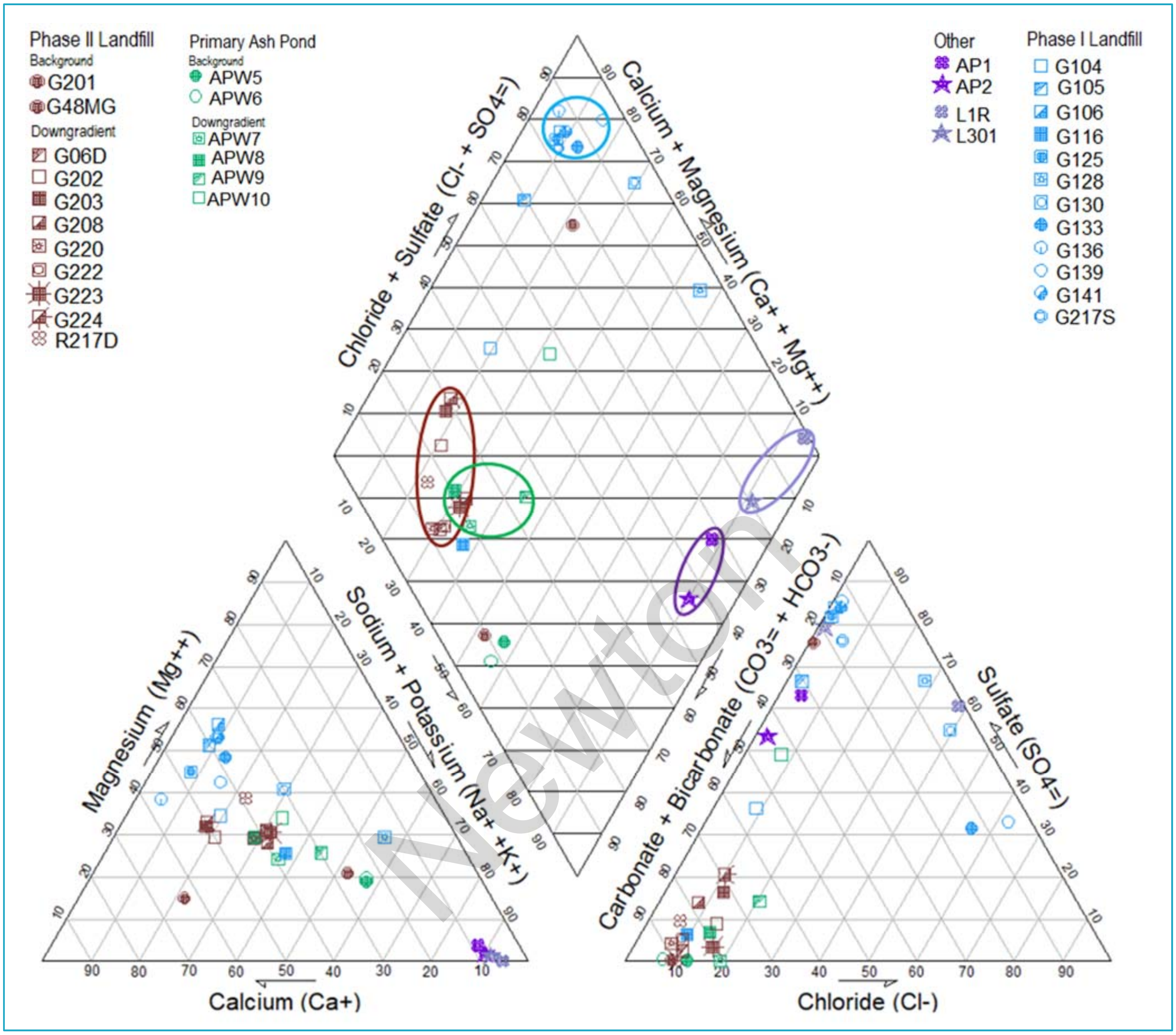


Figure 3. Piper diagram showing ionic composition of samples of background and downgradient groundwater associated with Phase I Landfill (LF1), Phase II Landfill (LF2), and Primary Ash Pond versus landfill leachate and Primary Ash Pond water

The ionic characteristics of the water samples in each grouping are provided in Table 1 below:

Grouping	Burgundy	Green	Blue	Light Purple	Purple
Locations	Phase II Landfill Wells (LF2) Groundwater	Primary Ash Pond (PAP) Groundwater	Phase I Landfill Wells (LF1) Groundwater	Landfill Leachate	Primary Ash Pond Water
Dominant Cation	No dominant cation	No dominant cation	No dominant cation	**Very High Sodium-Potassium**	**Very High Sodium-Potassium**
Dominant Anion	**Very High Carbonate-Bicarbonate**	**Very High Carbonate-Bicarbonate**	**High Sulfate**	No dominant anion	No dominant anion

Table 1. Summary of Ionic Classification

The results can be categorized into three distinct groups. The LF2 groundwater samples (burgundy grouping) and the PAP groundwater samples (green grouping) are very high carbonate-bicarbonate waters with no dominant cation. The LF1 wells (blue grouping) also have no dominant cation, but these waters are high in sulfate. The PAP waters (light purple grouping) and the landfill leachate (purple grouping) are very high sodium-potassium with no dominant anion.

The groundwater samples for both LF2 and PAP are tightly clustered on the Piper diagram. This tight grouping indicates that the groundwater is either not being influenced by other sources, or is being influenced by a consistent, steady-state source, such as LF1, that is influencing all the wells equally and simultaneously.

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

Figure 4 is an enlargement of the LF2 and PAP groundwater sample groupings on the Piper diagram in Figure 3. The intermingling of the results from Cells 1 and 2, and Cell 3 on the Piper diagram indicates that the ionic composition of these groundwaters are similar, despite the distance between them.

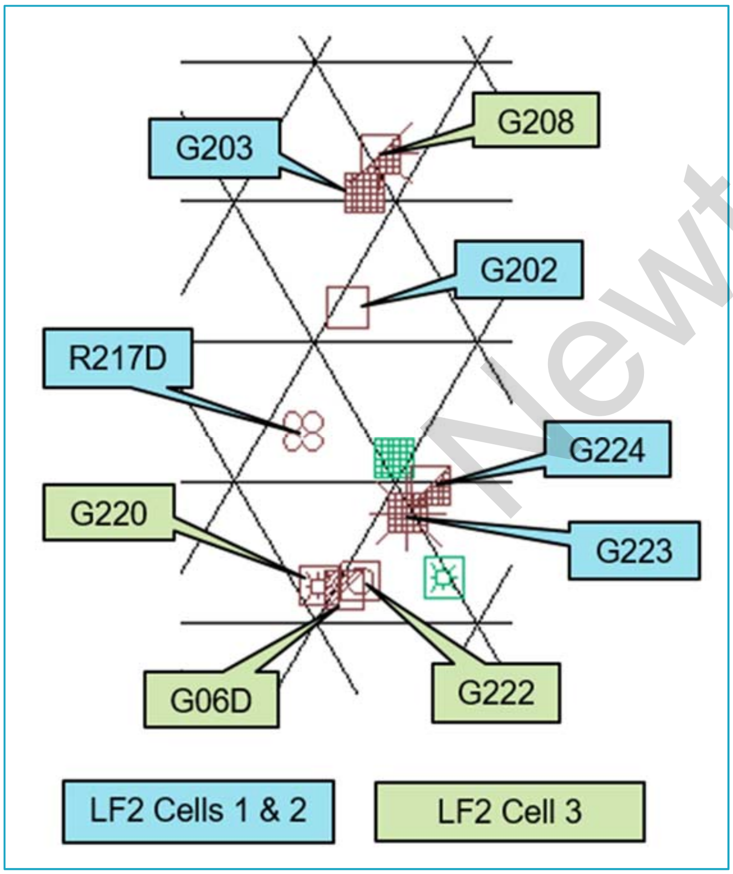


Figure 4. Enlargement of Piper Diagram

3.3 LINES OF EVIDENCE FOR SSI PARAMETERS BY WELL

3.3.1 Boron

3.3.1.1 Wells G220 and G222 (Cell 3)

Monitoring wells G220, and G222 are part of the downgradient monitoring wells for LF2 Cell 3. Cell 3 does not contain CCR; therefore, it cannot be the source of the boron in G220 or G222. The alternate source is likely a steady-state source, as inferred from the Piper diagram, such as LF1.

3.3.1.2 Well G223 (Cells 1 and 2)

It is evident from the Piper diagram (Figure 3) that groundwater samples from G223 have similar ionic composition as groundwater samples from the Cell 3 wells. Box plots of the boron concentrations observed in Cell 3 wells and G223 are shown in the figure below.

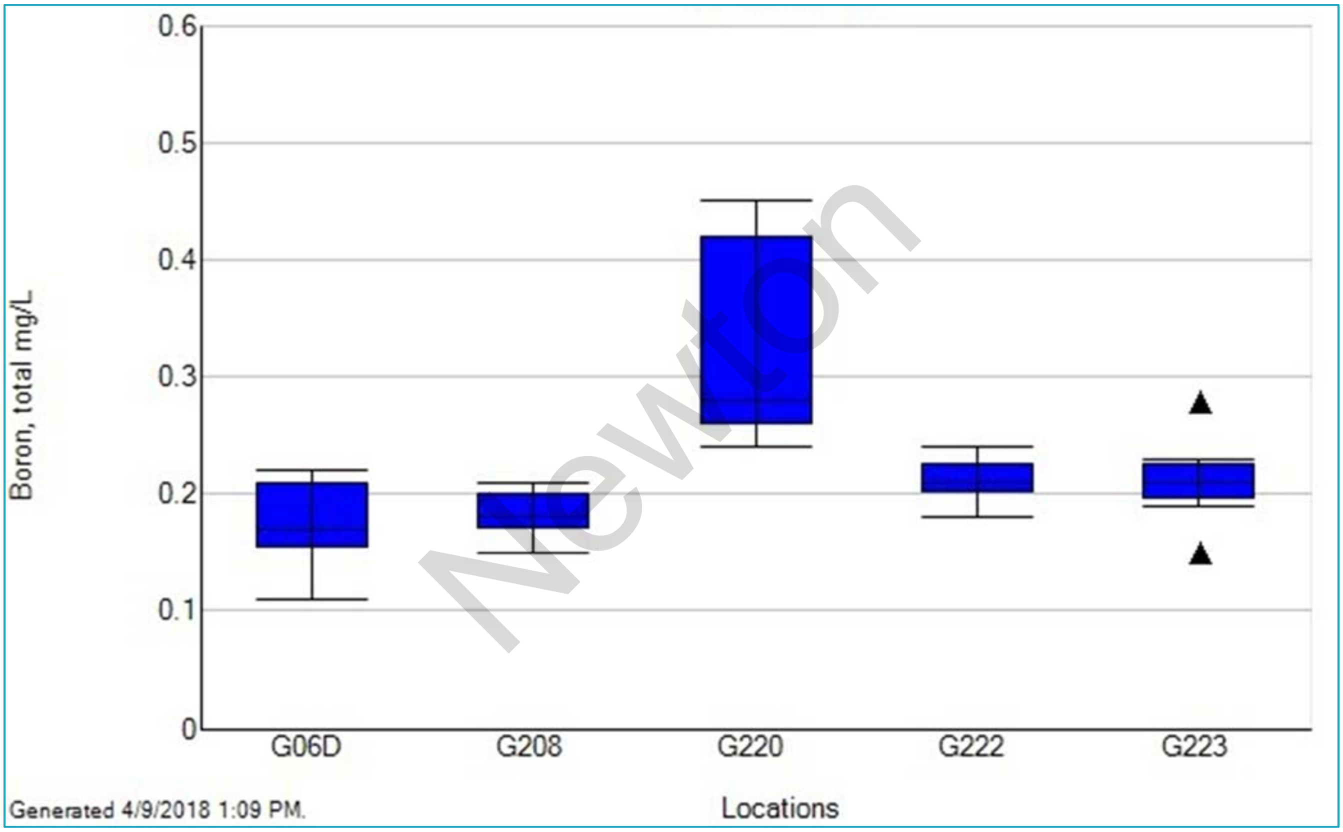


Figure 5. Box plot for boron concentrations in groundwater samples collected from Cell 3 monitoring wells and G223

Figure 5 demonstrates the following:

- Boron concentrations in groundwater samples collected from monitoring well G223 exhibit non-parametric characteristics as shown by the outliers (arrows) at 1.5 times the interquartile range (IQR).
- Boron concentrations in groundwater samples collected from the monitoring wells exhibit some level of skewness, with G06D and G220 having the most, and G223 the least.

The Kruskal-Wallis test was used to see if boron concentrations observed at G223 are part of the same statistical population as those observed at the wells near Cell 3. This is the appropriate test for comparing two or more groups that contain non-parametric data. The null hypothesis (H_0) is that the groups of data being compared have identical distributions. The hypothesis is true if chi-squared is greater than the H statistic. The test resulted in chi-squared value of 3.841 and an H statistic of 0.029, indicating that the null hypothesis is true, and the boron concentrations observed at well G223 are part of the same statistical population as those observed in the wells near Cell 3. Test results are provided in Appendix A.

Cumulative distribution curves are provided in Figure 6 below.

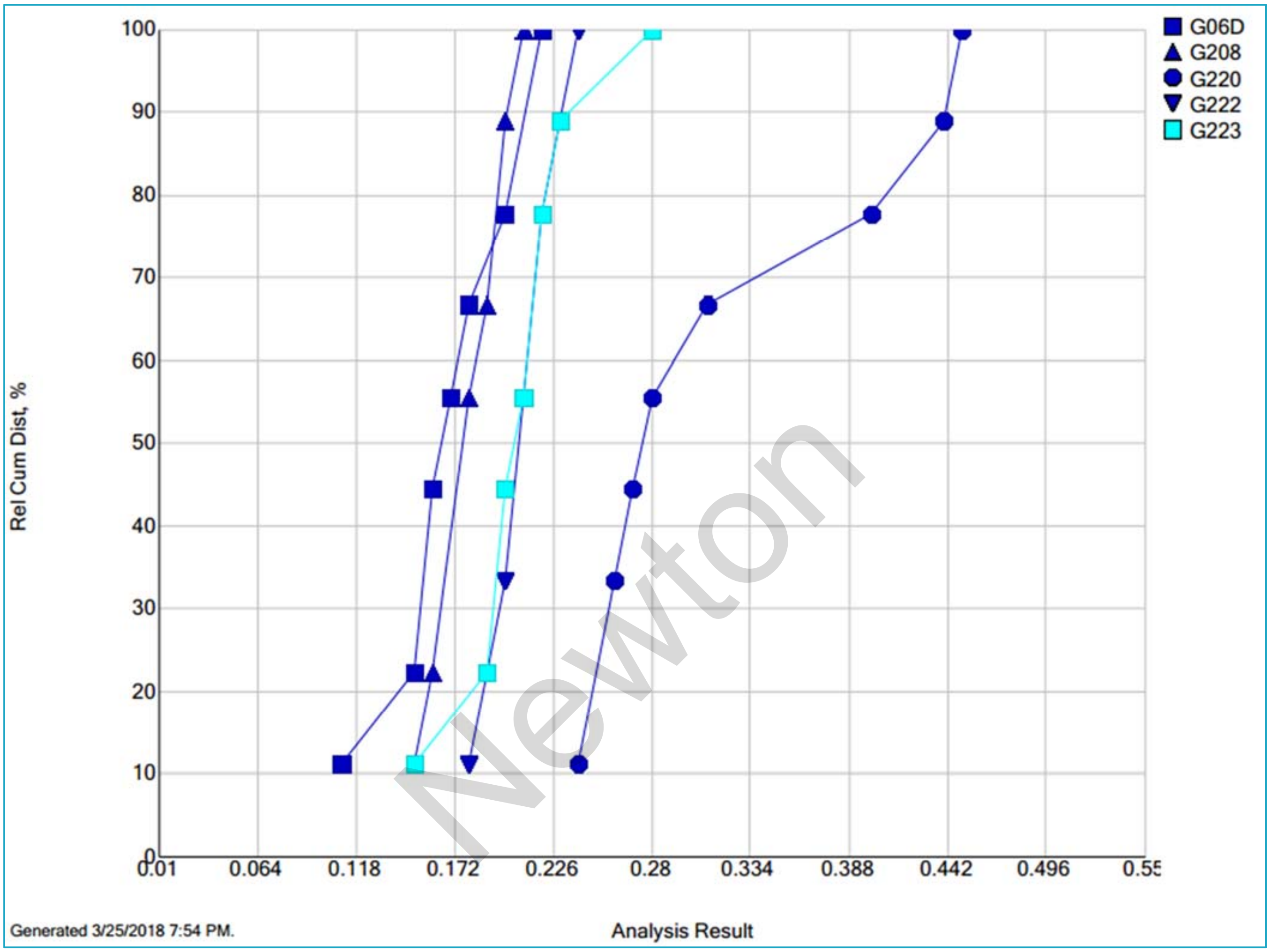


Figure 6. Boron Cumulative Distribution Curve for Cell 3 monitoring wells and G223

The near vertical lines shown in Figure 6, with the exception of G220 (Cell 3), indicate that the concentrations of boron in the wells are stable. The curve for G223 overlaps the curve for G222, further reinforcing that boron concentrations observed at G223 are part of the same statistical population as those observed in the wells near Cell 3.

Boron concentrations observed at well G223 are stable and in the same statistical population as boron concentrations observed in the wells near Cell 3; therefore, it is also likely influenced by an alternate source.

3.3.2 Calcium – G202 (Cells 1 and 2)

Calcium in groundwater at well G202, located downgradient from Cells 1 and 2, generally occurs at concentrations greater than observed in LF2 leachate at sampling location L301. Conversely, the calcium content in the LF1 leachate, as measured at sampling location L1R, is extremely elevated.

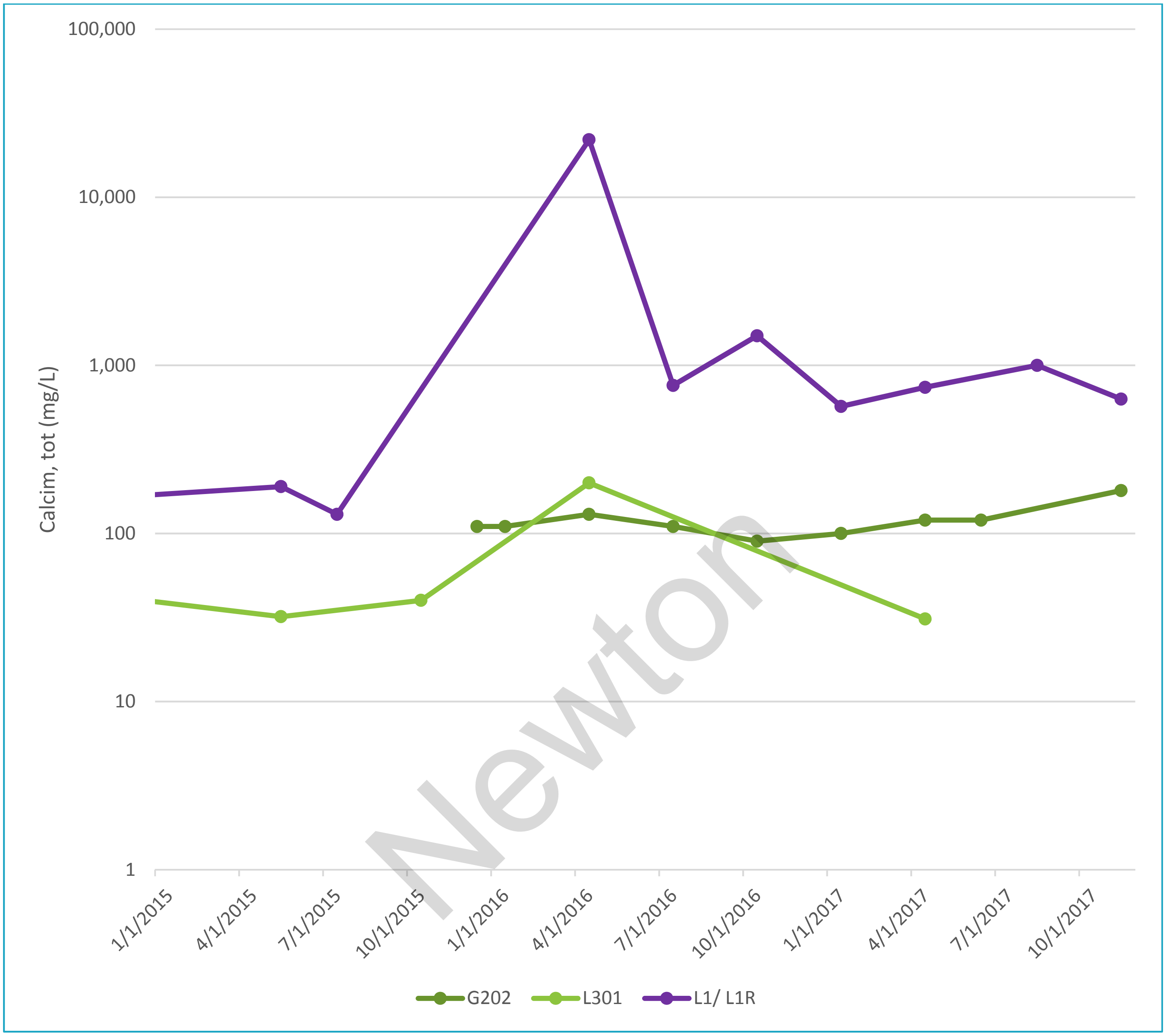


Figure 7. Calcium Time Series (logarithmic) of Leachate and G202

Figure 7 is a time series plot of calcium concentrations observed in groundwater at G202 and leachate from LF1 and LF2 from January 2015 to April 2017 and demonstrates the following:

- Calcium concentrations from LF1 leachate (sampling location L1/L1R) range from 110 to 22,000 mg/L with a median value of 180 mg/L; the 22,000 mg/L concentration appears to be an outlier
- Calcium concentrations from LF2 leachate (sampling location L301) range from 19 to 290 mg/L with a median of 52 mg/L
- Calcium concentrations in downgradient well G202 range from 90 to 180 mg/L with a median of 110 mg/L

Since median calcium concentrations measured in LF2 leachate are less than the median concentrations in well G202, LF2 cannot be the source. The source is likely LF1 since the calcium concentrations in LF1 leachate are significantly greater than in those observed in well G202. The median calcium concentration for LF1 leachate is approximately 1.5 times greater than the median calcium concentration observed in groundwater at well G202 and 3.5 times greater than the median calcium concentration in LF2 leachate.

3.3.3 Chloride

3.3.3.1 Wells G06D, G208, G220, and G222 (Cell 3)

Monitoring wells G06D, G208, G220, and G222 are part of the downgradient monitoring system for LF2 Cell 3. Cell 3 does not contain CCR; therefore, it cannot be the source of the chloride in G06D, G208, G220, and G222. The alternate source is likely a steady-state source, as inferred from the Piper diagram, such as LF1.

3.3.3.2 Wells G202, G203, and G224 (Cells 1 and 2)

It is evident from the Piper diagram that groundwater quality at G202, G203, and G224 is similar to the groundwater at Cell 3 wells. Boxplots of the Cell 3 wells and G202, G203, and G224 are shown in Figure 8.

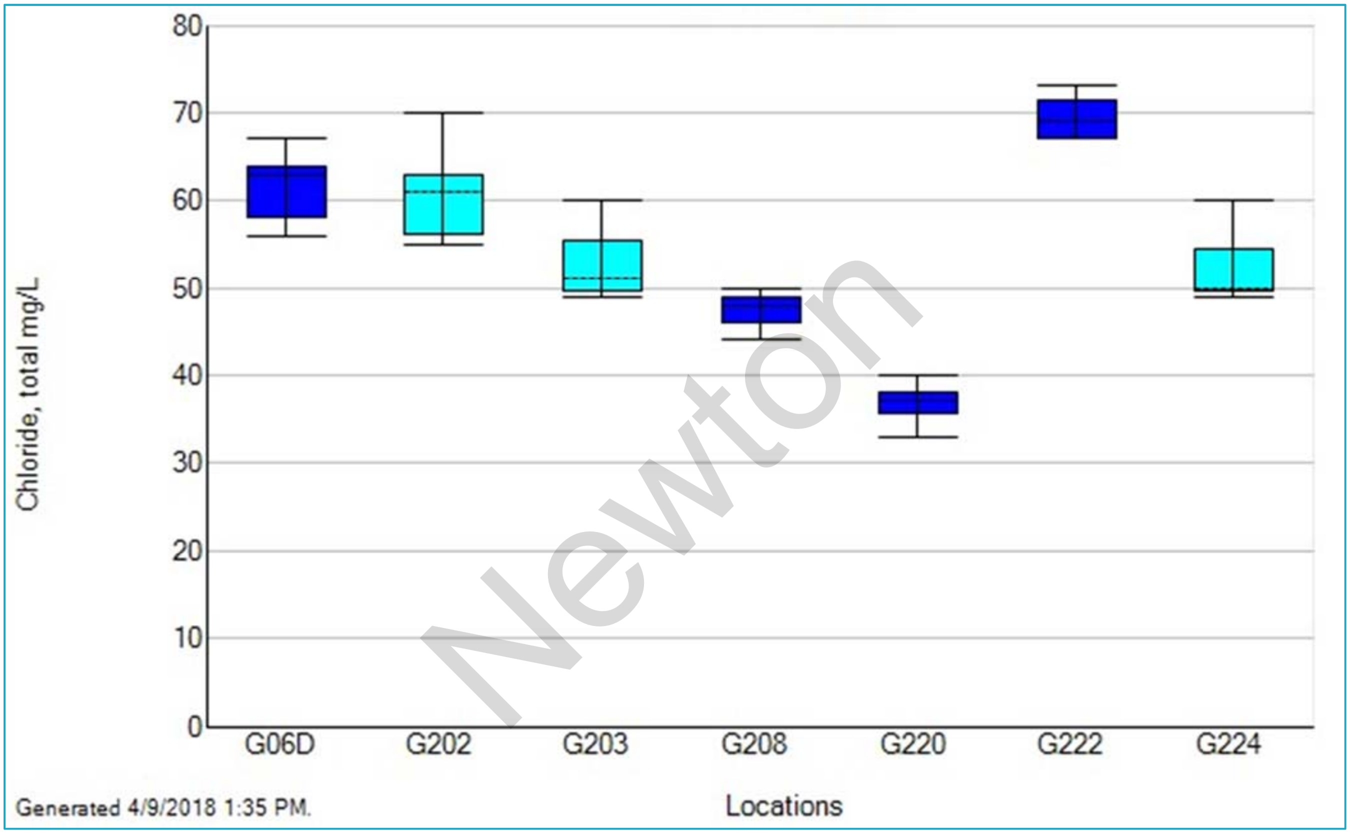


Figure 8. Chloride Boxplot for Cell 3 monitoring wells and G202, G203, and G224

The following observations can be made from Figure 8:

- The ranges of the boxes overlap, indicating that the data between the 75th and 25th quartile are similar
- The minimum and maximum chloride concentrations range from 35 to 72 mg/L
- Chloride concentrations in wells G06D, G202, G203, G208, and G224 are bounded by lower and higher concentrations at the Cell 3 downgradient wells G220 and G222

The Kruskal-Wallis test was used to see if chloride concentrations observed at wells G202, G203, and G224 are part of the same statistical population as chloride concentrations observed in groundwater downgradient from Cell 3. The test resulted in chi-squared value of 7.8 and an H statistic of 4.7, indicating that the null hypothesis is true, and the chloride concentrations observed in wells G202, G203, and G224 are part of the same statistical population as those observed near Cell 3. Test results are provided in Appendix A.

Cumulative distribution curves are presented in the figure below.

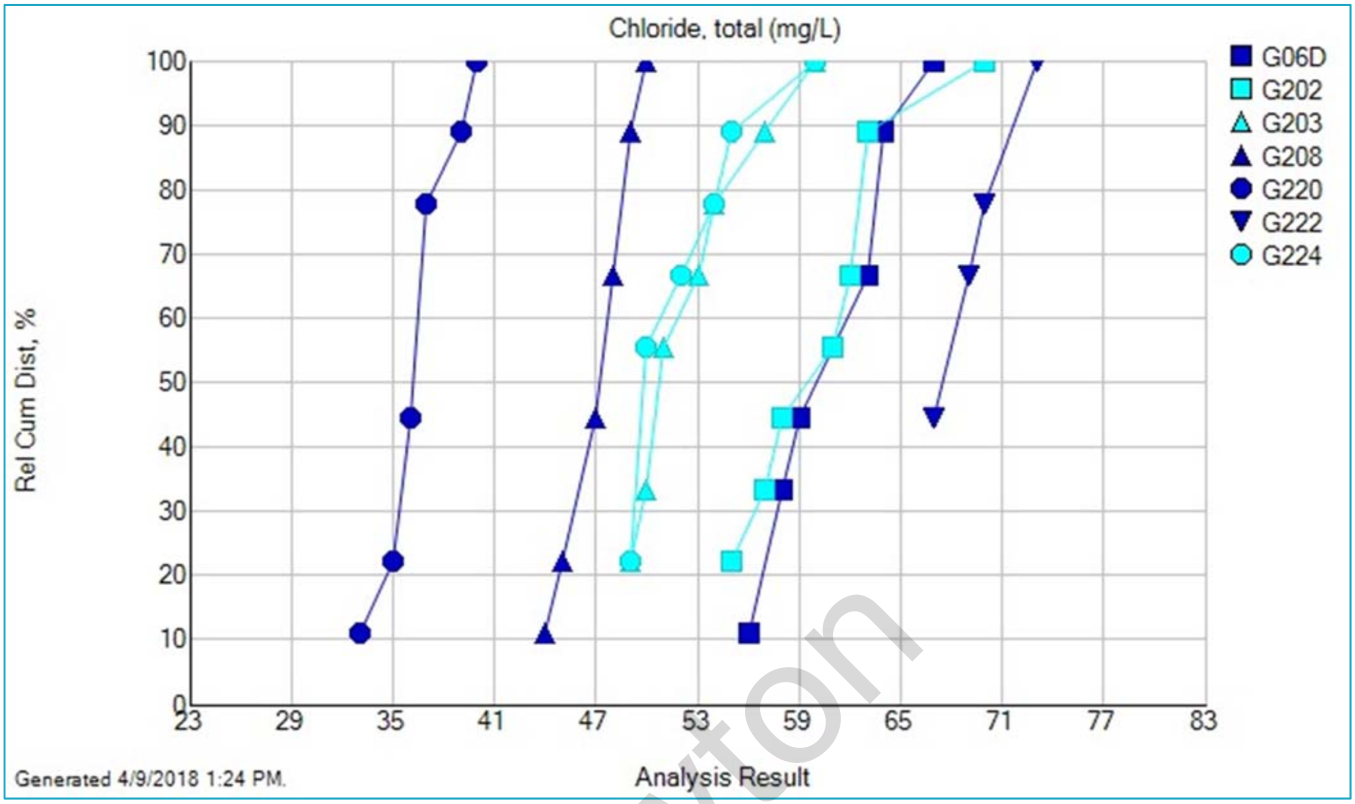


Figure 9. Chloride Cumulative Distribution Curve for Cell 3 monitoring wells and G202, G203, and G224

The near vertical lines shown in Figure 9, indicate that the concentration of chloride observed in the monitoring wells is stable. The distribution curves for concentrations observed in G202, G203, and G224 have the same shape and are parallel to those for the concentrations observed in the Cell 3 wells, further supporting that these wells are in the same statistical population.

Chloride concentrations at wells G202, G203, and G224 are stable and in the same population as Cell 3 wells; therefore, chloride in groundwater at these wells must be influenced by an alternate source.

3.3.3.3 High Concentrations in LF1 Leachate Relative to Groundwater

Additional evidence of an alternate source is the extremely high concentrations of chloride in LF1 leachate, as shown on the time series below.

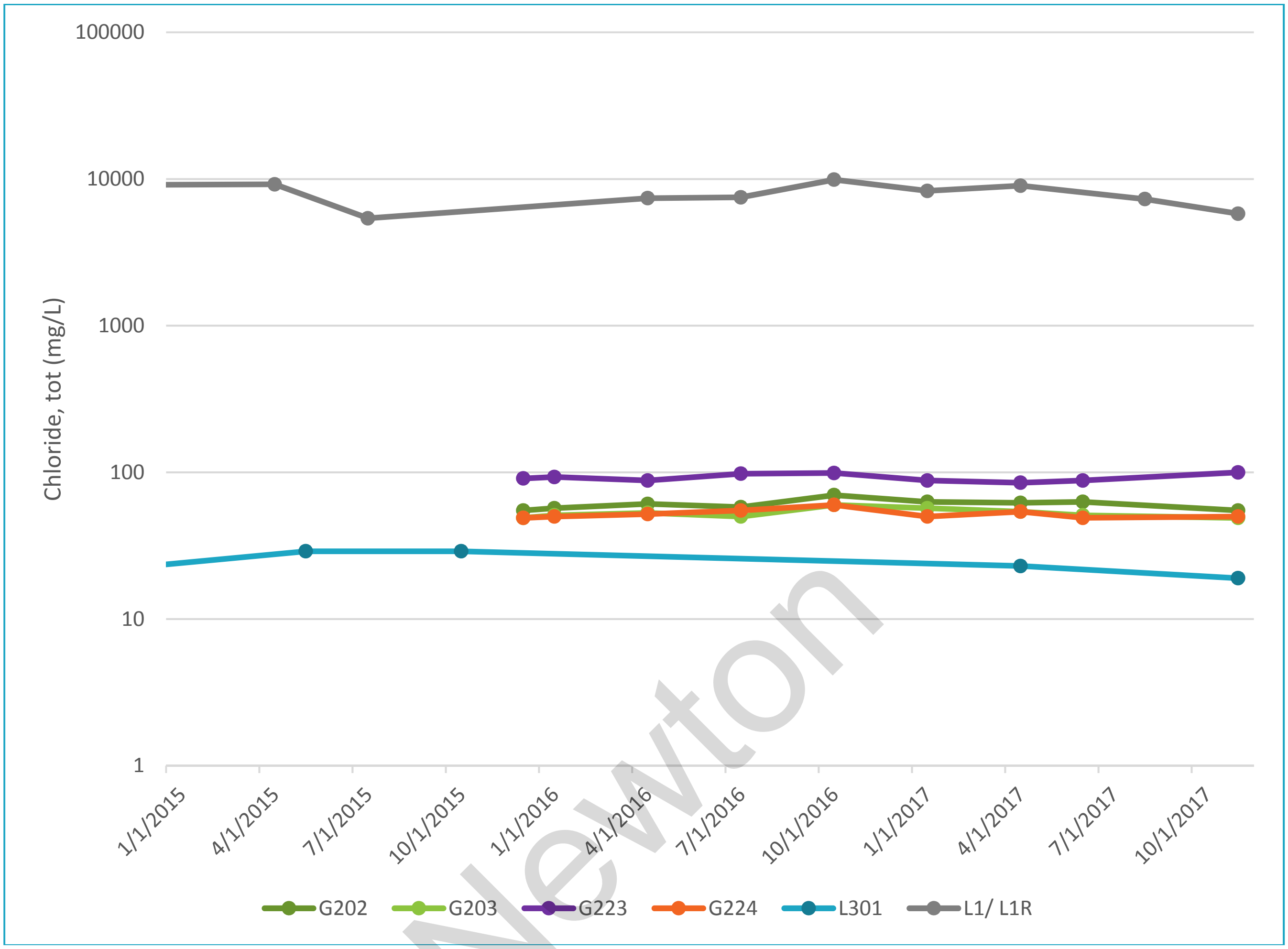


Figure 10. Chloride Time series (logarithmic) of Leachate and G202, G203, G223, and G224

The following observations can be made:

- Chloride concentrations in LF1 leachate (sampling location L1/L1R) range from 5,400 to 9,900 mg/L with a median of 7,500 mg/L
- Chloride concentrations in LF2 leachate (sampling location L301) range from 19 to 29 mg/L with a median of 26 mg/L
- Chloride concentrations in well G202 range from 55 mg/L to 70 mg/L with a median of 61 mg/L
- Chloride concentrations in well G203 range from 49 mg/L to 60 mg/L with a median of 51 mg/L
- Chloride concentrations in well G223 range from 85 mg/L to 100 mg/L with a median of 91mg/L
- Chloride concentrations in well G224 range from 49 mg/L to 60 mg/L with a median of 50 mg/L

Since the chloride concentrations in LF2 leachate are less than the concentrations in downgradient wells G202, G203, G223, and G224, LF2 cannot be the source. The alternate source is likely LF1 since the chloride concentrations in leachate are significantly greater, by two orders of magnitude, than in groundwater at wells G202, G203, G223, and G224.

3.3.4 Fluoride – G208, G220, and G222 (Cell 3)

Monitoring wells G208, G220, and G222 are part of the downgradient monitoring system for LF2 Cell 3. Cell 3 does not contain CCR; therefore, it cannot be the source of the fluoride in wells G208, G220, and G222. The alternate source is likely a steady-state source, as inferred from the Piper diagram, such as LF1.

3.3.5 Total Dissolved Solids (TDS) –G222 (Cell 3)

Monitoring well G222 is part of the downgradient monitoring system for LF2 Cell 3. Cell 3 does not contain CCR; therefore, it cannot be the source of the TDS in G222. The alternate source is likely a steady-state source, as inferred from the Piper diagram, such as LF1.

4 SUMMARY

The following bullets summarize the key information and findings:

- Overall groundwater flow within the uppermost aquifer beneath LF2 is southward toward Newton Lake, but with a predominantly eastward flow under Cell 3.
- Cell 3 does not contain CCR; therefore, it cannot be the source of any SSI.
- Groundwater quality in the uppermost aquifer beneath LF2 Cells 1/2 and Cell 3 is statistically similar (i.e. parameter concentrations are part of the same statistical population).
- Boron, calcium, and chloride concentrations in groundwater at wells with an SSI determination are stable, indicating a steady-state source, such as LF1.
- Calcium and chloride concentrations in leachate from LF1 are significantly greater than those observed in the downgradient monitoring wells with an SSI determination, and median concentrations in leachate from LF2 are less than those observed in downgradient monitoring wells with an SSI determination.

5 CONCLUSIONS AND CERTIFICATION

The lines of evidence for this ASD are summarized below.

- Boron SSIs at monitoring wells G220 and G222 are the result of an alternate source because LF2 Cell 3 does not contain CCR; therefore, it cannot be the source.
- Boron SSI at well G223 (Cells 1 and 2) is the result of an alternate source because boron concentrations in well G223 are in the same statistical population as those in the wells monitoring LF2 Cell 3; therefore, Cells 1 and 2 must also be influenced by an alternate source.
- Calcium SSI at well G202 (Cells 1 and 2) is not the result of LF2 because the calcium concentrations in LF2 leachate are lower than the concentrations in well G202. The SSI is the result of an alternate source, likely LF1, since calcium concentrations in LF1 leachate are greater than in well G202.
- Chloride SSIs at wells G06D, G208, G220, and G222 are the result of an alternate source because LF2 Cell 3 does not contain CCR; therefore, it cannot be the source.
- Chloride SSIs at wells G202, G203, G223, and G224 (Cells 1 and 2) are not the result of LF2 impacts to groundwater, as supported by the following:
  - Chloride concentration in LF2 leachate is less than the concentrations in wells G202, G203, G223, and G224. The SSI is the result of an alternate source, likely LF1, since chloride concentrations in LF1 leachate are greater than those in wells G202, G203, G223, and G224.
  - Chloride concentrations in wells G202, G203, and G224 are in the same statistical population as those in the wells monitoring LF2 Cell 3; therefore, Cells 1 and 2 must also be influenced by an alternate source.
- Fluoride SSIs at wells G208, G220, and G222 are the result of an alternate source because LF2 Cell 3 does not contain CCR; therefore, it cannot be the source.
- Total dissolved solids SSI at well G222 is the result of an alternate source because LF2 Cell 3 does not contain CCR; therefore, it cannot be the source.

Based on these lines of evidence, it has been demonstrated that the SSIs in G06D, G202, G203, G208, G220, G222, G223, and G224 are not due to the Newton Landfill 2.

This information serves as the written alternate source demonstration prepared in accordance with 40 CFR § 257.94(e)(2) that SSIs observed during the detection monitoring program were not due to the CCR unit but were from anthropogenic impacts from the closed Phase I Landfill, which is not subject to the USEPA CCR Rule. Therefore, an assessment monitoring program is not required and the Newton Phase II Landfill will remain in detection monitoring.

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.
Date: April 9, 2018

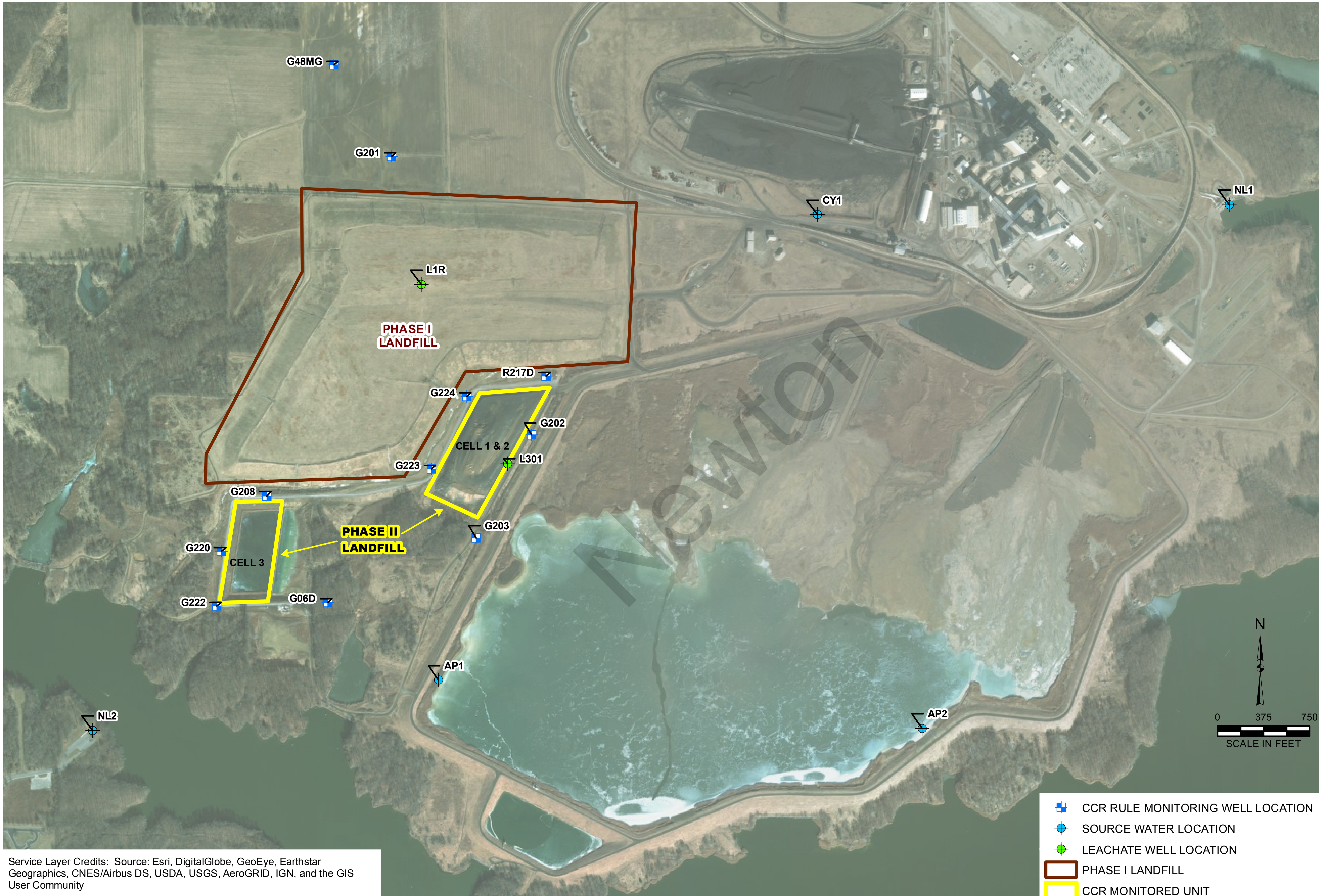
LICENSED PROFESSIONAL ENGINEER
ERIC J. TLACHAC
062-063091
STATE OF ILLINOIS

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.
Date: April 9, 2018

LICENSED PROFESSIONAL GEOLOGIST
NICOLE M. PAGANO
196-000750
ILLINOIS

Figures



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

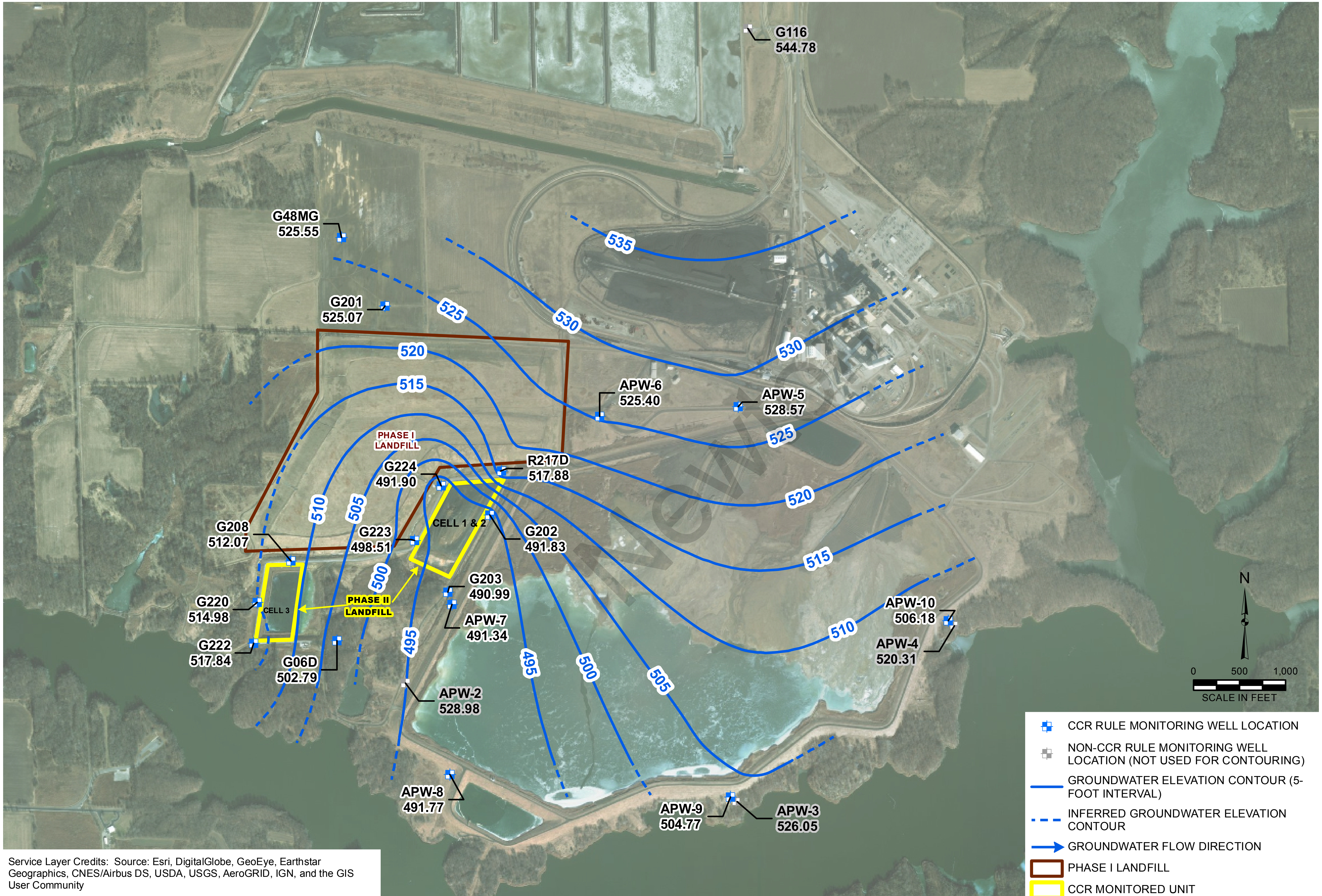
DRAWN BY/DATE: SDS 3/28/18
REVIEWED BY/DATE: JJW 3/28/18
APPROVED BY/DATE: NMP 3/30/18

FACILITY LOCATION MAP WITH MANAGEMENT UNITS AND SAMPLE LOCATIONS - NEWTON PHASE II LANDFILL

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 67719

FIGURE NO: 1



CCR RULE MONITORING WELL LOCATION
NON-CCR RULE MONITORING WELL LOCATION (NOT USED FOR CONTOURING)
GROUNDWATER ELEVATION CONTOUR (5-FOOT INTERVAL)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
PHASE I LANDFILL
CCR MONITORED UNIT

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

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

POTENTIOMETRIC SURFACE ROUND 9: NOVEMBER 14, 2017

ALTERNATE SOURCE DEMONSTRATION
NEWTON POWER STATION
NEWTON, ILLINOIS

PROJECT NO: 67719

FIGURE NO: 2

Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Dem\Figure 2_Newton Potentiometric SurfaceR9.mxd Author: stolzsd; Date/Time: 4/6/2018, 3:31:22 PM

Appendix A

Kruskal-Wallis Test Results for Boron Observed in Monitoring Well G223, and Chloride in G202, G203, G224

Newton
Kruskal-Wallis (Intergroup) Test for Group Comparison
Statistical Comparison Report

User Supplied Information

Date Range Selected:	**12/14/2015 to 11/29/2017**	**Option for LT Pts.:**	**x 0.50**
Confidence level:	**95.00%**	**Period Length, mn:**	**3**
Compliance Locations:	**G223**	**Data Averaged:**	**No**
Background Locations:	**G06D,G208,G220,G222**		

Parameter Code	**Parameter Name**	**Units**
01022	**Boron, total**	**mg/L**

Number of Groups	Total Points	Chi-Squared	H Statistic	H Statistic (Adj. for ties)	Number of Groups (tied)
2	36	3.841	0.029	0.029	11

Since H Statistic is less than Chi-Square, the means of the compliance and background groups are the same at the 5.00% significance level.
Post-hoc comparisons of compliance wells are not applicable.

Post-hoc Comparisons

Location	Type	Class Assigned	Background Rank Sum	Background Rank Average
G223	None		0.000	0.000

Critical Difference	Compliance Rank Average	Difference	Statistical Evidence of Exceedance
N/A	N/A	N/A	N/A

Newton
Kruskal-Wallis (Intergroup) Test for Group Comparison
Statistical Comparison Report

User Supplied Information

Date Range Selected:	**12/14/2015 to 11/29/2017**	**Option for LT Pts.:**	**x 0.50**
Confidence level:	**95.00%**	**Period Length, mn:**	**3**
Compliance Locations:	**G202,G203,G224**	**Data Averaged:**	**No**
Background Locations:	**G06D,G208,G220,G222**		

Parameter Code	Parameter Name	Units
00940	**Chloride, total**	**mg/L**

Number of Groups	Total Points	Chi-Squared	H Statistic	H Statistic (Adj. for ties)	Number of Groups (tied)
4	36	7.8	4.7	4.7	18

Since H Statistic is less than Chi-Square, the means of the compliance and background groups are the same at the 5.00% significance level.
Post-hoc comparisons of compliance wells are not applicable.

Post-hoc Comparisons

Location	Type	Class Assigned	Background Rank Sum	Background Rank Average
G224	None		0.0	0.0

Critical Difference	Compliance Rank Average	Difference	Statistical Evidence of Exceedance
N/A	N/A	N/A	N/A

Location	Type	Class Assigned	Background Rank Sum	Background Rank Average
G203	None		0.0	0.0

Critical Difference	Compliance Rank Average	Difference	Statistical Evidence of Exceedance
N/A	N/A	N/A	N/A

Location	Type	Class Assigned	Background Rank Sum	Background Rank Average
G202	None		0.0	0.0

Critical Difference	Compliance Rank Average	Difference	Statistical Evidence of Exceedance
N/A	N/A	N/A	N/A

OBG
Part of Ramboll