2018 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

CCR LANDFILL
SIBLEY GENERATING STATION
SIBLEY, MISSOURI

Presented To:
KCP&L Greater Missouri Operations Company

SCS ENGINEERS

27213169.18 | January 2019

8575 W 110th Street, Suite 100
Overland Park, Kansas 66210
913-681-0030

CERTIFICATIONS

I, John R. Rockhold, being a qualified groundwater scientist and Registered Geologist in the State of Missouri, do hereby certify that the 2018 Annual Groundwater Monitoring and Corrective Action Report for the CCR Landfill at the Sibley Generating Station was prepared by me or under my direct supervision and fulfills the requirements of 40 CFR 257.90(e).

John R. Rockhold, R.G.

SCS Engineers

I, Douglas L. Doerr, being a qualified licensed Professional Engineer in the State of Missouri, do hereby certify that the 2018 Annual Groundwater Monitoring and Corrective Action Report for the CCR Landfill at the Sibley Generating Station was prepared by me or under my direct supervision and fulfills the requirements of 40 CFR 257.90(e).

Douglas L. Doerr

Digitally signed by Douglas L. Doerr
Date: 2019.01.30 15:40:01 -06'00'

Douglas L. Doerr, P.E.

SCS Engineers

Revision Number	Revision Date	Revision Section	Summary of Revisions

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Appendices

1 INTRODUCTION

This 2018 Annual Groundwater Monitoring and Corrective Action Report was prepared to support compliance with the groundwater monitoring requirements of the "Coal Combustion Residuals (CCR) Final Rule" (Rule) published by the United States Environmental Protection Agency (USEPA) in the *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule*, dated April 17, 2015 (USEPA, 2015). Specifically, this report was prepared to fulfill the requirements of 40 CFR 257.90 (e). The applicable sections of the Rule are provided below in *italics*, followed by applicable information relative to the 2018 Annual Groundwater Monitoring and Corrective Action Report for the CCR Landfill at the Sibley Generating Station.

2 § 257.90(E) ANNUAL REPORT REQUIREMENTS

Annual groundwater monitoring and corrective action report. *For existing CCR landfills and existing CCR surface impoundments, no later than January 31, 2018, and annually thereafter, the owner or operator must prepare an annual groundwater monitoring and corrective action report. For new CCR landfills, new CCR surface impoundments, and all lateral expansions of CCR units, the owner or operator must prepare the initial annual groundwater monitoring and corrective action report no later than January 31 of the year following the calendar year a groundwater monitoring system has been established for such CCR unit as required by this subpart, and annually thereafter. For the preceding calendar year, the annual report must document the status of the groundwater monitoring and corrective action program for the CCR unit, summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year. For purposes of this section, the owner or operator has prepared the annual report when the report is placed in the facility's operating record as required by § 257.105(h)(1). At a minimum, the annual groundwater monitoring and corrective action report must contain the following information, to the extent available:*

2.1 § 257.90(E)(1) SITE MAP

A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit;

A site map with an aerial image showing the CCR Landfill and all background (or upgradient) and downgradient monitoring wells with identification numbers for the CCR Landfill groundwater monitoring program is provided as **Figure 1** in **Appendix A**.

2.2 § 257.90(E)(2) MONITORING SYSTEM CHANGES

Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken;

No new monitoring wells were installed and no wells were decommissioned as part of the CCR groundwater monitoring program for the CCR Landfill in 2018.

2.3 § 257.90(E)(3) SUMMARY OF SAMPLING EVENTS

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;

Only detection monitoring was conducted during the reporting period (2018). Samples collected in 2018 were collected and analyzed for Appendix III detection monitoring constituents as indicated in **Appendix B**, **Table 1** (Appendix III Detection Monitoring Results, and **Table 2** (Detection Monitoring Field Measurements). The dates of sample collection, the monitoring program requiring the sample, and the results of the analyses are also provided in these tables. These tables include both the Spring 2018 semiannual detection monitoring data and the Fall 2018 semiannual detection monitoring data.

2.4 § 257.90(E)(4) MONITORING TRANSITION NARRATIVE

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); and

There was no transition between monitoring programs in 2018. Only detection monitoring was conducted in 2018.

2.5 § 257.90(e)(5) OTHER REQUIREMENTS

Other information required to be included in the annual report as specified in §§ 257.90 through 257.98.

A summary of potentially required information and the corresponding section of the Rule is provided in the following sections. In addition, the information, if applicable, is provided.

2.5.1 § 257.90(e) Program Status

Status of Groundwater Monitoring and Corrective Action Program.

The groundwater monitoring and corrective action program is in detection monitoring.

Summary of Key Actions Completed.

a. completion of the statistical evaluation of the initial Fall 2017 semiannual detection monitoring event per the certified statistical method,

b. completion of the 2017 Annual Groundwater Monitoring and Corrective Action Report,

c. completion of a successful alternative source demonstration for the Fall 2017 semiannual detection monitoring event,

d. completion of the Spring 2018 semiannual detection monitoring sampling and analysis event, and subsequent verification sampling per the certified statistical method,

e. completion of the statistical evaluation of the Spring 2018 semiannual detection monitoring event per the certified statistical method,

f. completion of a successful alternative source demonstration for the Spring 2018 semiannual

detection monitoring event, and

g. initiation of the Fall 2018 semiannual detection monitoring sampling and analysis event.

Description of Any Problems Encountered.

No noteworthy problems were encountered.

Discussion of Actions to Resolve the Problems.

Not applicable because no noteworthy problems were encountered.

Projection of Key Activities for the Upcoming Year (2019).

Semiannual Spring and Fall 2019 groundwater sampling and analysis. Completion of verification sampling and analyses and statistical evaluation of Fall 2018 and Spring 2019 detection monitoring data and, if required, alternative source demonstration(s).

2.5.2 § 257.94(d)(3) Demonstration for Alternative Detection Monitoring Frequency

The owner or operator must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration for an alternative groundwater sampling and analysis frequency meets the requirements of this section. The owner or operator must include the demonstration providing the basis for the alternative monitoring frequency and the certification by a qualified professional engineer or the approval from the Participating State Director or approval from EPA where EPA is the permitting authority in the annual groundwater monitoring and corrective action report required by § 257.90(e).

Not applicable because no alternative monitoring frequency for detection monitoring and certification was pursued.

2.5.3 § 257.94(e)(2) Detection Monitoring Alternate Source Demonstration

Demonstration that a source other than the CCR unit caused the statistically significant increase (SSI) over background levels for a constituent or that the SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. In addition, certification of the demonstration is to be included in the annual report.

The following reports are included in **Appendix C**:

C.1 CCR Groundwater Monitoring Alternative Source Demonstration Report October 2017 Groundwater Monitoring Event, CCR Landfill, Sibley Generating Station (April 2018).

C.2. Supplemental Data for CCR Groundwater Monitoring Alternative Source Demonstration Report October 2017 Groundwater Monitoring Event, CCR Landfill, Sibley Generating Station (April 2018).

C.3 CCR Groundwater Monitoring Alternative Source Demonstration Report May 2018 Groundwater Monitoring Event, CCR Landfill, Sibley Generating Station (December 2018).

C.4 Supplemental Data for Groundwater Monitoring Alternative Source Demonstration Report May 2018 Groundwater Monitoring Event, CCR Landfill, Sibley Generating Station (December 2018).

2.5.4 § 257.95(c)(3) Demonstration for Alternative Assessment Monitoring Frequency

The owner or operator must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration for an alternative groundwater sampling and analysis frequency meets the requirements of this section. The owner or operator must include the demonstration providing the basis for the alternative monitoring frequency and the certification by a qualified professional engineer or the approval from the Participating State Director or the approval from EPA where EPA is the permitting authority in the annual groundwater monitoring and corrective action report required by § 257.90(e).

Not applicable because there was no assessment monitoring conducted.

2.5.5 § 257.95(d)(3) Assessment Monitoring Concentrations and Groundwater Protection Standards

Include the concentrations of Appendix III and detected Appendix IV constituents from the assessment monitoring, the established background concentrations, and the established groundwater protection standards.

Not applicable because there was no assessment monitoring conducted.

2.5.6 § 257.95(g)(3)(ii) Assessment Monitoring Alternate Source Demonstration

Demonstrate that a source other than the CCR unit caused the contamination, or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Any such demonstration must be supported by a report that includes the factual or evidentiary basis for any conclusions and must be certified to be accurate by a qualified professional engineer. If a successful demonstration is made, the owner or operator must continue monitoring in accordance with the assessment monitoring program pursuant to this section, and may return to detection monitoring if the constituents in appendices III and IV to this part are at or below background as specified in paragraph (e) of this section. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer or the approval from the Participating State Director or approval from EPA where EPA is the permitting authority.

Not applicable because there was no assessment monitoring conducted.

2.5.7 § 257.96(a) Demonstration for Additional Time for Assessment of Corrective Measures

Within 90 days of finding that any constituent listed in appendix IV to this part has been detected at a statistically significant level exceeding the groundwater protection standard defined under § 257.95(h), or immediately upon detection of a release from a CCR unit, the owner or operator must initiate an assessment of corrective measures to prevent further releases, to remediate any releases

and to restore affected area to original conditions. The assessment of corrective measures must be completed within 90 days, unless the owner or operator demonstrates the need for additional time to complete the assessment of corrective measures due to site-specific conditions or circumstances. The owner or operator must obtain a certification from a qualified professional engineer attesting that the demonstration is accurate. The 90-day deadline to complete the assessment of corrective measures may be extended for no longer than 60 days. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer or the approval from the Participating State Director or approval from EPA where EPA is the permitting authority.

Not applicable because there was no assessment monitoring conducted.

3 GENERAL COMMENTS

This report has been prepared and reviewed under the direction of a qualified groundwater scientist and qualified professional engineer. The information contained in this report is a reflection of the conditions encountered at the Sibley Generating Station at the time of fieldwork. This report includes a review and compilation of the required information and does not reflect any variations of the subsurface, which may occur between sampling locations. Actual subsurface conditions may vary and the extent of such variations may not become evident without further investigation.

Conclusions drawn by others from the result of this work should recognize the limitation of the methods used. Please note that SCS Engineers does not warrant the work of regulatory agencies or other third parties supplying information used in the assimilation of this report. This report is prepared in accordance with generally accepted environmental engineering and geological practices, within the constraints of the client's directives. It is intended for the exclusive use of KCP&L Greater Missouri Operations Company for specific application to the Sibley Generating Station CCR Landfill. No warranties, express or implied, are intended or made.

APPENDIX A

FIGURES

Figure 1: Site Map

LEGEND:

506 CCR GROUNDWATER MONITORING SYSTEM WELLS

CCR LANDFILL UNIT BOUNDARY

NOTES:

1. HORIZONTAL & VERTICAL DATUM: URS PLANS FOR CONSTRUCTION, KCP&L SIBLEY GENERATING STATION, DESIGN FILE 16530511.00001, DATED JANUARY 2010
2. GOOGLE EARTH AERIAL IMAGE, MARCH 2015. MONITOR WELL LOCATIONS ARE APPROXIMATE.
3. BOUNDARY AND MONITORING WELL LOCATIONS SHOWN ARE APPROXIMATE.

200 0 200 400

SCALE FEET

REV.	DATE
-	-

SHEET TITLE
SITE MAP
CCR LANDFILL
CCR GROUNDWATER MONITORING SYSTEM

PROJECT TITLE
2018 GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT

CLIENT
KCP&L GREATER MISSOURI OPERATIONS CO.
SIBLEY GENERATING STATION
SIBLEY, MISSOURI

SCS ENGINEERS
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Overland Park, Kansas 66210
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PROJ. NO.	DWN. BY:	Q/A RVW BY:	
27213167.18	TGW	JRF	
DSN. BY:	CHK. BY:	PROJ. MGR.	
TGW	JRF	JRF	

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FIG 1 - SIBLEY LF V0.02.DWG

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FIGURE NO.
1

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APPENDIX B

TABLES

Table 1: Appendix III Detection Monitoring Results

Table 2: Detection Monitoring Field Measurements

Table 1
CCR Landfill
Appendix III Detection Monitoring Results
KCP&L GMO Sibley Generating Station

Well Number	Sample Date	Appendix III Constituents						
		Boron (mg/L)	Calcium (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	pH (S.U.)	Sulfate (mg/L)	Total Dissolved Solids (mg/L)
MW-504	5/17/2018	<0.200	33.3	1.11	0.216	6.41	32.8	193
MW-504	6/27/2018	---	---	---	*0.135	**6.70	*31.8	---
MW-504	8/8/2018	---	---	---	---	**6.62	*32.3	---
MW-504	11/15/2018	<0.200	45.0	<1.00	0.208	7.01	33.9	211
MW-505	5/17/2018	<0.200	28.2	1.09	0.247	6.60	14.0	170
MW-505	6/27/2018	---	*25.8	---	---	**6.82	---	---
MW-505	11/15/2018	<0.200	30.8	<1.00	0.212	7.09	14.6	167
MW-506	5/17/2018	<0.200	94.9	6.69	0.32	6.97	75.7	442
MW-506	6/27/2018	---	---	*5.80	---	**7.02	---	---
MW-506	11/15/2018	<0.200	93.4	6.69	0.199	7.08	70.8	426
MW-510	5/17/2018	<0.200	120	3.44	0.348	6.82	17.3	494
MW-510	6/27/2018	---	---	---	*0.282	**7.01	---	---
MW-510	11/15/2018	<0.200	120	3.15	0.204	7.05	17.5	478
MW-512	5/17/2018	<0.200	104	3.64	0.328	6.85	29.6	419
MW-512	6/27/2018	---	---	---	---	**6.95	*30.3	---
MW-512	8/8/2018	---	---	---	---	**6.78	*30.9	---
MW-512	11/15/2018	<0.200	110	3.89	0.192	7.09	51.4	452
MW-601	5/17/2018	<0.200	104	4.02	0.275	6.72	28.3	431
MW-601	6/27/2018	---	---	*2.82	---	**6.98	*10.3	---
MW-601	11/15/2018	<0.200	105	3.35	0.158	6.96	13.3	397

* Verification sample obtained per certified statistical method and Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance, March 2009.
**Extra Sample for Quality Control Validation or per Standard Sampling Procedure
mg/L - miligrams per liter
S.U. - Standard Units
--- Not Sampled

Table 2
CCR Landfill
Detection Monitoring Field Measurements
KCP&L GMO Sibley Generating Station

Well Number	Sample Date	pH (S.U.)	Specific Conductivity (µS)	Temperature (°C)	ORP (mV)	Turbidity (NTU)	DO (mg/L)	Water Level (ft btoc)	Groundwater Elevation (ft NGVD)
MW-504	5/17/2018	6.41	300	16.96	183	0.0	4.66	21.86	794.46
MW-504	6/27/2018	**6.70	257	15.96	157	0.0	3.95	22.48	793.84
MW-504	8/8/2018	**6.62	255	18.77	141	0.0	4.52	23.32	793.00
MW-504	11/15/2018	7.01	380	11.13	190	0.0	0.00	21.73	794.59
MW-505	5/17/2018	6.60	228	17.16	220	0.0	8.25	27.81	787.16
MW-505	6/27/2018	**6.82	249	16.19	166	0.0	5.09	28.10	786.87
MW-505	11/15/2018	7.09	278	12.27	183	0.0	0.00	27.38	787.59
MW-506	5/17/2018	6.97	693	18.61	217	0.0	6.52	BTP	NA
MW-506	6/27/2018	**7.02	710	21.45	161	0.0	6.12	BTP	NA
MW-506	11/15/2018	7.08	727	12.13	189	0.0	0.20	BTP	NA
MW-510	5/17/2018	6.82	748	17.00	229	0.0	3.10	45.50	740.29
MW-510	6/27/2018	**7.01	752	17.39	165	0.0	0.54	45.88	739.91
MW-510	11/15/2018	7.05	898	12.47	101	1.4	4.00	45.91	739.88
MW-512	5/17/2018	6.85	683	17.00	107	0.0	3.09	32.35	737.78
MW-512	6/27/2018	**6.95	658	19.95	163	0.0	0.29	32.99	737.14
MW-512	8/8/2018	**6.78	583	26.27	39	0.0	3.96	34.00	736.13
MW-512	11/15/2018	7.09	792	13.36	120	0.0	0.00	29.90	740.23
MW-601	5/17/2018	6.72	656	16.77	189	0.0	1.14	46.35	734.55
MW-601	6/27/2018	**6.98	603	16.48	169	0.0	0.56	46.57	734.33
MW-601	11/15/2018	6.96	753	12.86	105	0.0	0.00	46.14	734.76

**Extra Sample for Quality Control Validation or per Standard Sampling Procedure
S.U. - Standard Units
µS - microsiemens
°C - Degrees Celsius
ft btoc - Feet Below Top of Casing
ft NGVD - National Geodetic Vertical Datum (NAVD 88)
NTU - Nephelometric Turbidity Unit
BTP - Below Top of Pump
NA - Not Applicable

APPENDIX C

ALTERNATIVE SOURCE DEMONSTRATIONS

C.1 Groundwater Monitoring Alternative Source Demonstration Report October 2017 Groundwater Monitoring Event

C.2. Supplemental Data, Groundwater Monitoring Alternative Source Demonstration Report October 2017 Groundwater Monitoring Event

C.3 Groundwater Monitoring Alternative Source Demonstration Report May 2018 Groundwater Monitoring Event

C.4 Supplemental Data, Groundwater Monitoring Alternative Source Demonstration Report May 2018 Groundwater Monitoring Event

C.1 Groundwater Monitoring Alternative Source Demonstration Report October 2017 Groundwater Monitoring Event

CCR GROUNDWATER MONITORING
ALTERNATIVE SOURCE DEMONSTRATION REPORT
OCTOBER 2017 GROUNDWATER MONITORING EVENT

CCR LANDFILL
SIBLEY GENERATING STATION
SIBLEY, MISSOURI

Presented To:

KCP&L Greater Missouri Operations Company

Presented By:

SCS ENGINEERS
7311 West 130th Street, Suite 100
Overland Park, Kansas 66213
(913) 681-0030

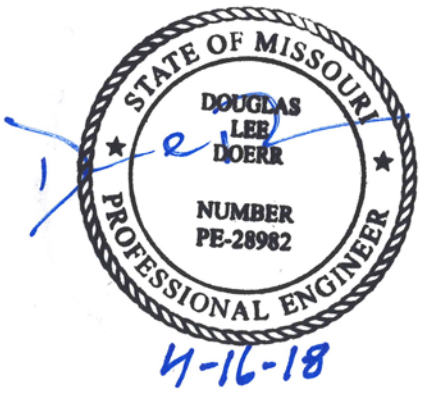
April 2018
File No. 27213169.17

CERTIFICATIONS

I, John R. Rockhold, being a qualified groundwater scientist and Registered Geologist in the State of Missouri, do hereby certify the accuracy of the information in the CCR Groundwater Monitoring Alternative Source Demonstration Report for the CCR Landfill at the Sibley Generating Station. The Alternative Source Demonstration was prepared by me or under my direct supervision in accordance with generally accepted hydrogeological practices and the local standard of care.

John R. Rockhold, R.G.
SCS Engineers

I, Douglas L. Doerr, being a qualified licensed Professional Engineer in the State of Missouri, do hereby certify the accuracy of the information in the CCR Groundwater Monitoring Alternative Source Demonstration Report for the CCR Landfill at the Sibley Generating Station. The Alternative Source Demonstration was prepared by me or under my direct supervision in accordance with generally accepted engineering practices and the local standard of care.



Douglas L. Doerr, P.E.
SCS Engineers

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Appendices

1 REGULATORY FRAMEWORK

In accordance with the Coal Combustion Residuals (CCR) Final Rule § 257.94(e)(2), the owner or operator of the CCR unit may demonstrate that a source other than the CCR unit caused the statistically significant increase (SSI) over background levels for a constituent, or that the SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The owner or operator must complete the written demonstration within 90 days of detecting a SSI over background levels to include obtaining a certification from a qualified professional engineer verifying the accuracy of the information in the report. If a successful demonstration is completed within the 90-day period, the owner or operator of the CCR unit may continue with a detection monitoring program under § 257.94. If a successful demonstration is not completed within the 90-day period, the owner or operator of the CCR unit must initiate an assessment monitoring program as required under § 257.95. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer.

2 STATISTICAL RESULTS

Statistical analysis of monitoring data from the groundwater monitoring system for the CCR Landfill at KCP&L Greater Missouri Operations Company's Sibley Generating Station has been completed in substantial compliance with the "Statistical Method Certification by a Qualified Professional Engineer" document dated October 12, 2017. Groundwater samples were collected and analyzed by October 17, 2017. A statistical analysis was conducted to determine whether there is a SSI over background values for each constituent listed in Appendix III to Part 257-Constituents for Detection Monitoring.

If an SSI is preliminarily identified by the prediction limit analysis, verification retesting will be performed in accordance with the certified statistical method and the resampling plan to verify the result is not due to an error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Up to two rounds of verification sampling and retesting may be conducted. Verification retesting with a "1 of 2" or "1 of 3" resampling plan is performed by collecting a verification sample(s) and comparing it to the calculated prediction limit. If the resulting concentration of any verification sample is not above the prediction limit, then an SSI has not occurred.

Determinations of SSIs for the CCR Landfill at the Sibley Generating Station were completed no later than January 15, 2018 and placed into the CCR Operating Record.

The completed statistical evaluation identified Appendix III constituent, chloride, above its prediction limit in monitoring wells MW-505 and MW-601. The prediction limit for chloride in upgradient monitoring well MW-505 is 1.19 mg/L. The detection monitoring sample was reported at 3.13 mg/L. The first verification sample was collected on November 16, 2017 with a result of 1.59 mg/L. The second verification sample was collected on December 28, 2017 with a result of 2.12 mg/L.

The prediction limit for chloride in monitoring well MW-601 is 3.58 mg/L. The detection monitoring sample was reported at 6.1 mg/L. The first verification sample was collected on November 16, 2017 with a result of 3.87 mg/L. The second verification sample was collected on December 28, 2017 with a result of 3.95 mg/L.

Therefore, in accordance with the procedures outlined in the Statistical Method Certification, the detection monitoring samples for chloride from monitoring wells MW-505 and MW-601 exceed their prediction limits and are confirmed SSIs over background.

3 ALTERNATIVE SOURCE DEMONSTRATION

An Alternative Source Demonstration (ASD) is a means to provide supporting lines of evidence that something other than a release from a regulated CCR unit caused an SSI. For the above identified SSIs for the CCR Landfill at the Sibley Generating Station, there are multiple lines of supporting evidence to indicate the above SSIs were not caused by a release from the CCR Landfill. Select multiple lines of supporting evidence are described as follows.

3.1 UPGRADIENT WELL LOCATION

Figure 1 in **Appendix A** shows a potentiometric surface contour map indicating the direction of groundwater flow at and near the CCR Landfill at the time of sampling. Although the groundwater flow directions indicated are for the October 2017 groundwater monitoring event, the flow directions shown are typical. As seen in the map, monitoring well MW-505 is located upgradient from the CCR Landfill indicating the SSI is not caused by a release from the CCR Landfill. This demonstrates that a source other than the CCR Landfill caused the SSI over background levels for chloride, or that the SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

3.2 BOX AND WHISKERS PLOTS

A commonly accepted method to demonstrate and visualize the distribution of data in a given data set is to construct box and whiskers plots. The basic box plotted graphically locates the median, 25th and 75th percentiles of the data set; the "whiskers" extend to the minimum and maximum values of the data set. The range between the ends of a box plot represents the Interquartile Range, which can be used as an estimate of spread or variability. The mean is denoted by a "+".

When comparing multiple wells or well groups, box plots for each well can be lined up on the same axes to roughly compare the variability in each well. This may be used as an exploratory screening for the test of homogeneity of variance across multiple wells.

Box and whiskers plots for chloride in monitoring wells MW-505 and MW-601 were compared to box and whisker plots for chloride in several upgradient and side-gradient non-CCR monitoring system wells installed for future state-permitted landfill expansion purposes. The comparison indicates the chloride concentrations in both MW-505 and MW-601 are well within expected concentration levels for non-impacted groundwater in the vicinity of the CCR Landfill. **Figure 1** in **Appendix A** shows these upgradient non-CCR monitoring system wells and their relationships

to groundwater flow near and beneath the CCR Landfill. Because the non-CCR monitoring system wells are located in a nearby area that has not been impacted by the landfill, and exhibit variability that includes chloride concentrations similar to those seen at MW-505 and MW-601, the observed chloride concentrations are within the range of expected natural spatial variation within and between wells. This demonstrates that a source other than the CCR Landfill caused the SSIs over background levels for chloride, or that the SSIs resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Box and whisker plots are provided in **Appendix B**.

3.3 PIPER DIAGRAM PLOTS

Piper diagrams are a form of tri-linear diagram, and a widely-accepted method to provide a visual representation of the ion concentration of groundwater. Piper diagrams portray water compositions and facilitate the interpretation and presentation of chemical analysis. They may be used to visually compare the chemical composition of water quality across wells, and aid in determining whether the waters are similar or dis-similar, and can over time indicate whether the waters are mixing.

A piper diagram has two triangular plots on the right and left side of a 4-sided center field. The three major cations are plotted in the left triangle and anions in the right. Each of the three cation/anion variables, in milliequivalents, is divided by the sum of the three values, to produce a percent of total cation/anions. These percentages determine the location of the associated symbol. The data points in the center field are located by extending the points in the lower triangles to the point of intersection. In order for a piper diagram to be produced, the selected data file must contain the following constituents: Sodium (Na), Potassium (K), Calcium (Ca), Magnesium (Mg), Chloride (Cl), Sulfate (SO4), Carbonate (CO3), and Bicarbonate (HCO3).

A piper diagram generated for MW-505, MW-601, and landfill leachate is provided in **Appendix C** and indicates the groundwater from these two wells does not exhibit the same geochemical characteristics as the leachate. The groundwater and the leachate plot in totally different hydrochemical facies indicating there is no mixing of the two types of water (groundwater and leachate). This demonstrates that a source other than the CCR Landfill caused the SSI over background levels for chloride, or that the SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

3.4 TIME SERIES PLOTS

Time series plots provide a graphical method to view changes in data at a particular well (monitoring point) or wells over time. Time series plots display the variability in concentration levels over time and can be used to indicate possible outliers or data errors (i.e. “spikes”). More than one well can be compared on the same plot to look for differences between wells. Non-detect data is plotted as censored data at one-half of the laboratory reporting limit. Time series plots can also be used to examine the data for trends.

Time series plots for the CCR monitoring system wells indicate parallel “spikes” in concentration levels from both upgradient and downgradient wells and from upgradient non-CCR monitoring

system wells. Time series plots for both CCR monitoring system wells and the non-CCR monitoring system wells installed for future state-permitted landfill expansion purposes are provided in **Appendix D**. These "spikes", similar in magnitude but from different monitor wells, are an indication of an otherwise unidentifiable laboratory or sampling issue, problem or change, and that the spikes are not likely the result of a release from the CCR Landfill, since a release would not be expected to cause such an increase across multiple wells (including upgradient wells) simultaneously. This demonstrates that a source other than the CCR Landfill caused the SSIs over background levels for chloride, or that the SSIs resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

4 CONCLUSION

Our opinion is that a sufficient body of evidence is available and presented above to demonstrate that a source other than the CCR Landfill caused the SSIs over background levels, or that the SSIs resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Based on the successful ASD, the owner or operator of the CCR Landfill may continue with the detection monitoring program under § 257.94.

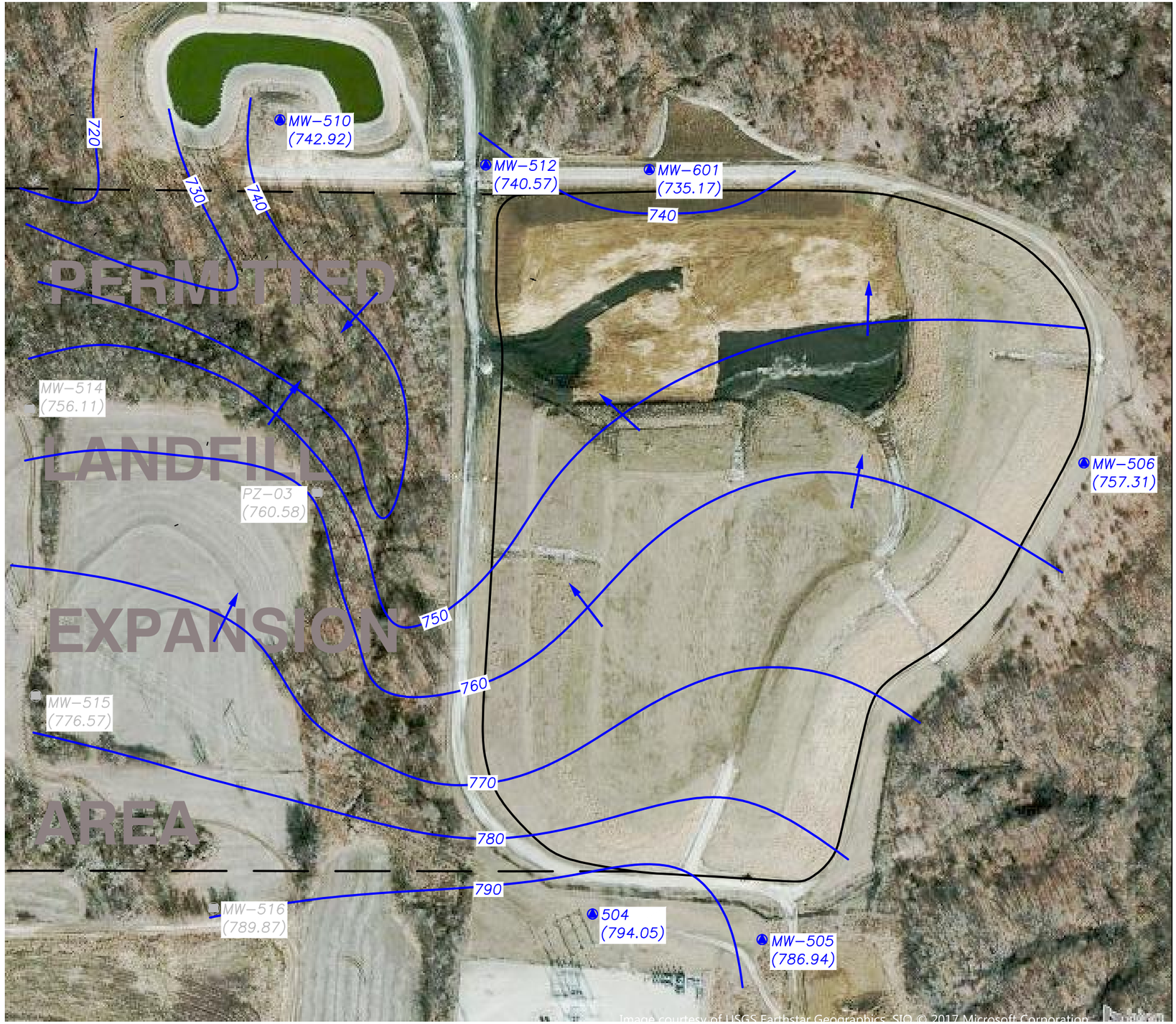
5 GENERAL COMMENTS

This report has been prepared and reviewed under the direction of a qualified groundwater scientist and qualified professional engineer. Please note that SCS Engineers does not warrant the work of regulatory agencies or other third parties supplying information used in the assimilation of this report. This report is prepared in accordance with generally accepted environmental engineering and geological practices, within the constraints of the client's directives. It is intended for the exclusive use of KCP&L Greater Missouri Operations Company for specific application to the Sibley Generating Station. No warranties, express or implied, are intended or made.

The signature of the certifying registered geologist and professional engineer on this document represents that to the best of his knowledge, information, and belief in the exercise of his professional judgement in accordance with the standard of practice, it is his professional opinion that the aforementioned information is accurate as of the date of such signature. Any opinion or decisions by him are made on the basis of his experience, qualifications, and professional judgement and are not to be construed as warranties or guaranties. In addition, opinions relating to regulatory, environmental, geologic, geochemical and geotechnical conditions interpretations or other estimates are based on available data, and actual conditions may vary from those encountered at the times and locations where data are obtained, despite the use of due care.

Appendix A

Figure 1



LEGEND:

- 760 — GROUNDWATER SURFACE ELEVATIONS (REPRESENTATIVE OF THIS UNIT)
- MW–514 (756.11) CCR GROUNDWATER MONITORING SYSTEM WELLS (GROUNDWATER ELEVATION)
- PERMITTED LANDFILL EXPANSION AREA
- PERMITTED LANDFILL EXPANSION AREA
- 514 (756.11) NON–CCR GROUNDWATER MONITORING WELLS

NOTES:

1. HORIZONTAL & VERTICAL DATUM: URS PLANS FOR CONSTRUCTION, KCP&L SIBLEY GENERATING STATION, DESIGN FILE 16530511.00001, DATED JANUARY 2010
2. GOOGLE EARTH AERIAL IMAGE, MARCH 2015.
3. MONITORING WELL AND UNIT BOUNDARY LOCATIONS SHOWN ARE APPROXIMATE.

200 0 200 400
SCALE FEET

REV.	DATE
-	-

SHEET TITLE: POTENTIOMETRIC SURFACE MAP (OCT 2017) CCR LANDFILL

PROJECT TITLE: CCR ALTERNATE SOURCE DEMONSTRATION

CLIENT: KCP&L GREATER MISSOURI OPERATIONS CO.
SIBLEY GENERATING STATION
SIBLEY, MISSOURI

SCS ENGINEERS
7311 W. 130th St, Ste. 100
Overland Park, Kansas 66213
PH. (913) 681-0030 FAX. (913) 681-0012

PROJ. NO. 27213167.17
DSN. BY: RCW
DWN. BY: RCW
CHK. BY: JRR
QA REW BY: JRR
PROJ. MGR.: JRF

CADD FILE: 18-MAR_CCR ASD.DWG

DATE: 4/16/18

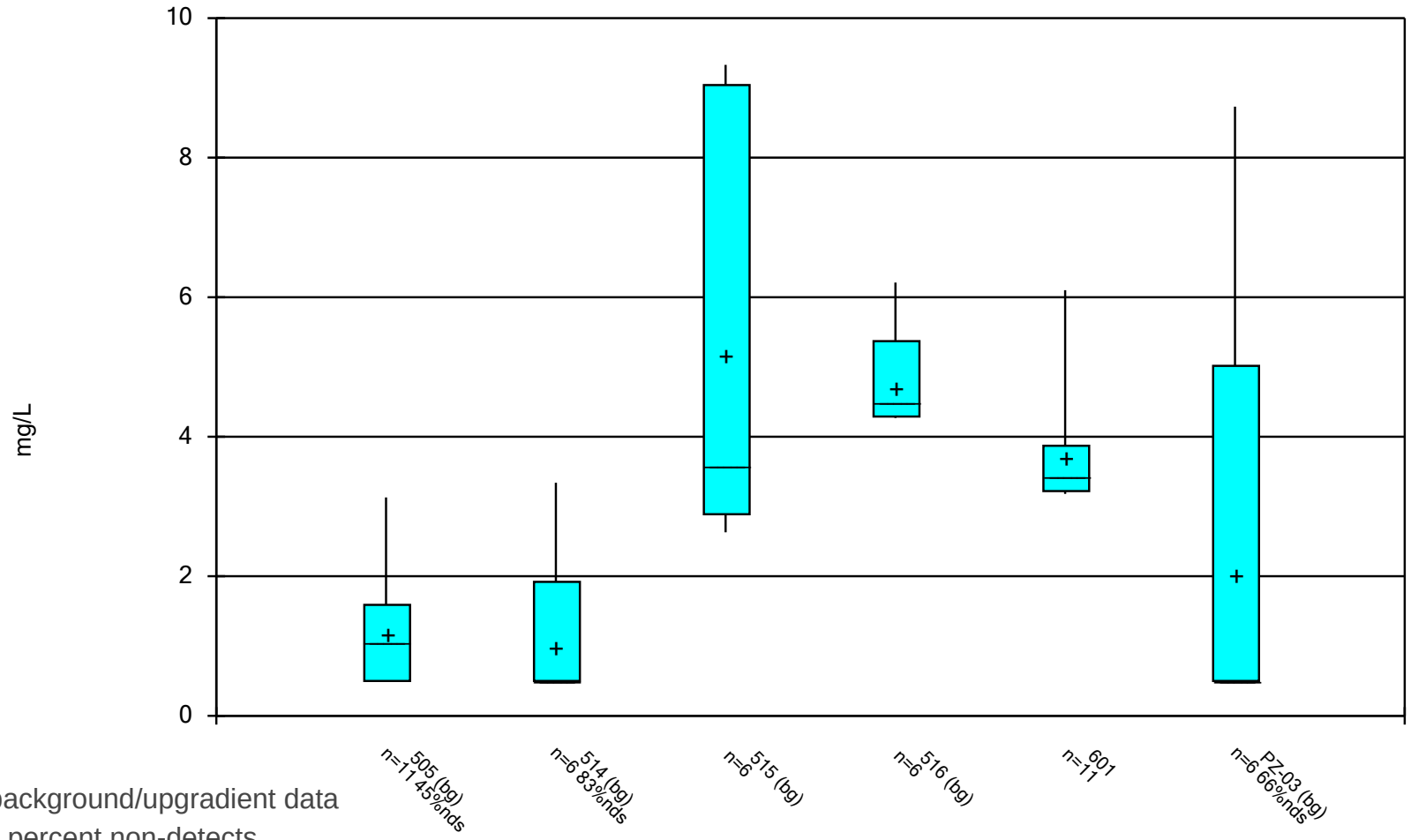
FIGURE NO. 1

N:\KCPL\Projects\Groundwater\DWG\Sibley\2018\03-20 _ CCR Alternative Source Demonstration\18-MAR_CCR ASD.dwg Apr 16, 2018 - 11:06am Layout Name: Fig 1 - Landfill By: 4121rcw

Appendix B

Box and Whiskers Plots

Box & Whiskers Plot



(bg) = background/upgradient data
%nds = percent non-detects
n = number of samples

Constituent: Chloride Analysis Run 3/5/2018 10:42 AM View: LF III

Sibley Client: SCS Engineers Data: Sibley

The basic box plot graphically locates the median, 25th and 75th percentiles of the data set; the "whiskers" extend to the minimum and maximum values of the data set. The range between the ends of a box plot represents the Interquartile Range. The mean is denoted by a "+".

Box & Whiskers Plot

Constituent: Chloride (mg/L) Analysis Run 3/5/2018 10:44 AM View: LF III

Sibley Client: SCS Engineers Data: Sibley

	505 (bg)	514 (bg)	515 (bg)	516 (bg)	601	PZ-03 (bg)
12/15/2015		<1	2.63	4.53	3.3	<1
12/16/2015	<1					
2/18/2016	1.05				3.22	
5/25/2016	<1					
5/26/2016		<1			3.18	<1
6/2/2016			3.46	4.27		
8/23/2016	1.19				3.41	
11/11/2016	<1	<1	3.69	4.31	3.51	<1
2/8/2017	<1				3.19	
5/3/2017					3.5	
5/4/2017	<1	<1	3.15	4.51		<1
8/1/2017	1.18				3.37	
10/3/2017	3.13	3.34	8.75	6.21	6.1	8.73
11/16/2017	1.59	<1	9.33	4.45	3.87	1.3
12/28/2017	2.12				3.95	
Median	1.05	0.5	3.58	4.48	3.41	0.5
LowerQ.	0.5	0.5	2.89	4.29	3.22	0.5
UpperQ.	1.59	1.92	9.04	5.37	3.87	5.02
Min	0.5	0.5	2.63	4.27	3.18	0.5
Max	3.13	3.34	9.33	6.21	6.1	8.73
Mean	1.16	0.973	5.17	4.71	3.69	2.01

Box & Whiskers Plot

Sibley Client: SCS Engineers Data: Sibley Printed 3/5/2018, 10:44 AM

Constituent	Well	N	Mean	Std. Dev.	Std. Err.	Median	Min.	Max.	%NDs
Chloride (mg/L)	505 (bg)	11	1.16	0.847	0.255	1.05	0.5	3.13	45.5
Chloride (mg/L)	514 (bg)	6	0.973	1.16	0.473	0.5	0.5	3.34	83.3
Chloride (mg/L)	515 (bg)	6	5.17	3.03	1.24	3.58	2.63	9.33	0
Chloride (mg/L)	516 (bg)	6	4.71	0.741	0.302	4.48	4.27	6.21	0
Chloride (mg/L)	601	11	3.69	0.839	0.253	3.41	3.18	6.1	0
Chloride (mg/L)	PZ-03 (bg)	6	2.01	3.31	1.35	0.5	0.5	8.73	66.7

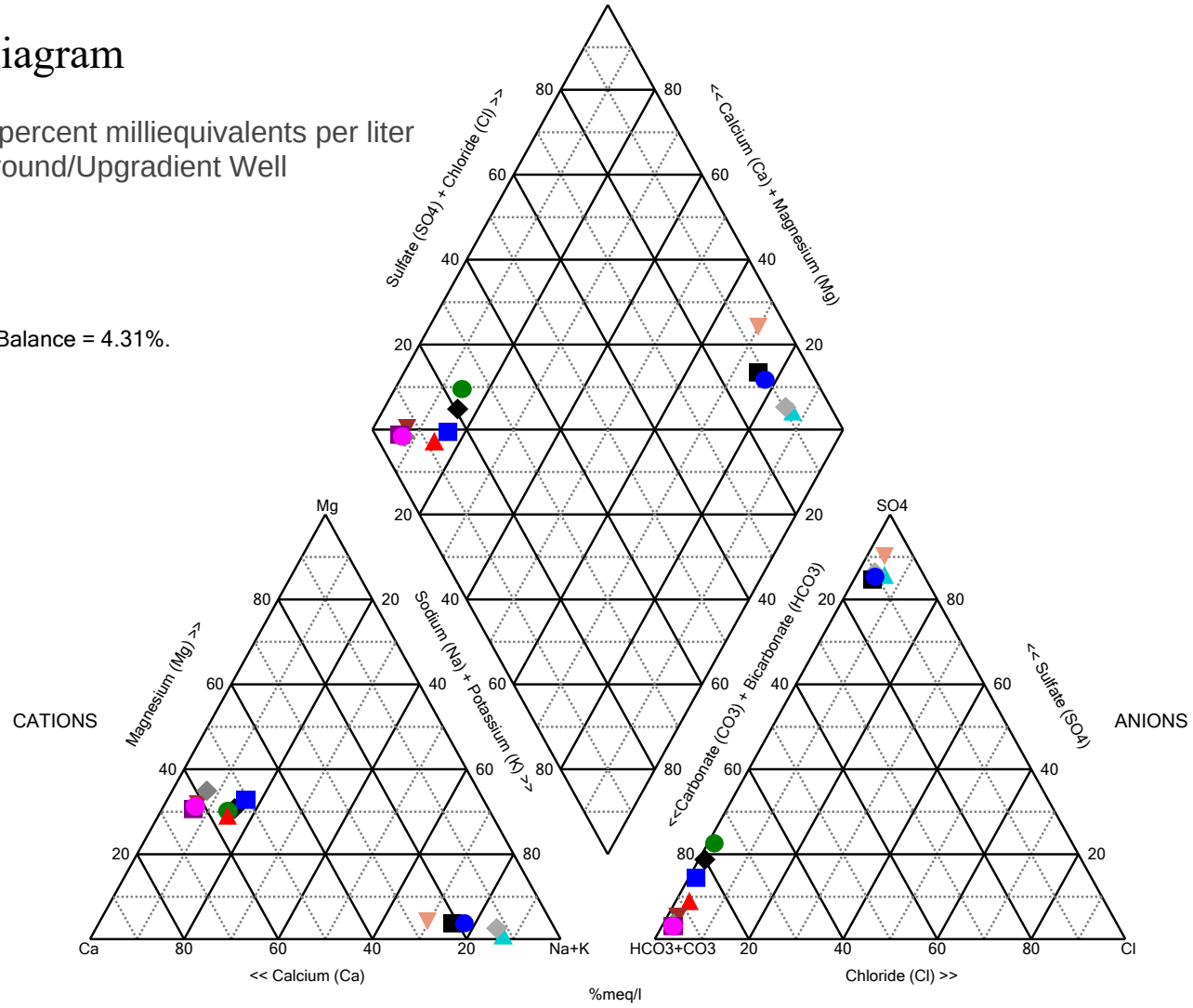
Appendix C

Piper Diagram

Piper Diagram

%meq/l = percent milliequivalents per liter
* = Background/Upgradient Well

Cation-Anion Balance = 4.31%.



505* 11/11/2016
505* 2/8/2017
505* 5/25/2016
505* 8/23/2016
601 11/11/2016
601 2/8/2017
601 5/26/2016
601 8/23/2016
LEACHATE 3/23/2018
LEACHATEPOND 11/10/2016
LEACHATEPOND 2/9/2017
LEACHATEPOND 5/25/2016
LEACHATEPOND 8/23/2016

Analysis Run 3/27/2018 11:34 AM View: LF III

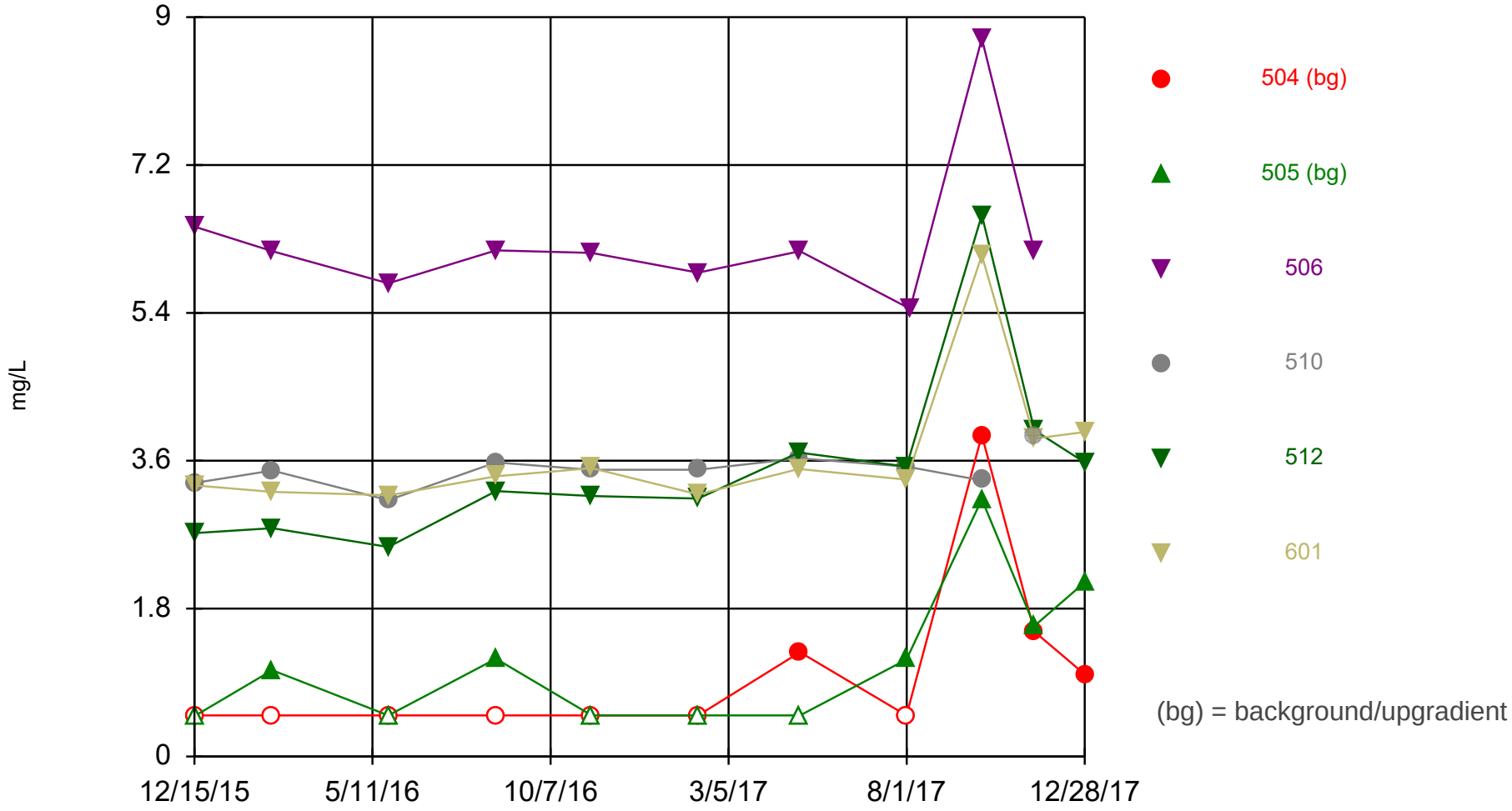
Sibley Client: SCS Engineers Data: Sibley

Appendix D

Time Series Plots

Hollow symbols indicate censored values.

Time Series



Constituent: Chloride Analysis Run 3/5/2018 11:58 AM View: LF III

Sibley Client: SCS Engineers Data: Sibley

Time Series

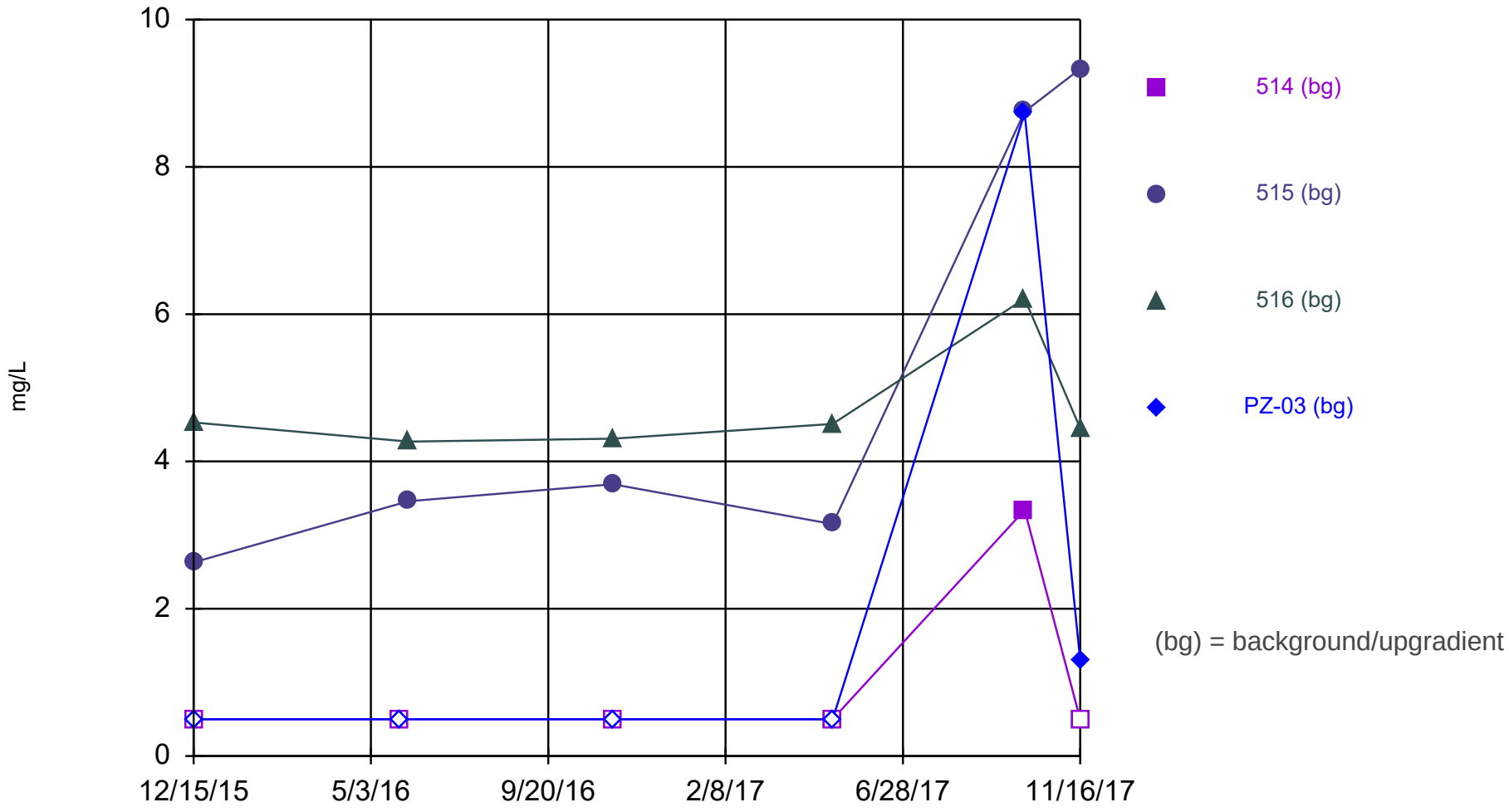
Constituent: Chloride (mg/L) Analysis Run 3/5/2018 11:59 AM View: LF III

Sibley Client: SCS Engineers Data: Sibley

	504 (bg)	505 (bg)	506	510	512	601
12/15/2015			6.45	3.33	2.72	3.3
12/16/2015	<1	<1				
2/18/2016	<1	1.05	6.15	3.48	2.78	3.22
5/25/2016	<1	<1	5.76	3.12	2.55	
5/26/2016						3.18
8/23/2016	<1	1.19	6.16	3.58	3.23	3.41
11/10/2016				3.49		
11/11/2016	<1	<1	6.13		3.17	3.51
2/8/2017	<1	<1	5.89	3.49	3.14	3.19
5/3/2017				3.63	3.7	3.5
5/4/2017	1.27	<1	6.15			
8/1/2017	<1	1.18		3.53	3.53	3.37
8/4/2017			5.45			
10/3/2017	3.91	3.13	8.74	3.36	6.59	6.1
11/16/2017	1.52	1.59	6.15	3.91 (i)	3.97	3.87
12/28/2017	1	2.12			3.58	3.95

Hollow symbols indicate censored values.

Time Series



Constituent: Chloride Analysis Run 3/5/2018 11:54 AM View: LF III

Sibley Client: SCS Engineers Data: Sibley

Time Series

Constituent: Chloride (mg/L) Analysis Run 3/5/2018 11:57 AM View: LF III

Sibley Client: SCS Engineers Data: Sibley

	514 (bg)	515 (bg)	516 (bg)	PZ-03 (bg)
12/15/2015	<1	2.63	4.53	<1
5/26/2016	<1			<1
6/2/2016		3.46	4.27	
11/11/2016	<1	3.69	4.31	<1
5/4/2017	<1	3.15	4.51	<1
10/3/2017	3.34	8.75	6.21	8.73
11/16/2017	<1	9.33	4.45	1.3

C.2. Supplemental Data, Groundwater Monitoring Alternative Source Demonstration Report October 2017 Groundwater Monitoring Event

Piper Diagram

Analysis Run 1/24/2019 5:26 PM View: Pipers ASD

Sibley Client: SCS Engineers Data: Sibley

Totals (ppm)	Na	K	Ca	Mg	Cl	SO4	HCO3	CO3
505* 5/25/2016	6.93	0.5	24.6	8.05	0.5	21.9	75.3	10
505* 8/23/2016	7.28	0.5	25.7	7.97	1.19	9.73	101	10
505* 11/11/2016	6.91	0.5	21.6	7.39	0.5	15.9	68.5	10
505* 2/8/2017	8.52	0.5	23.5	9.3	0.5	14.9	94	10
601 5/26/2016	11.9	1.55	103	30.4	3.18	8.85	361	10
601 8/23/2016	12.2	1.32	102	30.8	3.41	9.11	379	10
601 11/11/2016	12.9	1.78	105	32.8	3.51	16.1	359	10
601 2/8/2017	12.1	1.36	87.5	31.8	3.19	10.5	361	10
LEACHATEPOND 5/25/2016	499	58.6	129	12.9	44.1	1440	10	119
LEACHATEPOND 8/23/2016	479	56.8	108	12.8	42.8	1320	10	104
LEACHATEPOND 11/10/2016	651	75.3	224	22.5	50.4	1820	30.5	68.3
LEACHATEPOND 2/9/2017	678	66.2	89.4	10.8	64.5	2200	38.9	146
LEACHATE 3/23/2018	741	70.3	88.5	4.66	79.1	1690	10	108

C.3 Groundwater Monitoring Alternative Source Demonstration Report May 2018 Groundwater Monitoring Event

CCR GROUNDWATER MONITORING

ALTERNATIVE SOURCE DEMONSTRATION REPORT

MAY 2018 GROUNDWATER MONITORING EVENT

CCR LANDFILL

SIBLEY GENERATING STATION

SIBLEY, MISSOURI

Presented To:

KCP&L Greater Missouri Operations Company

Presented By:

SCS ENGINEERS

8575 West 110th Street, Suite 100

Overland Park, Kansas 66210

(913) 681-0030

December 2018

File No. 27213169.18

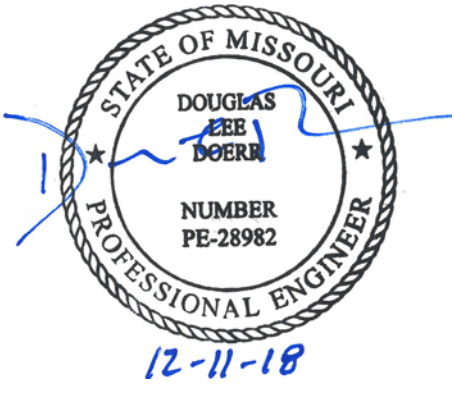
CERTIFICATIONS

I, John R. Rockhold, being a qualified groundwater scientist and Registered Geologist in the State of Missouri, do hereby certify the accuracy of the information in the CCR Groundwater Monitoring Alternative Source Demonstration Report for the CCR Landfill at the Sibley Generating Station. The Alternative Source Demonstration was prepared by me or under my direct supervision in accordance with generally accepted hydrogeological practices and the local standard of care.

John R. Rockhold, R.G.

SCS Engineers

I, Douglas L. Doerr, being a qualified licensed Professional Engineer in the State of Missouri, do hereby certify the accuracy of the information in the CCR Groundwater Monitoring Alternative Source Demonstration Report for the CCR Landfill at the Sibley Generating Station. The Alternative Source Demonstration was prepared by me or under my direct supervision in accordance with generally accepted engineering practices and the local standard of care.



Douglas L. Doerr, P.E.

SCS Engineers

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Section **Page**

Appendices

1 REGULATORY FRAMEWORK

Certain owners or operators of Coal Combustion Residuals (CCR) units are required to complete groundwater monitoring activities to evaluate whether a release from the unit has occurred. Included in the activities is the completion of a statistical analysis of the groundwater quality data as prescribed in § 257.93(h) of the CCR Final Rule. If the initial analysis indicates a statistically significant increase (SSI) over background levels, the owner or operator may perform an alternate source demonstration (ASD). In accordance with § 257.94(e)(2), the owner or operator of the CCR unit may demonstrate that a source other than the CCR unit caused the SSI over background levels for a constituent, or that the SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The owner or operator must complete the written demonstration within 90 days of detecting a SSI over background levels to include obtaining a certification from a qualified professional engineer verifying the accuracy of the information in the report. If a successful demonstration is completed within the 90-day period, the owner or operator of the CCR unit may continue with a detection monitoring program under § 257.94. If a successful demonstration is not completed within the 90-day period, the owner or operator of the CCR unit must initiate an assessment monitoring program as required under § 257.95. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer.

2 STATISTICAL RESULTS

Statistical analysis of monitoring data from the groundwater monitoring system for the CCR Landfill at KCP&L Greater Missouri Operations Company's Sibley Generating Station has been completed in substantial compliance with the "Statistical Method Certification by a Qualified Professional Engineer" document dated October 12, 2017. Detection monitoring groundwater samples were collected on May 17, 2018. Review and validation of the results from the May 2018 Detection Monitoring Event was completed on June 15, 2018, which constitutes completion and finalization of detection monitoring laboratory analyses. A statistical analysis was then conducted to determine whether there was a statistically significant increase (SSI) over background values for each constituent listed in Appendix III to Part 257-Constituents for Detection Monitoring. Two rounds of verification sampling were conducted for certain constituents on June 27, 2018 and August 8, 2018.

If an SSI is preliminarily identified by the prediction limit analysis, verification retesting is performed in accordance with the certified statistical method and the resampling plan to verify the result is not due to an error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Up to two rounds of verification sampling and retesting may be conducted. Verification retesting with a "1 of 2" or "1 of 3" resampling plan is performed by collecting a verification sample(s) and comparing it to the calculated prediction limit. If the resulting concentration of any verification sample is not above the prediction limit, then an SSI is not confirmed.

Determinations of SSIs for the CCR Landfill at the Sibley Generating Station were completed September 12, 2018 and placed into the CCR Operating Record.

The completed statistical evaluation identified Appendix III constituent, sulfate, above its respective prediction limit in monitoring wells MW-504 and MW-512.

The prediction limit for sulfate in upgradient monitoring well MW-504 is 24.6 milligrams per liter (mg/L). The detection monitoring sample was reported at 32.8 mg/L. The first verification re-sample was collected on June 27, 2018 with a result of 31.8 mg/L. The second verification re-sample was collected on August 8, 2018 with a result of 32.3 mg/L.

The prediction limit for sulfate in monitoring well MW-512 is 29.6 mg/L. The detection monitoring sample was reported at 29.6 mg/L. The first verification re-sample was collected on June 27, 2018 with a result of 30.3 mg/L. The second verification re-sample was collected on August 8, 2018 with a result of 30.9 mg/L.

Therefore, in accordance with the Statistical Method Certification, the detection monitoring sample for sulfate from monitoring wells MW-504 and MW-512 exceed their respective prediction limits and are confirmed statistically significant increases (SSIs) over background.

Determination: A statistical evaluation was completed for all Appendix III detection monitoring constituents in accordance with the certified statistical method. The statistical evaluation identified two SSIs above the background prediction limits for sulfate in upgradient monitoring well MW-504 and downgradient monitor well MW-512.

3 ALTERNATIVE SOURCE DEMONSTRATION

An Alternative Source Demonstration (ASD) is a means to provide supporting lines of evidence that something other than a release from a regulated CCR unit caused an SSI. For the above-identified SSIs for the CCR Landfill at the Sibley Generating Station, there are multiple lines of supporting evidence to indicate the above SSIs were not caused by a release from the CCR Landfill. Select multiple lines of supporting evidence are described as follows.

3.1 UPGRADIENT WELL LOCATION

Figure 1 in **Appendix A** shows a potentiometric surface contour map indicating the direction of groundwater flow at and near the CCR Landfill at the time of sampling. As seen on the map, monitoring well MW-504 is located upgradient from the CCR Landfill indicating the SSI is not caused by a release from the CCR Landfill. This demonstrates that a source other than the CCR Landfill caused the SSI over background levels for sulfate, or that the SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

3.2 BOX AND WHISKERS PLOTS

A commonly accepted method to demonstrate and visualize the distribution of data in a given data set is to construct box and whiskers plots. The basic box plotted graphically locates the median, 25th and 75th percentiles of the data set; the "whiskers" extend to the minimum and maximum values of the data set. The range between the ends of a box plot represents the Interquartile Range, which can be used as an estimate of spread or variability. The mean is denoted by a "+".

When comparing multiple wells or well groups, box plots for each well can be lined up on the same axes to roughly compare the variability in each well. This may be used as an exploratory screening for the test of homogeneity of variance across multiple wells.

Box and whiskers plots for sulfate in monitoring wells MW-504 and MW-512 were compared to box and whisker plots for sulfate in several upgradient and side-gradient non-CCR monitoring system wells installed for future state-permitted landfill expansion purposes. The comparison indicates the sulfate concentrations in both MW-504 and MW-512 are well within expected concentration levels for non-impacted groundwater in the vicinity of the CCR Landfill. **Figure 1** in **Appendix A** shows these upgradient non-CCR monitoring system wells and their relationships to groundwater flow near and beneath the CCR Landfill. Because the non-CCR monitoring system wells are located in a nearby area that has not been impacted by the landfill, and exhibit variability that includes sulfate concentrations similar to those seen at MW-504 and MW-512, the observed sulfate concentrations are within the range of expected natural spatial variation within and between wells. This demonstrates that a source other than the CCR Landfill caused the SSIs over background levels for sulfate, or that the SSIs resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Box and whisker plots for sulfate are provided in **Appendix B**.

3.3 PIPER DIAGRAM PLOTS

Piper diagrams are a form of tri-linear diagram, and a widely accepted method to provide a visual representation of the ion concentration of groundwater. Piper diagrams portray water compositions and facilitate the interpretation and presentation of chemical analysis. They may be used to visually compare the chemical composition of water quality across wells, and aid in determining whether the waters are similar or dis-similar, and can over time indicate whether the waters are mixing.

A piper diagram has two triangular plots on the right and left side of a 4-sided center field. The three major cations are plotted in the left triangle and anions in the right. Each of the three cation/anion variables, in milliequivalents, is divided by the sum of the three values, to produce a percent of total cation/anions. These percentages determine the location of the associated symbol. The data points in the center field are located by extending the points in the lower triangles to the point of intersection. In order for a piper diagram to be produced, the selected data file must contain the following constituents: Sodium (Na), Potassium (K), Calcium (Ca), Magnesium (Mg), Chloride (Cl), Sulfate (SO4), Carbonate (CO3), and Bicarbonate (HCO3).

A piper diagram generated for MW-504, MW-512, and landfill leachate is provided in **Appendix C** and indicates the groundwater from these two wells does not exhibit the same geochemical characteristics as the leachate. The groundwater and the leachate plot in different hydrochemical facies indicating there is no mixing of the two types of water (groundwater and leachate). This demonstrates that a source other than the CCR Landfill caused the SSIs over background levels for sulfate, or that the SSIs resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

3.4 TIME SERIES PLOTS

Time series plots provide a graphical method to view changes in data at a particular well (monitoring point) or wells over time. Time series plots display the variability in concentration levels over time and can be used to indicate possible outliers or data errors (i.e. “spikes”). More than one well can be compared on the same plot to look for differences between wells. Non-detect data is plotted as censored data at one-half of the laboratory reporting limit. Time series plots can also be used to examine the data for trends.

Sulfate concentrations for MW-504 and MW-512 were plotted against sulfate concentrations in several upgradient and side-gradient non-CCR monitoring system wells. The comparison indicates the sulfate concentrations in both upgradient well MW-504 and downgradient well MW-512 exhibit similar

trends are well within expected concentration levels for non-impacted groundwater in the vicinity of the CCR Landfill. **Figure 1** in **Appendix A** shows these upgradient and side-gradient non-CCR monitoring system wells and their relationships to groundwater flow near and beneath the CCR Landfill. Because the non-CCR monitoring system wells are located in a nearby area that has not been impacted by the landfill, and exhibit variability that includes sulfate concentrations similar to those seen at MW-504 and MW-512 (including similar but small upward trends), and a significant upward trend in upgradient well MW-515, the observed sulfate concentrations are within the range of expected natural spatial variation within and between wells. A release from the CCR Landfill would not be expected to cause an increase across multiple wells (including upgradient wells) simultaneously. This demonstrates that a source other than the CCR Landfill caused the SSIs over background levels for sulfate, or that the SSIs resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Time series plots for sulfate are provided in **Appendix D**.

This demonstrates that a source other than the CCR Landfill caused the SSIs over background levels for sulfate, or that the SSIs resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

4 CONCLUSION

Our opinion is that a sufficient body of evidence is available and presented above to demonstrate that a source other than the CCR Landfill caused the SSIs over background levels, or that the SSIs resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Based on the successful ASD, the owner or operator of the CCR Landfill may continue with the detection monitoring program under § 257.94.

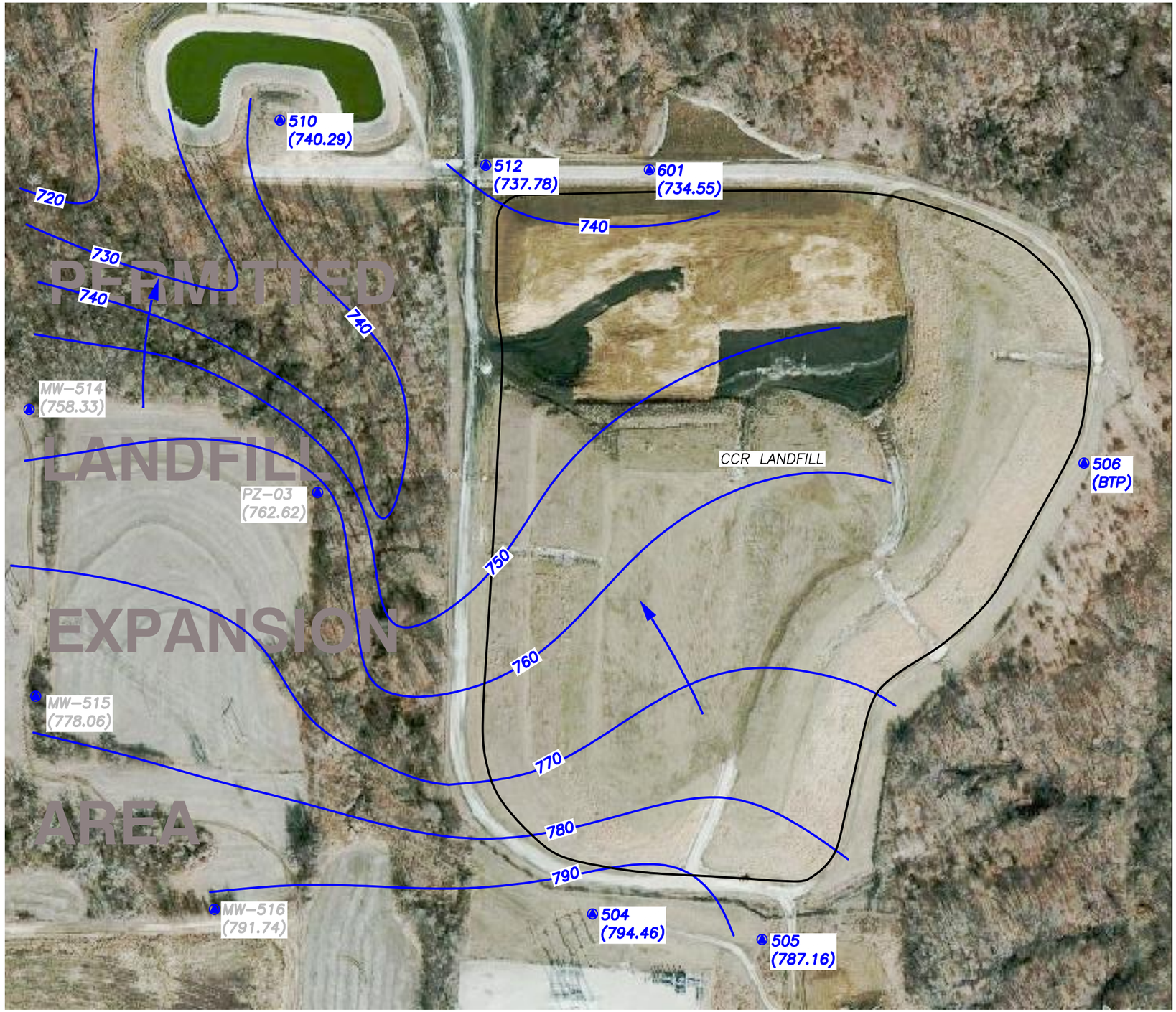
5 GENERAL COMMENTS

This report has been prepared and reviewed under the direction of a qualified groundwater scientist and qualified professional engineer. Please note that SCS Engineers does not warrant the work of regulatory agencies or other third parties supplying information used in the assimilation of this report. This report is prepared in accordance with generally accepted environmental engineering and geological practices, within the constraints of the client's directives. It is intended for the exclusive use of KCP&L Greater Missouri Operations Company for specific application to the Sibley Generating Station. No warranties, express or implied, are intended or made.

The signature of the certifying registered geologist and professional engineer on this document represents that to the best of their knowledge, information, and belief in the exercise of his professional judgement in accordance with the standard of practice, it is his professional opinion that the aforementioned information is accurate as of the date of such signature. Any opinion or decisions by them are made on the basis of his experience, qualifications, and professional judgement and are not to be construed as warranties or guaranties. In addition, opinions relating to regulatory, environmental, geologic, geochemical and geotechnical conditions interpretations or other estimates are based on available data, and actual conditions may vary from those encountered at the times and locations where data are obtained, despite the use of due care.

Appendix A

Figure 1



LEGEND:

– 760 –	GROUNDWATER POTENTIOMETRIC SURFACE ELEVATIONS (REPRESENTATIVE OF THIS UNIT)
601 (734.55)	GROUNDWATER MONITORING SYSTEM WELLS (GROUNDWATER ELEVATION)
	CCR LANDFILL UNIT BOUNDARY
	GROUNDWATER FLOW DIRECTION
BTP	BELOW TOP OF PUMP
MW–514 (758.33)	NON–CCR GROUNDWATER MONITORING WELLS (GROUNDWATER ELEVATION)

NOTES:

1. HORIZONTAL & VERTICAL DATUM: URS PLANS FOR CONSTRUCTION, KCP&L SIBLEY GENERATING STATION, DESIGN FILE 16530511.00001, DATED JANUARY 2010
2. GOOGLE EARTH AERIAL IMAGE. MARCH 2015.
3. BOUNDARY AND MONITORING WELL LOCATIONS SHOWN ARE APPROXIMATE.

200 0 200 400
SCALE FEET

REV.	DATE
-	-

SHEET TITLE: POTENTIOMETRIC SURFACE MAP (MAY 2018) CCR LANDFILL

PROJECT TITLE: CCR ALTERNATIVE SOURCE DEMONSTRATION

CLIENT: KCP&L GREATER MISSOURI OPERATIONS CO.
SIBLEY GENERATING STATION
SIBLEY, MISSOURI

SCS ENGINEERS
8575 W. 110th St. Ste. 100
Overland Park, Kansas 66210
PH. (913) 681-0030 FAX. (913) 681-0012

PROJ. NO. 27213167.18	DWN. BY: TGW
DSN. BY: JRR	CHK. BY: JRR
	Q/A RVW BY: JRR
	PROJ. MGR: JRR

CADD FILE: CCR ALTERNATIVE SOURCE DEMO.DWG

DATE: 10/25/18

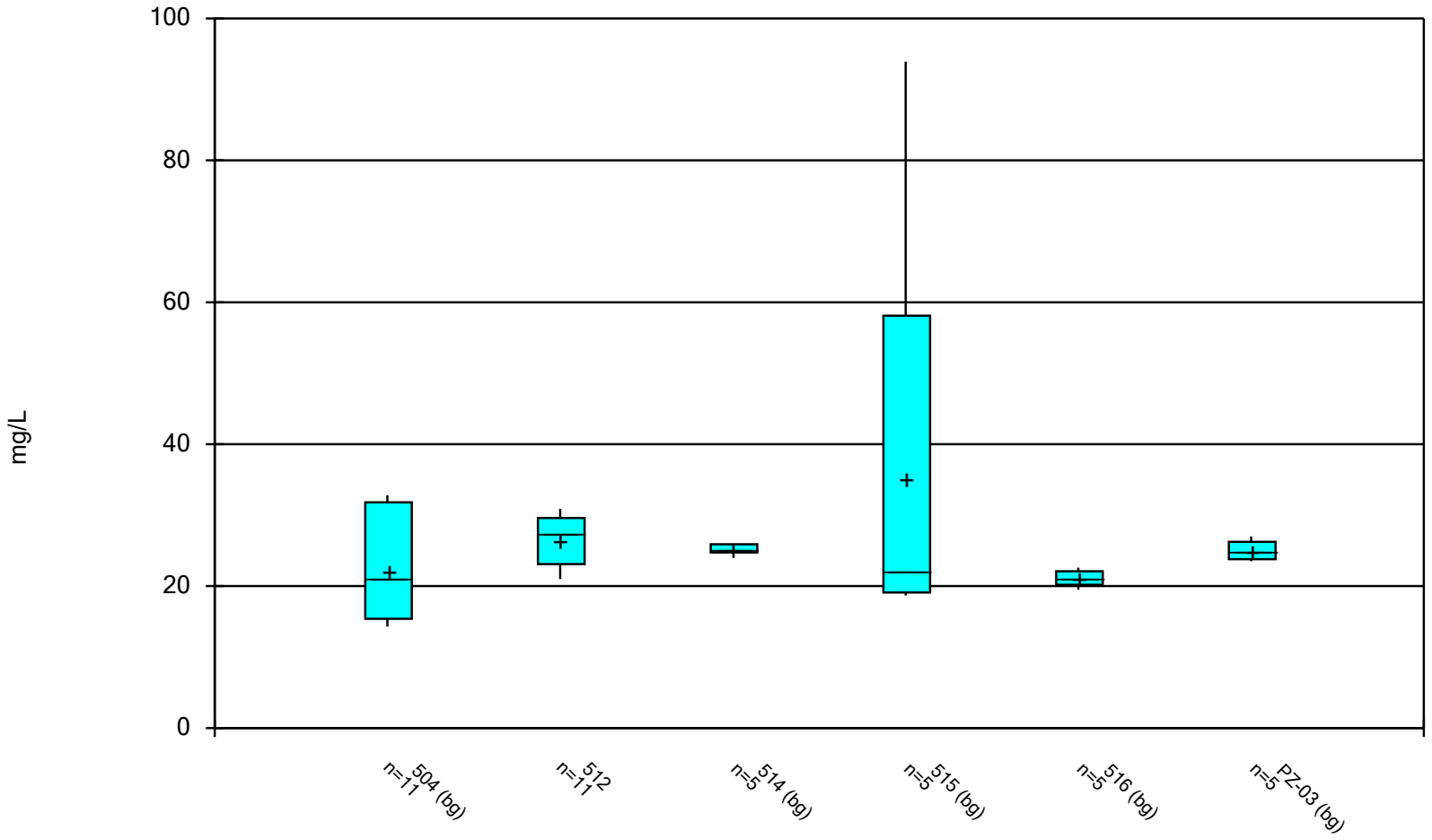
FIGURE NO. 1

T:\27213167.18\AutoCAD\CCR Alternative Source Demo.dwg Dec 10, 2018 - 12:16pm Layout Name: #1 By: 4338t_w

Appendix B

Box and Whiskers Plots

Box & Whiskers Plot



Constituent: Sulfate Analysis Run 8/20/2018 12:25 PM View: LF III

Sibley Client: SCS Engineers Data: Sibley

Box & Whiskers Plot

Constituent: Sulfate (mg/L) Analysis Run 8/20/2018 12:25 PM View: LF III

Sibley Client: SCS Engineers Data: Sibley

	504 (bg)	512	514 (bg)	515 (bg)	516 (bg)	PZ-03 (bg)
12/15/2015		23	25.9	22.1	22.6	25.5
12/16/2015	14.3					
2/18/2016	14.7	21				
5/25/2016	18.9	23.1				
5/26/2016			24.9			23.5
6/2/2016				22.3	21.6	
8/23/2016	15.4	24.4				
11/11/2016	17.4	24	25.2	19.5	21.1	24.7
2/8/2017	21	27.8				
5/3/2017		27.3				
5/4/2017	21.8		24.6	18.7	19.5	24.1
8/1/2017	23.3	28.1				
5/16/2018			25.9	93.9	20.9	27
5/17/2018	32.8	29.6				
6/27/2018	31.8	30.3				
8/8/2018	32.3	30.9				
Median	21	27.3	25.2	22.1	21.1	24.7
LowerQ.	15.4	23.1	24.8	19.1	20.2	23.8
UpperQ.	31.8	29.6	25.9	58.1	22.1	26.3
Min	14.3	21	24.6	18.7	19.5	23.5
Max	32.8	30.9	25.9	93.9	22.6	27
Mean	22.2	26.3	25.3	35.3	21.1	25

Box & Whiskers Plot

Sibley Client: SCS Engineers Data: Sibley Printed 8/20/2018, 12:25 PM

Constituent	Well	N	Mean	Std. Dev.	Std. Err.	Median	Min.	Max.	%NDs
Sulfate (mg/L)	504 (bg)	11	22.2	7.13	2.15	21	14.3	32.8	0
Sulfate (mg/L)	512	11	26.3	3.36	1.01	27.3	21	30.9	0
Sulfate (mg/L)	514 (bg)	5	25.3	0.587	0.263	25.2	24.6	25.9	0
Sulfate (mg/L)	515 (bg)	5	35.3	32.8	14.7	22.1	18.7	93.9	0
Sulfate (mg/L)	516 (bg)	5	21.1	1.13	0.505	21.1	19.5	22.6	0
Sulfate (mg/L)	PZ-03 (bg)	5	25	1.36	0.608	24.7	23.5	27	0

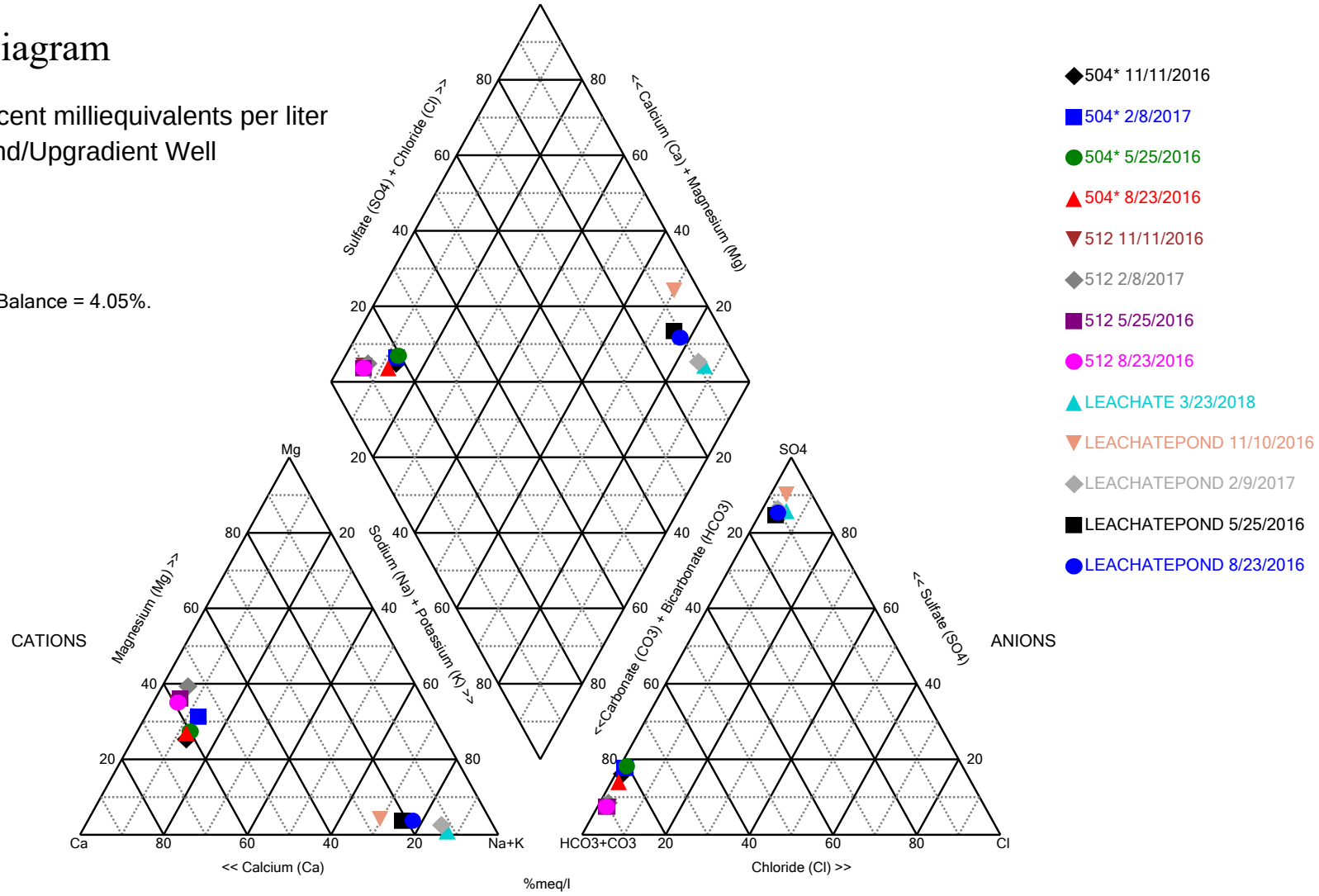
Appendix C

Piper Diagram

Piper Diagram

%meq/l = percent milliequivalents per liter
* = Background/Upgradient Well

Cation-Anion Balance = 4.05%.



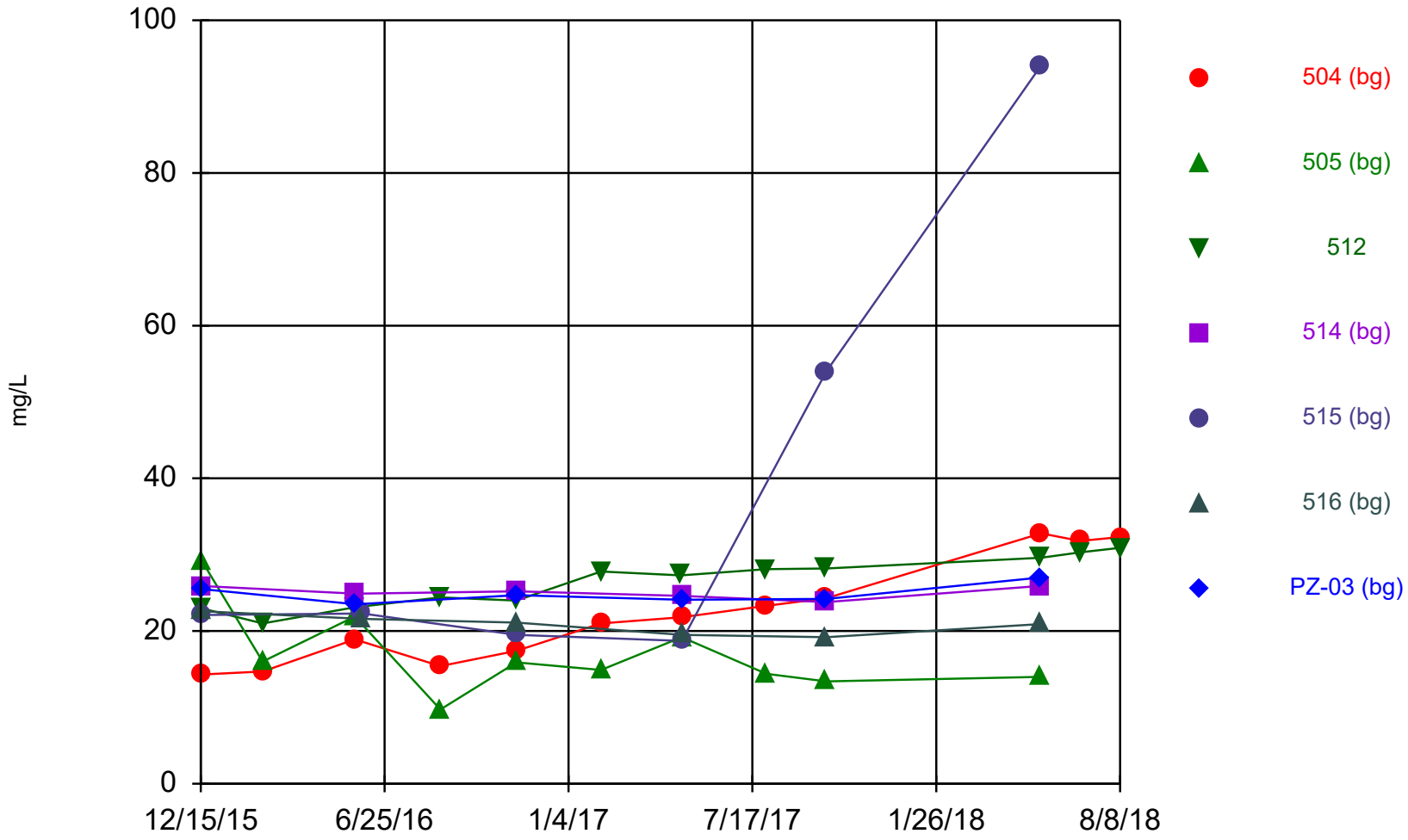
Analysis Run 8/20/2018 1:23 PM View: LF III

Sibley Client: SCS Engineers Data: Sibley

Appendix D

Time Series Plots

Time Series



Constituent: Sulfate Analysis Run 11/7/2018 3:06 PM View: LF III Sibley Client: SCS Engineers Data: Sibley

Time Series

Constituent: Sulfate (mg/L) Analysis Run 11/7/2018 3:07 PM View: LF III

Sibley Client: SCS Engineers Data: Sibley

	504 (bg)	505 (bg)	512	514 (bg)	515 (bg)	516 (bg)	PZ-03 (bg)
12/15/2015			23	25.9	22.1	22.6	25.5
12/16/2015	14.3	29.2					
2/18/2016	14.7	16	21				
5/25/2016	18.9	21.9	23.1				
5/26/2016				24.9			23.5
6/2/2016					22.3	21.6	
8/23/2016	15.4	9.73	24.4				
11/11/2016	17.4	15.9	24	25.2	19.5	21.1	24.7
2/8/2017	21	14.9	27.8				
5/3/2017			27.3				
5/4/2017	21.8	19.2		24.6	18.7	19.5	24.1
8/1/2017	23.3	14.4	28.1				
10/3/2017	24.3	13.4	28.2	23.8	54	19.2	24.2
5/16/2018				25.9	93.9	20.9	27
5/17/2018	32.8	14	29.6				
6/27/2018	31.8		30.3				
8/8/2018	32.3		30.9				

C.4 Supplemental Data, Groundwater Monitoring Alternative Source Demonstration Report May 2018 Groundwater Monitoring Event

Piper Diagram

Analysis Run 1/24/2019 5:29 PM View: Pipers ASD

Sibley Client: SCS Engineers Data: Sibley

Totals (ppm)	Na	K	Ca	Mg	Cl	SO4	HCO3	CO3
504* 5/25/2016	6.54	1.27	30.2	8.36	0.5	18.9	89	10
504* 8/23/2016	6.61	1.15	32.2	8.56	0.5	15.4	99.5	10
504* 11/11/2016	8.17	1.3	36.9	8.97	0.5	17.4	94.7	10
504* 2/8/2017	6.83	1.28	29.6	9.94	0.5	21	105	10
512 5/25/2016	10	2.24	98.9	36.8	2.55	23.1	356	10
512 8/23/2016	10.3	2.13	103	36.9	3.23	24.4	384	10
512 11/11/2016	9.96	2.16	100	35.6	3.17	24	352	10
512 2/8/2017	10	2.35	86.4	37.9	3.14	27.8	358	10
LEACHATEPOND 5/25/2016	499	58.6	129	12.9	44.1	1440	10	119
LEACHATEPOND 8/23/2016	479	56.8	108	12.8	42.8	1320	10	104
LEACHATEPOND 11/10/2016	651	75.3	224	22.5	50.4	1820	30.5	68.3
LEACHATEPOND 2/9/2017	678	66.2	89.4	10.8	64.5	2200	38.9	146
LEACHATE 3/23/2018	741	70.3	88.5	4.66	79.1	1690	10	108