2018 Annual Groundwater Monitoring and Corrective Action Report

Ottumwa Midland Landfill
Ottumwa, Iowa

Prepared for:

Alliant Energy

SCS ENGINEERS

25216073.18 | January 31, 2019

2830 Dairy Drive
Madison, WI 53718-6751
608-224-2830

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1.0 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) Rule [40 CFR 257.50-107]. 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 Units.

This report covers the period of groundwater monitoring from January 1, 2018, through December 31, 2018.

The groundwater monitoring system at the Ottumwa Midland Landfill (OML) is a multi-unit system that monitors two existing CCR landfills, the Existing Landfill and the Phase 1 Expansion, as required by 40 CFR 257.91(d). The groundwater monitoring system consists of two upgradient and three downgradient monitoring wells.

2.0 § 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 map showing the OML CCR units and all background (or upgradient) and downgradient monitoring wells with identification numbers for the groundwater monitoring program is provided as **Figure 1**.

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 groundwater monitoring program for OML 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;

Two groundwater sampling events were completed in 2018 for OML as part of ongoing detection monitoring.

Groundwater samples collected during the semiannual events, in April and October 2018, were analyzed for the Appendix III constituents. 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 program is included in Table 1. The results of the analytical laboratory analyses are provided in the laboratory reports in Appendices A1 through A2.

Assessment monitoring has not been initiated for the CCR units at OML.

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);

There were no transitions between monitoring programs during 2018. OML remained in the detection monitoring program.

In 2018, the monitoring results for the November 2017 and April 2018 monitoring events were evaluated for statistically significant increases (SSIs) in detection monitoring parameters relative to background. For both events, SSIs for chloride were identified; however, alternative source demonstrations (ASDs) were completed, demonstrating that sources other than the CCR units were the likely cause of the observed concentrations. The ASD reports are provided in Appendix B.

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.

Additional potentially applicable requirements for the annual report, and the location of the requirement within the Rule, are provided in the following sections. For each cited section of the Rule, the portion referencing the annual report requirement is provided below in italics, followed by applicable information relative to the 2018 Annual Groundwater Monitoring and Corrective Action Report for OML.

2.5.1 § 257.90(e) General Requirements

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.

Status of Groundwater Monitoring and Corrective Action Program. The groundwater monitoring and corrective action program is currently in detection monitoring.

Summary of Key Actions Completed.

- Statistical evaluation and determination of SSIs for the November 2017 and April 2018 monitoring events.
- ASD reports for the SSIs identified from the November 2017 and April 2018 monitoring events.
- Two semiannual groundwater sampling and analysis events (April and October 2018).

Description of Any Problems Encountered. No problems were encountered in 2018.

Discussion of Actions to Resolve the Problems. Not applicable.

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

- Statistical evaluation and determination of any SSIs for the October 2018 and April 2019 monitoring events.
- If an SSI is determined, then within 90 days either:
  - Complete ASD (if applicable), or
  - Establish an assessment monitoring program.
- Two semiannual groundwater sampling and analysis events (April and October 2019).

2.5.2 § 257.94(d) Alternative Detection Monitoring Frequency

The owner or operator must include the demonstration providing the basis for the alternative monitoring frequency and the certification by a qualified professional engineer in the annual groundwater monitoring and corrective action report required by § 257.90(e).

Not applicable. No alternative detection monitoring frequency has been proposed.

2.5.3 § 257.94(e)(2) Alternative Source Demonstration for Detection Monitoring

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.

The ASD reports prepared to address the SSIs observed for the November 2017 and April 2018 sampling events are provided in **Appendix B**. The ASD reports are certified by a qualified professional engineer.

2.5.4 § 257.95(c) Alternative Assessment Monitoring Frequency

The owner or operator must include the demonstration providing the basis for the alternative monitoring frequency and the certification by a qualified professional engineer in the annual groundwater monitoring and corrective action report required by § 257.90(e).

Not applicable. Assessment monitoring has not been initiated.

2.5.5 § 257.95(d)(3) Assessment Monitoring Results and Standards

Include the recorded concentrations required by paragraph (d)(1) of this section, identify the background concentrations established under § 257.94(b), and identify the groundwater protection standards established under paragraph (d)(2) of this section in the annual groundwater monitoring and corrective action report required by § 257.90(e).

Not applicable. Assessment monitoring has not been initiated.

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

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.

Not applicable. Assessment monitoring has not been initiated.

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

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 measure 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 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.

Not applicable. Corrective measures assessment has not been initiated.

Table 1

CCR Rule Groundwater Samples Summary

Table 1. CCR Rule Groundwater Samples Summary
Ottumwa Midland Landfill / SCS Engineers Project #25216073

Sample Dates	Downgradient Wells			Background Wells	
	MW-301	MW-302	MW-303	MW-102M	MW-122M
4/17/2018	D	D	D	D	D
10/15-16/2018	D	D	D	D	D
Total Samples	2	2	2	2	2

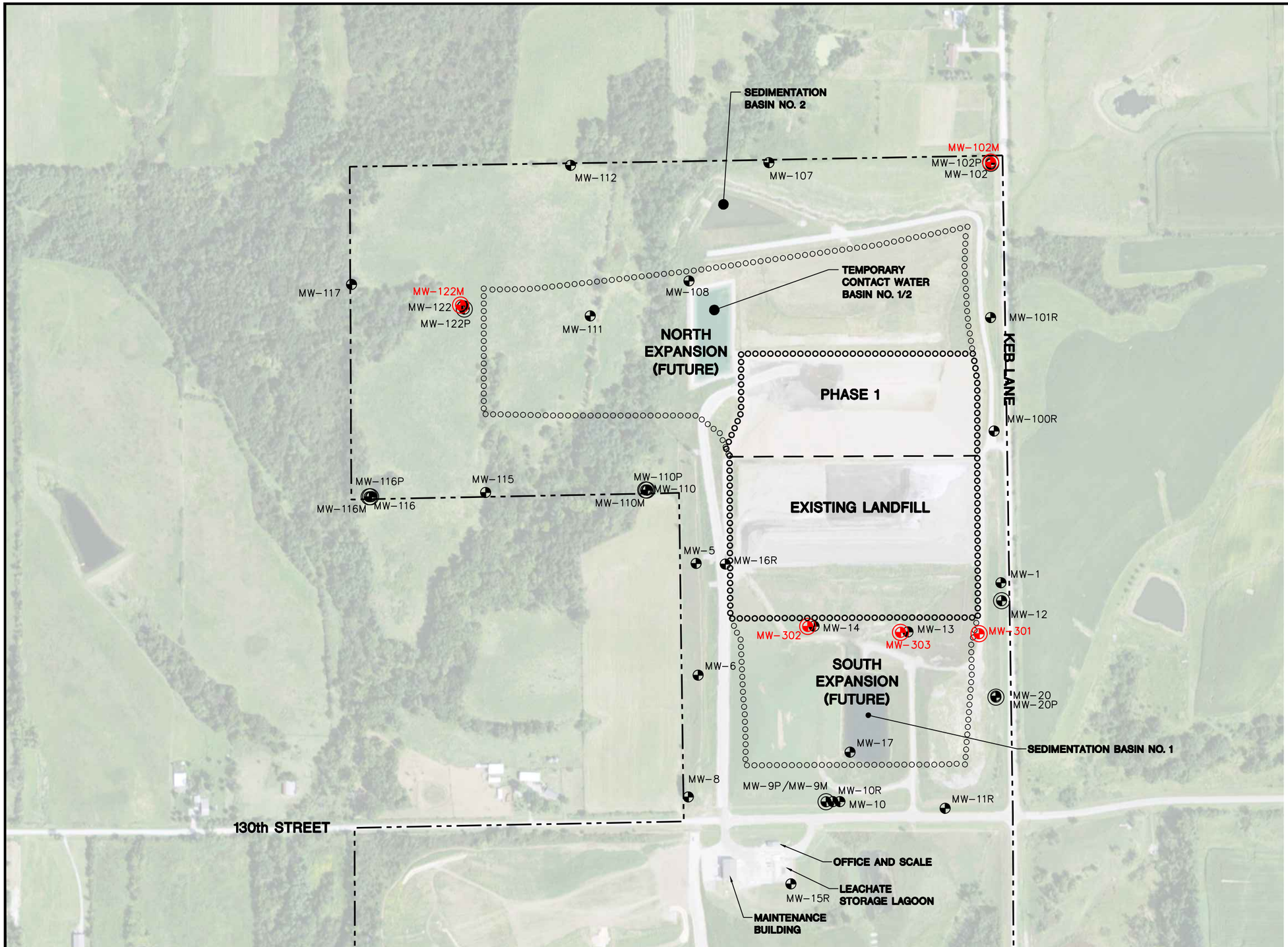
Abbreviations:
D = Required by Detection Monitoring Program

Created by:	NDK	Date:	1/4/2019
Last revision by:	NDK	Date:	1/4/2019
Checked by:	MDB	Date:	1/4/2019

I:\25216073.00\Deliverables\2018 Annual OML GW Mon. and CA Report\Table\[GW_Samples_Summary_Table_OML-1.xlsx]GW Summary

Figure 1

Site Plan and Monitoring Well Locations



LEGEND

- APPROXIMATE PROPERTY LINE
- EXISTING WASTE LIMITS
- PERMITTED WASTE LIMITS
- MONITORING WELL
- PIEZOMETER
- CCR RULE PIEZOMETER

NOTES:

1. 2015 AERIAL PHOTOGRAPH IS FROM THE IOWA GEOGRAPHIC MAP SERVER–IOWA STATE UNIVERSITY GEOGRAPHIC INFORMATION SYSTEMS SUPPORT & RESEARCH FACILITY.
2. PROPERTY LINE SOUTH OF 130TH STREET FROM SURVEY MAP PREPARED BY GARDEN & ASSOCIATES, OSKALOOSA, IOWA, DATED DECEMBER 20, 1988.
3. PROPERTY LINE NORTH OF 130TH STREET FROM PLAT OF SURVEY MAP PREPARED BY SCS ENGINEERS, MADISON, WISCONSIN, DATED FEBRUARY 20, 2013.
4. EXISTING LIMITS OF WASTE ARE APPROXIMATE.
5. MONITORING WELLS MW–301 AND MW–302 WERE INSTALLED BY CASCADE DRILLING BETWEEN NOVEMBER 16, 2015, AND DECEMBER 3, 2015.
6. MONITORING WELL MW–303 WAS INSTALLED BY TEAM SERVICES BETWEEN APRIL 11, 2016 AND APRIL 26, 2016.
7. MONITORING WELLS MW–301 THROUGH MW–303 WERE SURVEYED BY FRENCH–RENEKER–ASSOCIATES ON MAY 19, 2016.

N

400 0 400

SCALE: 1" = 400'

PROJECT NO.	25216073.18	DRAWN BY:	BJM/BSS
DRAWN:	11/17/11	CHECKED BY:	NK
REVISED:	01/10/19	APPROVED BY:	

ENGINEER: SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

CLIENT: INTERSTATE POWER AND LIGHT CO.
15300 130th STREET
OTTUMWA, IA 52501

SITE: OTTUMWA MIDLAND LANDFILL
OTTUMWA, IOWA

MONITORING WELL LOCATION MAP

FIGURE 1

I:\25216073.00\Drawings\□□R R□□Pi□□□□□rs.dwg, 1/10/2019 4:30:16 PM

Appendix A

Laboratory Reports

A1 April 2018 Detection Monitoring

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

May 04, 2018

Meghan Blodgett
SCS Engineers
2830 Dairy Drive
Madison, WI 53718

RE: Project: Ottumwa Midland LF/25216073.18
Pace Project No.: 60268634

Dear Meghan Blodgett:
Enclosed are the analytical results for sample(s) received by the laboratory on April 20, 2018. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Trudy Gipson

Trudy Gipson
trudy.gipson@pacelabs.com
1(913)563-1405
Project Manager

Enclosures

cc: Tom Karwaski, SCS Engineers
Kyle Kramer, SCS Engineers
Jeff Maxted, Alliant Energy

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CERTIFICATIONS

Project: Ottumwa Midland LF/25216073.18
Pace Project No.: 60268634

Kansas Certification IDs

9608 Loiret Boulevard, Lenexa, KS 66219
WY STR Certification #: 2456.01
Arkansas Certification #: 17-016-0
Illinois Certification #: 200030
Iowa Certification #: 118
Kansas/NELAP Certification #: E-10116
Louisiana Certification #: 03055
Nevada Certification #: KS000212018-1
Oklahoma Certification #: 9205/9935
Texas Certification #: T104704407
Utah Certification #: KS00021
Kansas Field Laboratory Accreditation: # E-92587
Missouri Certification: 10070

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

SAMPLE SUMMARY

Project: Ottumwa Midland LF/25216073.18
Pace Project No.: 60268634

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60268634001	**MW-301**	Water	04/17/18 12:10	04/20/18 08:45
60268634002	**MW-302**	Water	04/17/18 10:00	04/20/18 08:45
60268634003	**MW-303**	Water	04/17/18 10:50	04/20/18 08:45
60268634004	**MW-102M**	Water	04/17/18 13:00	04/20/18 08:45
60268634005	**MW-122M**	Water	04/17/18 13:45	04/20/18 08:45
60268634006	**FIELD BLANK**	Water	04/17/18 11:40	04/20/18 08:45

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SAMPLE ANALYTE COUNT

Project: Ottumwa Midland LF/25216073.18
Pace Project No.: 60268634

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60268634001	**MW-301**	EPA 6010	TDS	2	PASI-K
		SM 2540C	OL	1	PASI-K
		EPA 9040	MJK	1	PASI-K
		EPA 9056	LDB	3	PASI-K
60268634002	**MW-302**	EPA 6010	TDS	2	PASI-K
		SM 2540C	OL	1	PASI-K
		EPA 9040	MJK	1	PASI-K
		EPA 9056	LDB	3	PASI-K
60268634003	**MW-303**	EPA 6010	TDS	2	PASI-K
		SM 2540C	OL	1	PASI-K
		EPA 9040	MJK	1	PASI-K
		EPA 9056	OL	3	PASI-K
60268634004	**MW-102M**	EPA 6010	TDS	2	PASI-K
		SM 2540C	OL	1	PASI-K
		EPA 9040	MJK	1	PASI-K
		EPA 9056	OL	3	PASI-K
60268634005	**MW-122M**	EPA 6010	TDS	2	PASI-K
		SM 2540C	OL	1	PASI-K
		EPA 9040	MJK	1	PASI-K
		EPA 9056	OL	3	PASI-K
60268634006	**FIELD BLANK**	EPA 6010	TDS	2	PASI-K
		SM 2540C	OL	1	PASI-K
		EPA 9040	MJK	1	PASI-K
		EPA 9056	OL	3	PASI-K

Pace Analytical Services, LLC
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ANALYTICAL RESULTS

Project: Ottumwa Midland LF/25216073.18
Pace Project No.: 60268634

Sample: MW-301 **Lab ID: 60268634001** Collected: 04/17/18 12:10 Received: 04/20/18 08:45 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Field Data	Analytical Method:								
Collected By	**CLIENT**				1		04/17/18 12:10		
Field pH	**7.09**	Std. Units	0.10	0.050	1		04/17/18 12:10		
Field Temperature	**13.0**	deg C	0.50	0.25	1		04/17/18 12:10		
Field Specific Conductance	**1910**	umhos/cm	1.0	1.0	1		04/17/18 12:10		
Field Oxidation Potential	**-102.8**	mV			1		04/17/18 12:10		
Oxygen, Dissolved	**0.16**	mg/L			1		04/17/18 12:10	7782-44-7	
Turbidity	**1.13**	NTU	1.0	1.0	1		04/17/18 12:10		
Groundwater Elevation	**684.85**	feet			1		04/17/18 12:10		
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Boron	**854**	ug/L	100	12.5	1	04/26/18 17:10	04/30/18 19:32	7440-42-8	
Calcium	**131**	mg/L	0.20	0.054	1	04/26/18 17:10	04/30/18 19:32	7440-70-2	
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**1400**	mg/L	5.0	5.0	1		04/24/18 11:55		
9040 pH	Analytical Method: EPA 9040								
pH	**6.8**	Std. Units	0.10	0.10	1		04/24/18 14:33		H6
9056 IC Anions	Analytical Method: EPA 9056								
Chloride	**33.9**	mg/L	5.0	2.3	5		04/28/18 14:21	16887-00-6	
Fluoride	**0.87**	mg/L	0.20	0.063	1		04/28/18 14:06	16984-48-8	
Sulfate	**638**	mg/L	50.0	11.8	50		04/30/18 02:42	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

ANALYTICAL RESULTS

Project: Ottumwa Midland LF/25216073.18
Pace Project No.: 60268634

Sample: MW-302 **Lab ID: 60268634002** Collected: 04/17/18 10:00 Received: 04/20/18 08:45 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Field Data	Analytical Method:								
Collected By	**CLIENT**				1		04/17/18 10:00		
Field pH	**7.8**	Std. Units	0.10	0.050	1		04/17/18 10:00		
Field Temperature	**12.7**	deg C	0.50	0.25	1		04/17/18 10:00		
Field Specific Conductance	**1091**	umhos/cm	1.0	1.0	1		04/17/18 10:00		
Field Oxidation Potential	**-138.7**	mV			1		04/17/18 10:00		
Oxygen, Dissolved	**0.30**	mg/L			1		04/17/18 10:00	7782-44-7	
Turbidity	**200.6**	NTU	1.0	1.0	1		04/17/18 10:00		
Groundwater Elevation	**683.87**	feet			1		04/17/18 10:00		
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Boron	**834**	ug/L	100	12.5	1	04/26/18 17:10	04/30/18 19:34	7440-42-8	
Calcium	**77.3**	mg/L	0.20	0.054	1	04/26/18 17:10	04/30/18 19:34	7440-70-2	
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**690**	mg/L	5.0	5.0	1		04/24/18 11:55		
9040 pH	Analytical Method: EPA 9040								
pH	**7.6**	Std. Units	0.10	0.10	1		04/24/18 14:28		H6
9056 IC Anions	Analytical Method: EPA 9056								
Chloride	**8.6**	mg/L	1.0	0.46	1		04/28/18 15:20	16887-00-6	
Fluoride	**1.0**	mg/L	0.20	0.063	1		04/28/18 15:20	16984-48-8	
Sulfate	**79.3**	mg/L	5.0	1.2	5		04/30/18 02:57	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: Ottumwa Midland LF/25216073.18
Pace Project No.: 60268634

Sample: MW-303 **Lab ID: 60268634003** Collected: 04/17/18 10:50 Received: 04/20/18 08:45 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Field Data	Analytical Method:								
Collected By	**CLIENT**				1		04/17/18 10:50		
Field pH	**7.32**	Std. Units	0.10	0.050	1		04/17/18 10:50		
Field Temperature	**13.3**	deg C	0.50	0.25	1		04/17/18 10:50		
Field Specific Conductance	**1358**	umhos/cm	1.0	1.0	1		04/17/18 10:50		
Field Oxidation Potential	**-103.8**	mV			1		04/17/18 10:50		
Oxygen, Dissolved	**0.38**	mg/L			1		04/17/18 10:50	7782-44-7	
Turbidity	**248**	NTU	1.0	1.0	1		04/17/18 10:50		
Groundwater Elevation	**684.68**	feet			1		04/17/18 10:50		
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Boron	**738**	ug/L	100	12.5	1	04/26/18 17:10	04/30/18 19:36	7440-42-8	
Calcium	**103**	mg/L	0.20	0.054	1	04/26/18 17:10	04/30/18 19:36	7440-70-2	
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**839**	mg/L	5.0	5.0	1		04/24/18 11:55		
9040 pH	Analytical Method: EPA 9040								
pH	**7.2**	Std. Units	0.10	0.10	1		04/24/18 14:30		H6
9056 IC Anions	Analytical Method: EPA 9056								
Chloride	**7.3**	mg/L	1.0	0.46	1		05/01/18 09:40	16887-00-6	
Fluoride	**0.80**	mg/L	0.20	0.063	1		05/01/18 09:40	16984-48-8	
Sulfate	**262**	mg/L	20.0	4.7	20		05/01/18 14:00	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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(913)599-5665

ANALYTICAL RESULTS

Project: Ottumwa Midland LF/25216073.18
Pace Project No.: 60268634

Sample: MW-102M **Lab ID: 60268634004** Collected: 04/17/18 13:00 Received: 04/20/18 08:45 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Field Data	Analytical Method:								
Collected By	**CLIENT**				1		04/18/18 08:30		
Field pH	**8.34**	Std. Units	0.10	0.050	1		04/18/18 08:30		
Field Temperature	**10.1**	deg C	0.50	0.25	1		04/18/18 08:30		
Field Specific Conductance	**2113**	umhos/cm	1.0	1.0	1		04/18/18 08:30		
Field Oxidation Potential	**-77.8**	mV			1		04/18/18 08:30		
Oxygen, Dissolved	**4.51**	mg/L			1		04/18/18 08:30	7782-44-7	
Groundwater Elevation	**717.38**	feet			1		04/18/18 08:30		
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Boron	**1550**	ug/L	100	12.5	1	04/26/18 17:10	04/30/18 19:39	7440-42-8	
Calcium	**25.3**	mg/L	0.20	0.054	1	04/26/18 17:10	04/30/18 19:39	7440-70-2	
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**1540**	mg/L	5.0	5.0	1		04/24/18 11:55		
9040 pH	Analytical Method: EPA 9040								
pH	**8.0**	Std. Units	0.10	0.10	1		04/24/18 14:35		H6
9056 IC Anions	Analytical Method: EPA 9056								
Chloride	**13.5**	mg/L	1.0	0.46	1		05/01/18 11:58	16887-00-6	
Fluoride	**4.5**	mg/L	0.20	0.063	1		05/01/18 11:58	16984-48-8	
Sulfate	**352**	mg/L	50.0	11.8	50		05/01/18 14:41	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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Lenexa, KS 66219
(913)599-5665

ANALYTICAL RESULTS

Project: Ottumwa Midland LF/25216073.18
Pace Project No.: 60268634

Sample: MW-122M **Lab ID: 60268634005** Collected: 04/17/18 13:45 Received: 04/20/18 08:45 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Field Data	Analytical Method:								
Collected By	**CLIENT**				1		04/17/18 13:55		
Field pH	**6.65**	Std. Units	0.10	0.050	1		04/17/18 13:55		
Field Temperature	**13.4**	deg C	0.50	0.25	1		04/17/18 13:55		
Field Specific Conductance	**13773**	umhos/cm	1.0	1.0	1		04/17/18 13:55		
Field Oxidation Potential	**-61.1**	mV			1		04/17/18 13:55		
Oxygen, Dissolved	**0.36**	mg/L			1		04/17/18 13:55	7782-44-7	
Groundwater Elevation	**723.25**	feet			1		04/17/18 13:55		
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Boron	**5560**	ug/L	100	12.5	1	04/26/18 17:10	04/30/18 19:41	7440-42-8	
Calcium	**402**	mg/L	0.20	0.054	1	04/26/18 17:10	04/30/18 19:41	7440-70-2	
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**14400**	mg/L	5.0	5.0	1		04/24/18 11:55		
9040 pH	Analytical Method: EPA 9040								
pH	**6.4**	Std. Units	0.10	0.10	1		04/24/18 14:36		H6
9056 IC Anions	Analytical Method: EPA 9056								
Chloride	**8.0**	mg/L	1.0	0.46	1		05/01/18 12:25	16887-00-6	
Fluoride	**<0.063**	mg/L	0.20	0.063	1		05/01/18 12:25	16984-48-8	
Sulfate	**10400**	mg/L	1000	236	1000		05/01/18 13:46	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

ANALYTICAL RESULTS

Project: Ottumwa Midland LF/25216073.18
Pace Project No.: 60268634

Sample: FIELD BLANK **Lab ID: 60268634006** Collected: 04/17/18 11:40 Received: 04/20/18 08:45 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Boron	**<12.5**	ug/L	100	12.5	1	04/26/18 17:10	04/30/18 19:44	7440-42-8	
Calcium	**0.11J**	mg/L	0.20	0.054	1	04/26/18 17:10	04/30/18 19:44	7440-70-2	
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**6.0**	mg/L	5.0	5.0	1		04/24/18 11:55		
9040 pH	Analytical Method: EPA 9040								
pH	**6.2**	Std. Units	0.10	0.10	1		04/24/18 14:32		H6
9056 IC Anions	Analytical Method: EPA 9056								
Chloride	**<0.46**	mg/L	1.0	0.46	1		05/01/18 15:35	16887-00-6	
Fluoride	**<0.063**	mg/L	0.20	0.063	1		05/01/18 15:35	16984-48-8	
Sulfate	**<0.24**	mg/L	1.0	0.24	1		05/01/18 15:35	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

QUALITY CONTROL DATA

Project: Ottumwa Midland LF/25216073.18
Pace Project No.: 60268634

QC Batch: 523410 Analysis Method: EPA 6010
QC Batch Method: EPA 3010 Analysis Description: 6010 MET
Associated Lab Samples: 60268634001, 60268634002, 60268634003, 60268634004, 60268634005, 60268634006

METHOD BLANK: 2142788 Matrix: Water
Associated Lab Samples: 60268634001, 60268634002, 60268634003, 60268634004, 60268634005, 60268634006

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Boron	ug/L	<12.5	100	12.5	04/30/18 19:16	
Calcium	mg/L	<0.054	0.20	0.054	04/30/18 19:16	

LABORATORY CONTROL SAMPLE: 2142789

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	1000	982	98	80-120	
Calcium	mg/L	10	10.4	104	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2142790 2142791

Parameter	Units	60268626009 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	1340	1000	1000	2380	2340	104	100	75-125	2	20	
Calcium	mg/L	150	10	10	170	168	204	176	75-125	2	20	M1

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Ottumwa Midland LF/25216073.18
Pace Project No.: 60268634

QC Batch: 522900 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60268634001, 60268634002, 60268634003, 60268634004, 60268634005, 60268634006

METHOD BLANK: 2140683 Matrix: Water
Associated Lab Samples: 60268634001, 60268634002, 60268634003, 60268634004, 60268634005, 60268634006

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<5.0	5.0	5.0	04/24/18 11:55	

LABORATORY CONTROL SAMPLE: 2140684

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	999	100	80-120	

SAMPLE DUPLICATE: 2140685

Parameter	Units	60268297005 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	506	507	0	10	H1

SAMPLE DUPLICATE: 2140686

Parameter	Units	60268634001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	1400	1410	1	10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Ottumwa Midland LF/25216073.18
Pace Project No.: 60268634

QC Batch: 522990 Analysis Method: EPA 9040
QC Batch Method: EPA 9040 Analysis Description: 9040 pH
Associated Lab Samples: 60268634001, 60268634002, 60268634003, 60268634004, 60268634005, 60268634006

SAMPLE DUPLICATE: 2140945

Parameter	Units	60268289002 Result	Dup Result	RPD	Max RPD	Qualifiers
pH	Std. Units	13.4	13.4	0	10	H6

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Ottumwa Midland LF/25216073.18
Pace Project No.: 60268634

QC Batch: 523619 Analysis Method: EPA 9056
QC Batch Method: EPA 9056 Analysis Description: 9056 IC Anions
Associated Lab Samples: 60268634001, 60268634002, 60268634003, 60268634004, 60268634005

METHOD BLANK: 2143926 Matrix: Water
Associated Lab Samples: 60268634001, 60268634002, 60268634003, 60268634004, 60268634005

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.46	1.0	0.46	04/28/18 09:52	
Fluoride	mg/L	<0.063	0.20	0.063	04/28/18 09:52	

LABORATORY CONTROL SAMPLE: 2143927

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.9	98	80-120	
Fluoride	mg/L	2.5	2.4	98	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2143928 2143929

Parameter	Units	60268626007 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Fluoride	mg/L	0.11J	2.5	2.5	2.8	2.9	106	110	80-120	3	15	

SAMPLE DUPLICATE: 2143930

Parameter	Units	60268626008 Result	Dup Result	RPD	Max RPD	Qualifiers
Chloride	mg/L	153	149	3	15	
Fluoride	mg/L	0.10J	0.11J		15	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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Lenexa, KS 66219
(913)599-5665

QUALITY CONTROL DATA

Project: Ottumwa Midland LF/25216073.18
Pace Project No.: 60268634

QC Batch: 523648 Analysis Method: EPA 9056
QC Batch Method: EPA 9056 Analysis Description: 9056 IC Anions
Associated Lab Samples: 60268634001, 60268634002

METHOD BLANK: 2144152 Matrix: Water
Associated Lab Samples: 60268634001, 60268634002

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Sulfate	mg/L	<0.24	1.0	0.24	04/30/18 00:58	

LABORATORY CONTROL SAMPLE: 2144153

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	5	4.8	96	80-120	

SAMPLE DUPLICATE: 2144156

Parameter	Units	60268626009 Result	Dup Result	RPD	Max RPD	Qualifiers
Sulfate	mg/L	373	352	6	15	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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(913)599-5665

QUALITY CONTROL DATA

Project: Ottumwa Midland LF/25216073.18
Pace Project No.: 60268634

QC Batch: 523924 Analysis Method: EPA 9056
QC Batch Method: EPA 9056 Analysis Description: 9056 IC Anions
Associated Lab Samples: 60268634003, 60268634004, 60268634005, 60268634006

METHOD BLANK: 2144833 Matrix: Water
Associated Lab Samples: 60268634003, 60268634004, 60268634005, 60268634006

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.46	1.0	0.46	05/01/18 08:40	
Fluoride	mg/L	<0.063	0.20	0.063	05/01/18 08:40	
Sulfate	mg/L	<0.24	1.0	0.24	05/01/18 08:40	

LABORATORY CONTROL SAMPLE: 2144834

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.8	97	80-120	
Fluoride	mg/L	2.5	2.4	98	80-120	
Sulfate	mg/L	5	4.9	99	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2144835 2144836

Parameter	Units	60268634003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	7.3	5	5	12.6	12.7	107	109	80-120	1	15	
Fluoride	mg/L	0.80	2.5	2.5	3.3	3.4	101	103	80-120	2	15	
Sulfate	mg/L	262	100	100	352	367	90	104	80-120	4	15	

SAMPLE DUPLICATE: 2144837

Parameter	Units	60268634004 Result	Dup Result	RPD	Max RPD	Qualifiers
Chloride	mg/L	13.5	13.5	0	15	
Fluoride	mg/L	4.5	4.5	1	15	
Sulfate	mg/L	352	342	3	15	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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(913)599-5665

QUALIFIERS

Project: Ottumwa Midland LF/25216073.18
Pace Project No.: 60268634

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K	Pace Analytical Services - Kansas City

ANALYTE QUALIFIERS

H1	Analysis conducted outside the EPA method holding time.
H6	Analysis initiated outside of the 15 minute EPA required holding time.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Ottumwa Midland LF/25216073.18
Pace Project No.: 60268634

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60268634001	**MW-301**		524189		
60268634002	**MW-302**		524189		
60268634003	**MW-303**		524189		
60268634004	**MW-102M**		524189		
60268634005	**MW-122M**		524189		
60268634001	**MW-301**	EPA 3010	523410	EPA 6010	523461
60268634002	**MW-302**	EPA 3010	523410	EPA 6010	523461
60268634003	**MW-303**	EPA 3010	523410	EPA 6010	523461
60268634004	**MW-102M**	EPA 3010	523410	EPA 6010	523461
60268634005	**MW-122M**	EPA 3010	523410	EPA 6010	523461
60268634006	**FIELD BLANK**	EPA 3010	523410	EPA 6010	523461
60268634001	**MW-301**	SM 2540C	522900		
60268634002	**MW-302**	SM 2540C	522900		
60268634003	**MW-303**	SM 2540C	522900		
60268634004	**MW-102M**	SM 2540C	522900		
60268634005	**MW-122M**	SM 2540C	522900		
60268634006	**FIELD BLANK**	SM 2540C	522900		
60268634001	**MW-301**	EPA 9040	522990		
60268634002	**MW-302**	EPA 9040	522990		
60268634003	**MW-303**	EPA 9040	522990		
60268634004	**MW-102M**	EPA 9040	522990		
60268634005	**MW-122M**	EPA 9040	522990		
60268634006	**FIELD BLANK**	EPA 9040	522990		
60268634001	**MW-301**	EPA 9056	523619		
60268634001	**MW-301**	EPA 9056	523648		
60268634002	**MW-302**	EPA 9056	523619		
60268634002	**MW-302**	EPA 9056	523648		
60268634003	**MW-303**	EPA 9056	523619		
60268634003	**MW-303**	EPA 9056	523924		
60268634004	**MW-102M**	EPA 9056	523619		
60268634004	**MW-102M**	EPA 9056	523924		
60268634005	**MW-122M**	EPA 9056	523619		
60268634005	**MW-122M**	EPA 9056	523924		
60268634006	**FIELD BLANK**	EPA 9056	523924		

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Sample Condition Upon Receipt

WO# : 60268634

60268634

Client Name: SCS ENGINEERS

Courier: FedEx ☑ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☐ Client ☐ Other ☐

Tracking #: 4122 4945 6428 Pace Shipping Label Used? Yes ☐ No ☑

Custody Seal on Cooler/Box Present: Yes ☑ No ☐ Seals intact: Yes ☑ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☐ Other ☑ ZIPLC

Thermometer Used: T298 **Type of Ice:** (Wet) Blue None

Cooler Temperature (°C): **As-read** 0.9 **Corr. Factor** +1.1 **Corrected** 2.0

Date and initials of person examining contents: 5/16/4-20-18

Temperature should be above freezing to 6°C

Chain of Custody present:	☑Yes ☐No ☐N/A	
Chain of Custody relinquished:	☐Yes ☑No ☐N/A	
Samples arrived within holding time:	☑Yes ☐No ☐N/A	
Short Hold Time analyses (<72hr):	☑Yes ☐No ☐N/A	
Rush Turn Around Time requested:	☐Yes ☑No ☐N/A	
Sufficient volume:	☑Yes ☐No ☐N/A	
Correct containers used:	☑Yes ☐No ☐N/A	
Pace containers used:	☑Yes ☐No ☐N/A	
Containers intact:	☑Yes ☐No ☐N/A	
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	☐Yes ☐No ☑N/A	
Filtered volume received for dissolved tests?	☐Yes ☐No ☑N/A	
Sample labels match COC: Date / time / ID / analyses	☑Yes ☐No ☐N/A	
Samples contain multiple phases? Matrix: WT	☐Yes ☑No ☐N/A	
Containers requiring pH preservation in compliance? (HNO_3, H_2SO_4, HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	☑Yes ☐No ☐N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks: Lead acetate strip turns dark? (Record only)	☐Yes ☐No	
Potassium iodide test strip turns blue/purple? (Preserve)	☐Yes ☐No	
Trip Blank present:	☐Yes ☐No ☑N/A	
Headspace in VOA vials (>6mm):	☐Yes ☐No ☑N/A	
Samples from USDA Regulated Area: State:	☐Yes ☐No ☑N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	☐Yes ☐No ☑N/A	

Client Notification/ Resolution: Copy COC to Client? Y / (N) Field Data Required? Y / N

Person Contacted: _____ Date/Time: _____

Comments/ Resolution: _____

Project Manager Review: [signature] Date: 4-20-18

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: of

Section A — **Required** Client Information:

Company:	SCS Engineers
Address:	2830 Dairy Drive
	Madison WI 53718
Email To:	mblodgett@scsengineers.com
Phone: 608-216-7362	Fax:
Requested Due Date/TAT:	

Section B — **Required** Project Information:

Report To:	Meghan Blodgett
Copy To:	Tom Karwaski
Purchase Order No.:	
Project Name:	Ottumwa Midland Landfill
Project Number:	25216073.18

Section C — Invoice Information:

Attention:	Meghan Blodgett/Jess Valcheff
Company Name:	SCS Engineers
Address:	
Pace Quote Reference:	
Pace Project Manager:	Trudy Gipson 913-563-1405
Pace Profile #:	6696 Line 2

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER _____

Site Location STATE: IA

Section D — **Required** Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
WIPE	WP
AIR	AR
OTHER	OT
TISSUE	TS

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED: COMPOSITE START DATE	COMPOSITE START TIME	COMPOSITE END/GRAB DATE	COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	6010 Total Metals: B-Ca-Fe-Mn-Na*	6020 Total Metals*	7470 Total Hg*	9056 Chloride-Fluoride-Sulfate	2540C TDS	9040 pH	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
																		N	N	N						
1	MW-301	WT	G	xxx	xxx	4-17-18	12:10	13.5	3	1		2							X	X	X	X	X	X			60268634 001
2	MW-302	WT	G	xxx	xxx		10:20	12.7	3	1		2							X	X	X	X	X	X			002
3	MW-303	WT	G	xxx	xxx		10:50	13.3	3	1		2							X	X	X	X	X	X			003
4	MW-102M	WT	G	xxx	xxx		13:00	10.1	3	1		2							X	X	X	X	X	X			004
5	MW-122M	WT	G	xxx	xxx		13:45	13.4	3	1		2							X	X	X	X	X	X			005
6	FIELD BLANK	WT	G	xxx	xxx	V	11:40	—	3	1		2							X	X	X	X	X	X			006
7																											
8																											
9																											
10																											
11																											
12																											

BP2U, BP3N(2)

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS: Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
Ship To: 9608 Loiret Boulevard, Lenexa, KS 66219				PACE	4-20-18	0845	2.0	Y	Y	N
* Sb-As-Ba-Be-Cd-Cr-Co-Pb-Mo-Se-Tl										
*4.23.18: Per Meghan Blodgett. JVA										

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER: DATE Signed (MM/DD/YY):

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.07, 15-Feb-2007

A2 October 2018 Detection Monitoring

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

November 01, 2018

Meghan Blodgett
SCS Engineers
2830 Dairy Drive
Madison, WI 53718

RE: Project: Ottumwa Midland Landfill
Pace Project No.: 60284061

Dear Meghan Blodgett:
Enclosed are the analytical results for sample(s) received by the laboratory on October 18, 2018. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Hank Kapka
hank.kapka@pacelabs.com
(913)599-5665
PM Lab Management

Enclosures

cc: Tom Karwaski, SCS Engineers
Nicole Kron, SCS Engineers
Jeff Maxted, Alliant Energy
Jess Valcheff, SCS Engeineers

Pace Analytical Services, LLC
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Lenexa, KS 66219
(913)599-5665

CERTIFICATIONS

Project: Ottumwa Midland Landfill
Pace Project No.: 60284061

Kansas Certification IDs

9608 Loiret Boulevard, Lenexa, KS 66219
Missouri Certification Number: 10090
Arkansas Drinking Water
WY STR Certification #: 2456.01
Arkansas Certification #: 18-016-0
Arkansas Drinking Water
Illinois Certification #: 004455
Iowa Certification #: 118
Kansas/NELAP Certification #: E-10116
Louisiana Certification #: 03055
Nevada Certification #: KS000212018-1
Oklahoma Certification #: 9205/9935
Texas Certification #: T104704407-18-11
Utah Certification #: KS000212018-8
Kansas Field Laboratory Accreditation: # E-92587
Missouri Certification: 10070
Missouri Certification Number: 10090

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SAMPLE SUMMARY

Project: Ottumwa Midland Landfill
Pace Project No.: 60284061

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60284061001	**MW-301**	Water	10/15/18 15:30	10/18/18 09:00
60284061002	**MW-302**	Water	10/15/18 14:35	10/18/18 09:00
60284061003	**MW-303**	Water	10/16/18 08:23	10/18/18 09:00
60284061004	**MW-102M**	Water	10/16/18 09:20	10/18/18 09:00
60284061005	**MW-122M**	Water	10/16/18 09:00	10/18/18 09:00
60284061006	**FIELD BLANK**	Water	10/16/18 10:00	10/18/18 09:00

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: Ottumwa Midland Landfill
Pace Project No.: 60284061

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60284061001	**MW-301**	EPA 6010	EMR	2	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 9040	RMT	1	PASI-K
		EPA 9056	WNM	3	PASI-K
60284061002	**MW-302**	EPA 6010	EMR	2	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 9040	RMT	1	PASI-K
		EPA 9056	WNM	3	PASI-K
60284061003	**MW-303**	EPA 6010	EMR	2	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 9040	RMT	1	PASI-K
		EPA 9056	WNM	3	PASI-K
60284061004	**MW-102M**	EPA 6010	EMR	2	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 9040	RMT	1	PASI-K
		EPA 9056	WNM	3	PASI-K
60284061005	**MW-122M**	EPA 6010	EMR	2	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 9040	RMT	1	PASI-K
		EPA 9056	WNM	3	PASI-K
60284061006	**FIELD BLANK**	EPA 6010	EMR	2	PASI-K
		SM 2540C	LDF	1	PASI-K
		EPA 9040	RMT	1	PASI-K
		EPA 9056	WNM	3	PASI-K

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ANALYTICAL RESULTS

Project: Ottumwa Midland Landfill
Pace Project No.: 60284061

Sample: MW-301 **Lab ID: 60284061001** Collected: 10/15/18 15:30 Received: 10/18/18 09:00 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Field Data	Analytical Method:								
Collected By	**Client**				1		10/15/18 15:30		
Collected Date	**10/15/2018**				1		10/15/18 15:30		
Collected Time	**15:30**				1		10/15/18 15:30		
Field pH	**6.59**	Std. Units	0.10	0.050	1		10/15/18 15:30		
Field Temperature	**13.6**	deg C	0.50	0.25	1		10/15/18 15:30		
Field Specific Conductance	**2,112**	umhos/cm	1.0	1.0	1		10/15/18 15:30		
Oxygen, Dissolved	**0.20**	mg/L			1		10/15/18 15:30	7782-44-7	
REDOX	**88.2**	mV			1		10/15/18 15:30		
Turbidity	**4.91**	NTU	1.0	1.0	1		10/15/18 15:30		
Groundwater Elevation	**684.58**	feet			1		10/15/18 15:30		
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Boron	**784**	ug/L	100	12.5	1	10/19/18 11:20	10/19/18 20:25	7440-42-8	
Calcium	**135**	mg/L	0.20	0.054	1	10/19/18 11:20	10/19/18 20:25	7440-70-2	
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**1550**	mg/L	5.0	5.0	1		10/22/18 16:06		
9040 pH	Analytical Method: EPA 9040								
pH	**7.5**	Std. Units	0.10	0.10	1		10/24/18 16:26		H6
9056 IC Anions	Analytical Method: EPA 9056								
Chloride	**26.9**	mg/L	5.0	1.4	5		10/27/18 19:45	16887-00-6	
Fluoride	**0.84**	mg/L	0.20	0.19	1		10/28/18 00:53	16984-48-8	
Sulfate	**837**	mg/L	50.0	12.0	50		10/27/18 20:01	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: Ottumwa Midland Landfill
Pace Project No.: 60284061

Sample: MW-302 **Lab ID: 60284061002** Collected: 10/15/18 14:35 Received: 10/18/18 09:00 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Field Data	Analytical Method:								
Collected By	**Client**				1		10/15/18 14:35		
Collected Date	**10/15/2018**				1		10/15/18 14:35		
Collected Time	**14:35**				1		10/15/18 14:35		
Field pH	**7.25**	Std. Units	0.10	0.050	1		10/15/18 14:35		
Field Temperature	**13.4**	deg C	0.50	0.25	1		10/15/18 14:35		
Field Specific Conductance	**1,102**	umhos/cm	1.0	1.0	1		10/15/18 14:35		
Oxygen, Dissolved	**0.22**	mg/L			1		10/15/18 14:35	7782-44-7	
REDOX	**-103.6**	mV			1		10/15/18 14:35		
Turbidity	**131.5**	NTU	1.0	1.0	1		10/15/18 14:35		
Groundwater Elevation	**683.52**	feet			1		10/15/18 14:35		
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Boron	**752**	ug/L	100	12.5	1	10/19/18 11:20	10/19/18 20:28	7440-42-8	
Calcium	**66.9**	mg/L	0.20	0.054	1	10/19/18 11:20	10/19/18 20:28	7440-70-2	
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**708**	mg/L	5.0	5.0	1		10/22/18 16:06		
9040 pH	Analytical Method: EPA 9040								
pH	**7.5**	Std. Units	0.10	0.10	1		10/24/18 16:26		H6
9056 IC Anions	Analytical Method: EPA 9056								
Chloride	**9.2**	mg/L	1.0	0.29	1		10/28/18 01:08	16887-00-6	
Fluoride	**1.1**	mg/L	0.20	0.19	1		10/28/18 01:08	16984-48-8	
Sulfate	**80.9**	mg/L	5.0	1.2	5		10/27/18 20:33	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: Ottumwa Midland Landfill
Pace Project No.: 60284061

Sample: MW-303 **Lab ID: 60284061003** Collected: 10/16/18 08:23 Received: 10/18/18 09:00 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Field Data	Analytical Method:								
Collected By	**Client**				1		10/16/18 08:20		
Collected Date	**10/16/2018**				1		10/16/18 08:20		
Collected Time	**08:20**				1		10/16/18 08:20		
Field pH	**6.87**	Std. Units	0.10	0.050	1		10/16/18 08:20		
Field Temperature	**13.5**	deg C	0.50	0.25	1		10/16/18 08:20		
Field Specific Conductance	**1,416**	umhos/cm	1.0	1.0	1		10/16/18 08:20		
Oxygen, Dissolved	**0.41**	mg/L			1		10/16/18 08:20	7782-44-7	
REDOX	**-117.7**	mV			1		10/16/18 08:20		
Turbidity	**61.64**	NTU	1.0	1.0	1		10/16/18 08:20		
Groundwater Elevation	**684.33**	feet			1		10/16/18 08:20		
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Boron	**661**	ug/L	100	12.5	1	10/19/18 11:20	10/19/18 20:30	7440-42-8	
Calcium	**90.5**	mg/L	0.20	0.054	1	10/19/18 11:20	10/19/18 20:30	7440-70-2	
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**891**	mg/L	5.0	5.0	1		10/22/18 16:06		
9040 pH	Analytical Method: EPA 9040								
pH	**7.1**	Std. Units	0.10	0.10	1		10/24/18 16:29		H6
9056 IC Anions	Analytical Method: EPA 9056								
Chloride	**7.4**	mg/L	1.0	0.29	1		10/28/18 01:22	16887-00-6	
Fluoride	**0.84**	mg/L	0.20	0.19	1		10/28/18 01:22	16984-48-8	
Sulfate	**310**	mg/L	50.0	12.0	50		10/27/18 22:09	14808-79-8	

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ANALYTICAL RESULTS

Project: Ottumwa Midland Landfill
Pace Project No.: 60284061

Sample: MW-102M **Lab ID: 60284061004** Collected: 10/16/18 09:20 Received: 10/18/18 09:00 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Field Data	Analytical Method:								
Collected By	**Client**				1		10/16/18 09:20		
Collected Date	**10/16/2018**				1		10/16/18 09:20		
Collected Time	**09:20**				1		10/16/18 09:20		
Field pH	**7.80**	Std. Units	0.10	0.050	1		10/16/18 09:20		
Field Temperature	**12.9**	deg C	0.50	0.25	1		10/16/18 09:20		
Field Specific Conductance	**2,162**	umhos/cm	1.0	1.0	1		10/16/18 09:20		
Oxygen, Dissolved	**2.14**	mg/L			1		10/16/18 09:20	7782-44-7	
REDOX	**-104.7**	mV			1		10/16/18 09:20		
Groundwater Elevation	**717.05**	feet			1		10/16/18 09:20		
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Boron	**1340**	ug/L	100	12.5	1	10/19/18 11:20	10/19/18 20:32	7440-42-8	
Calcium	**12.9**	mg/L	0.20	0.054	1	10/19/18 11:20	10/19/18 20:32	7440-70-2	
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**1500**	mg/L	5.0	5.0	1		10/22/18 16:06		
9040 pH	Analytical Method: EPA 9040								
pH	**8.0**	Std. Units	0.10	0.10	1		10/24/18 16:32		H6
9056 IC Anions	Analytical Method: EPA 9056								
Chloride	**13.6**	mg/L	1.0	0.29	1		10/28/18 01:36	16887-00-6	
Fluoride	**4.7**	mg/L	0.20	0.19	1		10/28/18 01:36	16984-48-8	
Sulfate	**384**	mg/L	50.0	12.0	50		10/27/18 22:41	14808-79-8	

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ANALYTICAL RESULTS

Project: Ottumwa Midland Landfill
Pace Project No.: 60284061

Sample: MW-122M **Lab ID: 60284061005** Collected: 10/16/18 09:00 Received: 10/18/18 09:00 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Field Data	Analytical Method:								
Collected By	**Client**				1		10/15/18 09:00		
Collected Date	**10/15/2018**				1		10/15/18 09:00		
Collected Time	**09:00**				1		10/15/18 09:00		
Field pH	**6.31**	Std. Units	0.10	0.050	1		10/15/18 09:00		
Field Temperature	**11.8**	deg C	0.50	0.25	1		10/15/18 09:00		
Field Specific Conductance	**13,094**	umhos/cm	1.0	1.0	1		10/15/18 09:00		
Oxygen, Dissolved	**1.48**	mg/L			1		10/15/18 09:00	7782-44-7	
REDOX	**-53.5**	mV			1		10/15/18 09:00		
Groundwater Elevation	**723.36**	feet			1		10/15/18 09:00		
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Boron	**4580**	ug/L	100	12.5	1	10/19/18 11:20	10/19/18 20:34	7440-42-8	
Calcium	**366**	mg/L	0.20	0.054	1	10/19/18 11:20	10/19/18 20:34	7440-70-2	
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**13300**	mg/L	5.0	5.0	1		10/22/18 16:06		
9040 pH	Analytical Method: EPA 9040								
pH	**6.4**	Std. Units	0.10	0.10	1		10/24/18 16:31		H6
9056 IC Anions	Analytical Method: EPA 9056								
Chloride	**8.6**	mg/L	1.0	0.29	1		10/28/18 01:50	16887-00-6	
Fluoride	**<0.19**	mg/L	0.20	0.19	1		10/28/18 01:50	16984-48-8	
Sulfate	**<0.24**	mg/L	1.0	0.24	1		10/28/18 01:50	14808-79-8	

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ANALYTICAL RESULTS

Project: Ottumwa Midland Landfill
Pace Project No.: 60284061

Sample: FIELD BLANK **Lab ID: 60284061006** Collected: 10/16/18 10:00 Received: 10/18/18 09:00 Matrix: Water

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Boron	**<12.5**	ug/L	100	12.5	1	10/19/18 11:20	10/19/18 20:37	7440-42-8	
Calcium	**<0.054**	mg/L	0.20	0.054	1	10/19/18 11:20	10/19/18 20:37	7440-70-2	
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**<5.0**	mg/L	5.0	5.0	1		10/22/18 16:06		
9040 pH	Analytical Method: EPA 9040								
pH	**6.1**	Std. Units	0.10	0.10	1		10/24/18 16:34		H6
9056 IC Anions	Analytical Method: EPA 9056								
Chloride	**<0.29**	mg/L	1.0	0.29	1		10/28/18 02:05	16887-00-6	
Fluoride	**<0.19**	mg/L	0.20	0.19	1		10/28/18 02:05	16984-48-8	
Sulfate	**4.9**	mg/L	1.0	0.24	1		10/28/18 02:05	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Ottumwa Midland Landfill
Pace Project No.: 60284061

QC Batch: 550414 Analysis Method: EPA 6010
QC Batch Method: EPA 3010 Analysis Description: 6010 MET
Associated Lab Samples: 60284061001, 60284061002, 60284061003, 60284061004, 60284061005, 60284061006

METHOD BLANK: 2256930 Matrix: Water
Associated Lab Samples: 60284061001, 60284061002, 60284061003, 60284061004, 60284061005, 60284061006

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Boron	ug/L	<12.5	100	12.5	10/19/18 19:46	
Calcium	mg/L	<0.054	0.20	0.054	10/19/18 19:46	

LABORATORY CONTROL SAMPLE: 2256931

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	1000	917	92	80-120	
Calcium	mg/L	10	9.4	94	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2256932 2256933

Parameter	Units	60283505006 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	705	1000	1000	1640	1650	94	94	75-125	0	20	
Calcium	mg/L	452000 ug/L	10	10	449	456	-29	38	75-125	1	20	M1

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Ottumwa Midland Landfill
Pace Project No.: 60284061

QC Batch: 550934 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60284061001, 60284061002, 60284061003, 60284061004, 60284061005

METHOD BLANK: 2259346 Matrix: Water
Associated Lab Samples: 60284061001, 60284061002, 60284061003, 60284061004, 60284061005

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<5.0	5.0	5.0	10/22/18 16:06	

LABORATORY CONTROL SAMPLE: 2259347

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	981	98	80-120	

SAMPLE DUPLICATE: 2259348

Parameter	Units	60283721001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	226	228	1	10	

SAMPLE DUPLICATE: 2259349

Parameter	Units	60283911002 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	577	592	3	10	

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QUALITY CONTROL DATA

Project: Ottumwa Midland Landfill
Pace Project No.: 60284061

QC Batch: 550935 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60284061006

METHOD BLANK: 2259350 Matrix: Water
Associated Lab Samples: 60284061006

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	<5.0	5.0	5.0	10/22/18 16:06	

LABORATORY CONTROL SAMPLE: 2259351

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	1010	101	80-120	

SAMPLE DUPLICATE: 2259352

Parameter	Units	60284115001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	5420	5430	0	10	

SAMPLE DUPLICATE: 2259353

Parameter	Units	60284115002 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	8.0	5.5	37	10	D6

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Ottumwa Midland Landfill
Pace Project No.: 60284061

QC Batch: 551115 Analysis Method: EPA 9040
QC Batch Method: EPA 9040 Analysis Description: 9040 pH
Associated Lab Samples: 60284061001, 60284061002, 60284061003, 60284061004, 60284061005, 60284061006

SAMPLE DUPLICATE: 2260274

Parameter	Units	60284061002 Result	Dup Result	RPD	Max RPD	Qualifiers
pH	Std. Units	7.5	7.5	1	10	H6

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Ottumwa Midland Landfill
Pace Project No.: 60284061

QC Batch: 551837 Analysis Method: EPA 9056
QC Batch Method: EPA 9056 Analysis Description: 9056 IC Anions
Associated Lab Samples: 60284061001, 60284061002, 60284061003, 60284061004

METHOD BLANK: 2263033 Matrix: Water
Associated Lab Samples: 60284061001, 60284061002, 60284061003, 60284061004, 60284061005, 60284061006

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.29	1.0	0.29	10/27/18 11:47	
Sulfate	mg/L	<0.24	1.0	0.24	10/27/18 11:47	

LABORATORY CONTROL SAMPLE: 2263034

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.6	93	80-120	
Sulfate	mg/L	5	4.8	96	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2263035 2263036

Parameter	Units	60283868001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	1.8	5	5	6.0	7.1	85	106	80-120	16	15	R1
Sulfate	mg/L	3.7	5	5	8.1	9.3	88	113	80-120	15	15	

SAMPLE DUPLICATE: 2263037

Parameter	Units	2086025002 Result	Dup Result	RPD	Max RPD	Qualifiers
Chloride	mg/L	6480	6600	2	15	
Sulfate	mg/L	1240	1260	2	15	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Ottumwa Midland Landfill
Pace Project No.: 60284061

QC Batch: 552042 Analysis Method: EPA 9056
QC Batch Method: EPA 9056 Analysis Description: 9056 IC Anions
Associated Lab Samples: 60284061001, 60284061002, 60284061003, 60284061004, 60284061005, 60284061006

METHOD BLANK: 2264261 Matrix: Water
Associated Lab Samples: 60284061001, 60284061002, 60284061003, 60284061004, 60284061005, 60284061006

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	<0.29	1.0	0.29	10/28/18 00:25	
Fluoride	mg/L	<0.19	0.20	0.19	10/28/18 00:25	
Sulfate	mg/L	<0.24	1.0	0.24	10/28/18 00:25	

LABORATORY CONTROL SAMPLE: 2264262

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.8	96	80-120	
Fluoride	mg/L	2.5	2.6	104	80-120	
Sulfate	mg/L	5	5.0	100	80-120	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

QUALIFIERS

Project: Ottumwa Midland Landfill
Pace Project No.: 60284061

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K	Pace Analytical Services - Kansas City

WORKORDER QUALIFIERS

WO: 60284061

[1]	Rev. 1 11/1/2018
[2]	Corrected manual data entry error, reported groundwater elevation.

ANALYTE QUALIFIERS

D6	The precision between the sample and sample duplicate exceeded laboratory control limits.
H6	Analysis initiated outside of the 15 minute EPA required holding time.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.
R1	RPD value was outside control limits.

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Ottumwa Midland Landfill
Pace Project No.: 60284061

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60284061001	**MW-301**		551586		
60284061002	**MW-302**		551586		
60284061003	**MW-303**		551586		
60284061004	**MW-102M**		551586		
60284061005	**MW-122M**		551586		
60284061001	**MW-301**	EPA 3010	550414	EPA 6010	550619
60284061002	**MW-302**	EPA 3010	550414	EPA 6010	550619
60284061003	**MW-303**	EPA 3010	550414	EPA 6010	550619
60284061004	**MW-102M**	EPA 3010	550414	EPA 6010	550619
60284061005	**MW-122M**	EPA 3010	550414	EPA 6010	550619
60284061006	**FIELD BLANK**	EPA 3010	550414	EPA 6010	550619
60284061001	**MW-301**	SM 2540C	550934		
60284061002	**MW-302**	SM 2540C	550934		
60284061003	**MW-303**	SM 2540C	550934		
60284061004	**MW-102M**	SM 2540C	550934		
60284061005	**MW-122M**	SM 2540C	550934		
60284061006	**FIELD BLANK**	SM 2540C	550935		
60284061001	**MW-301**	EPA 9040	551115		
60284061002	**MW-302**	EPA 9040	551115		
60284061003	**MW-303**	EPA 9040	551115		
60284061004	**MW-102M**	EPA 9040	551115		
60284061005	**MW-122M**	EPA 9040	551115		
60284061006	**FIELD BLANK**	EPA 9040	551115		
60284061001	**MW-301**	EPA 9056	551837		
60284061001	**MW-301**	EPA 9056	552042		
60284061002	**MW-302**	EPA 9056	551837		
60284061002	**MW-302**	EPA 9056	552042		
60284061003	**MW-303**	EPA 9056	551837		
60284061003	**MW-303**	EPA 9056	552042		
60284061004	**MW-102M**	EPA 9056	551837		
60284061004	**MW-102M**	EPA 9056	552042		
60284061005	**MW-122M**	EPA 9056	552042		
60284061006	**FIELD BLANK**	EPA 9056	552042		

REPORT OF LABORATORY ANALYSIS

Pace Analytical
www.pacelabs.com

Sample Condition Upon Receipt

WO# : 60284061

60284061

Client Name: SCS Engineers

Courier: FedEx ☒ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Xroads ☐ Client ☐ Other ☐

Tracking #: 454227836473 Pace Shipping Label Used? Yes ☐ No ☒

Custody Seal on Cooler/Box Present: Yes ☒ No ☐ Seals intact: Yes ☒ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☐ Other ☒ Ziplc

Thermometer Used: T300 **Type of Ice:** (Wet) Blue None

Cooler Temperature (°C): **As-read** 1.6 **Corr. Factor** +0.2 **Corrected** 1.8

Date and initials of person examining contents: 10/18/18 WT

Temperature should be above freezing to 6°C

Chain of Custody present:	☒Yes ☐No ☐N/A	
Chain of Custody relinquished:	☐Yes ☒No ☐N/A	
Samples arrived within holding time:	☒Yes ☐No ☐N/A	
Short Hold Time analyses (<72hr):	☒Yes ☐No ☐N/A	PH
Rush Turn Around Time requested:	☐Yes ☒No ☐N/A	
Sufficient volume:	☒Yes ☐No ☐N/A	
Correct containers used:	☒Yes ☐No ☐N/A	
Pace containers used:	☒Yes ☐No ☐N/A	
Containers intact:	☒Yes ☐No ☐N/A	
Unpreserved 5035A / TX1005/1006 soils frozen in 48hrs?	☐Yes ☐No ☒N/A	
Filtered volume received for dissolved tests?	☐Yes ☐No ☒N/A	
Sample labels match COC: Date / time / ID / analyses	☒Yes ☐No ☐N/A	
Samples contain multiple phases? Matrix: WT	☐Yes ☒No ☐N/A	
Containers requiring pH preservation in compliance? (HNO$_3$, H$_2$SO$_4$, HCl<2; NaOH>9 Sulfide, NaOH>10 Cyanide) (Exceptions: VOA, Micro, O&G, KS TPH, OK-DRO)	☒Yes ☐No ☐N/A	List sample IDs, volumes, lot #'s of preservative and the date/time added.
Cyanide water sample checks: Lead acetate strip turns dark? (Record only)	☐Yes ☐No	
Potassium iodide test strip turns blue/purple? (Preserve)	☐Yes ☐No	
Trip Blank present:	☐Yes ☐No ☒N/A	
Headspace in VOA vials (>6mm):	☐Yes ☐No ☒N/A	
Samples from USDA Regulated Area: State:	☐Yes ☐No ☒N/A	
Additional labels attached to 5035A / TX1005 vials in the field?	☐Yes ☐No ☒N/A	

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: _____ Date/Time: _____

Comments/ Resolution: _____

Hank
02:22 pm,Oct 18,2018
Kapka

Project Manager Review: _____ Date: _____

Pace Analytical
www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: of

Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:	
Company:	SCS Engineers	Report To:	Meghan Blodgett	Attention:	Meghan Blodgett/Jess Valcheff
Address:	2830 Dairy Drive	Copy To:	Tom Karwaski	Company Name:	SCS Engineers
	Madison WI 53718			Address:	
Email To:	mblodgett@scsengineers.com	Purchase Order No.:		Pace Quote Reference:	
Phone:	608-216-7362 Fax:	Project Name:	Ottumwa Midland Landfill	Pace Project Manager:	Hank Kapka 913-563-1404
Requested Due Date/TAT:		Project Number		Pace Profile #:	6696 Line 2

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER

☐ UST ☐ RCRA ☐ OTHER _____

Site Location STATE: IA

Section D Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
WIPE	WP
AIR	AR
OTHER	OT
TISSUE	TS

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	Requested Analysis Filtered (Y/N): N	6010 Total Metals: B-Ca	9056 Chloride-Fluoride-Sulfate	2540C TDS	9040 pH	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1	MW-301	WT	G	xxx	xxx	10/15/18	15:30	12.0	3	1		2						X	X	X	X		BPIN, BP30	60284061 001
2	MW-302	WT	G	xxx	xxx	10/15/18	14:35	13.4	3	1		2						X	X	X	X			002
3	MW-303	WT	G	xxx	xxx	10/16/18	8:23	13.5	3	1		2						X	X	X	X			003
4	MW-102M	WT	G	xxx	xxx	10/16/18	9:20	12.9	3	1		2						X	X	X	X			004
5	MW-122M	WT	G	xxx	xxx	10/16/18	9:00	11.9	3	1		2						X	X	X	X			005
6	FIELD BLANK	WT	G	xxx	xxx	10/16/18	10:00	[illegible]	3	1		2						X	X	X	X			006
7																									
8																									
9																									
10																									
11																									
12																									

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS: Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
Ship To: 9608 Loiret Boulevard, Lenexa, KS 66219				UPS	10/18/18	0900	1.8	✓	Y	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER: DATE Signed (MM/DD/YY):

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

Appendix B

Alternative Source Demonstrations

B1 Alternative Source Demonstration, November 2017 Detection Monitoring

SCS ENGINEERS

Alternative Source Demonstration
November 2017 Detection Monitoring

Ottumwa Midland Landfill
Ottumwa, Iowa

Prepared for:

Alliant Energy

Prepared by:

SCS ENGINEERS
2830 Dairy Drive
Madison, Wisconsin 53718-6751
(608) 224-2830

April 16, 2018
File No. 25216073.18

Alternative Source Demonstration
November 2017 Detection Monitoring
Ottumwa Midland Landfill
Ottumwa, Iowa

Prepared for:

Alliant Energy

Prepared by:

SCS ENGINEERS
2830 Dairy Drive
Madison, Wisconsin 53718-6751
(608) 224-2830

April 16, 2018
File No. 25216073.18

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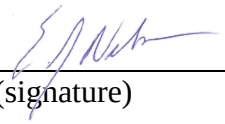
Figures

Appendices

l:\25216073.00\Reports\2018 ASD Report\180416_ASD_OML_Final.docx

PE CERTIFICATION

	I, Eric J. Nelson, hereby certify that that the information in this alternate source demonstration is accurate and meets the requirements of 40 CFR 257.94(e)(2). This certification is based on my review of the groundwater data and related site information available for the Ottumwa Midland Landfill. I am a duly licensed Professional Engineer under the laws of the State of Iowa.
	 4/16/2018
	(signature) (date)
	Eric J. Nelson
	(printed or typed name)
	License number 23136
	My license renewal date is December 31, 2018.
	Pages or sheets covered by this seal: Alternative Source Demonstration November 2017
	Detection Monitoring, Ottumwa Midland Landfill,
	Ottumwa, Iowa

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1.0 INTRODUCTION

This Alternative Source Demonstration (ASD) was prepared to support compliance with the groundwater monitoring requirements of the "Coal Combustion Residuals (CCR) Final Rule" published by the U.S. 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) and subsequent amendments. Specifically, this report was prepared to fulfill the requirements of 40 CFR 257.94(e)(2). The applicable sections of the Rule are provided below in *italics*.

1.1 §257.94(E)(2) ALTERNATIVE SOURCE DEMONSTRATION REQUIREMENTS

The owner and operator may demonstrate that a source other than the CCR Unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase 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 statistically significant increase over background levels.

An ASD is completed when there are exceedances of one or more benchmarks established within the groundwater monitoring program. The ASD is completed to determine if any other sources are likely causes of the identified exceedance(s) of established benchmark(s) at the site. This ASD was performed in response to results indicating a statistically significant increase (SSI) over background levels during detection monitoring under the CCR Rule.

The ASD report is evaluating the SSI observed in the statistical evaluation of the November 2017 detection monitoring event at the Ottumwa Midland Landfill (OML).

1.2 SITE INFORMATION AND MAP

The OML facility is located at 15300 130th Street in Ottumwa, Wappello County, Iowa (**Figure 1**). OML is an active landfill, operating under Iowa Department of Natural Resources (IDNR) permit #90-SDP-8-92P. There are two existing CCR landfill units at the site:

- OML Existing Landfill (existing CCR landfill)
- OML Landfill Expansion Phase 1 (existing CCR landfill)

These CCR Units are monitored with a multi-unit groundwater monitoring system. There are no closed CCR landfills or existing, inactive, or closed CCR surface impoundments at OML.

The locations of the CCR Units and all background (or upgradient) and downgradient monitoring wells with identification numbers for the groundwater monitoring program are shown on **Figure 2**.

1.3 STATISTICALLY SIGNIFICANT INCREASES IDENTIFIED

The only SSI for the November 2017 monitoring event was for chloride at monitoring well MW-301. A summary of the November 2017 constituent concentrations and the established benchmark concentrations is provided in **Table 1**. The constituent concentrations with SSIs above the background concentration are highlighted in the table.

1.4 OVERVIEW OF ASD

This ASD report includes:

- Background information (**Section 2.0**)
- Evaluation of potential that SSIs are due to methodology or analysis (**Section 3.0**)
- Evaluation of potential that SSIs are due to natural sources or man-made sources other than the CCR Units (**Section 4.0**)
- ASD conclusions (**Section 5.0**)
- Monitoring recommendations (**Section 6.0**)

The chloride results from background and compliance sampling under the CCR Rule are provided in **Table 2**, and concentration trends for chloride are shown in **Appendix A**. Complete laboratory reports for the background monitoring events and the November 2017 detection monitoring event were included in the 2017 Annual Groundwater Monitoring and Corrective Action Report for OML.

2.0 BACKGROUND

2.1 REGIONAL GEOLOGY AND HYDROGEOLOGY

The uppermost bedrock unit in the site area consists of Pennsylvanian shales with minor siltstone, sandstone, limestone, and coal intervals. The continuity of these minor beds is highly variable. The thickness of the Pennsylvanian shale is variable; in some areas of Wapello County it is over 100 feet thick, while in other areas it is absent. The variation in thickness is due to erosion of the bedrock surface. Underlying the Pennsylvanian shales are Mississippian limestone and dolomite, with some shale and sandstone. The Devonian units underlying the Mississippian are composed of shale, dolomite, and limestone, and are in turn underlain by Silurian dolomite.

A summary of the regional hydrogeologic stratigraphy is presented in **Appendix B**. Maps showing regional bedrock surface topography and the top of the Mississippian limestone in Southeastern Iowa are also included in **Appendix B**. The bedrock surface elevation is highly variable due to erosion.

For the purposes of groundwater monitoring, the Mississippian limestone unit is considered to be the uppermost aquifer unit at the OML site as defined under 40 CFR 257.53.

The Des Moines River and associated alluvial aquifers are a major source of surface water and shallow groundwater in the area; however, the alluvial aquifer is not present at the OML site. Unconsolidated deposits at the site consist of clays overlain by loess, which are not productive sources of groundwater. The uppermost Pennsylvanian bedrock unit is considered to be a regional aquitard. The Mississippian unit is the shallowest regional bedrock aquifer. The Cambrian-Ordovician aquifer, comprised of dolomite and sandstone, is commonly the source of municipal and industrial high-capacity wells in the region (Coble, 1971).

Regional information indicates that groundwater flow within the Mississippian limestone is to the south-southeast. A map showing the regional potentiometric surface in the Mississippian limestone is included with the hydrogeologic background information presented in **Appendix B**.

2.2 CCR MONITORING SYSTEM

The groundwater monitoring system established within the CCR Rule consists of two upgradient (background) monitoring wells and three downgradient monitoring wells. The upgradient monitoring wells include MW-122M and MW-102M. The downgradient monitoring wells include MW-301, MW-302, and MW-303. The CCR Rule wells are installed in the upper portions of the Mississippian Limestone aquifer. Well depths range from approximately 150.0 to 204.5 feet, measured from the top of the wells' casing.

2.3 OTHER MONITORING WELLS

Forty-two groundwater monitoring wells currently exist at OML as part of the monitoring system developed for the state monitoring program. The well locations are shown on **Figure 2**. These monitoring wells are used to monitor groundwater conditions at the site under the IDNR state monitoring program.

Monitoring wells for the state monitoring program are installed in the unconsolidated deposits and in the Pennsylvanian shale unit, which are not the uppermost aquifer as defined under 40 CFR 257.53. This shallow monitoring system includes water table wells, piezometers in the Pennsylvanian shale, and piezometers in the Mississippian limestone. Well depths range from approximately 20 to 177 feet, measured from the top of the well casing.

2.4 GROUNDWATER FLOW DIRECTION

Shallow groundwater flow at the water table appears to be controlled partially by the landfill underdrain system and partially by the top of the Pennsylvanian shale. Shallow groundwater, near the current fill area, flows toward the landfill and the sedimentation pond, as shown on **Figure 3**. The landfill underdrain system includes a drainage layer and collection piping below the landfill liner, and is used to ensure that shallow groundwater does not affect performance of the landfill liner. The water table map on **Figure 3** represents the site conditions of the unconsolidated deposits during the last monitoring event in August 2017. The groundwater elevations for the August 2017 monitoring event are provided in **Table 3**.

Based on water levels in the existing Mississippian piezometers at the OML site, a generally south-southeast flow direction has been identified in the Mississippian limestone aquifer, consistent with the regional flow information. Two potentiometric surface maps of the limestone aquifer show site groundwater conditions at the beginning of background sampling for the CCR groundwater monitoring program in May 2016 (**Figure 4**), as well as site conditions at the time of the first compliance sampling at OML in November 2017 (**Figure 5**). The groundwater elevations for both sampling events, May 2016 and November 2017, are shown in **Table 4**.

A 1994 potentiometric surface map for the site, prior to CCR disposal, also indicates a flow direction to the south-southeast (Montgomery Watson, 1994), consistent with current results. The 1994 map, based on water levels measured in three piezometers in the Mississippian limestone, is included in **Appendix B**.

3.0 METHODOLOGY AND ANALYSIS REVIEW

To evaluate the potential that an SSI is due to a source other than the regulated CCR Unit, SCS Engineers (SCS) used a two-step evaluation process. First, the sample collection, field and laboratory analysis, and statistical evaluation were reviewed to identify any potential error or analysis that led to exceedance of the benchmark. Second, potential alternative sources, including natural variation and man-made sources other than the CCR Unit, were evaluated. This section provides the findings of the methodology and analysis review. **Section 4.0** of this report addresses the potential alternative sources.

3.1 SAMPLING AND FIELD ANALYSIS REVIEW

Field notes and sampling results were reviewed to determine if any sampling error may have caused or contributed to the observed SSIs for chloride. Potential field sampling errors or issues could include mislabeling of samples, improper sample handling, missed holding times, cross contamination during sampling, or other field error. Field blank sample results were also reviewed for any indication of potential contamination from sampling equipment or containers. Based on the review of the field notes and results, SCS did not identify any indication that the chloride SSI was due to a sampling error.

Because chloride is a laboratory parameter, there is little potential for a field analysis error to contribute to an SSI.

3.2 LABORATORY ANALYSIS REVIEW

Laboratory reports for the background monitoring and the November 2017 detection monitoring were reviewed to determine if any laboratory analysis error or issue may have caused or contributed to the observed SSI for chloride. The laboratory report review included reviewing the laboratory quality control flags and narrative, verifying that correct methods were used and desired detection limits were achieved, and checking the field and laboratory blank sample results. Laboratory reports were included in the 2017 Annual Groundwater Monitoring and Corrective Action Report for the facility.

The June 2016 laboratory report was revised due to the incorrect sample time identified for MW-102M, during the review. The original June 2016 laboratory report noted the sampling time for MW-102M as 14:15 while the chain of custody (COC) indicates the sample time is 17:15. The revised report displaying the correct sample time noted on the COC is included in **Appendix C**.

Based on the review of the laboratory reports, SCS did not identify any indication that the chloride SSI was due to a laboratory analysis error. There were no laboratory quality control flags or issues identified in the laboratory report that affect the usability of the data for detection monitoring.

A time series plot of the analytical data for chloride was reviewed for any anomalous results that might indicate a possible sampling or laboratory error (e.g., dilution error or incorrect sample labeling). The time series plot is provided in **Appendix A**. No anomalous results affecting the SSI determinations were identified.

The chloride concentration trends appear to be stable or decreasing during the background and the compliance sampling. The MW-301 chloride concentration appears to be high early on during the background sampling period but decreased and stabilized in later sampling events. Because an interwell analysis was used for the SSI evaluation, which compares compliance well results to background well results, the initial background results for chloride at MW-301 do not affect the SSI determination for the November 2017 detection monitoring.

3.3 STATISTICAL EVALUATION REVIEW

The review of the statistical results and methods include a quality control check of the following:

- Input analytical data vs. laboratory analytical reports
- Review statistical method and outlier concentration lists for each monitoring well/CCR Unit

Based on the review of the statistical evaluation, SCS did not identify any errors or issues in the statistical evaluation that caused or contributed to the determination of an interwell SSI for chloride at well MW-301.

3.4 SUMMARY OF METHODOLOGY AND ANALYSIS REVIEW FINDINGS

In summary, there were no changes to the SSI determinations for the November 2017 monitoring event based on the methodology and analysis review, and no errors or issues causing or contributing to the reported chloride SSI were identified.

4.0 ALTERNATIVE SOURCES

This section of the report discusses the potential alternative sources for the chloride SSI at MW-301, identifies the most likely alternative source(s), and presents the lines of evidence indicating that an alternative source is the most likely cause of the observed SSI for chloride.

4.1 POTENTIAL CAUSES OF SSI

4.1.1 Natural Variation

The statistical analysis was completed using an interwell approach, comparing the November 2017 detection monitoring results to the Upper Prediction Limits (UPLs) calculated based on sampling of the background wells (MW-102 and MW-122M). If concentrations of a constituent that is naturally present in the aquifer vary spatially, then the potential exists that the downgradient concentrations may be higher than upgradient concentrations due to natural variation.

Chloride is naturally present in the limestone aquifer based on observations of previous studies in the area. Based on regional and site information, discussed below, natural variation appears to be a likely cause of the chloride SSI for well MW-301.

4.1.2 Man-made Alternative Sources

Man-made alternative sources that could potentially contribute to the chloride SSI at MW-301 include on-site management of CCR leachate or contact water, or non-CCR sources such as road salt use, septic systems, or surrounding agricultural land use. Based on the depth to the Mississippian aquifer and the low permeability of the overlying Pennsylvanian shale, it does not appear likely that one or more of these man-made alternative sources is the cause of the chloride SSI.

4.2 LINES OF EVIDENCE

The lines of evidence indicating that the SSI for chloride in compliance wells MW-301 relative to the background wells is due to natural variability include:

1. Regional and site-specific groundwater information indicates that the observed chloride concentrations for MW-301 are within typical ranges for the Mississippian limestone aquifer.

2. Other CCR indicator parameters, such as boron, were not detected at concentrations exceeding background levels in the sample from MW-301.

3. The hydraulic conductivity of the Pennsylvanian shale aquitard overlying the Mississippian limestone aquifer is very low, and there is limited hydrogeologic connection between the shallow groundwater and the aquifer.

4. Both the original landfill and expansion Phase 1 are designed with low permeability liner systems and underdrain systems that collect groundwater below the liner.

5. Monitoring results for the shallow groundwater below and adjacent to the landfill do not show elevated chloride concentrations.

Each of these lines of evidence and the supporting data are discussed in more detail in the following sections.

4.2.1 Mississippian Limestone Aquifer Water Quality

Regional and site-specific information indicates that chloride concentrations in the Mississippian limestone aquifer are variable and the concentrations detected in samples from MW-301 are well within the range of concentrations naturally present in the aquifer. The U.S. Geological Survey (USGS) Water completed an Open File Report 82-1014, Hydrology of Area 38, of the Western Region, Interior Coal Province of Iowa and Missouri. OML is located within the area of investigation, and a chapter from the report addressed water quality in the Mississippian limestone aquifer (**Appendix D**). The USGS investigation reported chloride concentrations ranging from 0.5 to 3,570 milligrams per liter (mg/L) for the limestone aquifer within the study area, with an average chloride concentration of 137 mg/L. The chloride concentration for MW-301 in the November 2017 detection monitoring event was 28.9 mg/L; therefore, the observed concentration for MW-301 was well below the average concentration of chloride in the limestone aquifer.

In background sampling performed for the Phase 1 expansion, four monitoring wells installed in the Mississippian aquifer were sampled in April 2013, prior to construction of the expansion. The wells included the two wells used as background wells for the CCR Rule monitoring system (MW-102M and MW-122M) and two additional wells in the Mississippian (MW-110M and MW-116M). The chloride results for the sample event ranged from 20 to 75.8 mg/L, with three of the four results exceeding the November 2017 chloride concentration at MW-301.

4.2.2 Leachate Versus Groundwater Concentrations

Although chloride exceeded the interwell SSI, other CCR indicator parameters, such as boron, were not detected at concentrations exceeding background levels in the sample from MW-301. In recent samples from the leachate lagoon, boron and sulfate have typically been detected at concentrations at least an order of magnitude higher than the chloride concentration. Leachate and ash contact water are monitored under the state monitoring program for the landfill. Monitoring results for leachate and contact water samples collected in 2016 and 2017 for the detection monitoring parameters included in the state monitoring program are summarized in **Table 5**. If leachate from the CCR landfill were the source of elevated chloride, then some increase in boron and sulfate relative to background would also be expected. The absence of other CCR indicator parameters with SSIs, or increasing concentration trends, suggests that the chloride SSI is due to natural variation rather than CCR disposal.

4.2.3 Overlying Pennsylvanian Shale Aquitard

The hydraulic conductivity of the Pennsylvanian shale aquitard overlying the Mississippian limestone aquifer is low, and there is limited hydrogeologic connection between the shallow groundwater and the aquifer. The lack of hydrogeologic connection is evidenced by large differences between water levels measured in wells in the unconsolidated deposits or Pennsylvanian shale and water levels measured in wells in the Mississippian limestone. Water levels in Mississippian aquifer monitoring wells MW-302 and MW-303 are approximately 40 feet below the water levels measured in adjacent Pennsylvanian shale monitoring wells MW-14 and MW-13.

4.2.4 Landfill Liner System

Both the original landfill and expansion Phase 1 have low permeability liners. The original landfill was lined with 4 feet of compacted fine-grained soil having a hydraulic conductivity of no more than 1×10^{-7} centimeters per second (cm/sec). Expansion Phase 1 has a composite liner system including 2 feet of compacted clay, a 60-mil high density polyethylene (HDPE) geomembrane, and a leachate collection drainage layer. The original landfill and expansion Phase 1 both have underdrain systems that collect groundwater below the liner and maintain separation between the water table and the liner.

4.2.5 Shallow Groundwater Monitoring Results

Monitoring results for the shallow groundwater below and adjacent to the landfill, summarized in **Table 6**, do not show elevated chloride concentrations. In the four monitoring wells sampled in the shallow hydrogeologic unit under the state monitoring program, the highest chloride concentrations were at upgradient well MW-1, which may be affected by road salt. Chloride concentrations in the remaining three shallow wells in the state program were below the October 2017 chloride concentration in CCR compliance well MW-301. The groundwater samples collected from the underdrain system, which collects groundwater below the landfill liner, also had chloride concentrations below the level in the upgradient well (MW-1) and below the chloride concentration in CCR compliance well MW-301.

5.0 ASD CONCLUSIONS

The lines of evidence discussed above regarding the SSI reported for the chloride concentration in downgradient monitoring well MW-301 demonstrate that the SSI is likely due to naturally occurring chloride in the limestone aquifer at the OML site.

6.0 SITE GROUNDWATER MONITORING RECOMMENDATIONS

In accordance with section 257.94(e)(2) of the CCR Rule, the OML site may continue with detection monitoring based on this ASD. The ASD report will be included in the 2018 Annual Report due January 31, 2019.

7.0 REFERENCES

Coble, R.W., 1971, The Water Resources of Southeast Iowa, Iowa Geological Survey Water Atlas Number 4, 1971.

Montgomery Watson, 1994, Ottumwa-Midland Development Corporation, Potentiometric Surface Contours – Mississippian, Figure 4-18, (03-02-94).

SCS Engineers, 2017 Annual Groundwater Monitoring and Corrective Action Report, Ottumwa Midland Landfill, Ottumwa, IA, 2018.

U.S. Environmental Protection Agency, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule, April 2015.

U.S. Geological Survey Water Resources Investigations Open File Report 82-1014, Hydrogeology Area 38, Western Region, Interior Coal Province, Iowa and Missouri; Rolla, Missouri and Iowa City, Iowa, May 1983.

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TABLES

Table 1. Detection Monitoring Results Summary - November 2017

IPL - Ottumwa Midland Landfill

Ottumwa, Iowa

Parameter Name	Units	Interwell Upper Prediction Limit (UPL)	Background Wells		Compliance Wells		
			MW-102M	MW-122M	MW-301	MW-302	MW-303
Boron	ug/L	5220	1480	5220	1010	848	738
Calcium	mg/L	599	10.4	383	161	74	94.9
Chloride	mg/L	21.9	12.3	7.2	**28.9**	7.8	6.9
Fluoride	mg/L	6.31	4.6	0.5	0.77	1.2	0.77
Field pH	Std. Units	8.63	8.16	6.16	6.56	7.41	6.96
Sulfate	mg/L	17500	335	9440	926	77.5	232
Total Dissolved Solids	mg/L	18100	1410	13400	1760	607	783

149 Statistically significant increase at compliance well

Notes:

1. UPL based on parametric prediction limit based on 1-of-2 resampling methodology for fluoride and pH.
2. UPL for boron, calcium, chloride, sulfate and total dissolved solids based on non-parametric prediction limit (highest background value). Optional resampling for chloride at MW-301 not performed.
3. UPLs calculated from background well results for April 2016 through November 2017.
4. Analytical laboratory reports provided in the 2017 Annual Groundwater Monitoring and Corrective Action Report.

I:\25216073.00\Reports\2018 ASD Report\Tables\[OML ASD Tables_R1.xlsx]Table 1. Detect Monit. Sum

Table 2. Chloride Analytical Results - CCR Detection Monitoring Program
IPL - Ottumwa Midland Landfill
Ottumwa, Iowa

Well Group	Well	Collection Date	Chloride (mg/L)
Background	MW-102M	5/4/2016	16.3
		6/22/2016	13.8
		8/10/2016	13.4
		10/26/2016	13
		1/18/2017	12.3
		4/20/2017	12.5
		6/21/2017	12.8
		8/22/2017	13.1
		11/8/2017	12.3
	MW-122M	5/5/2016	16.4
		6/23/2016	21.9
		8/10/2016	11.8
		10/26/2016	8.2
		1/18/2017	8.3
		4/20/2017	8
		6/21/2017	7.8
		8/22/2017	7.8
		11/8/2017	7.2
Compliance	MW-301	5/4/2016	42.4
		6/22/2016	112
		8/9/2016	46.6
		10/26/2016	43.4
		1/17/2017	32.6
		4/20/2017	58
		6/20/2017	38.9
		8/22/2017	40.8
		11/7/2017	28.9
	MW-302	5/4/2016	9.2
		6/22/2016	8.1
		8/10/2016	7.5
		10/26/2016	6
		1/17/2017	7.7
		4/19/2017	8
		6/20/2017	8
		8/22/2017	8.5
		11/7/2017	7.8

Table 2. Chloride Analytical Results - CCR Detection Monitoring Program
IPL - Ottumwa Midland Landfill
Ottumwa, Iowa

Well Group	Well	Collection Date	Chloride (mg/L)
Compliance	MW-303	5/4/2016	13.5
		6/22/2016	11.5
		8/9/2016	8.7
		10/26/2016	7.5
		1/17/2017	7.1
		4/19/2017	6.9
		7/19/2017	7.2
		8/22/2017	7.3
		11/7/2017	6.9

Abbreviations:
mg/L = milligrams per liter or parts per billion (ppm)

Notes:
1. Laboratory reports included in 2017 Annual Groundwater Monitoring and Corrective Action Report, Ottumwa Midland Landfill.

Created by:	NDK	2/22/2018
Last revision by:	NDK	2/22/2018
Checked by:	JD	3/1/2018

I:\25216073.00\Reports\2018 ASD Report\Tables\[OML ASD Tables.xlsx]Table 2 CCR Cl

Table 3. Groundwater Elevation Table – State Monitoring Program
IPL - Ottumwa Midland Landfill
Ottumwa, Iowa

	MW-10R	MW-100R	MW-101R	MW-102	MW-107	MW-108	MW-110	MW-111	MW-112	MW-115	MW-116	MW-117	MW-122
Well Information													
Ground Surface Elevation (feet amsl)	786.06	819.84	796.73	795.16	786.14	756.90	758.11	785.29	809.94	749.84	740.20	778.46	792.06
Top of Casing Elevation (feet amsl)	788.56	822.40	799.358	797.24	788.50	765.57	760.39	787.38	811.93	752.44	742.47	780.77	794.02
Screen Length (ft)	15	15	15	15	15	15	15	15	15	15	15	15	15
Total Depth (from top of casing)	40.3	27.9	29.0	29.7	26.8	27.7	37.6	42.7	27.9	27.4	27.7	28.7	43.8
Top of Well Screen Elevation (ft)	763.06	809.65	785.4	782.80	776.75	746.62	737.92	760.05	799.6	740.59	729.98	769.96	765.84
Ground Water Elevation in feet above mean sea level (amsl)													
August 21, 2017	757.17	807.20	782.16	780.01	768.05	740.51	739.80	747.13	787.80	727.69	727.03	759.36	773.55
Bottom of Well Elevation (ft amsl)	748.26	794.5	770.358	767.54	761.7	731.39	722.79	744.68	784.03	725.04	714.77	752.07	750.22

Table 3. Groundwater Elevation Table – State Monitoring Program
IPL - Ottumwa Midland Landfill
Ottumwa, Iowa

	MW1	MW5	MW6	MW8	MW13	MW14	MW15R	MW16R	MW17
Well Information									
Ground Surface Elevation (feet amsl)[(5)]	N/A	N/A	N/A	N/A	N/A	N/A	805.98	811.57	N/A
Top of Casing Elevation (feet amsl)	821.01	784.31	797.21	804.96	762.48	761.02	808.49	814.13	760.85
Screen Length (ft)	15.0	10.0	15.0	10.0	10.0	10.0	15.0	15.0	5.0
Total Depth (from top of casing)	19.6	56.4	25.3	20.4	48.4	48.0	57.7	105.0	19.6
Top of Well Screen Elevation (ft)	816.46	737.88	786.89	794.56	724.08	723.04	765.79	724.13	746.23
August 21, 2017	808.41	735.06	780.63	788.23	724.51	723.56	759.35	723.44	746.73
Bottom of Well Elevation (ft amsl)	801.46	727.88	771.89	784.56	714.08	713.04	750.79	709.13	741.23

Notes:
N/A = information not available
amsl = above mean sea level

Created By: NDK Date: 2/27/2018
Revision By: NDK Date: 2/27/2018
Checked By: JD Date: 3/1/2018

I:\25216073.00\Reports\2018 ASD Report\Tables\[OML ASD Tables_R1.xlsx]Table 3 State GW elev

Table 4. Groundwater Elevations – CCR Rule Monitoring Network

IPL - Ottumwa Midland Landfill
Ottumwa, Iowa

Well Number	Ground Water Elevation in feet above mean sea level (amsl)				
	MW-301	MW-302	MW-303	MW-102M	MW-122M
Top of Casing Elevation (feet amsl)	817.88	761.77	762.40	798.03	792.70
Screen Length (ft)	5.00	5.00	5.00	5.00	5.00
Total Depth (ft from top of casing)	204.50	157.70	150.00	152.10	155.30
Top of Well Screen Elevation (ft)	618.38	609.07	617.40	652.65	642.94
Measurement Date					
May 4, 2016	686.46	685.80	686.04	728.73	729.27
August 21-22, 2017	684.96	683.89	684.70	713.23	722.02
November 7-8, 2017	684.50	683.38	684.26	713.53	720.52
Bottom of Well Elevation (ft)	613.38	604.07	612.40	645.93	637.40

Notes:
NM = not measured
Water levels collected during Sample Collection

Created by: NDK Date: 2/21/2018
Last revision by: NDK Date: 2/21/2018
Checked by: JD Date: 3/1/2018

I:\25216073.00\Reports\2018 ASD Report\Tables\[OML ASD Tables_R1.xlsx]Table 4 CCR GW elevations

Table 5. Leachate and Contact Water Analytical Results - 2016-2017 State Monitoring Program

IPL - Ottumwa Midland Landfill

Ottumwa, Iowa

Monitoring Point	Date	pH, Field (s.u.)	Boron (µg/L)	Chloride (mg/L)	Fluoride (mg/L)	Sulfate (mg/L)	Total Dissolved Soilds (mg/L)
Leachate Basin	9/7/2016	7.13	4,550	127	0.87	5,000	6,730
Leachate Lagoon	8/29/2017	6.71	5,330	138	0.78	5,290	8,340
Temporary Contact Water Basin TCB-1/2	3/23/2016	8.48	422	4.9	0.25	229	383
Temporary Contact Water Basin TCB-1/2	6/22/2016	7.92	455	5.8	0.21	223	391
Temporary Contact Water Basin TCB-1/2	9/7/2016	8.89	570	5.6	0.19 J	240	334
Temporary Contact Water Basin TCB-1/2	8/29/2017	7.80	820	8.5	0.24	411	611

Abbreviations:

µg/L = micrograms per liter

mg/L = milligrams per liter

s.u. = standard units

Notes:

(1): Laboratory results from the 2016 and 2017 Annual Water Quality Reports for OML.

(2): Laboratory analyses are reported as total concentrations for all monitoring points.

I:\25216073.00\Reports\2018 ASD Report\Tables\[OML ASD Tables_R1.xlsx]Table 5. Leachate Results

Table 6. Chloride Analytical Results for Shallow Groundwater - 2016-2017 State Monitoring Program
IPL - Ottumwa Midland Landfill
Ottumwa, Iowa

Monitoring Point	Date	Chloride (mg/L)
Shallow Hydrogeologic Unit		
MW-1	9/7/2016	64.9
MW-1	8/24/2017	60.6
MW-15R	9/7/2016	7.4
MW-15R	8/29/2017	5.6
MW-17	9/7/2016	6.7
MW-17	8/29/2017	7.0
MW-100R	9/7/2016	27.4
MW-100R	8/24/2017	26.4
Underdrain Groundwater		
Underdrain Lift Station (GU-EX)	9/7/2016	19.4
Underdrain Lift Station (GU-EX)	8/29/2017	14.8
Groundwater Underdrain GU-1 (Temp)	9/7/2016	17.2
Groundwater Underdrain GU-1 (Temp)	8/29/2017	16.7

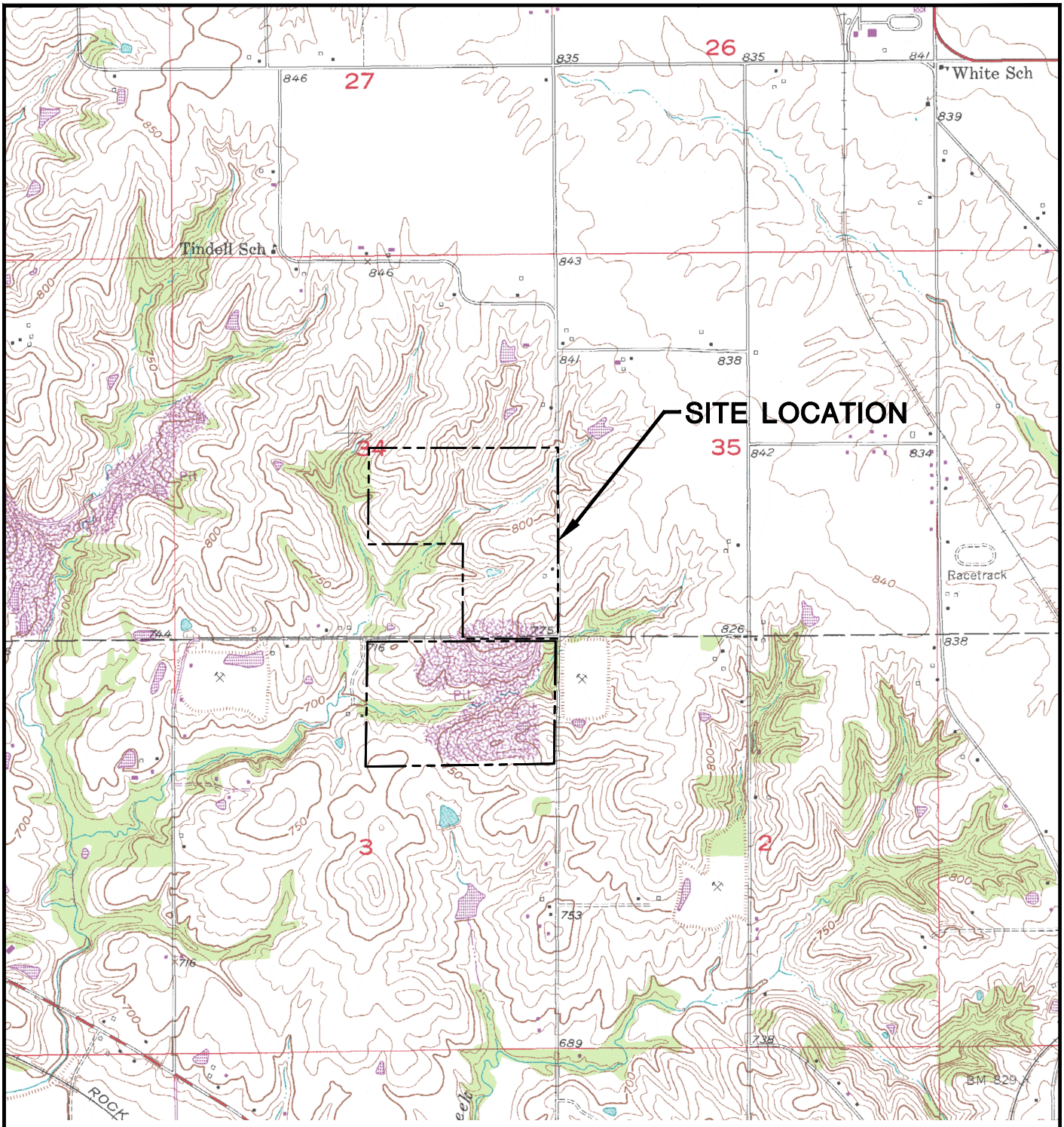
Abbreviations:
mg/L = milligrams per liter
NA = Not Applicable

Created by:	TLC	Date:	10/17/2013
Last Revision by:	MHL	Date:	9/21/2017
Checked by:	MDB	Date:	9/22/2017

Notes:
(1): Laboratory Results from the 2016 and 2017 Annual Water Quality Reports for OML.
(2): Laboratory analyses are reported as total concentrations for all monitoring points.

I:\25216073.00\Reports\2018 ASD Report\Tables\[OML ASD Tables_R1.xlsx]Table 6. State Cl GW Results

FIGURES



LEGEND

APPROXIMATE PROPERTY LINE

OTTUMWA NORTH QUADRANGLE
IOWA–WAPELLO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SW/4 OTTUMWA NORTH 15' QUADRANGLE
1976
SCALE: 1" = 2,000'

N

IOWA

CLIENT	INTERSTATE POWER AND LIGHT CO. 15300 130th STREET OTTUMWA, IA 52501	SITE	OTTUMWA MIDLAND LANDFILL OTTUMWA, IOWA

SITE LOCATION MAP

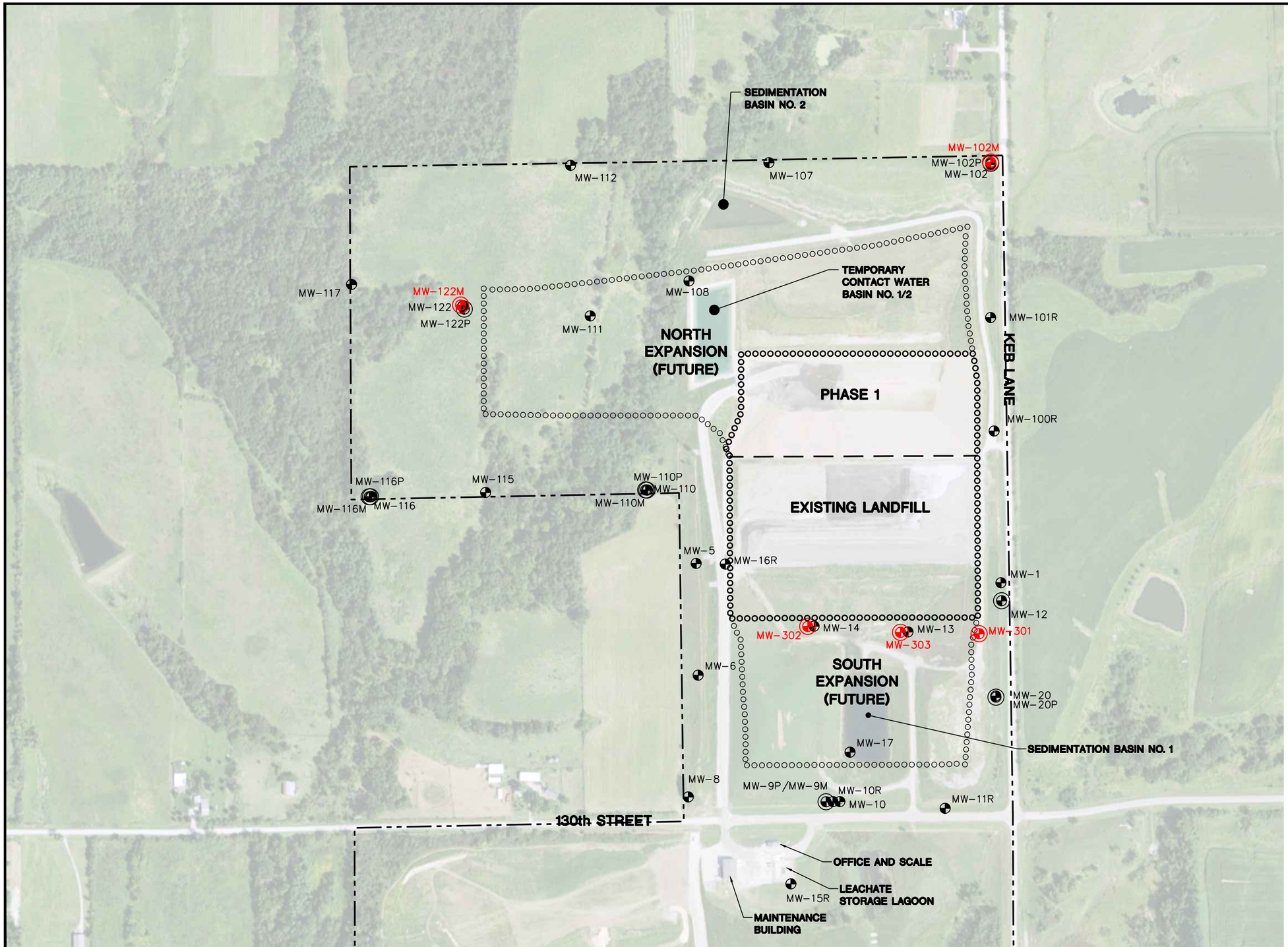
PROJECT NO.	25211509.03	DRAWN BY:	KP
DRAWN:	09/15/11	CHECKED BY:	MB
REVISED:	11/17/16	APPROVED BY:	

ENGINEER

SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718–6751
PHONE: (608) 224–2830

FIGURE
1

I:\25216073.00\Drawings\□□ 1□□i□ L□a i□n.dwg, 11/17/2016 1:49:51 PM



LEGEND

- APPROXIMATE PROPERTY LINE
- EXISTING WASTE LIMITS
- NORTH EXPANSION AREA
- MONITORING WELL
- PIEZOMETER
- CCR RULE PIEZOMETER

NOTES:

1. 2015 AERIAL PHOTOGRAPH IS FROM THE IOWA GEOGRAPHIC MAP SERVER–IOWA STATE UNIVERSITY GEOGRAPHIC INFORMATION SYSTEMS SUPPORT & RESEARCH FACILITY.
2. PROPERTY LINE SOUTH OF 130TH STREET FROM SURVEY MAP PREPARED BY GARDEN & ASSOCIATES, OSKALOOSA, IOWA, DATED DECEMBER 20, 1988.
3. PROPERTY LINE NORTH OF 130TH STREET FROM PLAT OF SURVEY MAP PREPARED BY SCS ENGINEERS, MADISON, WISCONSIN, DATED FEBRUARY 20, 2013.
4. EXISTING LIMITS OF WASTE ARE APPROXIMATE.
5. MONITORING WELLS MW–301 AND MW–302 WERE INSTALLED BY CASCADE DRILLING BETWEEN NOVEMBER 16, 2015, AND DECEMBER 3, 2015.
6. MONITORING WELL MW–303 WAS INSTALLED BY TEAM SERVICES BETWEEN APRIL 11, 2016 AND APRIL 26, 2016.
7. MONITORING WELLS MW–301 THROUGH MW–303 WERE SURVEYED BY FRENCH–RENEKER–ASSOCIATES ON MAY 19, 2016.

N

400 0 400

SCALE: 1" = 400'

PROJECT NO.	25216073.00	DRAWN BY:	BJM
DRAWN:	11/17/11	CHECKED BY:	NK
REVISED:	03/14/18	APPROVED BY:	

ENGINEER: SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

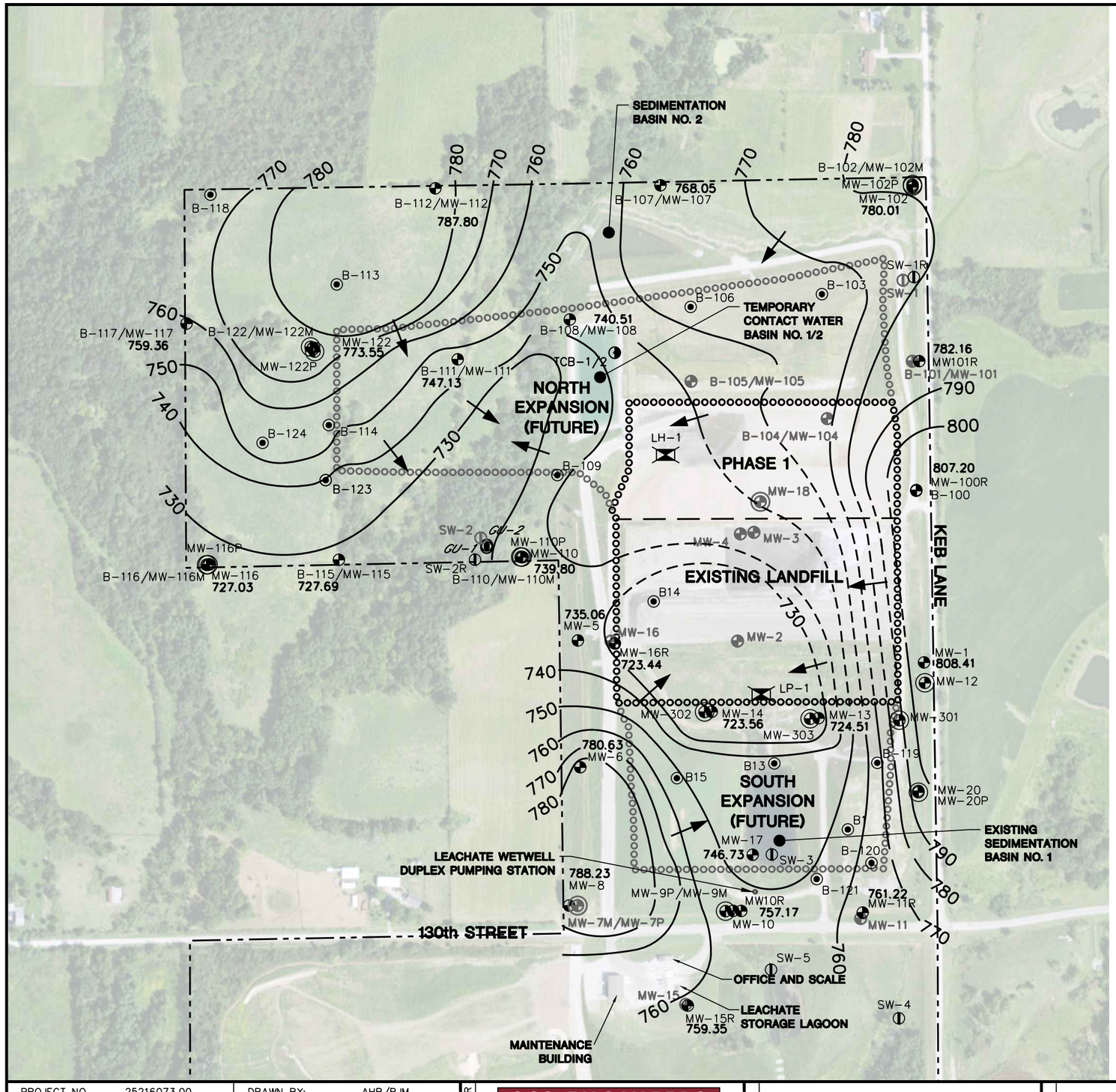
CLIENT: INTERSTATE POWER AND LIGHT CO.
15300 130th STREET
OTTUMWA, IA 52501

SITE: OTTUMWA MIDLAND LANDFILL
OTTUMWA, IOWA

MONITORING WELL LOCATION MAP

FIGURE 2

I:\25216073.00\Drawings\□□R R□□Pi□□□□□rs.dwg, 3/14/2018 4:09:14 PM



LEGEND

- APPROXIMATE PROPERTY LINE
- APPROVED LIMITS OF WASTE
- EXISTING WASTE LIMITS
- PHASE LIMIT
- EXISTING MONITORING WELL
- EXISTING PIEZOMETER
- EXISTING SURFACE WATER MONITORING STAFF GAUGE
- ABANDONED SURFACE WATER MONITORING STAFF GAUGE
- ABANDONED MONITORING WELL
- LEACHATE HEADWELL
- GROUNDWATER UNDERDRAIN
- TEMPORARY CONTACT WATER BASIN
- 780.01 WATER TABLE ELEVATION MEASURED IN 08/21/2017
- WATER TABLE CONTOUR (DASHED WHERE INFERRED)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTES:

1. 2015 AERIAL PHOTOGRAPH IS FROM THE IOWA GEOGRAPHIC MAP SERVER–IOWA STATE UNIVERSITY GEOGRAPHIC INFORMATION SYSTEMS SUPPORT & RESEARCH FACILITY.
2. PROPERTY LINE SOUTH OF 130TH STREET FROM SURVEY MAP PREPARED BY GARDEN & ASSOCIATES, OSKALOOSA, IOWA, DATED DECEMBER 20, 1988.
3. PROPERTY LINE NORTH OF 130TH STREET FROM PLAT OF SURVEY MAP PREPARED BY SCS ENGINEERS, MADISON, WISCONSIN, DATED FEBRUARY 20, 2013.
4. EXISTING LIMITS OF WASTE ARE APPROXIMATE.
5. MW–13 AND MW–14 ARE USED IN THE INTERPRETATION OF BOTH THE WATER TABLE MAP AND THE POTENTIOMETRIC SURFACE MAP BECAUSE THEY ARE SCREENED IN THE PENNSYLVANIAN UNIT (UPPERMOST AQUIFER) AND ACROSS WHAT COULD BE INTERPRETED AS THE WATER TABLE (1ST OCCURRENCE OF GROUNDWATER AT THE WELL LOCATIONS).
6. A GROUNDWATER UNDERDRAIN SYSTEM IS PRESENT BELOW THE BASE OF THE CURRENT FILL AREA. ELEVATIONS IN THE BASE UNDERDRAIN SYSTEM RANGE FROM 748' TO 762'. ADDITIONALLY, FINGER DRAINS WERE INSTALLED ALONG THE EASTERN EDGE OF THE FILL AREA AT THE AN ELEVATION OF APPROXIMATELY 795'. THESE FINGER DRAINS ARE TIED TO THE UNDERDRAIN SYSTEM.

N

400 0 400

SCALE: 1" = 400'

PROJECT NO.	25216073.00	DRAWN BY:	AHB/BJM
DRAWN:	10/24/16	CHECKED BY:	JD
REVISED:	11/08/17	APPROVED BY:	TK 11/21/17

ENGINEER: SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

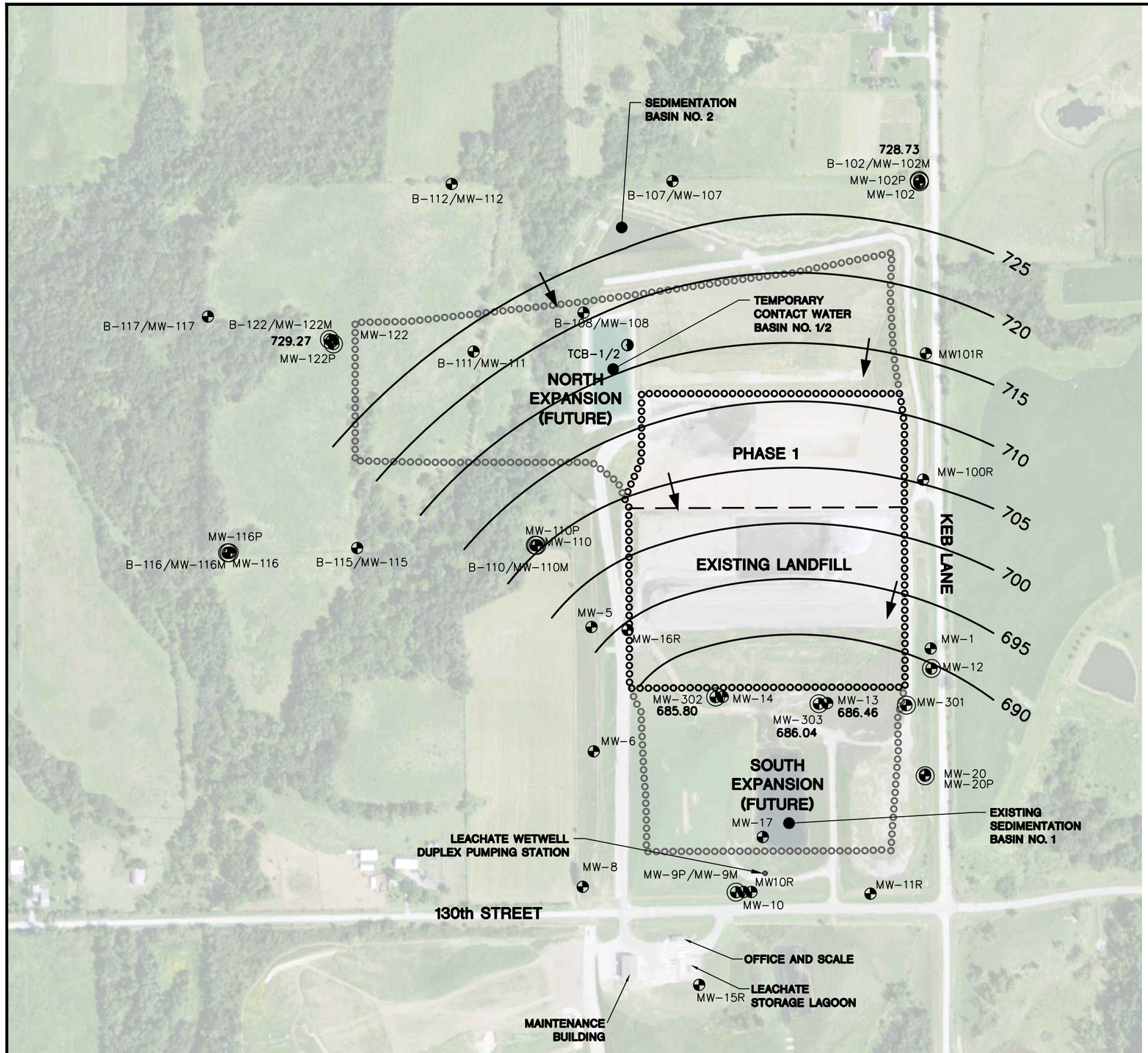
CLIENT: INTERSTATE POWER AND LIGHT CO.
15300 130th STREET
OTTUMWA, IA 52501

SITE: OTTUMWA MIDLAND LANDFILL
OTTUMWA, IOWA

WATER TABLE MAP
AUGUST 21, 2017

FIGURE 3

I:\25216073.00\Drawings\WTBL-A□□□□T 2017.dwg, 11/21/2017 3:34:14 PM



LEGEND

- APPROXIMATE PROPERTY LINE
- APPROVED WASTE LIMITS
- EXISTING WASTE LIMITS
- PHASE LIMIT
- EXISTING MONITORING WELL
- EXISTING PIEZOMETER
- TEMPORARY CONTACT WATER BASIN
- **686.46** WATER TABLE ELEVATION (MAY 2016)
- POTENTIOMETRIC SURFACE CONTOUR (DASHED WHERE INFERRED)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

N

400 0 400

SCALE: 1" = 400'

NOTES:

1. 2015 AERIAL PHOTOGRAPH IS FROM THE IOWA GEOGRAPHIC MAP SERVER–IOWA STATE UNIVERSITY GEOGRAPHIC INFORMATION SYSTEMS SUPPORT & RESEARCH FACILITY.
2. PROPERTY LINE SOUTH OF 130TH STREET FROM SURVEY MAP PREPARED BY GARDEN & ASSOCIATES, OSKALOOSA, IOWA, DATED DECEMBER 20, 1988.
3. PROPERTY LINE NORTH OF 130TH STREET FROM PLAT OF SURVEY MAP PREPARED BY SCS ENGINEERS, MADISON, WISCONSIN, DATED FEBRUARY 20, 2013.
4. EXISTING LIMITS OF WASTE ARE APPROXIMATE.
5. BORINGS AND WELLS INSTALLED DURING PREVIOUS SITE INVESTIGATIONS ARE NUMBERED B1 THROUGH B16, #1–#6, AND MW–1 THROUGH MW–18. WELLS INSTALLED IN 2012 TO THE SOUTH OF THE EXISTING LANDFILL UTILIZE THE EXISTING NUMBERING SCHEME. NUMBERING FOR NORTH EXPANSION AREA BORINGS/WELLS AND COAL SEAM BORINGS BEGINS WITH B–100.
6. MW–13 AND MW–14 ARE USED IN THE INTERPRETATION OF BOTH THE WATER TABLE MAP AND THE POTENTIOMETRIC SURFACE MAP BECAUSE THEY ARE SCREENED IN THE PENNSYLVANIAN UNIT (UPPERMOST AQUIFER) AND ACROSS WHAT COULD BE INTERPRETED AS THE WATER TABLE (1ST OCCURRENCE OF GROUNDWATER AT THE WELL LOCATIONS).

PROJECT NO.	25216073.18	DRAWN BY:	KP
DRAWN:	02/28/18	CHECKED BY:	NK
REVISED:	02/28/18	APPROVED BY:	

ENGINEER: SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

CLIENT: INTERSTATE POWER AND LIGHT CO.
15300 130th STREET
OTTUMWA, IA 52501

SITE: OTTUMWA MIDLAND LANDFILL
OTTUMWA, IOWA

POTENTIOMETRIC SURFACE MAP
MAY 2016

FIGURE
4

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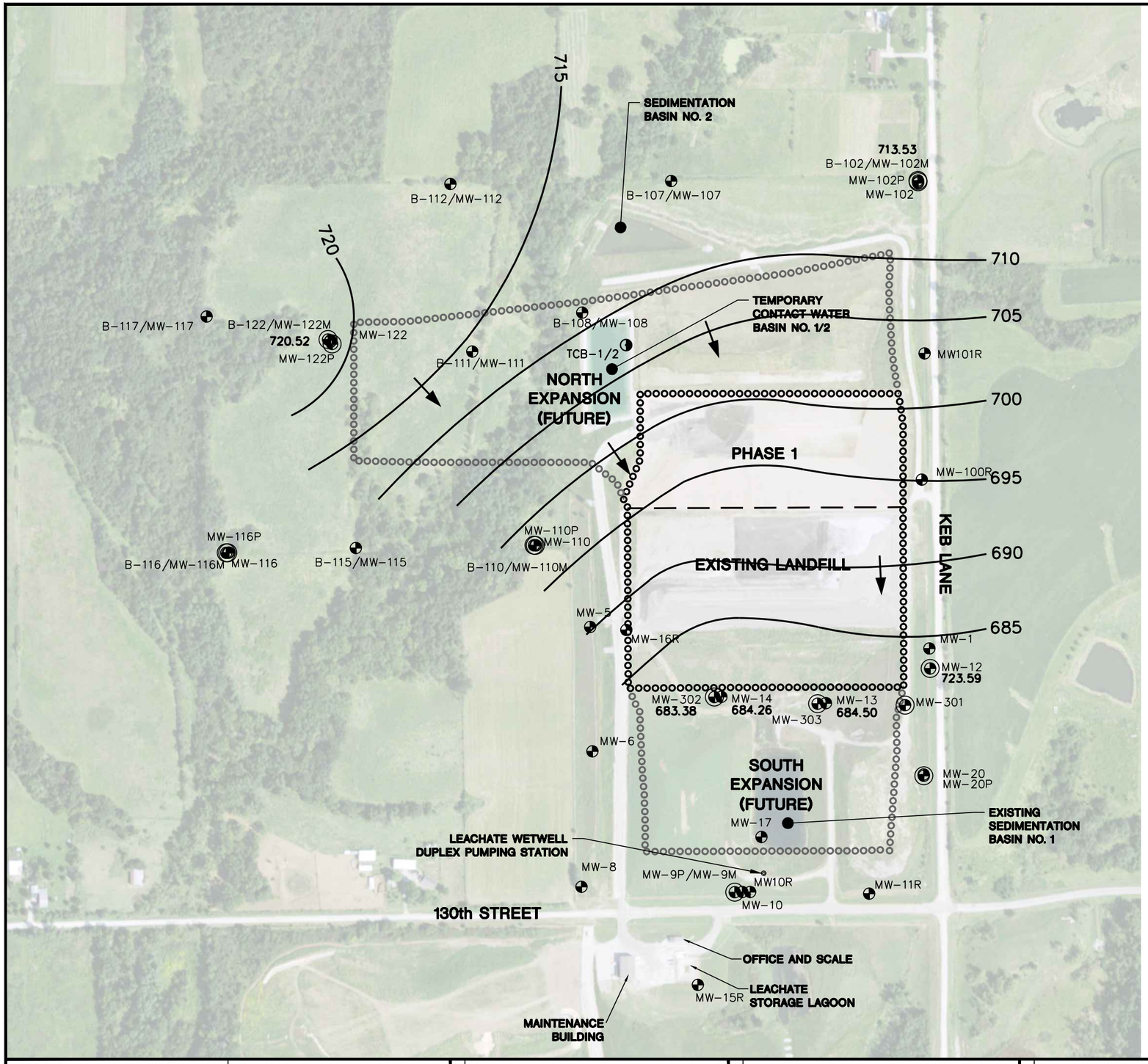

LEGEND

- APPROXIMATE PROPERTY LINE
- APPROVED WASTE LIMITS
- EXISTING WASTE LIMITS
- PHASE LIMIT
- EXISTING MONITORING WELL
- EXISTING PIEZOMETER
- TEMPORARY CONTACT WATER BASIN
- **684.50** WATER TABLE ELEVATION (NOVEMBER 2017)
- POTENTIOMETRIC SURFACE CONTOUR (DASHED WHERE INFERRED)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTES:

1. 2015 AERIAL PHOTOGRAPH IS FROM THE IOWA GEOGRAPHIC MAP SERVER–IOWA STATE UNIVERSITY GEOGRAPHIC INFORMATION SYSTEMS SUPPORT & RESEARCH FACILITY.
2. PROPERTY LINE SOUTH OF 130TH STREET FROM SURVEY MAP PREPARED BY GARDEN & ASSOCIATES, OSKALOOSA, IOWA, DATED DECEMBER 20, 1988.
3. PROPERTY LINE NORTH OF 130TH STREET FROM PLAT OF SURVEY MAP PREPARED BY SCS ENGINEERS, MADISON, WISCONSIN, DATED FEBRUARY 20, 2013.
4. EXISTING LIMITS OF WASTE ARE APPROXIMATE.
5. BORINGS AND WELLS INSTALLED DURING PREVIOUS SITE INVESTIGATIONS ARE NUMBERED B1 THROUGH B16, #1–#6, AND MW–1 THROUGH MW–18. WELLS INSTALLED IN 2012 TO THE SOUTH OF THE EXISTING LANDFILL UTILIZE THE EXISTING NUMBERING SCHEME. NUMBERING FOR NORTH EXPANSION AREA BORINGS/WELLS AND COAL SEAM BORINGS BEGINS WITH B–100.
6. MW–13 AND MW–14 ARE USED IN THE INTERPRETATION OF BOTH THE WATER TABLE MAP AND THE POTENTIOMETRIC SURFACE MAP BECAUSE THEY ARE SCREENED IN THE PENNSYLVANIAN UNIT (UPPERMOST AQUIFER) AND ACROSS WHAT COULD BE INTERPRETED AS THE WATER TABLE (1ST OCCURRENCE OF GROUNDWATER AT THE WELL LOCATIONS).

N

400 0 400

SCALE: 1" = 400'

PROJECT NO.	25216073.18	DRAWN BY:	KP
DRAWN:	02/28/18	CHECKED BY:	NK
REVISED:	02/28/18	APPROVED BY:	

ENGINEER: SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718–6751
PHONE: (608) 224–2830

CLIENT: INTERSTATE POWER AND LIGHT CO.
15300 130th STREET
OTTUMWA, IA 52501

SITE: OTTUMWA MIDLAND LANDFILL
OTTUMWA, IOWA

POTENTIOMETRIC SURFACE MAP
NOVEMBER 2017

FIGURE
5

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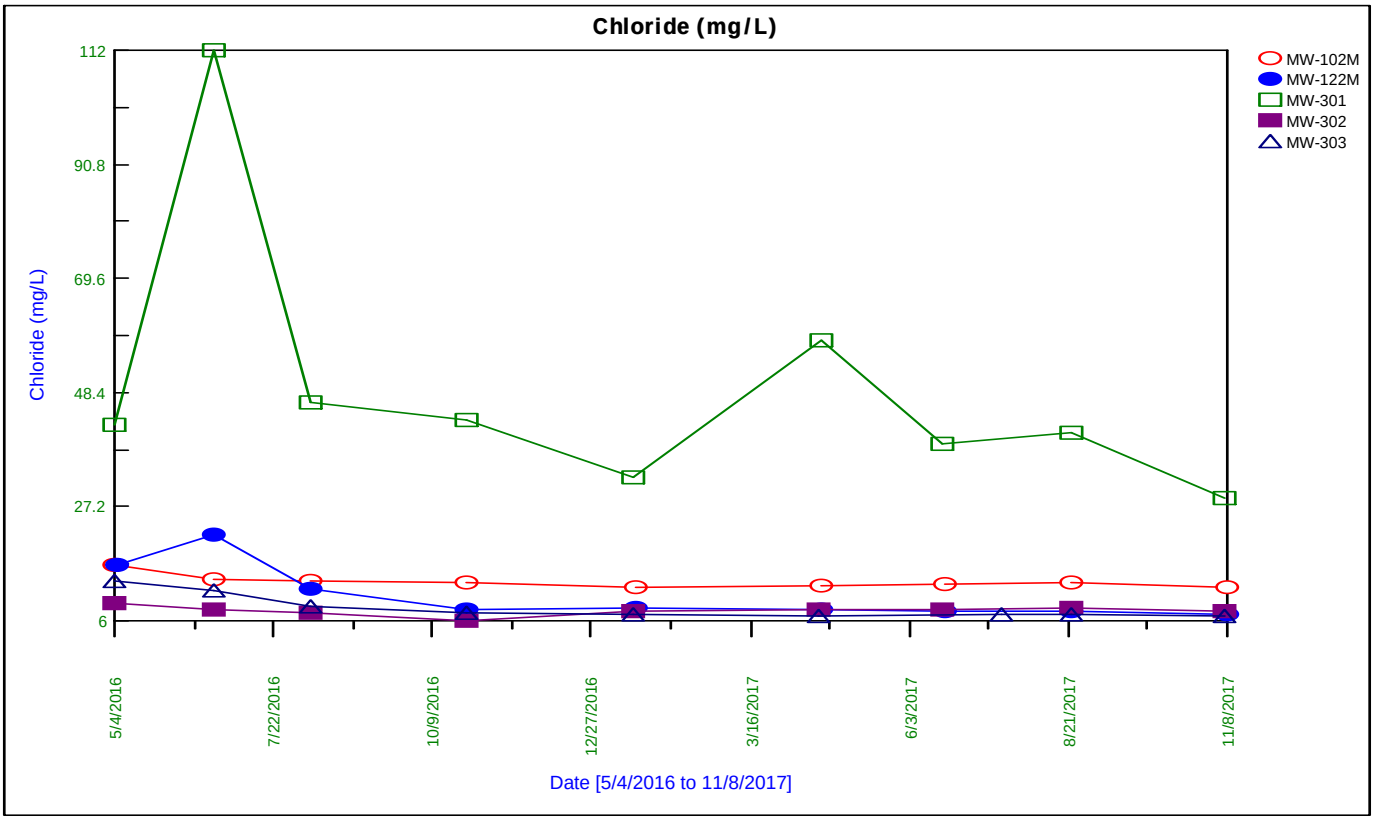
APPENDIX A

CCR Well Trend Plot – Chloride


Chloride (mg/L)
112
90.8
69.6
48.4
27.2
6
Chloride (mg/L)
MW-102M
MW-122M
MW-301
MW-302
MW-303
5/4/2016
7/22/2016
10/9/2016
12/27/2016
3/16/2017
6/3/2017
8/21/2017
11/8/2017
Date [5/4/2016 to 11/8/2017]

APPENDIX B

Regional Geologic and Hydrogeologic Information

Table OML-3. Regional Hydrogeologic Stratigraphy
Ottumwa Midland Landfill / SCS Engineers Project #25215053.01

Age of Rocks	Hydrogeologic Unit	General Thickness (feet)	Name of Rock Unit*	Type of Rock
Quaternary (0-1 million years old)	Surficial Aquifers • Alluvial • Buried-Channel • Drift	0 to 320	Undifferentiated	• Sand, gravel, silt, and clay • Sand, gravel, silt, and clay • Till (sandy, pebbly clay), sand, and silt
Pennsylvanian (180 to 310 million years old)	Aquiclude	0 to 370	Undifferentiated	• Shale, sandstone, limestone, and coal
Mississippian (310 to 345 million years old	Mississippian Aquifer • Upper	0 to 600	St. Louis Spergen	• Limestone and sandstone • Limestone
	• Lower		Warsaw Keokuk Burlington Hampton Starrs Cave	• Shale and dolomite • Dolomite, limestone, and shale • Dolomite and limestone • Limestone and dolomite • Limestone
	Aquiclude	0 to 425	Prospect Hill McCraney	• Siltstone • Limestone
Devonian (345 to 400 million years old)			Yellow Spring Lime Creek	• Shale, dolomite, and siltstone • Dolomite and shale
	Devonian Aquifer	110 to 420	Cedar Valley Wapsipinicon	• Limestone and dolomite • Dolomite, limestone, shale, and gypsum
Silurian (400 to 425 million years old)		0 to 105	Undifferentiated	• Dolomite
Ordovician (425 to 500 million years old)	Aquiclude	150 to 600	Maquoketa Galena Decorah Platteville	• Dolomite and shale • Dolomite and chert • Limestone and shale • Limestone, shale, and sandstone
	Cambrian-Ordovician aquifer	750 to 1,110	St. Peter Prairie du Chien	• Sandstone • Dolomite and sandstone
Cambrian (500 to 600 million years old)			Jordan St. Lawrence	• Sandstone • Dolomite
	Not considered an aquifer in southeast Iowa	450 to 750+	Franconia Galesville Eau Claire Mt. Simon	• Shale, siltstone, and sandstone • Sandstone • Sandstone, shale, and dolomite • Sandstone
Precambrian (600 million to 2 billion + years old)				• Sandstone, igneous rocks, and metamorphic rocks

*This nomenclature and classification of rock units in this report are those of the Iowa Geological Survey and do not necessarily coincide with those accepted by the U.S. Geological Survey.

Source: "Water Resources of Southeast Iowa," Iowa Geologic Survey Water Atlas No. 4.

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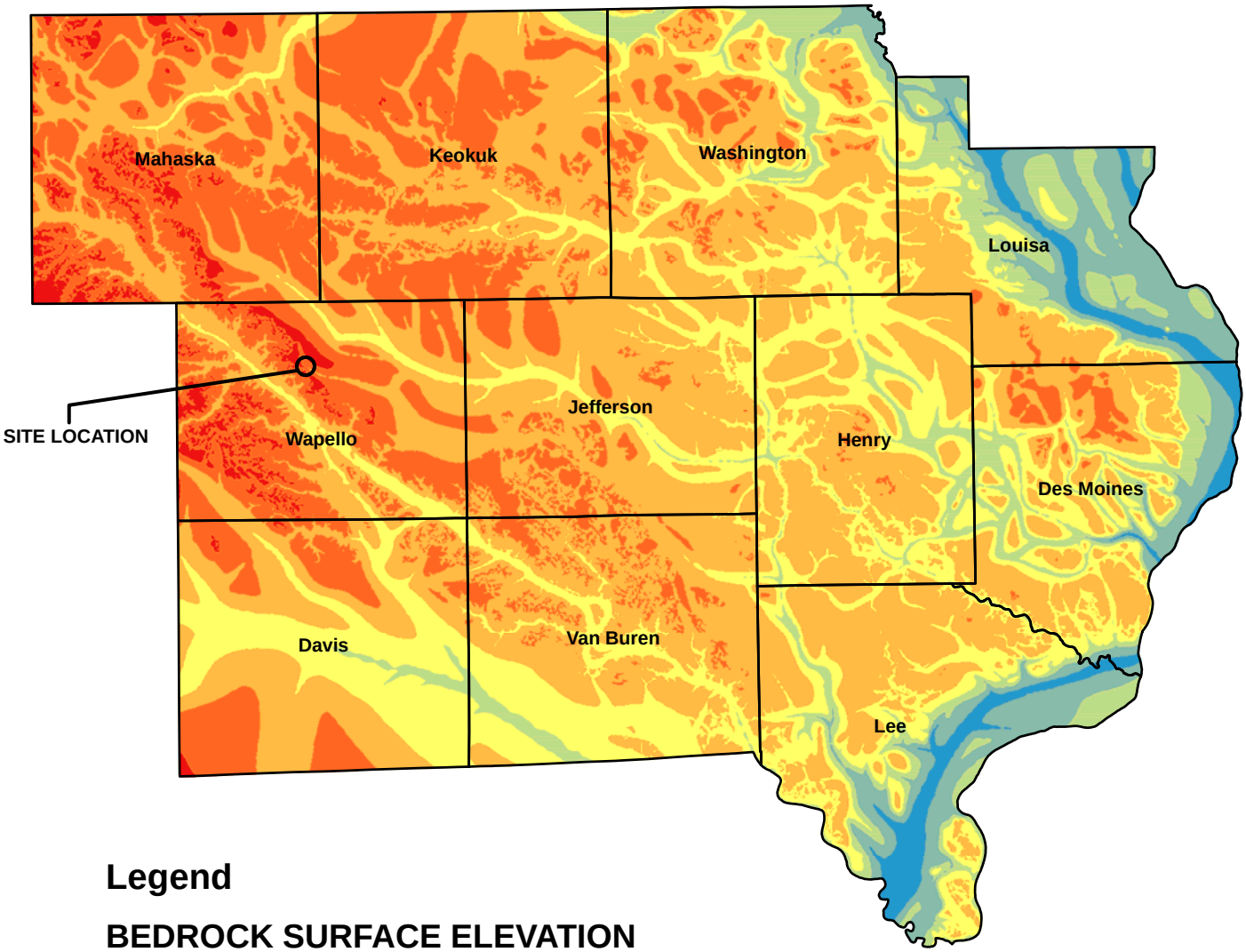

Legend

BEDROCK SURFACE ELEVATION

ELEVATION ABOVE MEAN SEA LEVEL IN FEET

- BELOW 300
- 300 TO 400
- 400 TO 500
- 500 TO 600
- 600 TO 700
- 700 TO 800
- 800 TO 900

N

0 5 10 20 Miles

MAP DATA DERIVED FROM IOWA GEOLOGICAL AND WATER SURVEY
IOWA BEDROCK SURFACE ELEVATION AS OBTAINED
FROM IOWA NATURAL RESOURCES
GEOGRAPHIC INFORMATION SYSTEMS LIBRARY

CLIENT	INTERSTATE POWER AND LIGHT CO. 15300 130TH STREET OTTUMWA, IA 52501	SITE	OTTUMWA MIDLAND LANDFILL OTTUMWA, IOWA
	SE IOWA REGIONAL BEDROCK SURFACE ELEVATION		

PROJECT NO.	25215053.03	DRAWN BY:	JB	ENGINEER	FIGURE
DRAWN:	07/29/13	CHECKED BY:	MDB	SCS ENGINEERS 2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830 FAX: (608) 224-2839	4
REVISED:	08/02/13	APPROVED BY:			

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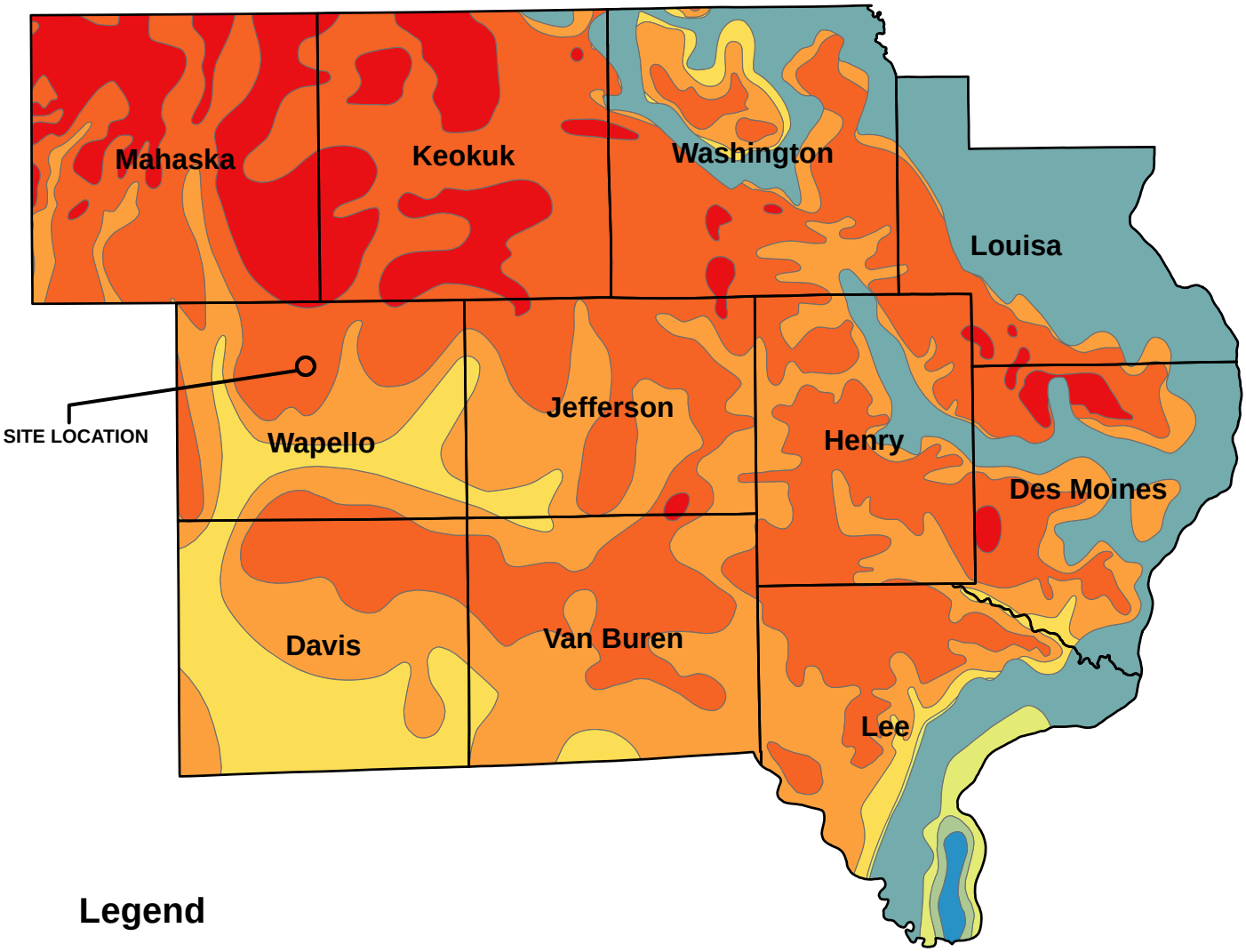

Legend

MISSISSIPIAN AQUIFER ELEVATION

ELEVATION ABOVE MEAN SEA LEVEL IN FEET

- MISSISSIPPIAN NOT PRESENT
- 150
- 250
- 350
- 450
- 550
- 650
- 750

N

0 5 10 20 Miles

MAP DATA DERIVED FROM IOWA GEOLOGICAL AND WATER SURVEY
MISSISSIPPIAN AQUIFER SURFACE ELEVATION AS OBTAINED
FROM IOWA NATURAL RESOURCES
GEOGRAPHIC INFORMATION SYSTEMS LIBRARY

CLIENT	INTERSTATE POWER AND LIGHT CO. 15300 130TH STREET OTTUMWA, IA 52501	SITE	OTTUMWA MIDLAND LANDFILL OTTUMWA, IOWA
	SE IOWA REGIONAL MISSISSIPIAN AQUIFER SURFACE ELEVATION		

PROJECT NO.	25215053.03	DRAWN BY:	JB	ENGINEER	SCS ENGINEERS
DRAWN:	07/29/13	CHECKED BY:	MDB		2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830 FAX: (608) 224-2839
REVISED:	08/02/13	APPROVED BY:			

FIGURE 5

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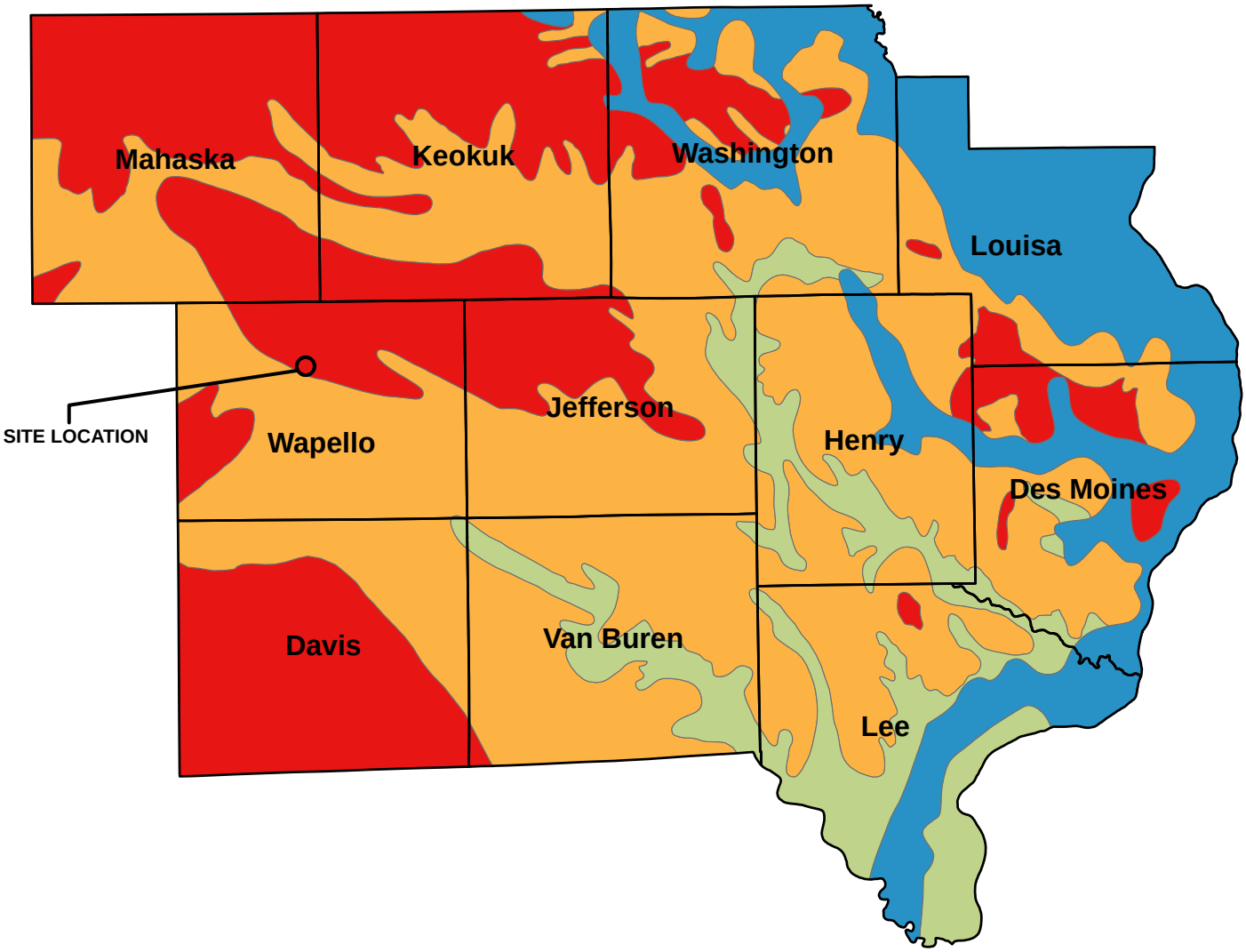

Legend

MISSISSIPIAN AQUIFER POTENTIOMETRIC SURFACE

ELEVATION ABOVE MEAN SEA LEVEL IN FEET

- MISSISSIPPIAN NOT PRESENT
- 550
- 650
- 750

N

0 5 10 20 Miles

MAP DATA DERIVED FROM IOWA GEOLOGICAL AND WATER SURVEY
MISSISSIPIAN AQUIFER POTENTIOMETRIC SURFACE ELEVATION AS OBTAINED
FROM IOWA NATURAL RESOURCES
GEOGRAPHIC INFORMATION SYSTEMS LIBRARY

CLIENT	INTERSTATE POWER AND LIGHT CO. 15300 130TH STREET OTTUMWA, IA 52501	SITE	OTTUMWA MIDLAND LANDFILL OTTUMWA, IOWA
	SE IOWA REGIONAL MISSISSIPIAN AQUIFER POTENTIOMETRIC SURFACE ELEVATION		

PROJECT NO.	25215053.03	DRAWN BY:	JB	ENGINEER	FIGURE
DRAWN:	07/29/13	CHECKED BY:	MDB		
REVISED:	08/02/13	APPROVED BY:			7

SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830 FAX: (608) 224-2839

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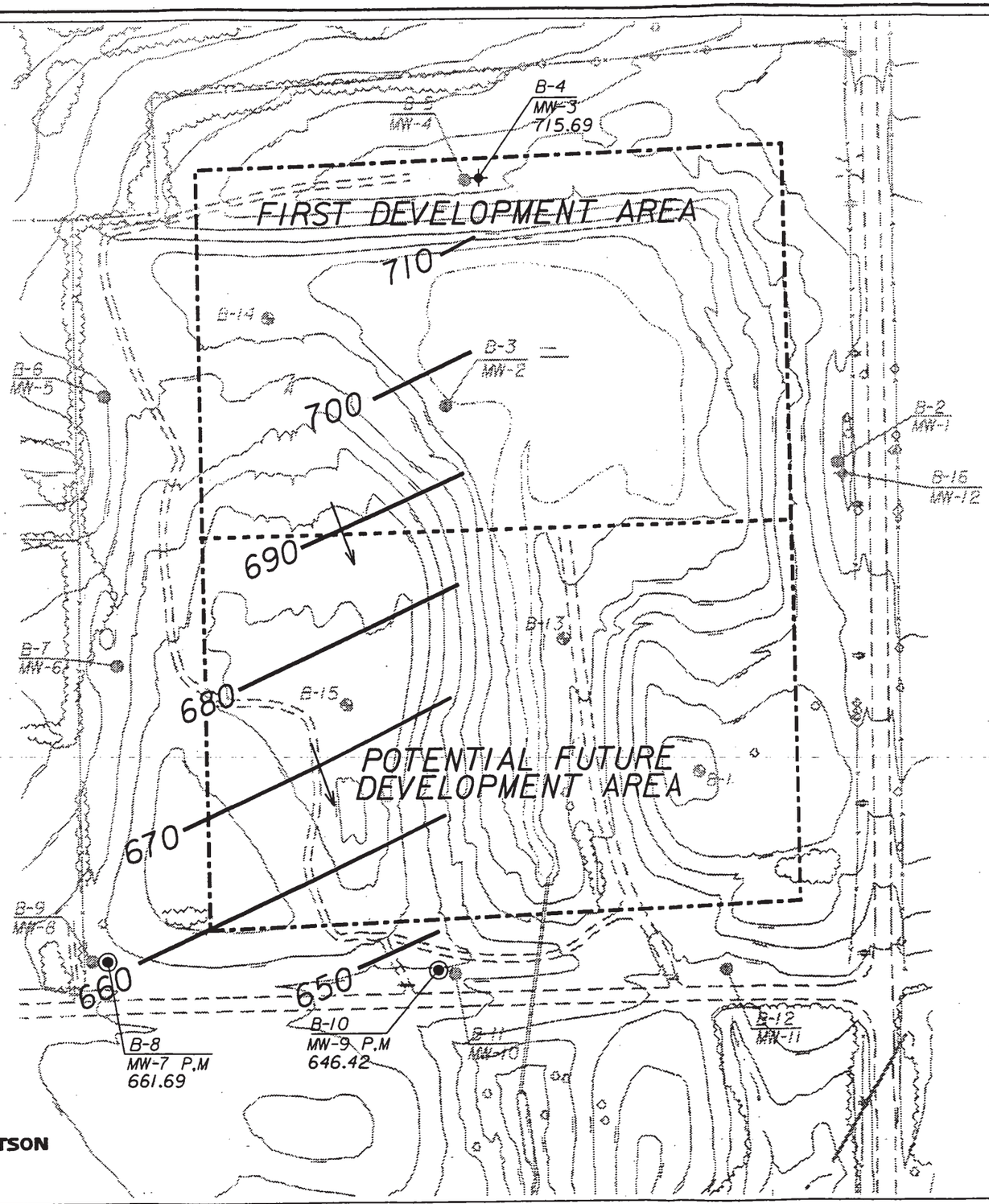

MONTGOMERY WATSON

N

0 - 200

SCALE IN FEET

LEGEND:

- BORING
- DEEP MONITORING WELL
- MULTIPLE-CASED DEEP WELL
- SHALLOW MONITORING WELL
- PROPOSED LANDFILL BOUNDARY
- 661.69 POTENTIOMETRIC SURFACE ELEVATION ON 03-02-94
- INFERRED DIRECTION OF GROUNDWATER FLOW

NOTES:

1. CONTOUR INTERVAL = 10 FT.
2. ALL ELEVATIONS ARE REFERENCED TO NGVD.

OTTUMWA-MIDLAND
DEVELOPMENT CORPORATION

POTENTIOMETRIC SURFACE CONTOURS – MISSISSIPPIAN (03-02-94)

FIGURE 4-18

APPENDIX C

Revised Laboratory Report – June 2016

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

February 21, 2018

Meghan Blodgett
SCS Engineers
2830 Dairy Drive
Madison, WI 53718

RE: Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

Dear Meghan Blodgett:
Enclosed are the analytical results for sample(s) received by the laboratory on June 25, 2016. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

Amended Report, Revision 1 on 2/21/18, Per 2/21/18 Jackie DeBruyne e-mail

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Trudy Gipson

Trudy Gipson
trudy.gipson@pacelabs.com
1(913)563-1405
Project Manager

Enclosures

cc: Tom Karwaski, SCS Engineers
Kyle Kramer, SCS Engineers
Jeff Maxted, Alliant Energy

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

CERTIFICATIONS

Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

Kansas Certification IDs

9608 Loiret Boulevard, Lenexa, KS 66219
WY STR Certification #: 2456.01
Arkansas Certification #: 17-016-0
Illinois Certification #: 200030
Iowa Certification #: 118
Kansas/NELAP Certification #: E-10116
Louisiana Certification #: 03055
Nevada Certification #: KS000212018-1
Oklahoma Certification #: 9205/9935
Texas Certification #: T104704407
Utah Certification #: KS00021
Kansas Field Laboratory Accreditation: # E-92587
Missouri Certification: 10070

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

SAMPLE SUMMARY

Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60222190001	**MW-301**	Water	06/22/16 12:30	06/25/16 08:50
60222190002	**MW-302**	Water	06/22/16 11:30	06/25/16 08:50
60222190003	**MW-303**	Water	06/22/16 10:15	06/25/16 08:50
60222190004	**MW-102M**	Water	06/22/16 17:15	06/25/16 08:50
60222190005	**MW-122M**	Water	06/23/16 08:00	06/25/16 08:50
60222190006	**FIELD BLANK**	Water	06/22/16 12:10	06/25/16 08:50

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

SAMPLE ANALYTE COUNT

Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60222190001	**MW-301**	EPA 6010	NDJ	3	PASI-K
		EPA 6020	SMW	11	PASI-K
		EPA 7470	ZBM	1	PASI-K
		SM 2540C	HAC	1	PASI-K
		EPA 9040	LDB	1	PASI-K
		EPA 9056	OL	3	PASI-K
60222190002	**MW-302**	EPA 6010	NDJ	3	PASI-K
		EPA 6020	SMW	11	PASI-K
		EPA 7470	ZBM	1	PASI-K
		SM 2540C	HAC	1	PASI-K
		EPA 9040	LDB	1	PASI-K
		EPA 9056	OL	3	PASI-K
60222190003	**MW-303**	EPA 6010	NDJ	3	PASI-K
		EPA 6020	SMW	11	PASI-K
		EPA 7470	ZBM	1	PASI-K
		SM 2540C	HAC	1	PASI-K
		EPA 9040	LDB	1	PASI-K
		EPA 9056	OL	3	PASI-K
60222190004	**MW-102M**	EPA 6010	NDJ	3	PASI-K
		EPA 6020	SMW	11	PASI-K
		EPA 7470	ZBM	1	PASI-K
		SM 2540C	HAC	1	PASI-K
		EPA 9040	LDB	1	PASI-K
		EPA 9056	OL	3	PASI-K
60222190005	**MW-122M**	EPA 6010	NDJ	3	PASI-K
		EPA 6020	SMW	11	PASI-K
		EPA 7470	ZBM	1	PASI-K
		SM 2540C	HAC	1	PASI-K
		EPA 9040	LDB	1	PASI-K
		EPA 9056	OL	3	PASI-K
60222190006	**FIELD BLANK**	EPA 6010	NDJ	3	PASI-K
		EPA 6020	SMW	11	PASI-K
		EPA 7470	ZBM	1	PASI-K
		SM 2540C	HAC	1	PASI-K
		EPA 9040	LDB	1	PASI-K
		EPA 9056	OL	3	PASI-K

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

ANALYTICAL RESULTS

Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

Sample: MW-301 **Lab ID: 60222190001** Collected: 06/22/16 12:30 Received: 06/25/16 08:50 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Boron	**1860**	ug/L	100	50.0	1	06/27/16 16:30	06/28/16 15:53	7440-42-8	
Calcium	**472**	mg/L	0.10	0.0081	1	06/27/16 16:30	06/28/16 15:53	7440-70-2	M1
Lithium	**268**	ug/L	10.0	4.9	1	06/27/16 16:30	06/28/16 15:53	7439-93-2	
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3010								
Antimony	ND	ug/L	2.0	0.12	2	06/27/16 16:30	06/30/16 11:00	7440-36-0	D3
Arsenic	**0.84J**	ug/L	2.0	0.21	2	06/27/16 16:30	06/30/16 11:00	7440-38-2	
Barium	**26.6**	ug/L	5.0	0.69	5	06/27/16 16:30	06/28/16 14:21	7440-39-3	
Beryllium	ND	ug/L	1.5	0.24	3	06/27/16 16:30	06/30/16 13:44	7440-41-7	
Cadmium	ND	ug/L	1.0	0.058	2	06/27/16 16:30	06/30/16 11:00	7440-43-9	D3
Chromium	ND	ug/L	2.0	0.68	2	06/27/16 16:30	06/30/16 11:00	7440-47-3	D3
Cobalt	ND	ug/L	2.0	1.0	2	06/27/16 16:30	06/30/16 11:00	7440-48-4	D3
Lead	ND	ug/L	5.0	0.96	5	06/27/16 16:30	06/28/16 14:21	7439-92-1	D3
Molybdenum	**2.0J**	ug/L	2.0	0.21	2	06/27/16 16:30	06/30/16 11:00	7439-98-7	B
Selenium	ND	ug/L	2.0	0.37	2	06/27/16 16:30	06/30/16 11:00	7782-49-2	D3
Thallium	ND	ug/L	5.0	2.5	5	06/27/16 16:30	06/28/16 14:21	7440-28-0	D3
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470								
Mercury	ND	ug/L	0.20	0.039	1	06/28/16 16:45	06/29/16 12:00	7439-97-6	
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**5380**	mg/L	5.0	5.0	1		06/28/16 10:28		
9040 pH	Analytical Method: EPA 9040								
pH	**6.2**	Std. Units	0.10	0.10	1		06/27/16 09:00		H6
9056 IC Anions	Analytical Method: EPA 9056								
Chloride	**112**	mg/L	10.0	5.0	10		07/03/16 15:17	16887-00-6	
Fluoride	**0.38**	mg/L	0.20	0.073	1		07/02/16 19:19	16984-48-8	
Sulfate	**5370**	mg/L	500	124	500		07/03/16 15:46	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

ANALYTICAL RESULTS

Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

Sample: MW-302 **Lab ID: 60222190002** Collected: 06/22/16 11:30 Received: 06/25/16 08:50 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Boron	**796**	ug/L	100	50.0	1	06/27/16 16:30	06/28/16 16:13	7440-42-8	
Calcium	**56.6**	mg/L	0.10	0.0081	1	06/27/16 16:30	06/28/16 16:13	7440-70-2	
Lithium	**81.2**	ug/L	10.0	4.9	1	06/27/16 16:30	06/28/16 16:13	7439-93-2	
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3010								
Antimony	**0.15J**	ug/L	1.0	0.058	1	06/27/16 16:30	06/28/16 14:25	7440-36-0	B
Arsenic	**0.39J**	ug/L	1.0	0.10	1	06/27/16 16:30	06/28/16 14:25	7440-38-2	
Barium	**45.4**	ug/L	1.0	0.14	1	06/27/16 16:30	06/28/16 14:25	7440-39-3	
Beryllium	**0.16J**	ug/L	0.50	0.080	1	06/27/16 16:30	06/30/16 13:12	7440-41-7	
Cadmium	ND	ug/L	0.50	0.029	1	06/27/16 16:30	06/28/16 14:25	7440-43-9	
Chromium	**6.2**	ug/L	1.0	0.34	1	06/27/16 16:30	06/28/16 14:25	7440-47-3	
Cobalt	**1.1**	ug/L	1.0	0.50	1	06/27/16 16:30	06/28/16 14:25	7440-48-4	
Lead	**0.90J**	ug/L	1.0	0.19	1	06/27/16 16:30	06/28/16 14:25	7439-92-1	
Molybdenum	**0.49J**	ug/L	1.0	0.10	1	06/27/16 16:30	06/28/16 14:25	7439-98-7	B
Selenium	**0.39J**	ug/L	1.0	0.18	1	06/27/16 16:30	06/28/16 14:25	7782-49-2	
Thallium	ND	ug/L	1.0	0.50	1	06/27/16 16:30	06/28/16 14:25	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470								
Mercury	ND	ug/L	0.20	0.039	1	06/28/16 16:45	06/29/16 12:02	7439-97-6	
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**715**	mg/L	5.0	5.0	1		06/28/16 10:28		
9040 pH	Analytical Method: EPA 9040								
pH	**7.1**	Std. Units	0.10	0.10	1		06/27/16 09:00		H6
9056 IC Anions	Analytical Method: EPA 9056								
Chloride	**8.1**	mg/L	1.0	0.50	1		07/02/16 19:48	16887-00-6	
Fluoride	**1.0**	mg/L	0.20	0.073	1		07/02/16 19:48	16984-48-8	
Sulfate	**133**	mg/L	10.0	2.5	10		07/03/16 16:15	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

ANALYTICAL RESULTS

Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

Sample: MW-303 **Lab ID: 60222190003** Collected: 06/22/16 10:15 Received: 06/25/16 08:50 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Boron	**2430**	ug/L	100	50.0	1	06/27/16 16:30	06/28/16 16:15	7440-42-8	
Calcium	**462**	mg/L	0.10	0.0081	1	06/27/16 16:30	06/28/16 16:15	7440-70-2	
Lithium	**270**	ug/L	10.0	4.9	1	06/27/16 16:30	06/28/16 16:15	7439-93-2	
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3010								
Antimony	ND	ug/L	1.0	0.058	1	06/27/16 16:30	06/30/16 11:09	7440-36-0	
Arsenic	**0.30J**	ug/L	1.0	0.10	1	06/27/16 16:30	06/30/16 11:09	7440-38-2	
Barium	**47.6**	ug/L	5.0	0.69	5	06/27/16 16:30	06/28/16 14:38	7440-39-3	
Beryllium	ND	ug/L	1.5	0.24	3	06/27/16 16:30	06/30/16 13:46	7440-41-7	D3
Cadmium	ND	ug/L	0.50	0.029	1	06/27/16 16:30	06/30/16 11:09	7440-43-9	
Chromium	**3.1**	ug/L	1.0	0.34	1	06/27/16 16:30	06/30/16 11:09	7440-47-3	
Cobalt	**1.6**	ug/L	1.0	0.50	1	06/27/16 16:30	06/30/16 11:09	7440-48-4	
Lead	**1.6J**	ug/L	5.0	0.96	5	06/27/16 16:30	06/28/16 14:38	7439-92-1	
Molybdenum	**0.38J**	ug/L	1.0	0.10	1	06/27/16 16:30	06/30/16 11:09	7439-98-7	B
Selenium	**0.38J**	ug/L	1.0	0.18	1	06/27/16 16:30	06/30/16 11:09	7782-49-2	
Thallium	ND	ug/L	5.0	2.5	5	06/27/16 16:30	06/28/16 14:38	7440-28-0	D3
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470								
Mercury	ND	ug/L	0.20	0.039	1	06/28/16 16:45	06/29/16 12:05	7439-97-6	
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**7120**	mg/L	5.0	5.0	1		06/28/16 10:30		
9040 pH	Analytical Method: EPA 9040								
pH	**6.2**	Std. Units	0.10	0.10	1		06/27/16 09:00		H6
9056 IC Anions	Analytical Method: EPA 9056								
Chloride	**11.5**	mg/L	1.0	0.50	1		07/02/16 20:03	16887-00-6	
Fluoride	**0.47**	mg/L	0.20	0.073	1		07/02/16 20:03	16984-48-8	
Sulfate	**4690**	mg/L	500	124	500		07/03/16 16:30	14808-79-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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Lenexa, KS 66219
(913)599-5665

ANALYTICAL RESULTS

Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

Sample: MW-102M **Lab ID: 60222190004** Collected: 06/22/16 17:15 Received: 06/25/16 08:50 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Boron	**1440**	ug/L	100	50.0	1	06/27/16 16:30	06/28/16 16:18	7440-42-8	
Calcium	**147**	mg/L	0.10	0.0081	1	06/27/16 16:30	06/28/16 16:18	7440-70-2	
Lithium	**80.7**	ug/L	10.0	4.9	1	06/27/16 16:30	06/28/16 16:18	7439-93-2	
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3010								
Antimony	**0.19J**	ug/L	1.0	0.058	1	06/27/16 16:30	06/28/16 14:43	7440-36-0	B
Arsenic	**0.68J**	ug/L	1.0	0.10	1	06/27/16 16:30	06/28/16 14:43	7440-38-2	
Barium	**39.5**	ug/L	1.0	0.14	1	06/27/16 16:30	06/28/16 14:43	7440-39-3	
Beryllium	**1.4**	ug/L	1.0	0.16	2	06/27/16 16:30	06/30/16 13:47	7440-41-7	
Cadmium	**0.12J**	ug/L	0.50	0.029	1	06/27/16 16:30	06/28/16 14:43	7440-43-9	
Chromium	**17.9**	ug/L	1.0	0.34	1	06/27/16 16:30	06/28/16 14:43	7440-47-3	
Cobalt	**4.5**	ug/L	1.0	0.50	1	06/27/16 16:30	06/28/16 14:43	7440-48-4	
Lead	**3.6**	ug/L	1.0	0.19	1	06/27/16 16:30	06/28/16 14:43	7439-92-1	
Molybdenum	**10.3**	ug/L	1.0	0.10	1	06/27/16 16:30	06/28/16 14:43	7439-98-7	
Selenium	**1.0**	ug/L	1.0	0.18	1	06/27/16 16:30	06/28/16 14:43	7782-49-2	
Thallium	ND	ug/L	1.0	0.50	1	06/27/16 16:30	06/28/16 14:43	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470								
Mercury	ND	ug/L	0.20	0.039	1	06/28/16 16:45	06/29/16 12:07	7439-97-6	
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**1530**	mg/L	5.0	5.0	1		06/28/16 10:30		
9040 pH	Analytical Method: EPA 9040								
pH	**7.9**	Std. Units	0.10	0.10	1		06/27/16 09:00		H6
9056 IC Anions	Analytical Method: EPA 9056								
Chloride	**13.8**	mg/L	1.0	0.50	1		07/02/16 20:18	16887-00-6	
Fluoride	**4.2**	mg/L	0.20	0.073	1		07/02/16 20:18	16984-48-8	
Sulfate	**350**	mg/L	50.0	12.4	50		07/03/16 16:45	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

Sample: MW-122M **Lab ID: 60222190005** Collected: 06/23/16 08:00 Received: 06/25/16 08:50 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Boron	**1720**	ug/L	100	50.0	1	06/27/16 16:30	06/28/16 16:20	7440-42-8	
Calcium	**312**	mg/L	0.10	0.0081	1	06/27/16 16:30	06/28/16 16:20	7440-70-2	
Lithium	**332**	ug/L	10.0	4.9	1	06/27/16 16:30	06/28/16 16:20	7439-93-2	
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3010								
Antimony	**1.0J**	ug/L	5.0	0.29	5	06/27/16 16:30	06/28/16 14:47	7440-36-0	B
Arsenic	ND	ug/L	5.0	0.52	5	06/27/16 16:30	06/28/16 14:47	7440-38-2	D3
Barium	**17.9**	ug/L	5.0	0.69	5	06/27/16 16:30	06/28/16 14:47	7440-39-3	
Beryllium	ND	ug/L	1.5	0.24	3	06/27/16 16:30	06/30/16 13:49	7440-41-7	D3
Cadmium	ND	ug/L	2.5	0.14	5	06/27/16 16:30	06/28/16 14:47	7440-43-9	D3
Chromium	ND	ug/L	5.0	1.7	5	06/27/16 16:30	06/28/16 14:47	7440-47-3	D3
Cobalt	**6.5**	ug/L	5.0	2.5	5	06/27/16 16:30	06/28/16 14:47	7440-48-4	
Lead	ND	ug/L	5.0	0.96	5	06/27/16 16:30	06/28/16 14:47	7439-92-1	D3
Molybdenum	**2.6J**	ug/L	5.0	0.52	5	06/27/16 16:30	06/28/16 14:47	7439-98-7	B
Selenium	ND	ug/L	5.0	0.92	5	06/27/16 16:30	06/28/16 14:47	7782-49-2	D3
Thallium	ND	ug/L	5.0	2.5	5	06/27/16 16:30	06/28/16 14:47	7440-28-0	D3
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470								
Mercury	ND	ug/L	0.20	0.039	1	06/28/16 16:45	06/29/16 12:09	7439-97-6	
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**7430**	mg/L	5.0	5.0	1		06/28/16 10:39		
9040 pH	Analytical Method: EPA 9040								
pH	**6.7**	Std. Units	0.10	0.10	1		06/27/16 09:00		H6
9056 IC Anions	Analytical Method: EPA 9056								
Chloride	**21.9**	mg/L	2.0	1.0	2		07/03/16 17:29	16887-00-6	
Fluoride	**0.89**	mg/L	0.20	0.073	1		07/02/16 20:33	16984-48-8	
Sulfate	**5330**	mg/L	500	124	500		07/03/16 17:44	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

Sample: FIELD BLANK **Lab ID: 60222190006** Collected: 06/22/16 12:10 Received: 06/25/16 08:50 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3010								
Boron	ND	ug/L	100	50.0	1	06/27/16 16:30	06/28/16 16:23	7440-42-8	
Calcium	**0.035J**	mg/L	0.10	0.0081	1	06/27/16 16:30	06/28/16 16:23	7440-70-2	
Lithium	ND	ug/L	10.0	4.9	1	06/27/16 16:30	06/28/16 16:23	7439-93-2	
6020 MET ICPMS	Analytical Method: EPA 6020 Preparation Method: EPA 3010								
Antimony	**0.083J**	ug/L	1.0	0.058	1	06/27/16 16:30	06/28/16 14:51	7440-36-0	B
Arsenic	ND	ug/L	1.0	0.10	1	06/27/16 16:30	06/28/16 14:51	7440-38-2	
Barium	**0.16J**	ug/L	1.0	0.14	1	06/27/16 16:30	06/28/16 14:51	7440-39-3	B
Beryllium	ND	ug/L	0.50	0.080	1	06/27/16 16:30	06/30/16 13:18	7440-41-7	
Cadmium	ND	ug/L	0.50	0.029	1	06/27/16 16:30	06/28/16 14:51	7440-43-9	
Chromium	**0.45J**	ug/L	1.0	0.34	1	06/27/16 16:30	06/28/16 14:51	7440-47-3	
Cobalt	ND	ug/L	1.0	0.50	1	06/27/16 16:30	06/28/16 14:51	7440-48-4	
Lead	ND	ug/L	1.0	0.19	1	06/27/16 16:30	06/28/16 14:51	7439-92-1	
Molybdenum	**0.15J**	ug/L	1.0	0.10	1	06/27/16 16:30	06/28/16 14:51	7439-98-7	B
Selenium	ND	ug/L	1.0	0.18	1	06/27/16 16:30	06/28/16 14:51	7782-49-2	
Thallium	ND	ug/L	1.0	0.50	1	06/27/16 16:30	06/28/16 14:51	7440-28-0	
7470 Mercury	Analytical Method: EPA 7470 Preparation Method: EPA 7470								
Mercury	ND	ug/L	0.20	0.039	1	06/28/16 16:45	06/29/16 12:11	7439-97-6	
2540C Total Dissolved Solids	Analytical Method: SM 2540C								
Total Dissolved Solids	**16.0**	mg/L	5.0	5.0	1		06/28/16 10:31		
9040 pH	Analytical Method: EPA 9040								
pH	**6.1**	Std. Units	0.10	0.10	1		06/27/16 09:00		H6
9056 IC Anions	Analytical Method: EPA 9056								
Chloride	ND	mg/L	1.0	0.50	1		07/03/16 14:33	16887-00-6	
Fluoride	ND	mg/L	0.20	0.073	1		07/03/16 14:33	16984-48-8	
Sulfate	ND	mg/L	1.0	0.25	1		07/03/16 14:33	14808-79-8	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

QC Batch: 436477 Analysis Method: EPA 7470
QC Batch Method: EPA 7470 Analysis Description: 7470 Mercury
Associated Lab Samples: 60222190001, 60222190002, 60222190003, 60222190004, 60222190005, 60222190006

METHOD BLANK: 1784604 Matrix: Water
Associated Lab Samples: 60222190001, 60222190002, 60222190003, 60222190004, 60222190005, 60222190006

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	0.039	06/29/16 11:33	

LABORATORY CONTROL SAMPLE: 1784605

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	5	5.0	99	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1784606 1784607

Parameter	Units	60222250001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mercury	ug/L	0.81	5	5	5.0	4.9	84	81	75-125	3	20	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

QC Batch: 436302 Analysis Method: EPA 6010
QC Batch Method: EPA 3010 Analysis Description: 6010 MET
Associated Lab Samples: 60222190001, 60222190002, 60222190003, 60222190004, 60222190005, 60222190006

METHOD BLANK: 1783844 Matrix: Water
Associated Lab Samples: 60222190001, 60222190002, 60222190003, 60222190004, 60222190005, 60222190006

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Boron	ug/L	ND	100	50.0	06/28/16 15:50	
Calcium	mg/L	ND	0.10	0.0081	06/28/16 15:50	
Lithium	ug/L	ND	10.0	4.9	06/28/16 15:50	

LABORATORY CONTROL SAMPLE: 1783845

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	1000	964	96	80-120	
Calcium	mg/L	10	9.4	94	80-120	
Lithium	ug/L	1000	986	99	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1783846 1783847

Parameter	Units	60222190001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Boron	ug/L	1860	1000	1000	2910	2870	106	102	75-125	1	20	
Calcium	mg/L	472	10	10	494	489	216	171	75-125	1	20	M1
Lithium	ug/L	268	1000	1000	1370	1370	110	110	75-125	0	20	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

QC Batch: 436303 Analysis Method: EPA 6020
QC Batch Method: EPA 3010 Analysis Description: 6020 MET
Associated Lab Samples: 60222190001, 60222190002, 60222190003, 60222190004, 60222190005, 60222190006

METHOD BLANK: 1783848 Matrix: Water
Associated Lab Samples: 60222190001, 60222190002, 60222190003, 60222190004, 60222190005, 60222190006

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Antimony	ug/L	0.094J	1.0	0.058	06/28/16 14:12	
Arsenic	ug/L	ND	1.0	0.10	06/28/16 14:12	
Barium	ug/L	0.15J	1.0	0.14	06/28/16 14:12	
Beryllium	ug/L	ND	0.50	0.080	06/30/16 13:03	
Cadmium	ug/L	ND	0.50	0.029	06/28/16 14:12	
Chromium	ug/L	ND	1.0	0.34	06/28/16 14:12	
Cobalt	ug/L	ND	1.0	0.50	06/28/16 14:12	
Lead	ug/L	ND	1.0	0.19	06/28/16 14:12	
Molybdenum	ug/L	0.17J	1.0	0.10	06/28/16 14:12	
Selenium	ug/L	ND	1.0	0.18	06/28/16 14:12	
Thallium	ug/L	ND	1.0	0.50	06/28/16 14:12	

LABORATORY CONTROL SAMPLE: 1783849

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	ug/L	40	42.4	106	80-120	
Arsenic	ug/L	40	43.5	109	80-120	
Barium	ug/L	40	40.8	102	80-120	
Beryllium	ug/L	40	43.8	109	80-120	
Cadmium	ug/L	40	42.7	107	80-120	
Chromium	ug/L	40	42.6	106	80-120	
Cobalt	ug/L	40	41.9	105	80-120	
Lead	ug/L	40	40.2	100	80-120	
Molybdenum	ug/L	40	42.5	106	80-120	
Selenium	ug/L	40	43.3	108	80-120	
Thallium	ug/L	40	39.3	98	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1783850 1783851

Parameter	Units	60222190002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Antimony	ug/L	0.15J	40	40	40.7	41.4	101	103	75-125	2	20	
Arsenic	ug/L	0.39J	40	40	41.5	42.5	103	105	75-125	2	20	
Barium	ug/L	45.4	40	40	86.7	87.8	103	106	75-125	1	20	
Beryllium	ug/L	0.16J	40	40	33.9	34.1	84	85	75-125	0	20	
Cadmium	ug/L	ND	40	40	40.7	41.3	102	103	75-125	1	20	
Chromium	ug/L	6.2	40	40	48.0	48.8	105	106	75-125	2	20	
Cobalt	ug/L	1.1	40	40	41.1	41.7	100	102	75-125	1	20	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1783850 1783851

Parameter	Units	60222190002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Lead	ug/L	0.90J	40	40	43.9	44.3	107	109	75-125	1	20	
Molybdenum	ug/L	0.49J	40	40	40.5	42.2	100	104	75-125	4	20	
Selenium	ug/L	0.39J	40	40	37.8	38.8	94	96	75-125	3	20	
Thallium	ug/L	ND	40	40	41.6	42.7	104	107	75-125	2	20	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

QC Batch: 436352 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60222190001, 60222190002

METHOD BLANK: 1784036 Matrix: Water
Associated Lab Samples: 60222190001, 60222190002

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	5.0	5.0	06/28/16 10:17	

LABORATORY CONTROL SAMPLE: 1784037

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	994	99	80-120	

SAMPLE DUPLICATE: 1784038

Parameter	Units	60222217003 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	2990	3020	1	10	

SAMPLE DUPLICATE: 1784039

Parameter	Units	60222138001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	1570	1580	0	10	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

QC Batch: 436354 Analysis Method: SM 2540C
QC Batch Method: SM 2540C Analysis Description: 2540C Total Dissolved Solids
Associated Lab Samples: 60222190003, 60222190004, 60222190005, 60222190006

METHOD BLANK: 1784043 Matrix: Water
Associated Lab Samples: 60222190003, 60222190004, 60222190005, 60222190006

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Total Dissolved Solids	mg/L	ND	5.0	5.0	06/28/16 10:29	

LABORATORY CONTROL SAMPLE: 1784044

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Total Dissolved Solids	mg/L	1000	962	96	80-120	

SAMPLE DUPLICATE: 1784045

Parameter	Units	60222267002 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	2130	2120	0	10	

SAMPLE DUPLICATE: 1784046

Parameter	Units	60222021001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Dissolved Solids	mg/L	1450	1440	1	10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

QUALITY CONTROL DATA

Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

QC Batch: 436165 Analysis Method: EPA 9040
QC Batch Method: EPA 9040 Analysis Description: 9040 pH
Associated Lab Samples: 60222190001, 60222190002, 60222190003, 60222190004, 60222190005, 60222190006

SAMPLE DUPLICATE: 1783487

Parameter	Units	60222190003 Result	Dup Result	RPD	Max RPD	Qualifiers
pH	Std. Units	6.2	6.1	0	10	H6

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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(913)599-5665

QUALITY CONTROL DATA

Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

QC Batch: 437069 Analysis Method: EPA 9056
QC Batch Method: EPA 9056 Analysis Description: 9056 IC Anions
Associated Lab Samples: 60222190001, 60222190002, 60222190003, 60222190004, 60222190005

METHOD BLANK: 1787659 Matrix: Water
Associated Lab Samples: 60222190001, 60222190002, 60222190003, 60222190004, 60222190005

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	0.50	07/02/16 17:34	
Fluoride	mg/L	ND	0.20	0.073	07/02/16 17:34	

LABORATORY CONTROL SAMPLE: 1787660

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.8	96	80-120	
Fluoride	mg/L	2.5	2.4	95	80-120	

SAMPLE DUPLICATE: 1787663

Parameter	Units	60222190001 Result	Dup Result	RPD	Max RPD	Qualifiers
Fluoride	mg/L	0.38	0.40	6	15	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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Lenexa, KS 66219
(913)599-5665

QUALITY CONTROL DATA

Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

QC Batch: 437083 Analysis Method: EPA 9056
QC Batch Method: EPA 9056 Analysis Description: 9056 IC Anions
Associated Lab Samples: 60222190001, 60222190002, 60222190003, 60222190004, 60222190005, 60222190006

METHOD BLANK: 1787896 Matrix: Water
Associated Lab Samples: 60222190001, 60222190002, 60222190003, 60222190004, 60222190005, 60222190006

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Chloride	mg/L	ND	1.0	0.50	07/03/16 12:50	
Fluoride	mg/L	ND	0.20	0.073	07/03/16 12:50	
Sulfate	mg/L	ND	1.0	0.25	07/03/16 12:50	

LABORATORY CONTROL SAMPLE: 1787897

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	5	4.8	95	80-120	
Fluoride	mg/L	2.5	2.5	99	80-120	
Sulfate	mg/L	5	5.1	102	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1787898 1787899

Parameter	Units	60222164001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	41.1	25	25	66.9	66.7	103	103	80-120	0	15	
Fluoride	mg/L	ND	12.5	12.5	12.8	12.8	98	98	80-120	0	15	
Sulfate	mg/L	61.6	25	25	89.5	89.1	111	110	80-120	0	15	

SAMPLE DUPLICATE: 1787922

Parameter	Units	60222190001 Result	Dup Result	RPD	Max RPD	Qualifiers
Chloride	mg/L	112	112	0	15	
Fluoride	mg/L	0.38	0.95J			
Sulfate	mg/L	5370	4750	12	15	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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(913)599-5665

QUALIFIERS

Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K	Pace Analytical Services - Kansas City

ANALYTE QUALIFIERS

B	Analyte was detected in the associated method blank.
D3	Sample was diluted due to the presence of high levels of non-target analytes or other matrix interference.
H6	Analysis initiated outside of the 15 minute EPA required holding time.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

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Lenexa, KS 66219
(913)599-5665

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Ottumwa Midland LF/25216073
Pace Project No.: 60222190

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60222190001	**MW-301**	EPA 3010	436302	EPA 6010	436337
60222190002	**MW-302**	EPA 3010	436302	EPA 6010	436337
60222190003	**MW-303**	EPA 3010	436302	EPA 6010	436337
60222190004	**MW-102M**	EPA 3010	436302	EPA 6010	436337
60222190005	**MW-122M**	EPA 3010	436302	EPA 6010	436337
60222190006	**FIELD BLANK**	EPA 3010	436302	EPA 6010	436337
60222190001	**MW-301**	EPA 3010	436303	EPA 6020	436339
60222190002	**MW-302**	EPA 3010	436303	EPA 6020	436339
60222190003	**MW-303**	EPA 3010	436303	EPA 6020	436339
60222190004	**MW-102M**	EPA 3010	436303	EPA 6020	436339
60222190005	**MW-122M**	EPA 3010	436303	EPA 6020	436339
60222190006	**FIELD BLANK**	EPA 3010	436303	EPA 6020	436339
60222190001	**MW-301**	EPA 7470	436477	EPA 7470	436523
60222190002	**MW-302**	EPA 7470	436477	EPA 7470	436523
60222190003	**MW-303**	EPA 7470	436477	EPA 7470	436523
60222190004	**MW-102M**	EPA 7470	436477	EPA 7470	436523
60222190005	**MW-122M**	EPA 7470	436477	EPA 7470	436523
60222190006	**FIELD BLANK**	EPA 7470	436477	EPA 7470	436523
60222190001	**MW-301**	SM 2540C	436352		
60222190002	**MW-302**	SM 2540C	436352		
60222190003	**MW-303**	SM 2540C	436354		
60222190004	**MW-102M**	SM 2540C	436354		
60222190005	**MW-122M**	SM 2540C	436354		
60222190006	**FIELD BLANK**	SM 2540C	436354		
60222190001	**MW-301**	EPA 9040	436165		
60222190002	**MW-302**	EPA 9040	436165		
60222190003	**MW-303**	EPA 9040	436165		
60222190004	**MW-102M**	EPA 9040	436165		
60222190005	**MW-122M**	EPA 9040	436165		
60222190006	**FIELD BLANK**	EPA 9040	436165		
60222190001	**MW-301**	EPA 9056	437069		
60222190001	**MW-301**	EPA 9056	437083		
60222190002	**MW-302**	EPA 9056	437069		
60222190002	**MW-302**	EPA 9056	437083		
60222190003	**MW-303**	EPA 9056	437069		
60222190003	**MW-303**	EPA 9056	437083		
60222190004	**MW-102M**	EPA 9056	437069		
60222190004	**MW-102M**	EPA 9056	437083		
60222190005	**MW-122M**	EPA 9056	437069		
60222190005	**MW-122M**	EPA 9056	437083		
60222190006	**FIELD BLANK**	EPA 9056	437083		

REPORT OF LABORATORY ANALYSIS

Pace Analytical
www.pacelabs.com

Sample Condition Upon Receipt

WO# : 60222190

60222190

Client Name: SCS

Optional
Proj Due Date:
Proj Name:

Courier: FedEx ☒ UPS ☐ VIA ☐ Clay ☐ PEX ☐ ECI ☐ Pace ☐ Other ☐ Client ☐

Tracking #: 7834 4170 1930 Pace Shipping Label Used? Yes ☐ No ☐

Custody Seal on Cooler/Box Present: Yes ☒ No ☐ Seals intact: Yes ☒ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☒ Other ☐

Thermometer Used: CF -0.1 T-239 / CF 0.0 T-262 **Type of Ice:** (Wet) Blue None (circle one) ☐ Samples received on ice, cooling process has begun.

Cooler Temperature: 0.8

Date and initials of person examining contents: JB 6/25

Temperature should be above freezing to 6°C

Chain of Custody present:	☒Yes ☐No ☐N/A	1.
Chain of Custody filled out:	☒Yes ☐No ☐N/A	2.
Chain of Custody relinquished:	☐Yes ☒No ☐N/A	3.
Sampler name & signature on COC:	☒Yes ☐No ☐N/A	4.
Samples arrived within holding time:	☒Yes ☐No ☐N/A	5.
Short Hold Time analyses (<72hr):	☒Yes ☐No ☐N/A	6. pH
Rush Turn Around Time requested:	☐Yes ☒No ☐N/A	7.
Sufficient volume:	☒Yes ☐No ☐N/A	8.
Correct containers used:	☒Yes ☐No ☐N/A	
Pace containers used:	☒Yes ☐No ☐N/A	9.
Containers intact:	☒Yes ☐No ☐N/A	10.
Unpreserved 5035A soils frozen w/in 48hrs?	☐Yes ☐No ☒N/A	11.
Filtered volume received for dissolved tests?	☐Yes ☐No ☒N/A	12.
Sample labels match COC:	☒Yes ☐No ☐N/A	
Includes date/time/ID/analyses Matrix: WT		13.
All containers needing preservation have been checked.	☒Yes ☐No ☐N/A	
All containers needing preservation are found to be in compliance with EPA recommendation.	☒Yes ☐No ☐N/A	14.
Exceptions: VOA, Coliform, O&G, WI-DRO (water)	☐Yes ☒No	Initial when completed / Lot # of added preservative
Trip Blank present:	☐Yes ☐No ☒N/A	
Pace Trip Blank lot # (if purchased):		15.
Headspace in VOA vials (>6mm):	☐Yes ☐No ☒N/A	16.
Project sampled in USDA Regulated Area:	☐Yes ☐No ☒N/A	17. List State:
Additional labels attached to 5035A vials in the field?	☐Yes ☐No ☒N/A	18.

Client Notification/ Resolution: Copy COC to Client? Y / (N) Field Data Required? Y / N

Person Contacted: _____ Date/Time: _____

Comments/ Resolution: _____

Project Manager Review: JMS Date: 6.27.16

Pace Analytical
www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: of

Section A Required Client Information:

Company:	SCS Engineers
Address:	2830 Dairy Drive
	Madison WI 53718
Email To:	mblodgett@scsengineers.com
Phone: 608-216-7362	Fax:
Requested Due Date/TAT:	

Section B Required Project Information:

Report To:	Meghan Blodgett
Copy To:	Tom Karwaski
Purchase Order No.:	
Project Name:	Ottumwa Midland Landfill
Project Number:	25216073

Section C Invoice Information:

Attention:	Meghan Blodgett/Jess Valcheff
Company Name:	SCS Engineers
Address:	
Pace Quote Reference:	
Pace Project Manager:	Trudy Gipson 913-563-1405
Pace Profile #:	6696 Line 2

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER _____

Site Location STATE: IA

Section D Required Client Information

SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
WIPE	WP
AIR	AR
OTHER	OT
TISSUE	TS

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	6010 Total Metals: B-Ca-Li	6020 Total Metals *	7470 Total Hg	9056 Chloride-Fluoride-Sulfate	2540C TDS	9040 pH	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D. 60222190
																		N	N	N						
1	MW-301	WT	G	xxx	xxx	6/22/16	12:30	MS	2	1		1						X	X	X	X	X	X			BP2N BP2N2.0 a1
2	MW-302	WT	G	xxx	xxx		11:30	MS	2	1		1						X	X	X	X	X	X			a2
3	MW-303	WT	G	xxx	xxx		10:15	MS	2	1		1						X	X	X	X	X	X			a3
4	MW-102M	WT	G	xxx	xxx		17:15	MS	2	1		1						X	X	X	X	X	X			a4
5	MW-122M	WT	G	xxx	xxx	6/23/16	8:00	MS	2	1		1						X	X	X	X	X	X			a5
6	FIELD BLANK	WT	G	xxx	xxx	6/22/16	12:10	—	2	1		1						X	X	X	X	X	X			a6
7																										
8																										
9																										
10																										
11																										
12																										

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
Ship To: 9608 Loiret Boulevard, Lenexa, KS 66219					6/25	0850	0.8	Y	Y	Y
* Sb-As-Ba-Be-Cd-Cr-Co-Pb-Mo-Se-Tl										

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Paul A. Grover

SIGNATURE of SAMPLER: Paul A. Grover DATE Signed (MM/DD/YY): 6/24/16

Temp in °C | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N)

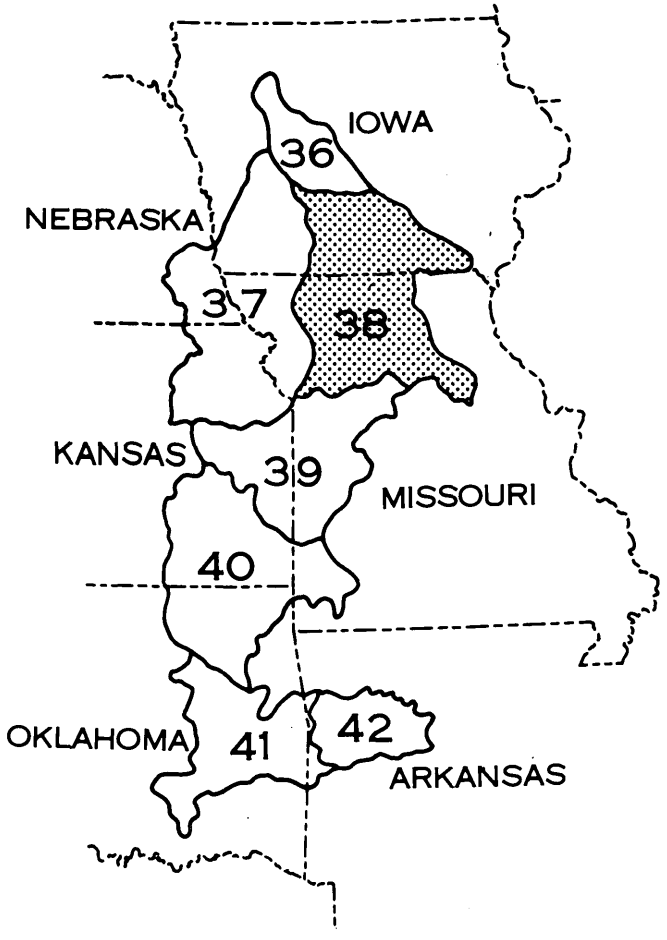
*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.07, 15-Feb-2007

APPENDIX D

USGS 1983 Open File Investigation – Mississippian Aquifer Groundwater Quality

HYDROLOGY OF AREA 38, WESTERN REGION, INTERIOR COAL PROVINCE IOWA AND MISSOURI



- CHARITON RIVER
- DES MOINES RIVER
- THOMPSON RIVER
- GRAND RIVER
- ELK FORK SALT RIVER

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER-RESOURCES INVESTIGATIONS
OPEN-FILE REPORT 82-1014

Chemical Quality of Water from Mississippian and Pennsylvanian Aquifers is Variable and Generally Not Potable

Dissolved-solids concentrations in water from the Mississippian aquifer ranged from 370 to 8,220 milligrams per liter and in water from the Pennsylvanian aquifer dissolved-solids concentrations ranged from 250 to 6,790 milligrams per liter; sulfate and sodium are the dominant ionic species in water from both aquifers.

The quality of water in the Mississippian and Pennsylvanian aquifers is variable from place to place, but the water generally is not potable. The areal extent of Mississippian and Pennsylvanian bedrock throughout Area 38 is significant (figure 7.3-1). Neither the Pennsylvanian nor the Mississippian aquifer is a significant source of potable water in Area 38. Limited data for bedrock wells make it difficult to adequately define the characteristics of bedrock water throughout Area 38; however a general data analysis has been provided.

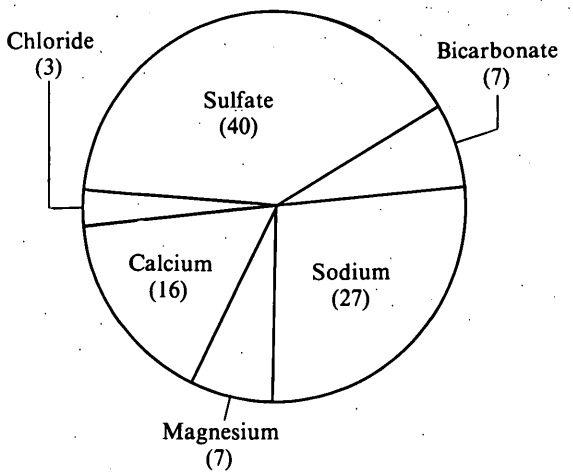
Minimum, maximum and average values for major chemical constituents in water from the Mississippian and Pennsylvanian aquifers are shown in tables 7.3-1 and 7.3-2. Ion-distribution diagrams are shown in figures 7.3-2 and 7.3-3 for both bedrock aquifers. These diagrams are designed to represent simultaneously the total solute concentration and the proportions assigned to each ionic species for a group of analyses.

Concentrations of dissolved solids averaged 3,140 mg/L (milligrams per liter) in water from wells completed in the Mississippian aquifer. The median pH was 7.2, and the average alkalinity was 345 mg/L. Sulfate concentrations ranged from 22 to 4,500 mg/L and sodium concentrations ranged from 6.8 to 2,660 mg/L. Sulfate and sodium are the dominant ionic species as they comprise 40 and 27 percent of the total solute concentration (93 milliequivalents per liter) in water from a typical well. Results of 70 chemical analyses of water from wells completed in the Mississippian aquifer in Iowa were used to compile figure 7.3-2.

The Mississippian aquifer is composed principally of carbonate rocks (limestone and dolomite). In Iowa, the aquifer can be divided into upper and lower units. The upper unit contains some gypsum and anhydrite beds that significantly affect the chemical quality of water (Cagle and Heinitz, 1978).

Concentrations of dissolved solids averaged 2,340 mg/L in water from wells completed in the Pennsylvanian aquifer. The median pH was 7.5 and the average alkalinity was 360 mg/L. Sulfate concentrations ranged from 1 to 4,000 mg/L and sodium concentrations ranged from 5.5 to 2,400 mg/L. Sodium and sulfate are the dominant ionic species as they comprise 35 and 31 percent of the total solute concentration (72 milliequivalents per liter) in water from a typical well. Results of 98 chemical analyses of water from wells completed in the Pennsylvanian aquifer, 76 in Iowa and 22 in Missouri, were used to compile figure 7.3-3.

The Pennsylvanian bedrock in Area 38 is composed predominately of impermeable shale beds, which are a regional confining bed that separates the surficial aquifer from underlying aquifers. However, limestone and sandstone beds are aquifers of local and subregional extent in parts of south-central Iowa (Cagle and Heinitz, 1978). Sources of the sodium and sulfate ions are ion exchange for sodium and pyrite for sulfate. Wells that penetrate clay and shale generally obtain water with excessive dissolved solids directly from the shale layers, which have large cation-exchange capabilities (Hem, 1970). Pyrite is commonly associated with biogenic deposits such as coal, which were deposited under extreme reducing conditions.



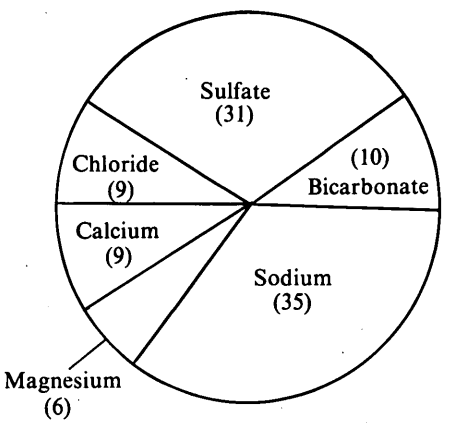
VALUES, IN PERCENTAGE OF TOTAL MILLEQUIVALENTS PER LITER

Figure 7.3-2 Average chemical composition for water from wells in the Mississippian aquifer.

Table 7.3-1 Summary of water-quality data available for the Mississippian aquifer.

[Concentrations in milligrams per liter unless otherwise specified; < = less than]

Constituent	Range	Average	Number of samples
Iron (Fe)	0.02 - 50	6.3	70
Manganese (Mn)	0.01 - 1.4	0.17	70
Calcium (Ca)	10 - 642	279	70
Magnesium (Mg)	3.1 - 340	77	70
Sodium (Na)	6.8 - 2,660	584	70
Potassium (K)	0.2 - 45	14	68
Bicarbonate (HCO_3)	168 - 1,350	420	70
Sulfate (SO_4)	22 - 4,500	1,697	70
Chloride (Cl)	0.5 - 3,570	137	70
Nitrate (NO_3)	<0.1 - 150	4.5	70
pH	6.3 - 8.0	(median)7.2	66
Hardness ($CaCO_3$)	38 - 2,950	1,029	69
Alkalinity ($CaCO_3$)	138 - 1,100	345	70
Dissolved solids	370 - 8,220	3,138	66
Specific conductance (micromhos per centimeter at 25° Celsius)	370 - 9,000	3,850	63



VALUES, IN PERCENTAGE OF TOTAL MILLEQUIVALENTS PER LITER

Figure 7.3-3 Average chemical composition for water from wells in the Pennsylvanian aquifer.

Table 7.3-2 Summary of water-quality data available for the Pennsylvanian aquifer.

[Concentrations in milligrams per liter unless otherwise specified; < = less than]

Constituent	Range	Average	Number of samples
Iron (Fe)	0.01 - 22	2.5	96
Manganese (Mn)	0.01 - 2.3	0.16	95
Calcium (Ca)	2.4 - 460	133	97
Magnesium (Mg)	1.5 - 394	48	97
Sodium (Na)	5.5 - 2,400	574	96
Potassium (K)	0.9 - 38	8.5	84
Bicarbonate (HCO_3)	120 - 1,240	437	94
Sulfate (SO_4)	1 - 4,000	1,046	97
Chloride (Cl)	0.5 - 3,060	222	98
Nitrate (NO_3)	<0.1 - 200	4.3	97
pH	6.5 - 8.3	(median)7.5	95
Hardness ($CaCO_3$)	29 - 2,000	528	96
Alkalinity ($CaCO_3$)	98 - 1,080	360	98
Dissolved solids	250 - 6,790	2,339	98
Specific conductance (micromhos per centimeter at 25° Celsius)	350 - 7,700	3,075	75

B2 Alternative Source Demonstration, April 2018 Detection Monitoring

Alternative Source Demonstration
April 2018 Detection Monitoring

Ottumwa Midland Landfill
Ottumwa, Iowa

Prepared for:

SCS ENGINEERS

25216073.18 | October 31, 2018

2830 Dairy Drive
Madison, WI 53718-6751
608-224-2830

Table of Contents

Section Page

Tables

Figures

Appendix

I:\25216073.00\Reports\2018 ASD Report 2\181031_ASD_OML.docx

PE CERTIFICATION

I, Eric J. Nelson, hereby certify that that the information in this alternate source demonstration is accurate and meets the requirements of 40 CFR 257.94(e)(2). This certification is based on my review of the groundwater data and related site information available for the Ottumwa Midland Landfill. I am a duly licensed Professional Engineer under the laws of the State of Iowa.

10/31/2018

(signature) (date)

Eric J. Nelson

(printed or typed name)

License number 23136

My license renewal date is December 31, 2018.

Pages or sheets covered by this seal:
Alternative Source Demonstration April 2018
Detection Monitoring, Ottumwa Midland Landfill,
Ottumwa, Iowa

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1.0 INTRODUCTION

This Alternative Source Demonstration (ASD) was prepared to support compliance with the groundwater monitoring requirements of the "Coal Combustion Residuals (CCR) Final Rule" published by the U.S. 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), and subsequent amendments. Specifically, this report was prepared to fulfill the requirements of 40 CFR 257.94(e)(2). The applicable sections of the Rule are provided below in italics.

1.1 §257.94(E)(2) ALTERNATIVE SOURCE DEMONSTRATION REQUIREMENTS

The owner and operator may demonstrate that a source other than the CCR Unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase 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 statistically significant increase over background levels.

An ASD is completed when there are exceedances of one or more benchmarks established within the groundwater monitoring program. The ASD is completed to determine if any other sources are likely causes of the identified exceedance(s) of established benchmark(s) at the site. This ASD was performed in response to results indicating a statistically significant increase (SSI) over background levels during detection monitoring under the CCR Rule.

This ASD report is evaluating the SSI observed in the statistical evaluation of the April 2018 detection monitoring event at the Ottumwa Midland Landfill (OML). An ASD was previously prepared for this facility evaluating the SSIs observed in the statistical evaluation of the November 2017 detection monitoring event (SCS, 2018b). The November 2017 ASD (dated April 2018) concluded that several lines of evidence demonstrated the SSI reported for the chloride concentration in downgradient monitoring well MW-301 is likely due to naturally occurring chloride in the bedrock aquifer at OML.

As discussed in more detail in Section 4.2 of this ASD, the findings of the April 2018 monitoring event were consistent with those for the previous event.

1.2 SITE INFORMATION AND MAP

The OML facility is located at 15300 130th Street in Ottumwa, Wappello County, Iowa (Figure 1). OML is an active landfill, operating under Iowa Department of Natural Resources (IDNR) permit #90-SDP-8-92P.

The locations of the CCR Units and all background (or upgradient) and downgradient monitoring wells with identification numbers for the groundwater monitoring program are shown on **Figure 2**.

1.3 STATISTICALLY SIGNIFICANT INCREASES IDENTIFIED

The only SSI for the April 2018 monitoring event was for chloride at monitoring well MW-301. A summary of the April 2018 constituent concentrations and the established benchmark concentrations is provided in **Table 1**. The November 2017 results are also included for comparison.

The constituent concentrations with SSIs above the background concentrations are highlighted in the table.

1.4 OVERVIEW OF ASD

This ASD report includes:

- Background information (**Section 2.0**)
- Evaluation of potential that SSIs are due to methodology or analysis (**Section 3.0**)
- Evaluation of potential that SSIs are due to natural sources or man-made sources other than the CCR Units (**Section 4.0**)
- ASD conclusions (**Section 5.0**)
- Monitoring recommendations (**Section 6.0**)

The chloride results from background and compliance sampling under the CCR Rule are provided in **Table 2**. Complete laboratory reports for the background monitoring events and the November 2017 detection monitoring event were included in the 2017 Annual Groundwater Monitoring and Corrective Action Report for OML (SCS, 2018a). The April 2018 detection monitoring report was previously transmitted to IPL and will be included in the 2018 annual report due in January 2019.

2.0 BACKGROUND

To provide context for the ASD evaluation, the following background information is provided in this section of the report, prior to the ASD evaluation sections:

- Geologic and hydrogeologic setting
- CCR Rule monitoring system
- Other monitoring wells

A more detailed discussion of the background information for the site is provided in the ASD for the November 2017 event (SCS, 2018b).

2.1 REGIONAL GEOLOGY AND HYDROGEOLOGY

For the purposes of groundwater monitoring, the Mississippian limestone unit is considered to be the uppermost aquifer unit at the OML site as defined under 40 CFR 257.53 at OML. Devonian aged units underlay the Mississippian limestone and are composed of shale, dolomite, and limestone. Silurian dolomite underlays the Devonian shale, dolomite, and limestone.

The Des Moines River and associated alluvial aquifers are a major source of surface water and shallow groundwater in the area; however, the alluvial aquifer is not present at the OML site.

Unconsolidated deposits at the site consist of clays overlain by loess, which are not productive sources of groundwater. The uppermost Pennsylvanian bedrock unit is considered to be a regional aquitard. The Cambrian-Ordovician aquifer, comprised of dolomite and sandstone, is commonly the source of municipal and industrial high-capacity wells in the region (Coble, 1971).

Regional information indicates that groundwater flow within the Mississippian limestone is to the south-southeast.

2.2 CCR MONITORING SYSTEM

The groundwater monitoring system established under the CCR Rule consists of two upgradient (background) monitoring wells and three downgradient monitoring wells. The upgradient monitoring wells include MW-122M and MW-102M. The downgradient monitoring wells include MW-301, MW-302, and MW-303. The CCR Rule wells are installed in the upper portions of the Mississippian limestone aquifer. Well depths range from approximately 150.0 to 204.5 feet, measured from the top of the well casing.

2.3 OTHER MONITORING WELLS

Forty-two groundwater monitoring wells currently exist at OML as part of the monitoring system developed for the state monitoring program. The well locations are shown on **Figure 2**. These monitoring wells are used to monitor groundwater conditions at the site under the IDNR state monitoring program.

Monitoring wells for the state monitoring program are installed in the unconsolidated deposits and in the Pennsylvanian shale unit, which are not the uppermost aquifer as defined under 40 CFR 257.53. This shallow monitoring system includes water table wells, piezometers in the Pennsylvanian shale, and piezometers in the underlying Mississippian limestone. Well depths range from approximately 20 to 177 feet, measured from the top of the well casing.

2.4 GROUNDWATER FLOW DIRECTION

As discussed in the November 2017 ASD (dated April 2018), shallow groundwater flow at the water table appears to be controlled partially by the landfill underdrain system and partially by the top of the Pennsylvanian shale. Shallow groundwater, near the current fill area, flows toward the landfill and the sedimentation pond.

The April 2018 potentiometric surface map (**Figure 3**) shows groundwater flow to the south to southeast, consistent with previous potentiometric surface maps, and the regional groundwater flow. The groundwater elevations for the April 2018 sampling event are shown on **Table 3**.

3.0 METHODOLOGY AND ANALYSIS REVIEW

To evaluate the potential that an SSI is due to a source other than the regulated CCR Unit, SCS Engineers (SCS) used a two-step evaluation process. First, the sample collection, field and laboratory analysis, and statistical evaluation were reviewed to identify any potential error or analysis that led to exceedance of the benchmark. Second, potential alternative sources, including natural variation and man-made sources other than the CCR Unit, were evaluated. This section provides the findings of the methodology and analysis review. **Section 4.0** of this report addresses the potential alternative sources.

3.1 SAMPLING AND FIELD ANALYSIS REVIEW

Field notes and sampling results were reviewed to determine if any sampling error may have caused or contributed to the observed SSI for chloride. Potential field sampling errors or issues could include mislabeling of samples, improper sample handling, missed holding times, cross contamination during sampling, or other field error. Field blank sample results were also reviewed for any indication of potential contamination from sampling equipment or containers. Based on the review of the field notes and results, SCS did not identify any indication that the chloride SSI was due to a sampling error.

Because chloride is a laboratory parameter, there is little potential for a field analysis error to contribute to an SSI.

3.2 LABORATORY ANALYSIS REVIEW

Laboratory reports for the background monitoring for the April 2018 detection monitoring were reviewed to determine if any laboratory analysis error or issue may have caused or contributed to the observed SSI for chloride. The laboratory report review included reviewing the laboratory quality control flags and narrative, verifying that correct methods were used and desired detection limits were achieved, and checking the field and laboratory blank sample results.

Based on the review of the laboratory reports, SCS did not identify any indication that the chloride SSI was due to a laboratory analysis error. There were no laboratory quality control flags or issues identified in the laboratory report that affect the usability of the data for detection monitoring.

A time series plot of the analytical data for chloride was reviewed for any anomalous results that might indicate a possible sampling or laboratory error (e.g., dilution error or incorrect sample labeling). The time series plot is provided in **Appendix A**. The April 2018 chloride results for MW-301 are consistent with historical data.

3.3 STATISTICAL EVALUATION REVIEW

The review of the statistical results and methods include a quality control check of the following:

- Input analytical data vs. laboratory analytical reports
- Review of statistical method and outlier concentration lists for each monitoring well/CCR Unit

Based on the review of the statistical evaluation, SCS did not identify any errors or issues in the statistical evaluation that caused or contributed to the determination of an interwell SSI for chloride at well MW-301.

3.4 SUMMARY OF METHODOLOGY AND ANALYSIS REVIEW FINDINGS

In summary, there were no changes to the SSI determinations for the April 2018 monitoring event based on the methodology and analysis review, and no errors or issues causing or contributing to the reported chloride SSI were identified.

4.0 ALTERNATIVE SOURCES

This section of the report discusses the potential alternative sources for the chloride SSI at MW 301, identifies the most likely alternative source(s), and presents the lines of evidence indicating that an alternative source is the most likely cause of the observed SSI for chloride.

4.1 POTENTIAL CAUSES OF SSI

4.1.1 Natural Variation

The statistical analysis was completed using an interwell approach, comparing the April 2018 detection monitoring results to the Upper Prediction Limits (UPLs) calculated based on sampling of the background wells (MW-102 and MW-122M). If concentrations of a constituent that is naturally

present in the aquifer vary spatially, then the potential exists that the downgradient concentrations may be higher than upgradient concentrations due to natural variation.

Chloride is naturally present in the limestone aquifer based on observations of previous studies in the area. Based on regional and site information, discussed below, natural variation appears to be a likely cause of the chloride SSI for well MW-301.

4.1.2 Man-made Alternative Sources

Man-made alternative sources that could potentially contribute to the chloride SSI at MW-301 include on-site management of CCR leachate or contact water, or non-CCR sources such as road salt use, septic systems, or surrounding agricultural land use. Based on the depth to the Mississippian aquifer and the low permeability of the overlying Pennsylvanian shale, it does not appear likely that one or more of these man-made alternative sources is the cause of the chloride SSI.

4.2 LINES OF EVIDENCE

Each of these lines of evidence and the supporting data were discussed in detail in the ASD for the November 2017 detection monitoring event (SCS, 2018b). The lines of evidence are discussed briefly below, focusing on any updated information collected since the previous ASD, with references to the previous ASD for additional details.

4.2.1 Mississippian Limestone Aquifer Water Quality

Regional and site-specific information indicates that chloride concentrations in the Mississippian limestone aquifer are variable, and the concentrations detected in samples from MW-301 are well within the range of concentrations naturally present in the aquifer. The U.S. Geological Survey (USGS) Water completed an Open File Report 82-1014, Hydrology of Area 38, of the Western Region, Interior Coal Province of Iowa and Missouri. OML is located within the area of investigation, and a chapter from the report addressed water quality in the Mississippian limestone aquifer. The USGS investigation reported chloride concentrations ranging from 0.5 to 3,570 milligrams per liter (mg/L) for the limestone aquifer within the study area, with an average chloride concentration of 137 mg/L. The chloride concentration for MW-301 in the April 2018 detection monitoring event was 33.9 mg/L; therefore, the observed concentration for MW-301 was well below the average concentration of chloride in the limestone aquifer.

In background sampling performed for the Phase 1 expansion, four monitoring wells installed in the Mississippian aquifer were sampled in April 2013, prior to construction of the expansion. The wells included the two wells used as background wells for the CCR Rule monitoring system (MW-102M and MW-122M) and two additional wells in the Mississippian aquifer (MW-110M and MW-116M). The chloride results for the sample event ranged from 20 to 75.8 mg/L, with two of the four results exceeding the April 2018 chloride concentration at MW-301.

4.2.2 Leachate Versus Groundwater Concentrations

Although chloride exceeded the interwell SSI, other CCR indicator parameters such as boron, were not detected at concentrations exceeding background levels in the sample from MW-301. In recent samples from the leachate lagoon, boron and sulfate have typically been detected at concentrations at least an order of magnitude higher than the chloride concentration. Leachate and ash contact water are monitored under the state monitoring program for the landfill. See the October 2017 ASD for additional details (SCS, 2018b).

If leachate from the CCR landfill were the source of elevated chloride, then some increase in boron and sulfate relative to background would also be expected. The absence of other CCR indicator parameters with SSIs, or increasing concentration trends, suggests that the chloride SSI is due to natural variation rather than CCR disposal.

4.2.3 Overlying Pennsylvanian Shale Aquitard

The hydraulic conductivity of the Pennsylvanian shale aquitard overlying the Mississippian limestone aquifer is low, and there is limited hydrogeologic connection between the shallow groundwater and the aquifer. The lack of hydrogeologic connection is evidenced by large differences between water levels measured in wells in the unconsolidated deposits or Pennsylvanian shale and water levels measured in wells in the Mississippian limestone. Water levels in Mississippian aquifer monitoring wells MW-302 and MW-303 are approximately 40 feet below the water levels measured in adjacent Pennsylvanian shale monitoring wells MW-14 and MW-13.

4.2.4 Landfill Liner System

Both the original landfill and expansion Phase 1 have low permeability liners. The original landfill was lined with 4 feet of compacted fine-grained soil having a hydraulic conductivity of no more than 1×10^{-7} centimeters per second (cm/sec). Expansion Phase 1 has a composite liner system including 2 feet of compacted clay, a 60-mil high density polyethylene (HDPE) geomembrane, and a leachate collection drainage layer. The original landfill and expansion Phase 1 both have underdrain systems that collect groundwater below the liner and maintain separation between the water table and the liner.

4.2.5 Shallow Groundwater Monitoring Results

Monitoring results for the shallow groundwater below and adjacent to the landfill do not show elevated chloride concentrations. In the four monitoring wells sampled in the shallow hydrogeologic unit under the state monitoring program, the highest chloride concentrations were at upgradient well MW-1, which may be affected by road salt. Chloride concentrations in the remaining three shallow wells in the state program were below the April 2018 chloride concentrations in CCR compliance well MW-301. The groundwater samples collected from the underdrain system, which collects groundwater below the landfill liner, also had chloride concentrations below the level in the upgradient well (MW-1) and below the chloride concentrations in CCR compliance well MW-301 for the April 2018 events. Additional details regarding the shallow groundwater data were provided in the October 2017 ASD (SCS, 2018b).

5.0 ASD CONCLUSIONS

The lines of evidence discussed above regarding the SSI reported for the chloride concentration in downgradient monitoring well MW-301 demonstrate that the SSI is likely due to naturally occurring chloride in the limestone aquifer at the OML site.

6.0 SITE GROUNDWATER MONITORING RECOMMENDATIONS

In accordance with section 257.94(e)(2) of the CCR Rule, the OML site may continue with detection monitoring based on this ASD. This ASD report will be included in the 2018 Annual Report due January 31, 2019.

For future detection monitoring events, SCS recommends that the statistical method for evaluating chloride data at the three compliance wells be modified to an intrawell approach. This approach is appropriate for constituents which exhibit natural spatial variability, as has been documented for chloride at the OML facility.

7.0 REFERENCES

Coble, R.W., 1971, The Water Resources of Southeast Iowa, Iowa Geological Survey Water Atlas Number 4, 1971.

SCS Engineers, 2018a, 2017 Annual Groundwater Monitoring and Corrective Action Report, Ottumwa Midland Landfill, Ottumwa, IA, January 2018. (2018a)

SCS Engineers, 2018b, Alternative Source Demonstration November 2017 Detection Monitoring, Ottumwa Midland Landfill, Ottumwa, IA, April 2018. (2018b)

U.S. Environmental Protection Agency, 2015, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule, April 2015.

U.S. Geological Survey, 1983, Water Resources Investigations Open File Report 82-1014, Hydrogeology Area 38, Western Region, Interior Coal Province, Iowa and Missouri; Rolla, Missouri and Iowa City, Iowa, May 1983.

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Tables

Table 1. Detection Monitoring Results Summary - November 2017 & April 2018
IPL - Ottumwa Midland Landfill
Ottumwa, Iowa

Parameter Name	Units	Interwell Upper Prediction Limit (UPL)	Background Wells				Compliance Wells					
			MW-102M		MW-122M		MW-301		MW-302		MW-303	
			11/8/2017	4/18/2018	11/8/2017	4/18/2018	11/7/2017	4/18/2018	11/7/2017	4/18/2018	11/7/2017	4/18/2018
Boron	ug/L	5,220	1480	1550	5220	5560	1010	854	848	834	738	738
Calcium	mg/L	599	10.4	25.3	383	402	161	131	74	77.3	94.9	103
Chloride	mg/L	21.9	12.3	13.5	7.2	8	**28.9**	**33.9**	7.8	8.6	6.9	7.3
Fluoride	mg/L	6.31	4.6	4.5	0.5	<0.063	0.77	0.87	1.2	1	0.77	0.8
Field pH	Std. Units	8.63	8.16	8.34	6.16	6.65	6.56	7.09	7.41	7.8	6.96	7.32
Sulfate	mg/L	17,500	335	352	9440	10400	926	638	77.5	79.3	232	262
Total Dissolved Solids	mg/L	18,100	1410	1540	13400	14400	1760	1400	607	690	783	839

149 Statistically significant increase at compliance well

Notes:
1. UPL based on parametric prediction limit based on 1-of-2 resampling methodology for fluoride and pH.
2. UPL for boron, calcium, chloride, sulfate and total dissolved solids based on non-parametric prediction limit (highest background value). Optional resampling for chloride at MW-301 not performed.
3. UPLs calculated from background well results for April 2016 through November 2017.
4. Analytical laboratory reports provided in the 2017 Annual Groundwater Monitoring and Corrective Action Report.
5. The April 2018 Analytical laboratory report provided in the 2018 Annual Groundwater Monitoring and Corrective Action Report.

I:\25216073.00\Reports\2018 ASD Report 2\Tables\[OML ASD Tables_1,2,3.xlsx]Table 1. Detect Monit. Sum

Table 2. Chloride Analytical Results - CCR Detection Monitoring Program

IPL - Ottumwa Midland Landfill

Ottumwa, Iowa

Well Group	Well	Collection Date	Chloride (mg/L)
Background	MW-102M	5/4/2016	16.3
		6/22/2016	13.8
		8/10/2016	13.4
		10/26/2016	13
		1/18/2017	12.3
		4/20/2017	12.5
		6/21/2017	12.8
		8/22/2017	13.1
		11/8/2017	12.3
		4/18/2018	13.5
	MW-122M	5/5/2016	16.4
		6/23/2016	21.9
		8/10/2016	11.8
		10/26/2016	8.2
		1/18/2017	8.3
		4/20/2017	8
		6/21/2017	7.8
		8/22/2017	7.8
		11/8/2017	7.2
		4/18/2018	8
Compliance	MW-301	5/4/2016	42.4
		6/22/2016	112
		8/9/2016	46.6
		10/26/2016	43.4
		1/17/2017	32.6
		4/20/2017	58
		6/20/2017	38.9
		8/22/2017	40.8
		11/7/2017	28.9
		4/18/2018	33.9
	MW-302	5/4/2016	9.2
		6/22/2016	8.1
		8/10/2016	7.5
		10/26/2016	6
		1/17/2017	7.7
		4/19/2017	8
		6/20/2017	8
		8/22/2017	8.5
		11/7/2017	7.8
		4/18/2018	8.6

Table 2. Chloride Analytical Results - CCR Detection Monitoring Program
IPL - Ottumwa Midland Landfill
Ottumwa, Iowa

Well Group	Well	Collection Date	Chloride (mg/L)
Compliance	MW-303	5/4/2016	13.5
		6/22/2016	11.5
		8/9/2016	8.7
		10/26/2016	7.5
		1/17/2017	7.1
		4/19/2017	6.9
		7/19/2017	7.2
		8/22/2017	7.3
		11/7/2017	6.9
		4/18/2018	7.3

Abbreviations:
mg/L = milligrams per liter or parts per billion (ppm)

Notes:
April 2016 through October 2017 analytical laboratory reports provided in the 2017 Annual Groundwater Monitoring and Corrective Action Report. The April 2018 analytical laboratory report will be provided in the 2018 Annual Groundwater Monitoring and Correction Action Report.

Created by:	NDK	2/22/2018
Last revision by:	NDK	9/10/2018
Checked by:	AJR	9/10/2018

I:\25216073.00\Reports\2018 ASD Report 2\Tables\[OML ASD Tables_1,2,3.xlsx]Table 2 CCR Cl

Table 3. Groundwater Elevations – CCR Rule Monitoring Network

IPL - Ottumwa Midland Landfill
Ottumwa, Iowa

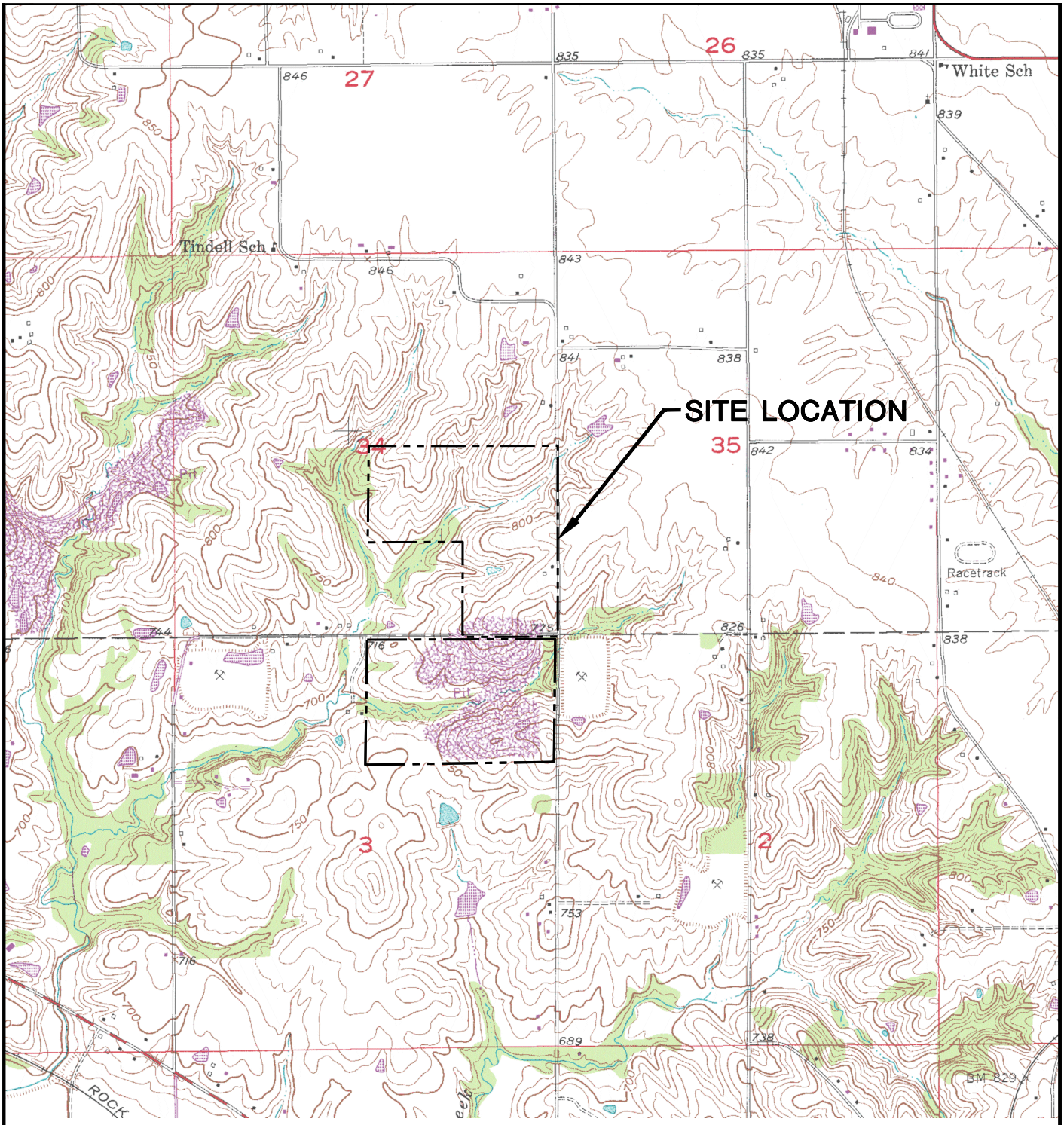
Well Number	Ground Water Elevation in feet above mean sea level (amsl)				
	MW-301	MW-302	MW-303	MW-102M	MW-122M
Top of Casing Elevation (feet amsl)	817.88	761.77	762.40	798.03	792.70
Screen Length (ft)	5.00	5.00	5.00	5.00	5.00
Total Depth (ft from top of casing)	204.50	157.70	150.00	152.10	155.30
Top of Well Screen Elevation (ft)	618.38	609.07	617.40	652.65	642.94
Measurement Date					
May 4, 2016	686.46	685.80	686.04	728.73	729.27
June 22, 2016	686.40	685.79	687.72	718.74	725.67
August 9, 2016	686.19	685.48	687.77	715.65	725.16
October 25-26, 2016	683.70	684.94	685.56	716.94	724.61
January 17, 2017	685.57	685.68	685.60	717.91	724.02
April 19-20, 2017	685.72	684.73	685.51	717.80	724.04
June 20-21, 2017	685.88	684.76	685.59	714.83	723.51
August 21-22, 2017	684.96	683.89	684.70	713.23	722.02
November 7-8, 2017	684.50	683.38	684.26	713.53	720.52
April 16-18, 2018	684.85	683.87	684.68	717.38	723.25
Bottom of Well Elevation (ft)	613.38	604.07	612.40	645.93	637.40

Notes:
NM = not measured
Water levels collected during Sample Collection

Created by: NDK Date: 2/21/2018
Last revision by: NDK Date: 9/10/2018
Checked by: AJR Date: 9/10/2018

I:\25216073.00\Reports\2018 ASD Report 2\Tables\[OML ASD Tables_1,2,3.xlsx]Table 3 CCR GW elevations

Figures



LEGEND

APPROXIMATE PROPERTY LINE

OTTUMWA NORTH QUADRANGLE
IOWA–WAPELLO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SW/4 OTTUMWA NORTH 15' QUADRANGLE
1976
SCALE: 1" = 2,000'

N

IOWA

CLIENT	INTERSTATE POWER AND LIGHT CO. 15300 130th STREET OTTUMWA, IA 52501	SITE	OTTUMWA MIDLAND LANDFILL OTTUMWA, IOWA

SITE LOCATION MAP

PROJECT NO.	25216073.00	DRAWN BY:	KP
DRAWN:	09/15/11	CHECKED BY:	MB
REVISED:	11/17/16	APPROVED BY:	TK 04/16/18

ENGINEER

SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

FIGURE 1

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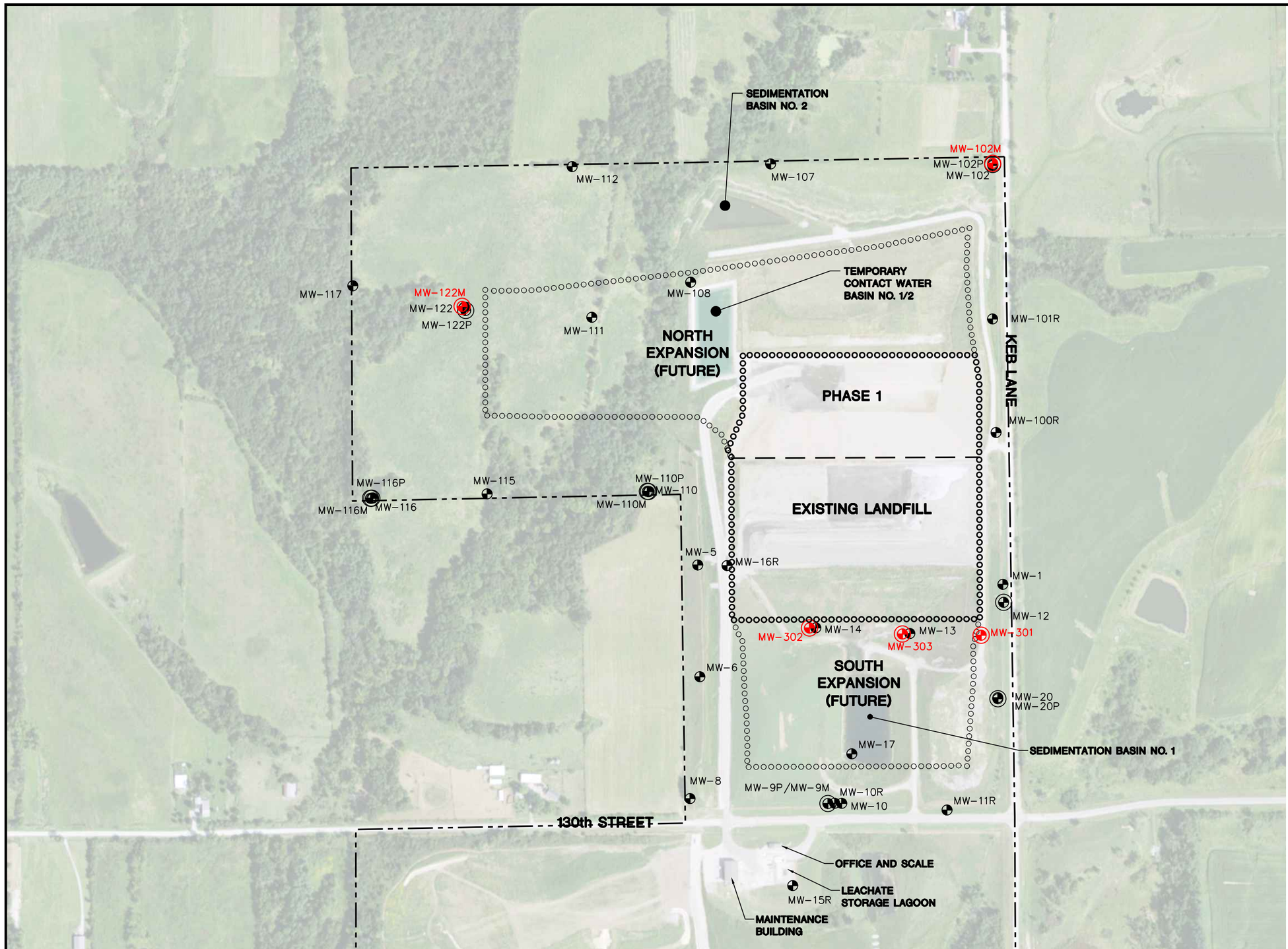


LEGEND

- APPROXIMATE PROPERTY LINE
- EXISTING WASTE LIMITS
- NORTH EXPANSION AREA
- MONITORING WELL
- PIEZOMETER
- CCR RULE PIEZOMETER

NOTES:

1. 2015 AERIAL PHOTOGRAPH IS FROM THE IOWA GEOGRAPHIC MAP SERVER–IOWA STATE UNIVERSITY GEOGRAPHIC INFORMATION SYSTEMS SUPPORT & RESEARCH FACILITY.
2. PROPERTY LINE SOUTH OF 130TH STREET FROM SURVEY MAP PREPARED BY GARDEN & ASSOCIATES, OSKALOOSA, IOWA, DATED DECEMBER 20, 1988.
3. PROPERTY LINE NORTH OF 130TH STREET FROM PLAT OF SURVEY MAP PREPARED BY SCS ENGINEERS, MADISON, WISCONSIN, DATED FEBRUARY 20, 2013.
4. EXISTING LIMITS OF WASTE ARE APPROXIMATE.
5. MONITORING WELLS MW–301 AND MW–302 WERE INSTALLED BY CASCADE DRILLING BETWEEN NOVEMBER 16, 2015, AND DECEMBER 3, 2015.
6. MONITORING WELL MW–303 WAS INSTALLED BY TEAM SERVICES BETWEEN APRIL 11, 2016 AND APRIL 26, 2016.
7. MONITORING WELLS MW–301 THROUGH MW–303 WERE SURVEYED BY FRENCH–RENEKER–ASSOCIATES ON MAY 19, 2016.

N

400 0 400

SCALE: 1" = 400'

PROJECT NO.	25216073.00	DRAWN BY:	BJM
DRAWN:	11/17/11	CHECKED BY:	NK
REVISED:	03/14/18	APPROVED BY:	TK 04/16/18

ENGINEER: SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718–6751
PHONE: (608) 224–2830

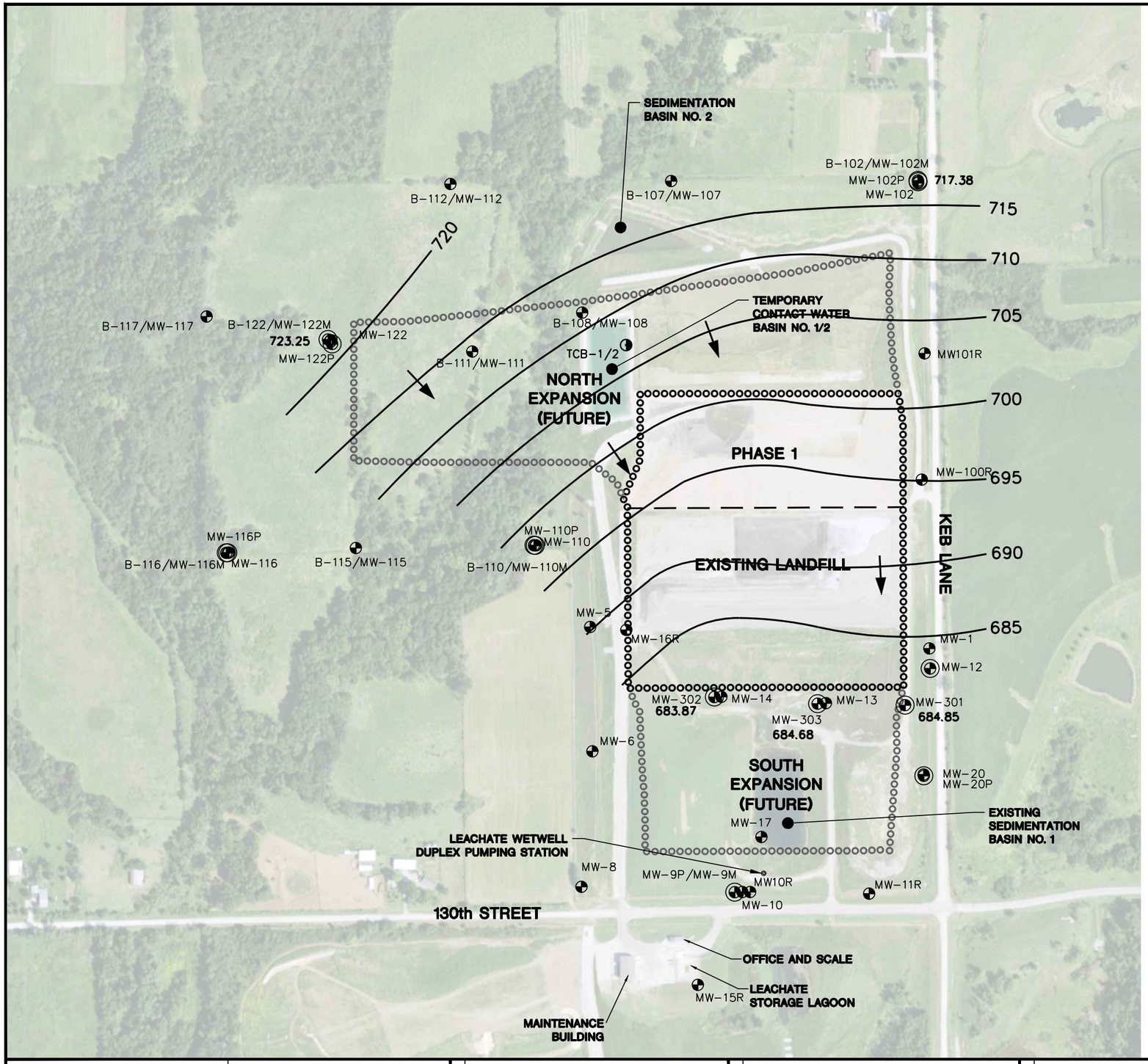
CLIENT: INTERSTATE POWER AND LIGHT CO.
15300 130th STREET
OTTUMWA, IA 52501

SITE: OTTUMWA MIDLAND LANDFILL
OTTUMWA, IOWA

MONITORING WELL LOCATION MAP

FIGURE 2

I:\25216073.00\Drawings\□□R R□□Pl□□□□ □□rs.dwg, 4/16/2018 6:45:37 AM



LEGEND

- APPROXIMATE PROPERTY LINE
- APPROVED WASTE LIMITS
- EXISTING WASTE LIMITS
- PHASE LIMIT
- EXISTING MONITORING WELL
- EXISTING PIEZOMETER
- TEMPORARY CONTACT WATER BASIN
- **684.85** WATER TABLE ELEVATION (APRIL 2018)
- POTENTIOMETRIC SURFACE CONTOUR (DASHED WHERE INFERRED)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTES:

1. 2015 AERIAL PHOTOGRAPH IS FROM THE IOWA GEOGRAPHIC MAP SERVER–IOWA STATE UNIVERSITY GEOGRAPHIC INFORMATION SYSTEMS SUPPORT & RESEARCH FACILITY.
2. PROPERTY LINE SOUTH OF 130TH STREET FROM SURVEY MAP PREPARED BY GARDEN & ASSOCIATES, OSKALOOSA, IOWA, DATED DECEMBER 20, 1988.
3. PROPERTY LINE NORTH OF 130TH STREET FROM PLAT OF SURVEY MAP PREPARED BY SCS ENGINEERS, MADISON, WISCONSIN, DATED FEBRUARY 20, 2013.
4. EXISTING LIMITS OF WASTE ARE APPROXIMATE.

N

400 0 400

SCALE: 1" = 400'

PROJECT NO.	25216073.18	DRAWN BY:	BSS/RJG
DRAWN:	09/11/18	CHECKED BY:	NK/SC
REVISED:	10/03/18	APPROVED BY:	TK

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SITE: OTTUMWA MIDLAND LANDFILL, OTTUMWA, IOWA

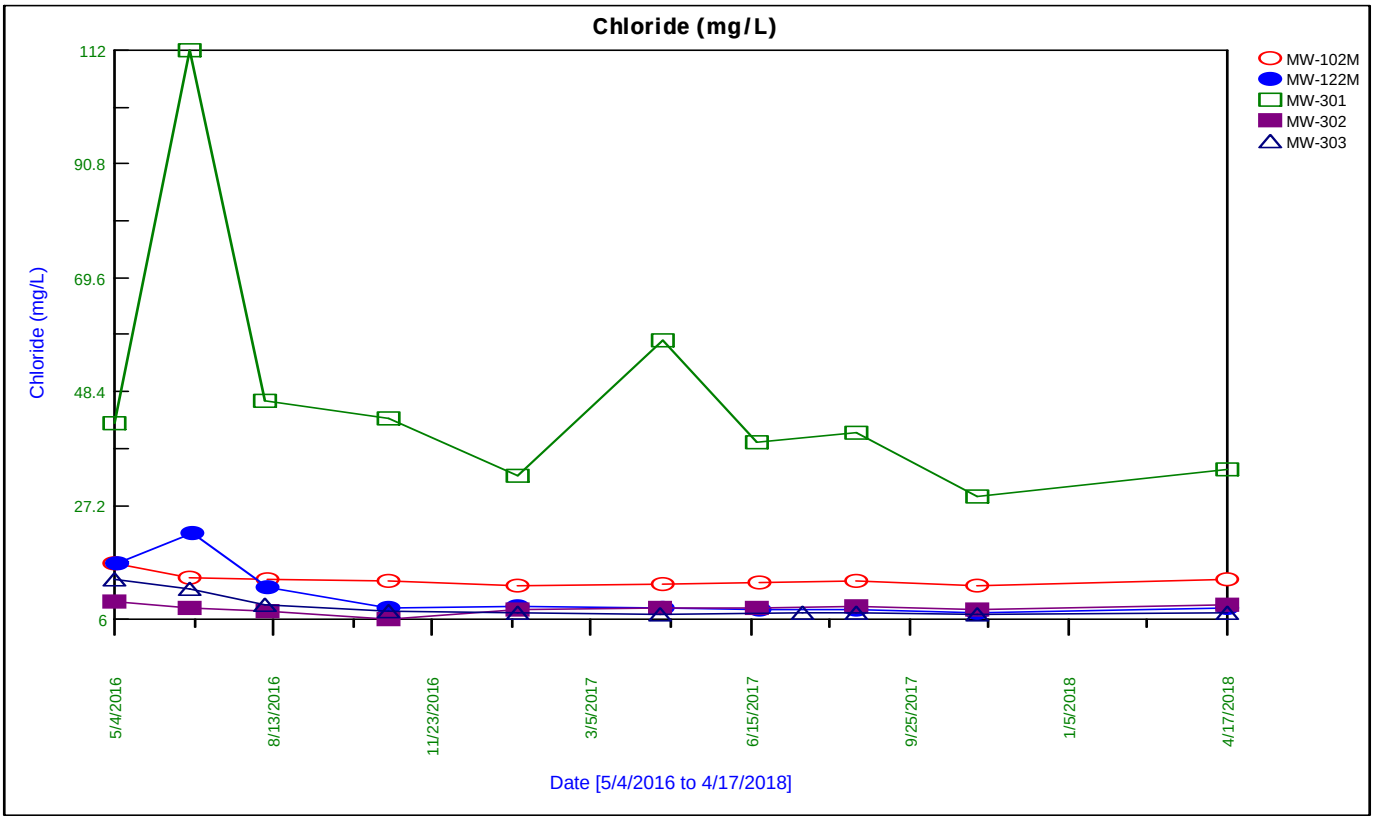
POTENTIOMETRIC SURFACE MAP APRIL 2018

FIGURE 3

I:\25216073.00\Drawings\WTBL-APRIL 2018.dwg, 10/16/2018 9:35:10 AM

Appendix A

CCR Well Trend Plot – Chloride


Chloride (mg/L)
112
90.8
69.6
48.4
27.2
6
Chloride (mg/L)
MW-102M
MW-122M
MW-301
MW-302
MW-303
5/4/2016
8/13/2016
11/23/2016
3/5/2017
6/15/2017
9/25/2017
1/5/2018
4/17/2018
Date [5/4/2016 to 4/17/2018]