2021 Annual Groundwater Monitoring and Corrective Action Report

Ottumwa Midland Landfill
Ottumwa, Iowa

Prepared for:

Alliant Energy

SCS ENGINEERS

25221073.00 | January 31, 2022

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OVERVIEW OF CURRENT STATUS

Ottumwa-Midland Landfill
2021 Annual Report

In accordance with §257.90(e)(6), this section at the beginning of the annual report provides an overview of the current status of groundwater monitoring and corrective action programs for the Coal Combustion Residual (CCR) unit. The groundwater monitoring system at the Ottumwa Midland Landfill (OML) monitors a single CCR unit. Supporting information is provided in the text of the annual report.

Category	Rule Requirement	Site Status
Monitoring Status – Start of Year	(i) At the start of the current annual reporting period, whether the CCR unit was operating under the detection monitoring program in §257.94 or the assessment monitoring program in §257.95;	Detection
Monitoring Status – End of Year	(ii) At the end of the current annual reporting period, whether the CCR unit was operating under the detection monitoring program in §257.94 or the assessment monitoring program in §257.95;	Detection
Statistically Significant Increases (SSIs)	(iii) If it was determined that there was a statistically significant increase over background for one or more constituents listed in appendix III to this part pursuant to §257.94(e):	
	(A) Identify those constituents listed in appendix III to this part and the names of the monitoring wells associated with such an increase; and	April 2021 No SSIs October 2021 No SSIs
	(B) Provide the date when the assessment monitoring program was initiated for the CCR unit.	Not applicable Assessment monitoring not required.

Category	Rule Requirement	Site Status
Statistically Significant Levels (SSL) Above Groundwater Protection Standard	(iv) If it was determined that there was a statistically significant level above the groundwater protection standard for one or more constituents listed in appendix IV to this part pursuant to §257.95(g) include all of the following:	Not applicable In detection monitoring
	(A) Identify those constituents listed in appendix IV to this part and the names of the monitoring wells associated with such an increase;	
	(B) Provide the date when the assessment of corrective measures was initiated for the CCR unit;	
	(C) Provide the date when the public meeting was held for the assessment of corrective measures for the CCR unit; and	
	(D) Provide the date when the assessment of corrective measures was completed for the CCR unit.	
Selection of Remedy	(v) Whether a remedy was selected pursuant to §257.97 during the current annual reporting period, and if so, the date of remedy selection; and	Not applicable In detection monitoring
Corrective Action	(vi) Whether remedial activities were initiated or are ongoing pursuant to §257.98 during the current annual reporting period.	Not applicable In detection monitoring

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1.0 INTRODUCTION

This 2021 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 2021 Annual Groundwater Monitoring and Corrective Action Report for the CCR Units.

This report covers the period of groundwater monitoring from January 1, 2021, through December 31, 2021.

The groundwater monitoring system at the Ottumwa Midland Landfill (OML) monitors a single CCR unit with two phases:

- OML Landfill & OML Landfill Expansion - Phase 1 (existing landfill)

The system is designed to detect monitored constituents in the uppermost aquifer at the waste boundary of OML as required by 40 CFR 257.91(d). The groundwater monitoring system consists of two upgradient and three downgradient monitoring wells.

2.0 BACKGROUND

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

- Geologic and hydrogeologic setting
- CCR Rule monitoring system

2.1 GEOLOGIC AND HYDROGEOLOGIC SETTING

2.1.1 Regional Information

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 (Montgomery Watson, 1994). A summary of the regional hydrogeologic stratigraphy is presented in **Appendix A**.

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).

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

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.

2.1.2 Site information

Unconsolidated soils at the site include clay, loam, silt loam, silty clay, sandy loam, and intermediate types. Where present, these soils are generally 5 to 7 feet thick. Pennsylvanian shales and Mississippian limestone underlie the unconsolidated soils. Soils encountered during the drilling and installation of the existing background wells MW-102M and MW-122M, were described as 10 to 11 feet of lean clay, overlying 126 to 129 feet of shale with intermittent stringers of sandstone and coal. The shale was underlain by Mississippian limestone at 138 to 139 feet below ground surface.

During drilling of CCR wells MW-301, MW-302, and MW-303, soils were described as 4 to 11 feet of clay and silt, overlying 112 to 173 feet of shale with intermittent stringers of sandstone and coal. The shale was underlain by Mississippian limestone at 116 to 168 feet below ground surface.

The boring logs for the landfill CCR monitoring wells are provided in Appendix B. All CCR monitoring wells are screened within the Mississippian bedrock unit.

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 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.

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. The potentiometric surface elevations and groundwater flow directions for the April 2021 monitoring event are shown on Figure 3, and the potentiometric surface elevations and groundwater flow directions for the October 2021 monitoring event are shown on Figure 4. The groundwater elevation data for the CCR monitoring wells are provided in Table 3. Calculated horizontal gradients and flow velocities for each of the flow paths are provided in Table 4.

2.2 CCR RULE MONITORING SYSTEM

The groundwater monitoring system established within the CCR Rule consists of two upgradient (background) monitoring wells and three downgradient monitoring wells (Table 1 and Figure 2). 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.

3.0 § 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:*

3.1 §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 location of the site is provided as **Figure 1.** The OML CCR units and all background (or upgradient) and downgradient monitoring wells with identification numbers for the groundwater monitoring program are shown on **Figure 2**.

3.2 §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 2021.

3.3 §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 semiannual groundwater sampling events were completed in 2021 for OML as part of ongoing detection monitoring.

Groundwater samples collected during the semiannual events, in April and October 2021, 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 2**.

The sampling results for Appendix III parameters in 2021 are summarized in **Tables 5.** Field parameter results for the 2021 sampling events are provided in **Table 6**. The results of the analytical laboratory analyses are provided in the laboratory reports in **Appendix C**. Historical results for each monitoring well are summarized in **Appendix D**.

3.4 § 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 2021. OML remained in the detection monitoring program.

In 2021, the monitoring results for the October 2020 and April 2021 monitoring events were evaluated for SSIs in detection monitoring parameters relative to background. For all parameters except chloride, the comparison to background was based on a prediction limit approach, comparing the results to interwell upper prediction limits (UPLs) based on background monitoring results from the upgradient wells (MW-122M and MW-102M). For chloride, the comparison to background used intrawell UPLs based on background monitoring results from the compliance wells (MW-301, MW-302, and MW-303). As described in the technical memorandum in **Appendix E**, interwell UPLs were initially used for all Appendix III parameters, but the site transitioned to intrawell evaluation for chloride beginning with the October 2018 monitoring event. The change in approach was implemented after determining that natural spatial variability was the most likely cause of chloride concentrations slightly above the interwell UPL in samples from well MW-301 in the November 2017 and April 2018 monitoring events. Evidence for this conclusion included local and regional monitoring data, the site geology, and the CCR unit construction, as described in more detail in the Alternative Source Demonstrations prepared for these events.

The interwell and intrawell UPLs were most recently updated in January 2021 using background data collected through October 2020 for interwell UPLs and through April 2020 for intrawell UPLs. The Unified Guidance for Statistical Analysis of Groundwater Monitoring Data at Recourse Conservation and Recovery Act (RCRA) Facilities (USEPA, 2009; Section 5.3.1) recommends periodic updating of background for both intrawell and interwell analyses. For semiannual monitoring, an update interval of 2 to 3 years is recommended. The UPL calculations are included in **Appendix E**. The UPLs calculated in January 2021 were applied to the evaluation of the October 2020 and April 2021 monitoring results.

No SSIs were identified based on the 2021 monitoring data evaluations.

3.5 § 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 2021 Annual Groundwater Monitoring and Corrective Action Report for OML.

3.5.1 § 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 October 2020 and April 2021 monitoring events.
- Two semiannual detection monitoring events (April and October 2021).

Description of Any Problems Encountered. No problems were encountered in 2021.

Discussion of Actions to Resolve the Problems. Not applicable.

Projection of Key Activities for the Upcoming Year (2022):

- Statistical evaluation and determination of any SSIs for the October 2021 and April 2022 monitoring events.

- If an SSI is determined, then within 90 days either:
  - Complete Alternative Source Demonstration (ASD) (if applicable), or
  - Establish an assessment monitoring program.

- Two semiannual groundwater sampling and analysis events (April and October 2022).

3.5.2 § 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.

3.5.3 § 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.

Not applicable. No ASDs were completed in 2021.

3.5.4 § 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.

3.5.5 § 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.

3.5.6 § 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.

3.5.7 § 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.

3.6 §257.90(E)(6) OVERVIEW

A section at the beginning of the annual report that provides an overview of the current status of groundwater monitoring and corrective action programs for the CCR unit.

The specific requirements for the overview under §257.90(e)(6) are listed and the information is provided at the beginning of this report, before the Table of Contents.

4.0 REFERENCES

Coble, R.W., and Roberts, J.V., 1971, The Water Resources of Southeast Iowa: Iowa Geological Survey Water Atlas Number 4, 101 p.

Montgomery Watson, 1994, May 24, 1994, Hydrogeological Investigation Report and Hydrologic Monitoring System Plan, Ottumwa-Midland Commercial Landfill, Montgomery Watson, 1994.

U.S. Environmental Protection Agency (USEPA), 2009, Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance, EPA 530-R-09-007, March 2009.

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1 Groundwater Monitoring Network
2 CCR Rule Groundwater Samples Summary
3 Groundwater Elevation Summary
4 Horizontal Gradients and Flow Velocity
5 Groundwater Analytical Results Summary –2021
6 Groundwater Field Data Summary

Table 1. Groundwater Monitoring Well Network
Ottumwa Midland Landfill / SCS Engineers Project #25221073.00

Monitoring Well	Location in Monitoring Network	Role in Monitoring Network
MW-102M	Upgradient	Background
MW-122M	Upgradient	Background
MW-301	Downgradient	Compliance
MW-302	Downgradient	Compliance
MW-303	Downgradient	Compliance

Created by:	RM	Date:	12/14/2020
Last revision by:	JAO	Date:	12/15/2021
Checked by:	MDB	Date:	12/21/2021

Table 2. CCR Rule Groundwater Samples Summary
Ottumwa Midland Landfill / SCS Engineers Project #25221073.00

Sample Dates	Downgradient Wells			Background Wells	
	MW-301	MW-302	MW-303	MW-102M	MW-122M
4/15-16/2020	D	D	D	D	D
10/5/2020	D	D	D	D	D
Total Samples	2	2	2	2	2

Abbreviations:
D = Required by Detection Monitoring Program
D-R = Detection Monitoring Retest Sample

Created by:	NDK	Date:	1/4/2019
Last revision by:	JAO	Date:	12/21/2021
Checked by:	MDB	Date:	12/21/2021

Table 3. Groundwater Elevation - CCR Rule Monitoring Network
Ottumwa-Midland Landfill / SCS Engineers Project #25221073.00

Ground Water Elevation in feet above mean sea level (amsl)					
Well Number	**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)	5.0	5.0	5.0	5.0	5.0
Total Depth (ft from top of casing)	204.5	157.7	150.0	152.1	155.3
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
July 17, 2017	NM	NM	684.92	NM	NM
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
October 15-16, 2018	684.58	683.52	684.33	717.05	723.36
April 16-17, 2019	686.38	685.35	686.13	717.97	723.43
June 6, 2019	NM	NM	686.05	NM	NM
August 7, 2019	NM	NM	NM	712.00	720.42
October 14-15,2019	686.56	685.44	686.08	715.50	708.94
May 20-26, 2020	687.29	686.25	687.14	717.61	724.23
June 29, 2020	NM	NM	687.36	NM	NM
October 5-6, 2020	686.80	685.86	686.35	712.05	718.39
April 12 - 13, 2021	687.25	686.26	687.05	710.95	720.52
October 5, 2021	686.87	685.85	686.84	714.85	717.76
Bottom of Well Elevation (ft)	613.38	604.07	612.40	645.93	637.40

Notes:
NM = not measured

Created by: NDK Date: 4/2/20219
Last rev. by: JAO Date: 12/15/2021
Checked by: MDB Date: 12/21/2021

I:\25221073.00\Deliverables\2021 OML Fed CCR Annual Report\Tables\[Table 3 - Groundwater Elevation Sumr

Table 4. Horizontal Gradients and Flow Velocity
Ottumwa Midland Landfill /
SCS Engineers Project #25221073.00
January - December 2021

	Southeast				
Sampling Dates	**h1 (ft)**	**h2 (ft)**	**Δl (ft)**	**Δh/Δl (ft/ft)**	**V (ft/d)**
April 12-13, 2021	705.00	686.26	980	0.019	0.3
October 5, 2021	705.00	685.85	1028	0.019	0.3

Well	K Value (cm/sec)	K Value (ft/d)
MW-102M	N/A	N/A
MW-122M	N/A	N/A
MW-301	8.0E-04	2.3
MW-302	3.6E-04	1.0
MW-303	1.1E-02	30
Geometric Mean	1.5E-03	4.1

Assumed Porosity, n
0.25

Groundwater flow velocity equation: V = [K*(Δh/Δl)] / n

ft = feet
ft/d = feet per day
K = hydraulic conductivity
n = effective porosity
V = groundwater flow velocity

h1, h2 = point interpreted groundwater elevation at locations 1 and 2
Δl = distance between location 1 and 2
Δh/Δl = hydraulic gradient
N/A = Not applicable, geometric mean K based on downgradient wells

Created by:	RM	Date:	12/29/2020
Last revision by:	MDB	Date:	1/4/2022
Checked by:	RM	Date:	1/4/2022

Table 5. Groundwater Analytical Results Summary - 2021
Ottumwa Midland Landfill / SCS Engineers Project #25221073.00

Parameter Name	Interwell UPL	Background Wells				Compliance Wells								
		MW-102M		MW-122M		MW-301			MW-302			MW-303		
		4/15/2021	10/5/2021	4/15/2021	10/5/2021	Intrawell UPL	4/12/2021	10/5/2021	Intrawell UPL	4/12/2021	10/5/2021	Intrawell UPL	4/12/2021	10/5/2021
Appendix III														
Boron, ug/L	5,560	1,600	1,300	5,100	5,500		790	700		820	740		730	630
Calcium, mg/L	599	43	71	410	440		160	150		58	52		100	92
Chloride, mg/L		14	16	8.0	8.7	62.9	28	29	10.2	6.6	7.1	8.72	7.6	8.3
Fluoride, mg/L	5.70	4.3	2.9	0.3 J	<0.28		0.73	<0.28		1.1	0.50		0.74	0.39 J
Field pH, Std. Units	8.63	7.85	7.81	6.78	7.18		6.62	6.71		7.13	7.20		6.80	6.76
Sulfate, mg/L	17,500	330	360	8,700	8,800		530	590		64	70		260	270
Total Dissolved Solids, mg/L	18,100	1,500	1,300	14,000	12,000		1,300	1,200		620	400		850	820

4.4 Blue shaded cell indicates the compliance well result exceeds the UPL and the LOQ.

Abbreviations:
UPL = Upper Prediction Limit
SSI = Statistically Significant Increase
LOQ = Limit of Quantitation
LOD = Limit of Detection
µg/L = micrograms per liter
mg/L = milligrams per liter

Lab Notes:
J = Estimated concentration at or above the LOD and below the LOQ.

Notes:
1. An individual result above the UPL does not constitute an SSI above background. See the accompanying report text for identification of statistically significant results.
2. Interwell UPLs calculated based on results from background wells MW-102M and MW-122M for the period from May 2016 through October 2020. Interwell UPLs based on 1-of-2 retesting approach. The UPLs were updated in January 2021.
3. Intrawell UPL for chloride was calculated based on results from each monitoring well for the period from April 2019 through May 2020. Intrawell UPLs based on 1-of-2 retesting approach. The UPLs were updated in January 2021.

Created by: NDK Date: 5/1/2018
Last revision by: JAO Date: 12/21/2021
Checked by: MDB Date: 12/21/2021
PM/Scient. QA/QC: MDB Date: 12/21/2021

Table 6. Groundwater Field Data Summary
Ottumwa Midland Landfill / SCS Engineers Project #25221073.00

Sample	Date	Groundwater Elevation (ft. amsl)	Temperature (Deg. C)	pH (Std. Units)	DO (mg/L)	Specific Conductivity (µmhos/cm)	ORP (mV)	Turbidity (NTU)
MW-102M	4/15/2021	710.95	11.5	7.85	5.24	2,145	164.0	196
	10/5/2021	714.85	13.5	7.81	2.32	2,041	82.2	28.10
MW-122M	4/15/2021	720.52	9.0	6.78	5.03	13,983	159.2	NM
	10/5/2021	717.76	13.3	7.18	0.84	13,044	-5.9	29
MW-301	4/12/2021	687.25	13.0	6.62	0.46	1,875	-79.6	4.60
	10/5/2021	686.87	13.8	6.71	0.35	1,717	-66.1	32.10
MW-302	4/12/2021	686.26	13.2	7.13	0.28	1,079	-74.2	127
	10/5/2021	685.85	13.5	7.20	0.35	993	-66.5	67.10
MW-303	4/12/2021	689.05	14.2	6.80	0.38	1,431	-64.6	168
	10/5/2021	686.84	13.8	6.76	0.48	1,287	-55.0	79.60

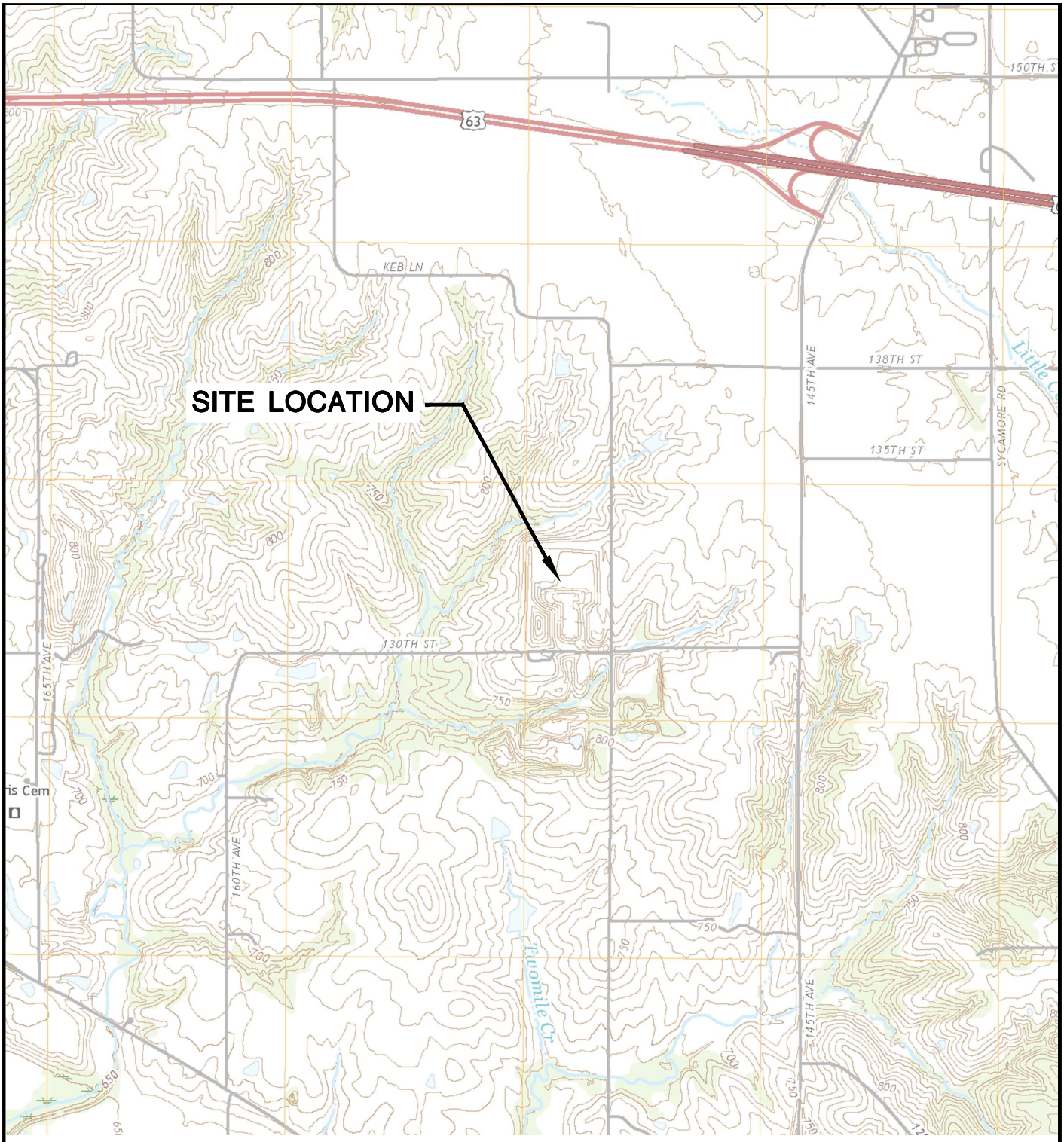
Abbreviations:
amsl = above mean sea level
µmhos/cm = microSiemens per centimeter
mg/L = milligrams per liter
NM = not measured.

Created by: AJR Date: 8/15/2019
Last revision by: JAO Date: 12/15/2021
Checked by: MDB Date: 12/21/2021

I:\25221073.00\Deliverables\2021 OML Fed CCR Annual Report\Tables\[Table 6 - 2021 Groundwater Field Data Summary.xlsx]GW Field Data

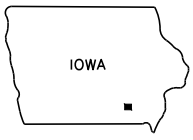
Figures

1 Site Location Map
2 Site Plan and Monitoring Well Locations
3 Potentiometric Surface Map, April 12-13, 2021
4 Potentiometric Surface Map, October 5, 2021



N

OTTUMWA NORTH QUADRANGLE
IOWA–WAPELLO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
2018
SCALE: 1" = 2,000'



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

SITE LOCATION MAP

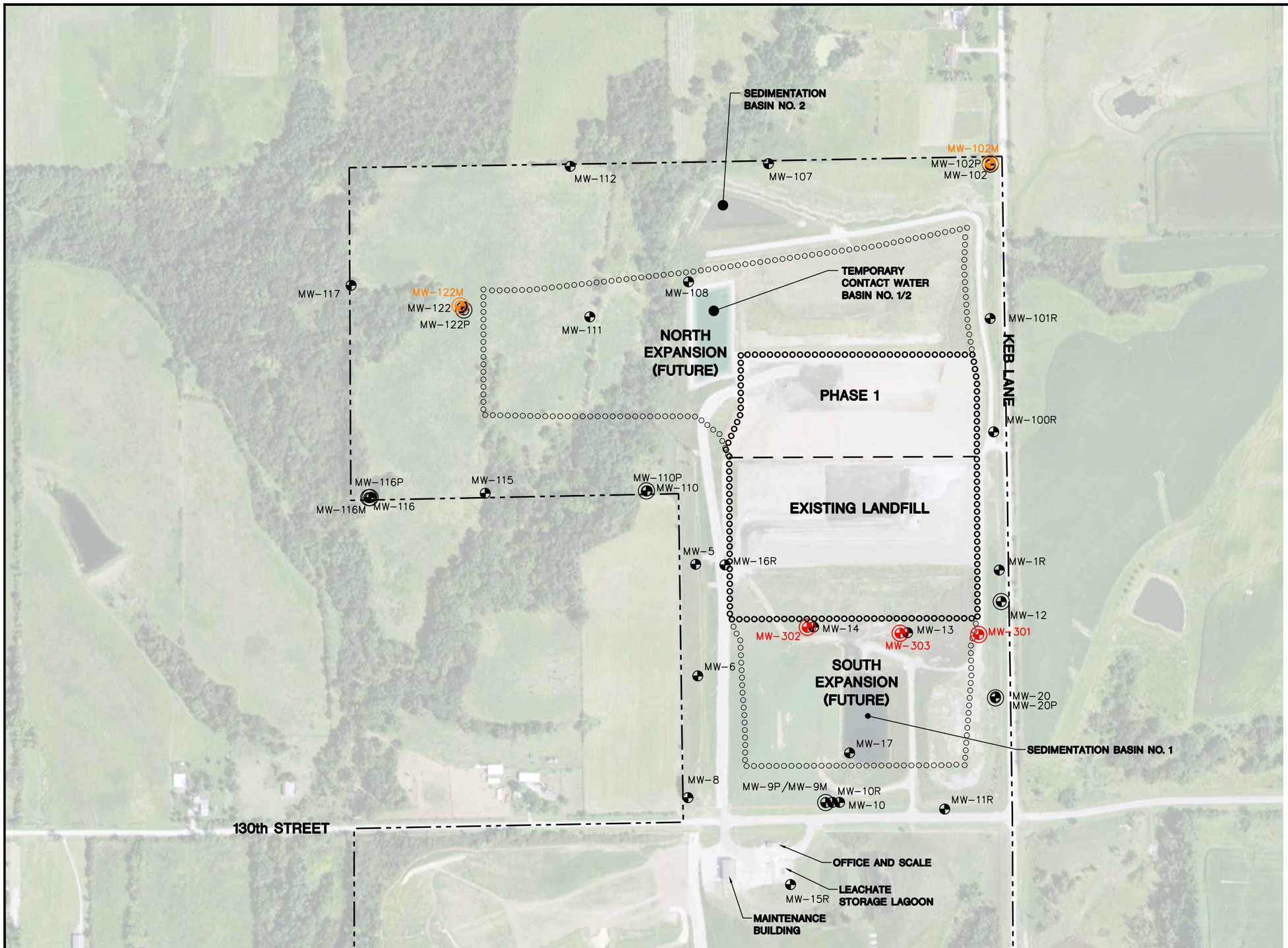
PROJECT NO.	252519073.00	DRAWN BY:	BSS
DRAWN:	11/18/2019	CHECKED BY:	MDB
REVISED:	01/13/2020	APPROVED BY:	TK 01/30/2020

ENGINEER

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

FIGURE
1

I:\25219073.00\Drawings\CCR 2019 Annual Report\Site Location Map.dwg, 1/30/2020 3:56:54 PM



LEGEND

- APPROXIMATE PROPERTY LINE
- EXISTING WASTE LIMITS
- PERMITTED WASTE LIMITS
- CCR RULE PIEZOMETER
- CCR BACKGROUND MONITORING WELL
- MONITORING WELL
- ADDITIONAL 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. THE BACKGROUND MONITORING WELLS FOR THE OTTUMWA MIDLAND LANDFILL ARE: MW–122M AND MW–102M.

N

400 0 400

SCALE: 1" = 400'

PROJECT NO.	25219073.00	DRAWN BY:	BSS
DRAWN:	11/18/2019	CHECKED BY:	MDB
REVISED:	01/30/2020	APPROVED BY:	TK 01/28/2021

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

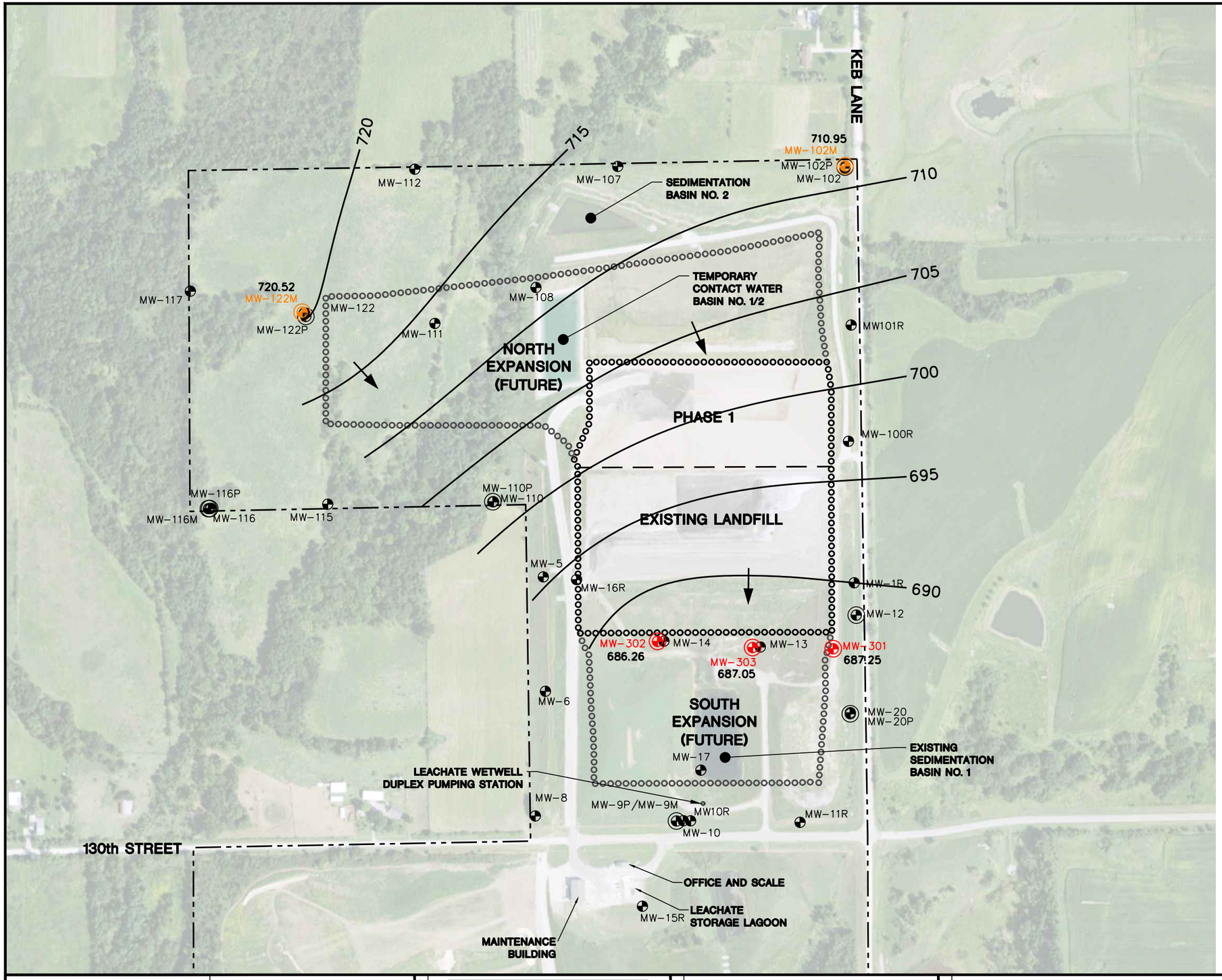
CLIENT: INTERSTATE POWER AND LIGHT CO.
15300 130TH STREET
OTTUMWA, IA 52501

SITE: ALLIANT ENERGY
OTTUMWA MIDLAND LANDFILL
OTTUMWA, IOWA

SITE PLAN AND MONITORING WELL LOCATIONS

FIGURE 2

I:\25219073.00\Drawings\CCR 2019 Annual Report\Site Plan and Monitoring Well Locations.dwg, 1/26/2021 2:09:49 PM



LEGEND

- APPROXIMATE PROPERTY LINE
- APPROVED WASTE LIMITS
- EXISTING WASTE LIMITS
- PHASE LIMIT
- EXISTING MONITORING WELL
- EXISTING PIEZOMETER
- CCR MONITORING WELL
- CCR BACKGROUND MONITORING WELL
- 687.25 — WATER TABLE ELEVATION MEASURED ON APRIL 12–13, 2021
- 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. THE BACKGROUND MONITORING WELLS FOR THE OTTUMWA MIDLAND LANDFILL ARE: MW–122M AND MW–102M.

400 0 400

SCALE: 1" = 400'

N

PROJECT NO.	25221073.00	DRAWN BY:	KP
DRAWN:	05/12/2021	CHECKED BY:	RM
REVISED:	06/29/2021	APPROVED BY:	TK 01/28/2022

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

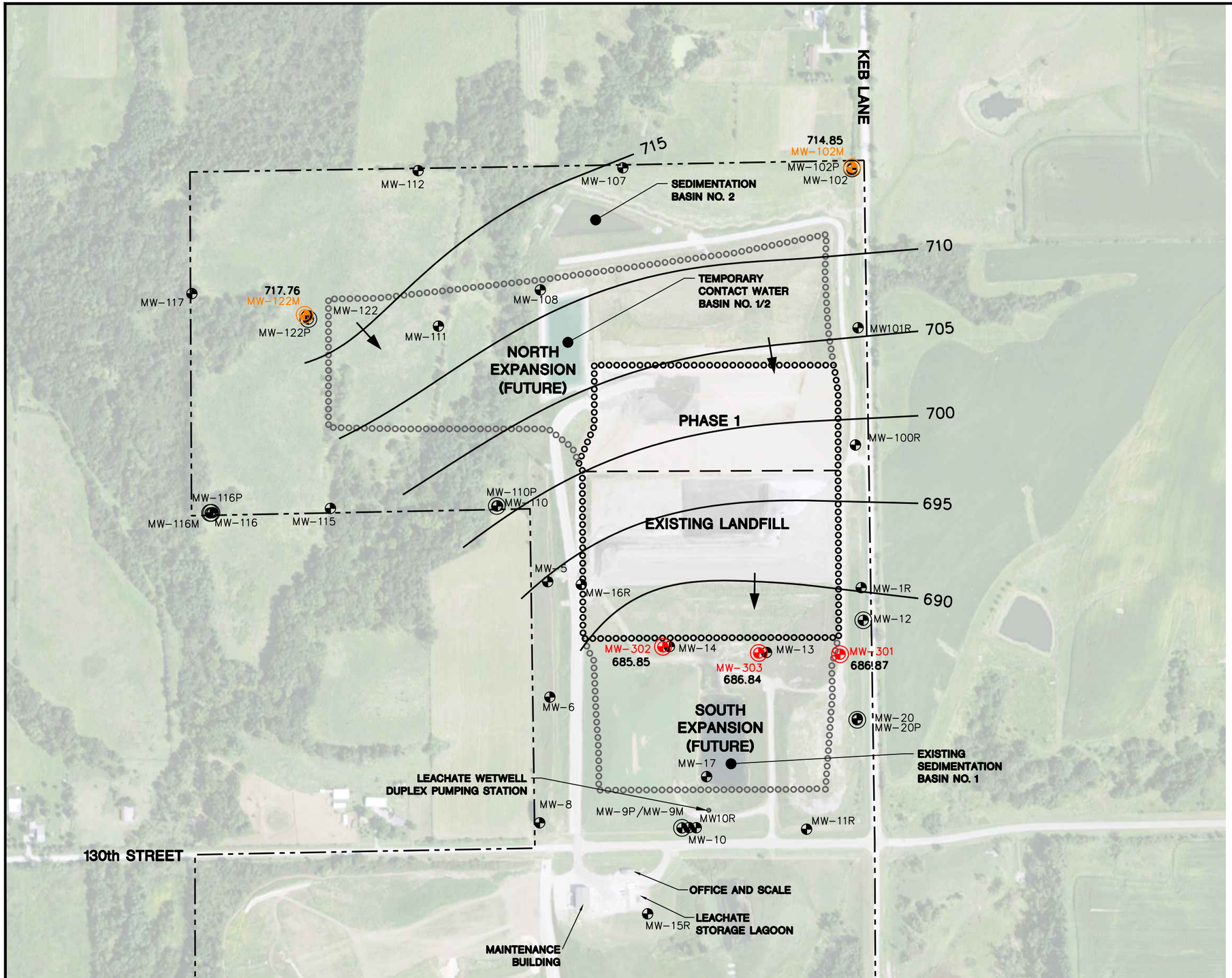
CLIENT: INTERSTATE POWER AND LIGHT CO., 15300 130th STREET, OTTUMWA, IA 52501

SITE: OTTUMWA MIDLAND LANDFILL, OTTUMWA, IOWA

POTENTIOMETRIC SURFACE MAP APRIL 12–13, 2021

FIGURE 3

I:\25221073.00\Drawings\□t□l.dwg, 12/27/2021 2:51:3□PM



LEGEND

- APPROXIMATE PROPERTY LINE
- APPROVED WASTE LIMITS
- EXISTING WASTE LIMITS
- PHASE LIMIT
- EXISTING MONITORING WELL
- EXISTING PIEZOMETER
- CCR MONITORING WELL
- CCR BACKGROUND MONITORING WELL
- 717.76 — WATER TABLE ELEVATION MEASURED ON OCTOBER 5, 2021
- 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. THE BACKGROUND MONITORING WELLS FOR THE OTTUMWA MIDLAND LANDFILL ARE: MW–122M AND MW–102M.

400 0 400

SCALE: 1" = 400'

N

PROJECT NO.	25221073.00	DRAWN BY:	KP
DRAWN:	10/14/2021	CHECKED BY:	NDK
REVISED:	10/14/2021	APPROVED BY:	TK 01/28/2022

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 OCTOBER 5, 2021

FIGURE 4

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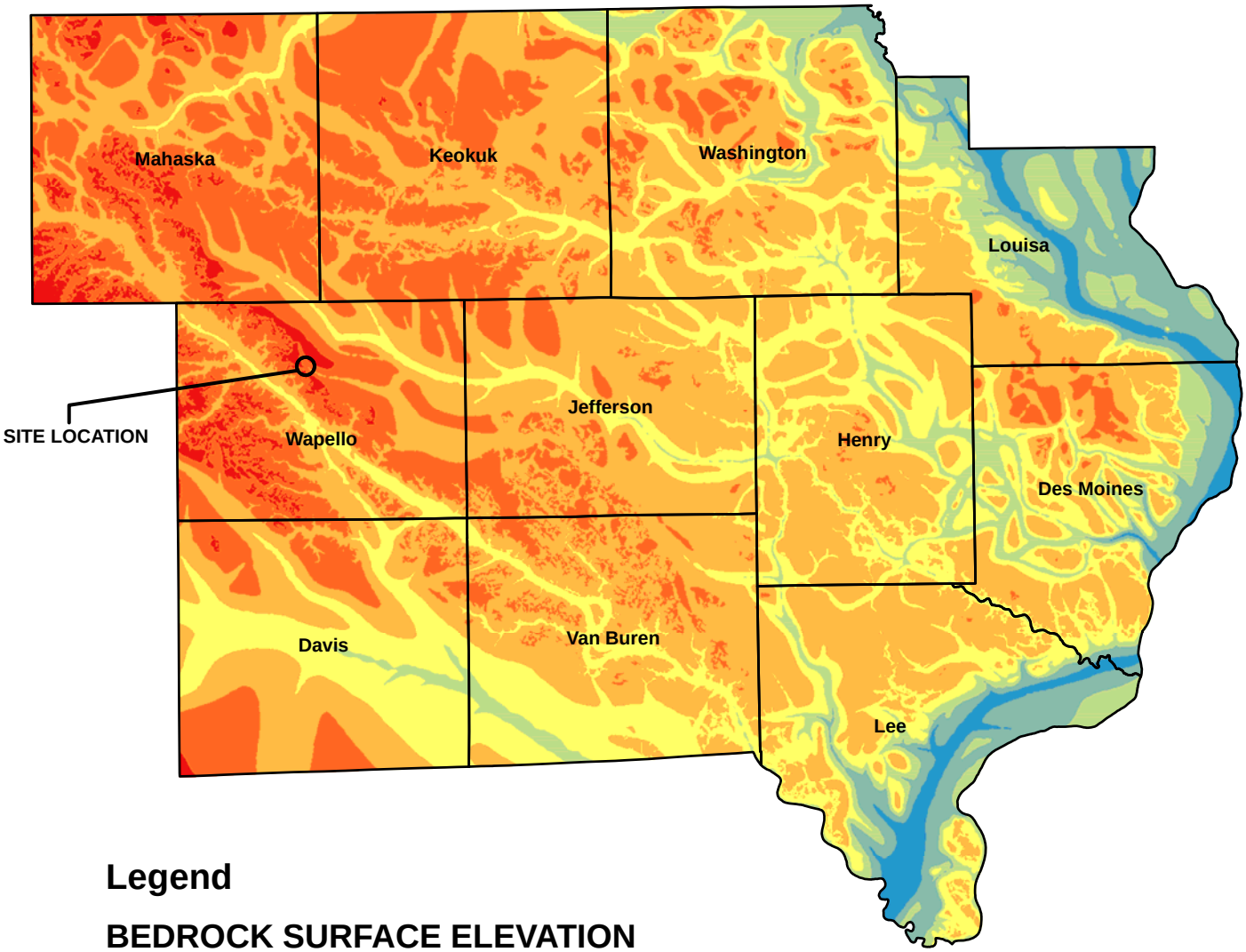
Appendix A

Regional Hydrogeologic Information



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

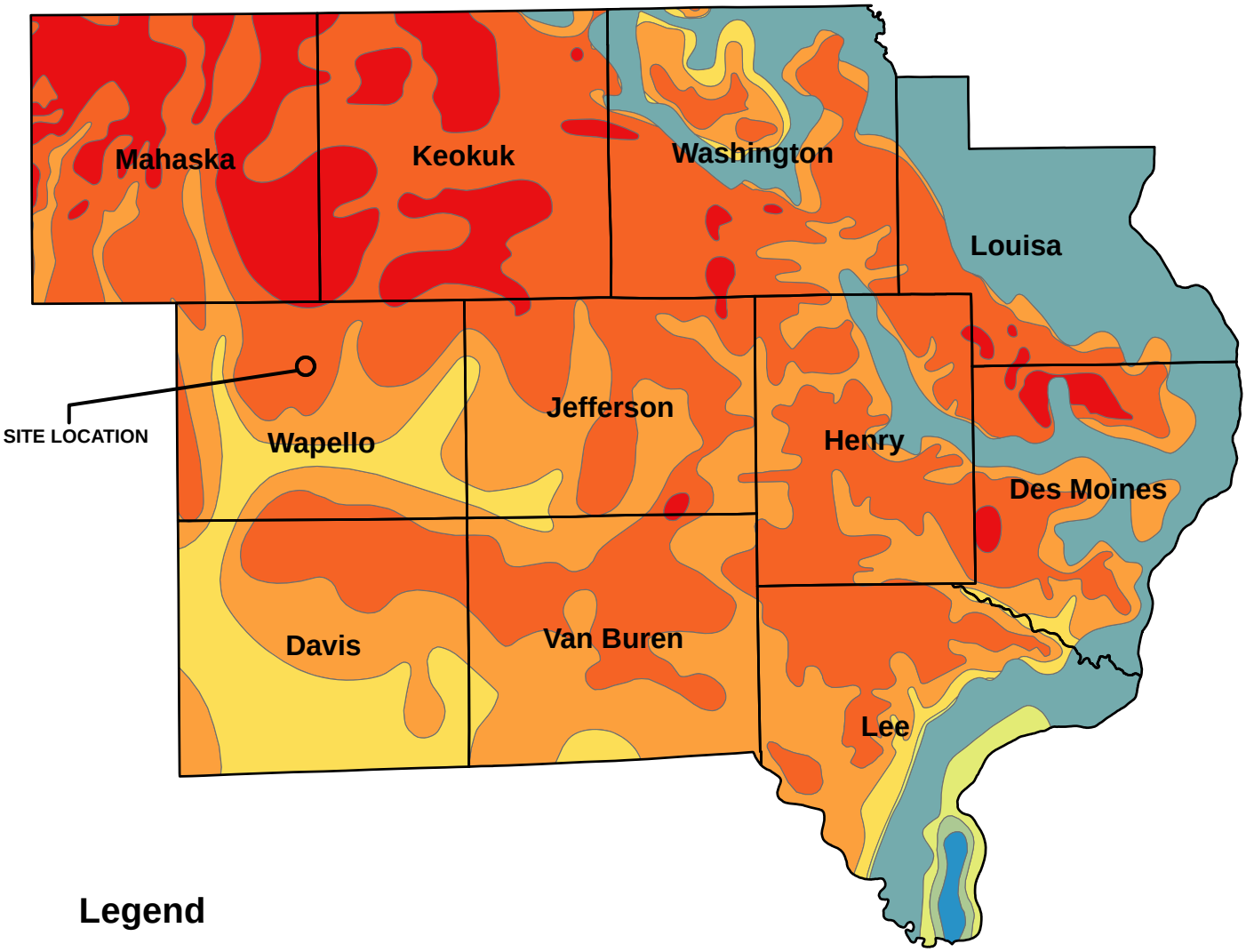
0 5 10 20 Miles

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	SCS ENGINEERS 2830 DAIRY DRIVE MADISON, WI 53718-6751 PHONE: (608) 224-2830 FAX: (608) 224-2839
DRAWN:	07/29/13	CHECKED BY:	MDB		FIGURE 4
REVISED:	08/02/13	APPROVED BY:			

I:\25215053\Drawings\OML\ArcMAP files\OML-BEDROCK TOPO 8.5X11 portrait.mxd



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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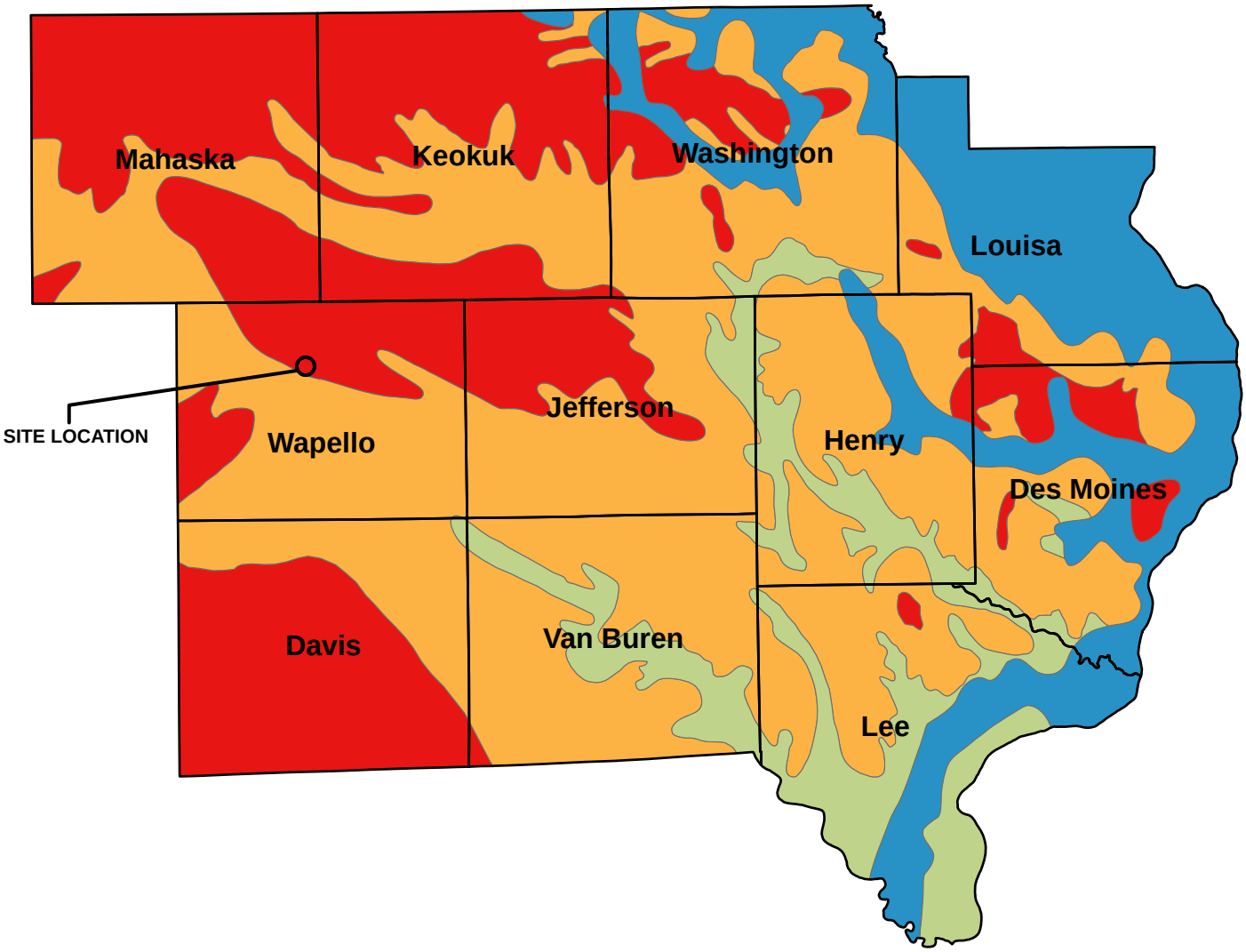

Legend

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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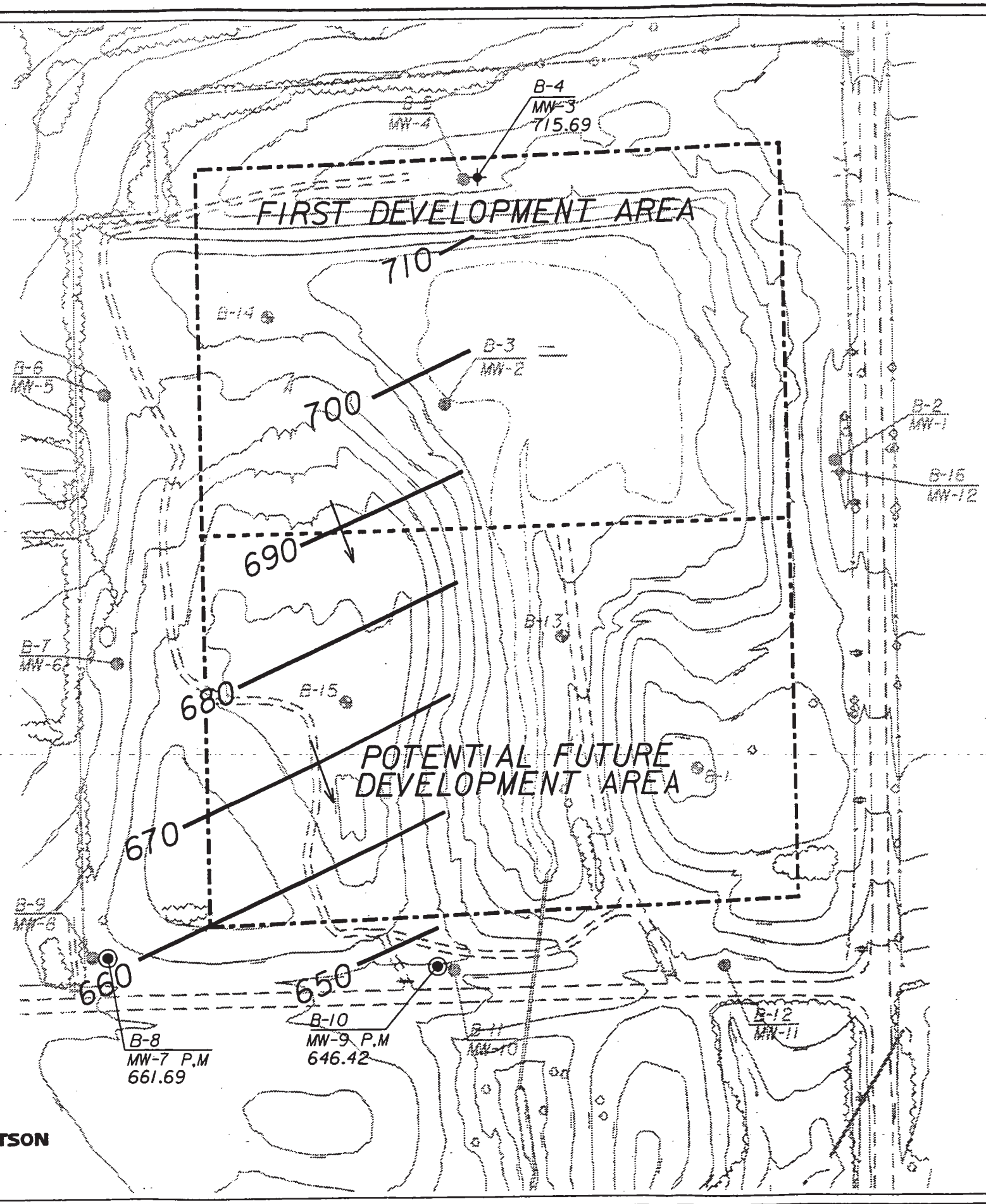


MONTGOMERY WATSON

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 B

Boring Logs and Well Construction Documentation

SCS ENGINEERS
Civil & Environmental Engineering

SOIL BORING LOG INFORMATION
10-92

Facility/Project Name: Ottumwa Midland Landfill SCS # 25211509.03		License/Permit/Monitoring Number	Boring Number: B-102
Boring Drilled By (Firm name and name of crew chief): Boart Longyear — Paul Dickinson		Drilling Started: 08/20/2012	Drilling Completed: 08/27/2012 / Drilling Method: HSA, Air Hammer, Core
Facility Well No.	Unique Well No. / Common Well Name: MW-102M	Static Water Level: Feet	Surface Elevation: 795.0 Feet / Borehole Diam.: 10.5/6 Inches
Boring Location: State Plane N, E; NE 1/4 of SE 1/4 of Section 34, T. 73 N., R. 14 W.		Lat. / Long.	Local Grid Location (If applicable)
County: Wapello	Location Code	Civil Town/City/or Village: Ottumwa	

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
S1	8	05,07 09,12		SILTY CLAY, dark brown (10YR 3/3), stiff, massive, few roots (topsoil/loess).	CL-ML				1.25	M		begin drilling with 6-1/4" hollow stem augers and sampling with split-spoons and 140 lb hammer
S2	8	06,13 09,18	5	LEAN CLAY, mottled olive yellow (2.5Y 6/8) and light olive brown (2.5Y 5/3), hard, blocky (loess).	CL				>4.5	M		
S3	14	12,17 10,14		LEAN CLAY, very dark grayish brown (2.5Y 3/2) mottled dark red (2.5YR 3/6), with silt, very stiff, cobble at 6' (till).	CL				>4.5 4.0	M M		
S4 ST	24									M		pushed shelby tube from 7.5' to 9.5'

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Tyler Munson — Firm: SCS ENGINEERS Tyler Munson

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
S5	10	12,21 38, 30/2"		CLAY, grayish brown (10YR 5/2) with black (10YR 2/1) and dark reddish brown (2.5YR 2.5/4) mottles, hard.	CL				4.25	M		
				WEATHERED SHALE, gray (2.5Y 5/1), trace to few black (2.5Y 2.5/1) zones, massive, with silt (Pennsylvanian).					>4.5	M		
S6	12	22,17 61/4"		As above, except silty with pale red zones instead of black zones.	Shale				>4.5	M		at 15' auger refusal, begin drilling with 6" air hammer and sample drill cuttings
			15	SHALE, light brownish gray (10YR 6/2) and brownish yellow (10YR 6/6).								
S7												
			20	As above, except trace very dark grayish brown (10YR 3/2).								
S8					Shale							
			25	As above, except gray (10YR 6/1 to 10YR 5/1).								
S9												

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
				As above.								
S10					Shale							
			35	SHALE with coal, black (10YR 2/1) to very dark brown (10YR 2/2).								
S11					Shale							
			40	COAL, black (10YR 2/1).								
S12					Coal							
			45	SHALE, light gray (10YR 7/1) to gray (10YR 6/1).								
S13					Shale							

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
				SHALE, gray (10YR 5/1)								
S14			55									
S15			60	As above, except gray (10YR 6/1) to dark gray (10YR 4/1).	Shale							
S16			65	As above, except very dark gray (10YR 3/1).								
S17												

SCS ENGINEERS

10-92

Boring Number B-102

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
				SHALE, gray (10YR 6/1).								
S18					Shale							
												at 74', begin NQ3 coring
				SILTY SHALE, gray (10YR 5/1), 1mm to 3mm-thick lamina, intensely fractured.	Shale							
			75	SANDSTONE, gray (10YR 5/1) with some light yellowish brown (10YR 6/4) lamina, strong, moderately fractured.	Sand-stone							
				SILTY SHALE, gray (10YR 5/1), 1mm to 3mm-thick lamina, moderately fractured, moderate to strong.	Shale							
				SANDSTONE, gray (10YR 5/1) with some light yellowish brown (10YR 6/4) lamina, strong, moderately fractured.	Sand-stone							Run 1 (74' to 81.5') TCR=74% SCR=74% MCR=45% RQD=Poor
Run 1	58/78			SILTY SHALE, gray (10YR 5/1), 1mm to 3mm-thick lamina, moderately fractured, moderate to strong.	Shale							
				SANDSTONE, gray (10YR 5/1), strong, moderately fractured.	Sand-stone							
			80	VOID or FRACTURES in possible shale.								lost circulation at 80'
					Shale							Run 2 (81.5' to 83.5') TCR=33% SCR=0% MCR=0% RQD=Very Poor
Run 2	8/24			WEATHERED SHALE (clay).	Shale							
				SHALE, very dark gray (10YR 3/1), moderate strength, intensely fractured, few pyrite nodules up to 1mm by 3mm in size, some highly decomposed zones.								
			85									
					Shale							Run 3 (83.5' to 91.5') TCR=59% SCR=53% MCR=8% RQD=Very Poor
Run 3	57/96											

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
				As above.	Shale							
				SILTY SHALE, black (10YR 2/1), weak to moderate strength, intensely fractured.								
			95									
Run 4	31/ 120				Shale							Run 4 (91.5' to 101.5') TCR=26% SCR=21% MCR=3% RQD=Very Poor
			100									
				SILTY SHALE, dark brown (7.5YR 3/2), very weak, 1mm to 3mm-thick lamina, highly decomposed.	Shale							
				SILTY SHALE, dark gray (7.5YR 4/1), moderate strength to strong, massive, few weak zones, no decomposition.								
			105									
Run 5	88/ 120				Shale							Run 5 (101.5'-111.5') TCR=73% SCR=73% MCR=35% RQD=Poor

SCS ENGINEERS

Boring Number B-102

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
Run 6	119/ 120		115	As above, except calcitic, pyrite nodules 5mm by 20mm in size at 112.8' and 117.3', slightly disintegrated and decomposed, slightly fractured, with some pyrite infilling.	Shale							Run 6 (111.5'-121.5') TCR=99% SCR=99% MCR=84% RQD=Good
			120	SHALE, greenish gray (5GY 6/1), weak to moderate strength, pyrite mineralization along laminated zones, few disintegrated zones.								
Run 7	44/ 120		125	As above, except dark gray (7.5YR 4/1), massive, aphanitic.	Shale							Run 7 (121.5'-131.5') TCR=37% SCR=35% MCR=27% RQD=Poor
				SHALE, reddish brown (2.5YR 4/3), highly decomposed.	Shale							
				SHALE, gray (7.5YR 5/1), weak to moderate strength, with white limestone	Shale							

SCS ENGINEERS

10-92

Boring Number B-102

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
				gravel, slighty to moderately disintegrated.	Shale							
				WEATHERED SHALE, highly decomposed, possibly soft shale in clay.								
			135									
Run 8	0/120				Shale							Run 8 (131.5'-141.5') TCR=0% SCR=0% MCR=0% RQD=Very Poor
				Possible limestone at 138'.								at 138', driller reports change in drilling
			140									
				LIMESTONE, gray (10YR 5/1), strong (Mississippian).								
Run 9	29/60				Lime-stone							Run 9 (141.5'-146.5') TCR=48% SCR=38% MCR=15% RQD=Very Poor
			145									
				Blind drill.								after coring, reamed hole with 6" air hammer to 153'
					.							

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
				Blind drill.								
				End of boring @ 153'. Set MW-102M with 5' PVC screen to 148'.								
			155									
			160									
			165									

SCS ENGINEERS
Civil & Environmental Engineering

SOIL BORING LOG INFORMATION
10-92

Facility/Project Name: Ottumwa Midland Landfill SCS # 25211509.03			License/Permit/Monitoring Number		Boring Number: B-122
Boring Drilled By (Firm name and name of crew chief): Boart Longyear — Paul Dickinson			Drilling Started: 12/06/2012	Drilling Completed: 12/09/2012	Drilling Method: HSA, Air Hammer, Core
Facility Well No.	Unique Well No.	Common Well Name: MW-122M	Static Water Level: Feet	Surface Elevation: 790.6 Feet	Borehole Diam.: 10.5/6 Inches
Boring Location: State Plane N, E; NW 1/4 of SE 1/4 of Section 34, T. 73 N., R. 14 W.			Lat. / Long.	Local Grid Location (If applicable)	
County: Wapello		Location Code	Civil Town/City/or Village: Ottumwa		

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
				SILT, dark yellowish brown (10YR 4/4), massive, few roots (topsoil/loess).	ML							
S1	9	06-10 14-20		LEAN CLAY, olive yellow (2.5Y 6/6) mottled gray (2.5Y 6/1) and reddish brown (5YR 4/4), trace fine to coarse sand (till).	CL				1.5 2.75 2.0	M		
S2	24	06-17 20-26		CLAY, gray (5Y 5/1), few olive yellow (2.5Y 6/6) and dark reddish brown (5YR 3/4) layers, hard, 1mm to 5mm-thick lamina (weathered shale).					4.5	M		
			5									
S3 ST	20				CL							pushed shelby tube from 5' to 7'
S4	24	07-17 27-34		As above, except less gray and with black layers/lamina.					3.5	M		at 10', auger refusal, and begin drilling with 6" air hammer and sampling drill cuttings
				CLAY, black (2.5Y 2.5/1), 1mm to 2mm-thick lamina (weathered shale)	CL							

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature: Meghan Blodgett — Firm: SCS ENGINEERS Meghan Blodgett

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
S5				WEATHERED SHALE, black (2.5Y 2.5/1), lamina up to 5mm-thick.								
			15	WEATHERED SHALE, dark gray (2.5Y 4/1) to black (2.5Y 2.5/1).								
S6												
			20	SHALE and WEATHERED SHALE, dark gray (2.5Y 4/1).	Shale							
S7												
			25	SHALE and WEATHERED SHALE, dark gray (2.5Y 4/1) to black (2.5Y 2.5/1).								
S8												

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
				As above.								
S9												
			35	SHALE, dark gray (2.5Y 4/1).								
S10												
			40	As above.	Shale							
S11												
			45	As above.								
S12												

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
				SHALE, dark gray (2.5Y 4/1) to black (2.5Y 2.5/1).								
S13												
			55	As above.								
S14												
			60	As above, except 6" coal seam at approximately 64.5'.	Shale							
S15												
			65	SHALE, light gray (2.5Y 7/1) to very dark gray (2.5y 3/1).								
S16												

SCS ENGINEERS

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
				SHALE, very dark gray (2.5Y 3/1) to gray (2.5Y 5/1), weak to moderate strength, 1mm to 5mm-thick lamina, moderatly decomposed (clay along fractures), intensely fractured, some sand at 70' to 71'.								begin NQ3 coring at 70'
Run 1	68/78											Run 1 (70' to 76.5') TCR=87% SCR=82% MCR=46% RQD=Poor
			75	As above, except few sandy intervals up to 2" in length at 77.5' to 78.5'.								
Run 2	54/60											Run 2 (76.5' to 81.5') TCR=90% SCR=75% MCR=8% RQD=Very Poor
			80	SHALE, very dark gray (2.5Y 3/1) with little gray (2.5Y 5/1 & 6/1), 1mm to 5mm-thick lamina, moderately weathered (clay along fractures), trace pyrite nodules throughout.	Shale							
Run 3	40/60											Run 3 (81.5' to 86.5') TCR=67% SCR=55% MCR=0% RQD= Very Poor
			85	As above.								
Run 4	36/60											Run 4 (86.5' to 91.5') TCR=60% SCR=53% MCR=40% RQD=Poor

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
Run 4 (cont)				As above.	Shale							
				SILTSTONE, very dark gray (2.5Y 3/1), moderately strong, massive, trace fractures infilled with calcite.	Silt-stone							four 6" to 8" bit drops one foot apart indicated possible voids from 93' to 97'
				SHALE, very dark gray (2.5Y 3/1), very weak to weak, 1mm to 5mm-thick lamina, moderately to highly decomposed (highly decomposed in top 2' of recovered shale), trace pyrite throughout, possible voids from approximately 93' to 97', bedding planes are horizontal where present.								
			95									
Run 5	59/ 120											Run 5 (91.5'-101.5') TCR=49% SCR=29% MCR=7% RQD=Very Poor
			100		Shale							
				SHALE, light to dark gray (2.5Y 7/1 to 4/1), weak, 1mm to 3mm-thick lamina, massive from 104' to 105', trace coal on fracture planes, trace pyrite throughout.								
Run 6	48/60											Run 6 (101.5'-106.5') TCR=80% SCR=68% MCR=48% RQD=Poor
			105									
				SHALE, gray (2.5Y 5/1), weak to moderate strength, 1mm to 3mm-thick lamina, silty.								
Run 7	6/60											Run 7 (106.5'-111.5') TCR=10% SCR=10% MCR=7% RQD=Very Poor

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
Run 7 (cont)				As above.								
Run 8	30/30		115	SHALE, dark gray (2.5Y 4/1) with gray (2.5Y 5/1), weak to moderate strength, bedding vairable, 1mm-thick lamina to 2cm-thick beds, moderately decomposed (clay in fractures), few 1cm to 3cm-thick sandy zones, trace pyrite nodules throughout.								Run 8 (111.5'-114') TCR=100% SCR=80% MCR=60% RQD=Fair
Run 9	65/90		120	Interbedded SHALE, SILTSTONE, and SANDSTONE, gray (10YR 6/1) to very dark gray (10YR 3/1), weak strength to strong, sandstone/siltstone/shale intervals are 1" to 10"-thick, bedding ranges from 1mm-thick lamina in shale to massive in siltstones, some slump/flame structures in sand, intensely fractured, fresh to moderately decomposed (clay in fractures), trace pyrite throughout.	Shale							Run 9 (114'-121.5') TCR=72% SCR=70% MCR=9% RQD=Very Poor
Run 10	12/12											Run 10 (121.5'-122.5') TCR=100% SCR=92% MCR=0% RQD=Very Poor
Run 11	108/ 108		125	SHALY SILTSTONE and SANDSTONE, black (2.5Y 2.5/1) with bands of light gray (2.5Y 7/1), moderate strength, 1mm to 10mm-thick lamina, trace pyrite throughout, moderately to intensely fractured.	Silt-stone							Run 11 (122.5'-131.5') TCR=100% SCR=95% MCR=60% RQD=Fair
				SHALE, black (2.5Y 2.5/1), weak, 1mm to 5mm-thick lamina, some silt and sand, moderatly decomposed, moderately fractured, trace pyrite throughout.	Shale							

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
Run 11 (cont)				As above.	Shale							
				SHALE, dark greensih gray (5GY 4/1), weak to moderate strength, 1mm to 5mm-thick lamina, moderately to highly decomposed.	Shale							
			135									
Run 12	110/ 120											Run 12 (131.5'-141.5') TCR=92% SCR=86% MCR=63% RQD=Fair
				LIMESTONE CONGLOMERATE, reddish brown (5YR 5/3) with gray shale between clasts, weak, massive.	Lime-stone							
			140									
				SHALY LIMESTONE, greenish gray (5GY 5/1), weak, massive, 2" of light gray clay at interface with above conglomerate.	Lime-stone							
				SHALY LIMESTONE, reddish brown (5YR 4/3), few greenish gray zones, moderate strength, few clasts of hard competent limestone up to 1.5" in diameter, moderately decomposed.								
			145									
Run 13	114/ 120				Lime-stone							Run 13 (141.5'-151.5') TCR=95% SCR=95% MCR=73% RQD=Fair

Sample Number	Sample Length Recovered	Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Max. PID/FID	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: P200	RQD/ Comments
Run 13 (cont)				SHALY LIMESTONE, yellowish gray (5GY 5/1), weak, massive, fresh to slightly decomposed.	Lime-stone							
Run 14	30/30			As above.								Run 14 (151.5'-154') TCR=100% SCR=90% MCR=90% RQD=Good
			155	End of Boring @ 154'. Set MW-122M with 5' PVC screen to 152'.								
			160									
			165									

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: IPL - Ottumwa Midland Landfill Permit No.: 90-SDP-8-92P

Well or Piezometer No: MW-301

Dates Started: 11/23/15 Date Completed: 11/24/15

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft):

Specify corner of site: SE

Distance & direction along boundary: 700'N

Distance & direction from boundary to wall: 90' W

Elevations (± 0.01 ft MSL):

Ground Surface: 815.51'

Top of protective casing: 818.36'

Top of well casing: 817.88'

Benchmark elevation: 818.70

Benchmark description: Control Point #2

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Cascade Drilling, LP
301 Alderson St
Schofield, WI 54476

Name of Driller: Todd Schmalfeld

Drilling Method: 4.25' HSA to 24.5'/Air Rotary to 164'/coring

Drilling Fluid: NA

Bore Hole Diameter: 8.50 inch/ 6 inch

Soil Sampling Method: Split Spoon/cuttings/core

Depth of Boring: 202'

C. MONITORING WELL INSTALLATION

Casing material: sch 80 PVC

Length of casing: 196'

Outside casing diameter: 2.38"

Inside casing diameter: 1.9"

Casing joint type: threaded

Casing/screen joint type: threaded

Screen material: PVC

Screen opening size: 0.010

Screen length: 5 ft

Depth of well: 201 ft

Filter Pack:

Material: Red Flint

Grain size: #40

Volume: 2 cubic ft

Seal (minimum 3 ft length above filter pack):

Material: AquaGuard grout

Placement method: tremie

Volume: 400 gallons

Backfill (if different from seal):

Material: 3/8" bentonite chips and Aqua Guard grout

Placement method: gravity/tremie

Volume:

Surface seal design:

Material of protective casing: Steel 6 inch

Material of grout between protective casing and well casing: sand

Protective cap:

Material: Steel

Vented: ☒ Yes ☐ No Locking: ■ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ■ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 125.9 Stabilization Time: 20 HR

Well development method: Surged and bailed, then pumped to reduce turbidity.

Average depth of frostline: 3.5'

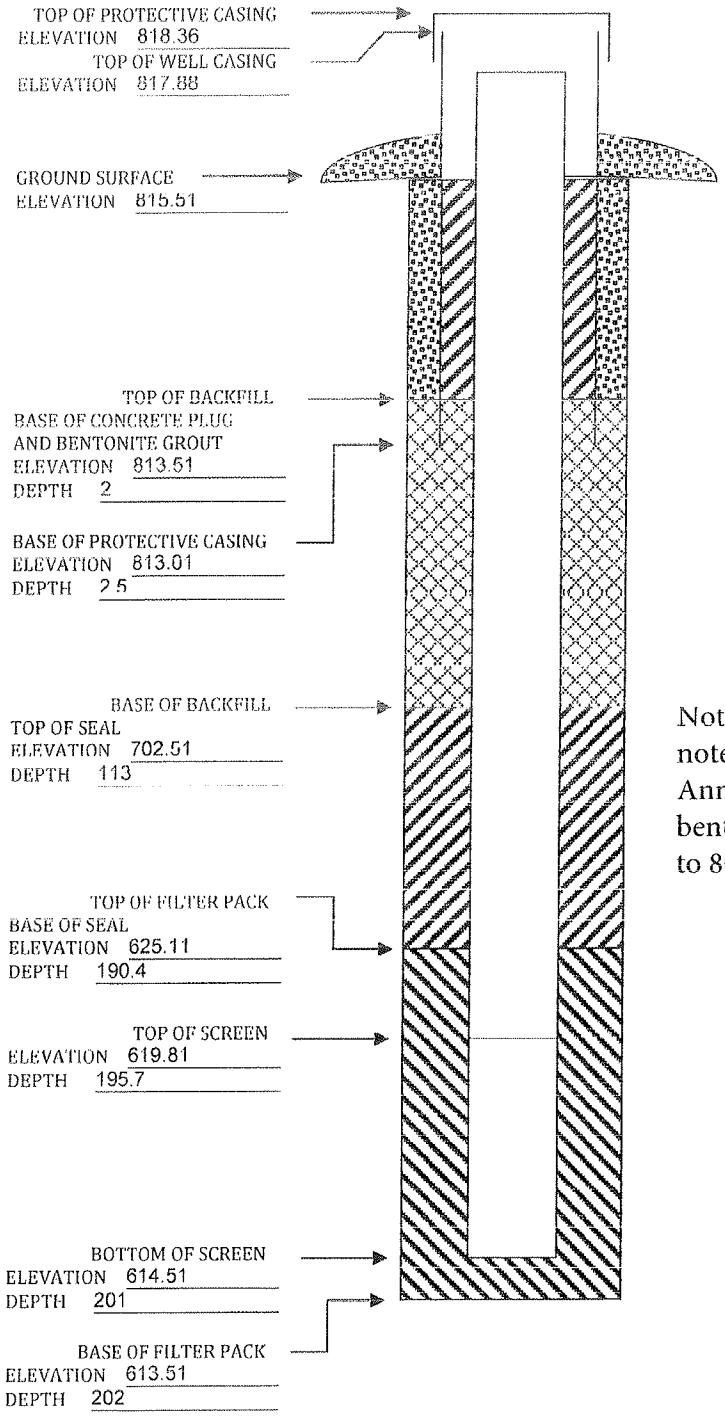
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Note: Grout placed from 190.4' bgs to 113' bgs. Void noted from 105' bgs to 113'. Grout basket placed at 95'bgs. Annular space above grout basket sealed with 3/8" bentonite chips (80'-95' bgs) and bentonite grout (3' bgs to 80' bgs).

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: IPL - Ottumwa Midland Landfill Permit No.: 90-SDP-8-92P

Well or Piezometer No: MW-302

Dates Started: 12/1/15 Date Completed: 12/3/15

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft):

Specify corner of site: SE

Distance & direction along boundary: 700' N

Distance & direction from boundary to wall: 725' W

Elevations (± 0.01 ft MSL):

Ground Surface: 759.50'

Top of protective casing: 762.31'

Top of well casing: 761.77'

Benchmark elevation: 818.70

Benchmark description: Control Point #2

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Cascade Drilling, LP
301 Alderson St
Schofield, WI 54476

Name of Driller: Todd Schmalfeld

Drilling Method: 4.25'HSA to 14.5'/Air Rotary to 95'/coring

Drilling Fluid: NA

Bore Hole Diameter: 8.5 inch/6 inch

Soil Sampling Method: Spoon/cuttings/core

Depth of Boring: 156.5'

C. MONITORING WELL INSTALLATION

Casing material: sch 80 PVC

Length of casing: 150'

Outside casing diameter: 2.38"

Inside casing diameter: 1.9"

Casing joint type: threaded

Casing/screen joint type: threaded

Screen material: PVC

Screen opening size: 0.010

Screen length: 5'

Depth of well: 155'

Filter Pack:

Material: Red Flint

Grain size: #40

Volume: 2 cubic ft

Seal (minimum 3 ft length above filter pack):

Material: 3/8" bentonite chips

Placement method: gravity

Volume: 0.5 cubic ft

Backfill (if different from seal):

Material: Agua Guard Grout

Placement method: Tremie

Volume: 300 gallons

Surface seal design:

Material of protective casing: Steel 6 inch

Material of grout between protective casing and well casing: sand

Protective cap:

Material: Steel

Vented: ☒ Yes ☐ No Locking: ■ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ■ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 75.97' Stabilization Time: <1 hour

Well development method: Surged and bailed then pumped to reduce turbidity

Average depth of frostline: 3.5'

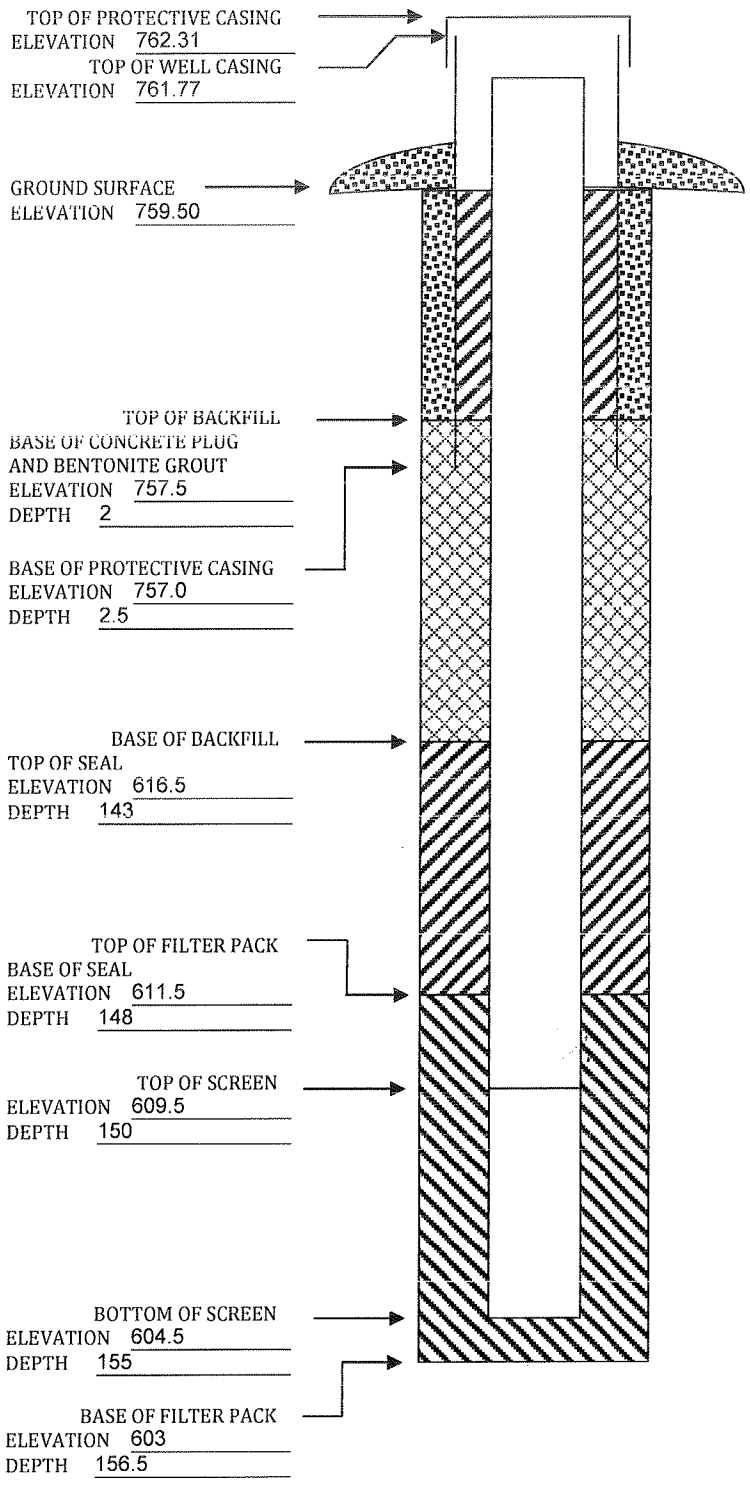
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: IPL - Ottumwa Midland Landfill Permit No.: 90-SDP-8-92P

Well or Piezometer No: MW-303

Dates Started: 4/25/16 Date Completed: 4/26/16

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft):

Specify corner of site: SE

Distance & direction along boundary: 700' N

Distance & direction from boundary to wall: 350' W

Elevations (± 0.01 ft MSL):

Ground Surface: 759.93

Top of protective casing: 762.94

Top of well casing: 762.40

Benchmark elevation: 818.70

Benchmark description: Control Point #2

B. SOIL BORING INFORMATION

Name & Address of Construction Company:

Name of Driller:

Drilling Method: 4.25'HSA to/Air Rotary/coring

Drilling Fluid: NA

Bore Hole Diameter: 8.5 inch/6 inch

Soil Sampling Method: Spoon/cuttings/core

Depth of Boring:

C. MONITORING WELL INSTALLATION

Casing material: sch 80 PVC

Length of casing: 142'

Outside casing diameter: 2.40"

Inside casing diameter: 1.9"

Casing joint type: threaded

Casing/screen joint type: threaded

Screen material: PVC sch 80

Screen opening size: 0.010

Screen length: 5'

Depth of well: 147'

Filter Pack:

Material: Unamin Filtersil

Grain size: 10/20 mesh

Volume: 2.5 cubic ft

Seal (minimum 3 ft length above filter pack):

Material: 3/8" bentonite chips

Placement method: tremie

Volume: 300 gal

Backfill (if different from seal):

Material: 3/8" bentonite chips

Placement method: gravity

Volume: 15 cubic ft

Surface seal design:

Material of protective casing: steel

Material of grout between protective casing and well casing: bentonite chips and sand

Protective cap:

Material: steel

Vented: ☒ Yes ☐ No Locking: ■ Yes ☐ No

Well Cap:

Material: Plastic

Vented: ■ Yes ☐ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 76.36 Stabilization Time: <1hr.

Well development method: surged and bailed, then pumped to reduce turbidity.

Average depth of frostline: 3.5

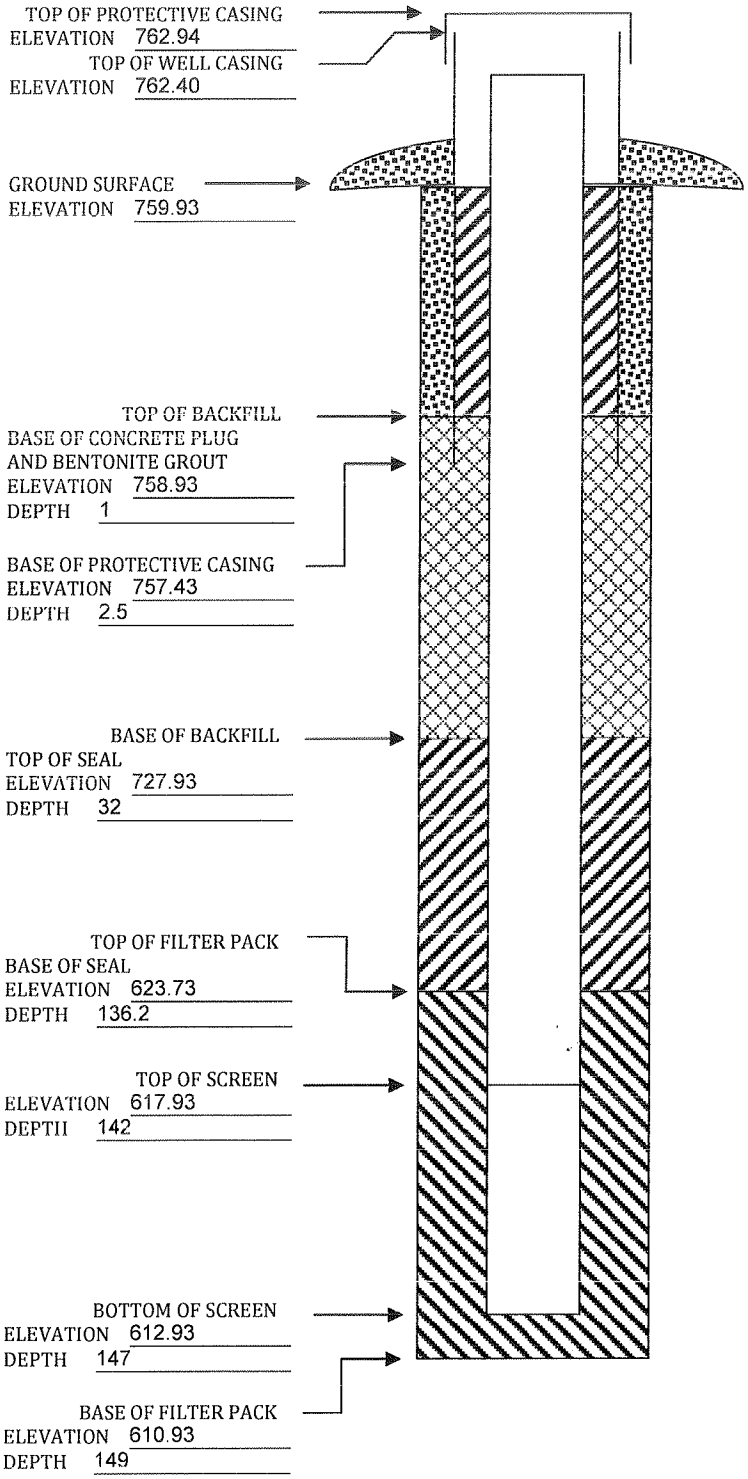
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Midland Landfill SCS#: 25215135.50	90-SDP-8-92P	MW-301

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Todd Schmalfeld Cascade Drilling	11/16/2015	11/19/2015	4.25'HSA /6"air rot/core

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
N/A	N/A	MW-301	Feet	815.5 Feet	8.5"/6" in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,930,292 N, 394,330 E S / C / N
NE 1/4 of SE 1/4 of Section 34, T 73 N, R 14 W
Lat ___ ° ___ ' ___ "
Long ___ ° ___ ' ___ "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
S1	16	5 6 8 10	1 2	FAT CLAY, very dark grayish brown, (2.5Y 3/2).	CH					M				
S2	16	5 6 6 9	3 4	FAT CLAY, black (2.5Y 2.5/1).						M				
S3	22	5 5 6 7	5 6 7	Same as above, except very dark grayish brown (2.5Y 3/2).						M				
S4	5	8 7 8 12	8 9	Same as above, except black (2.5Y 2.5/1).	CH					M				
S5	20	3 6 7 11	10 11 12							M				
S6	21	3 5 7 9	13 14	Same as above, except very dark grayish brown (2.5Y 3/2).						M				
			15											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm SCS Engineers
2830 Dairy Drive Madison, WI 53711

Tel: (608) 224-2830
Fax:

Boring Number MW-301

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
S7	23	3 4 8 9	16–17	LEAN CLAY WITH SAND, gray (2.5Y 5/1), fine grained sand.	CL					M				
S8	20	4 9 9 11	18–20	FAT CLAY, primary color-black (2.5Y 2.5/1), secondary color-yellowish brown (10YR 5/6).	CH					M				
S9	24	8 27 22 24	21–22	SILT, ash, black (2.5Y 2.5/1).	ML					M				
S10	16	18 28 34 44	23–24	SHALE, gray (10YR 5/1) matrix, moderate strength, massive.						M				Saturation @ 23.5 ft bgs
S11			25–30							S				Air Rotary
S12			31–34	Same as above, except light yellowish brown (10YR 6/4).						S				
S13			35–40	Same as above, except gray (10YR 5/1).						S				

Boring Number MW-301

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Vane Shear	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			40	SHALE, gray (10YR 5/1) matrix, moderate strength, massive. *(continued)*										
			41											
			42											
S14			43							S				
			44	Same as above, except yellowish brown (10YR 6/4).										
			45											
			46											
			47											
S15			48							S				
			49											
			50											
			51											
			52											
S16			53							S				
			54											
			55											
			56											
			57											
S17			58							S				
			59	Same as above, except dark gray (10YR 4/1).										
			60											
			61											
			62											
S18			63							S				
			64	Same as above, except black (10YR 2/1).										
			65											

Boring Number MW-301 Page 4 of 9

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			66	SHALE, gray (10YR 5/1) matrix, moderate strength, massive. *(continued)*										
			67											
S19			68							S				
			69											
			70											
			71											
			72											
S20			73							S				
			74											
			75											
			76											
			77											
S21			78	Same as above, except light gray (2.5Y 7/1).						S				
			79											
			80											
			81											
			82											
S22			83	Same as above, except very dark gray (5Y 3/1).						S				
			84											
			85											
			86											
			87											
S23			88							S				
			89											
			90											

Boring Number MW-301 Page 5 of 9

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			91	SHALE, gray (10YR 5/1) matrix, moderate strength, massive. *(continued)*										
			92											
S24			93							S				
			94											
			95											
			96	Same as above, except black (10YR 2/1).										
			97											
S25			98							S				
			99											
			100											
			101											
			102											
S26			103							S				
			104											
			105	VOID.										Void @ 105 ft bgs, sulfur smell.
			106											
			107											
			108											
			109											
			110											
			111											
			112											
			113	SHALE, black (10YR 2/1).										
S27			114							S				
			115											

Boring Number MW-301

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Vane Shear	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			115	SHALE, black (10YR 2/1). *(continued)*										
			116											
			117											
S28			118							S				
			119											
			120											
			121											
			122											
S29			123							S				
			124											
			125											
			126											
			127											
S30			128							S				
			129											
			130											
			131											
			132											
S31			133							S				
			134											
			135											
			136											
			137											
S32			138							S				
			139											
			140											

Boring Number MW-301

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			140	SHALE, black (10YR 2/1). *(continued)*										
			141											
			142											
S33			143							S				
			144											
			145											
			146											
			147											
S34			148							S				
			149											
			150	Same as above, except drak grayish brown (10YR 3/2).										
			151											
			152											
S35			153							S				
			154											
			155	WEATHERED SHALE AND LIMESTONE, dark grayish brown (10YR 3/2), gray limestone (10YR 6/1).										
			156											
			157											
S36			158							S				
			159											
			160	NO RECOVERY.										
			161											
			162											
			163											
			164	WEATHERED SHALE, gray (2.5Y 6/1),soft shale in clay.										
			165											

Boring Number MW-301 Page 8 of 9

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			166	WEATHERED SHALE, gray (2.5Y 6/1),soft shale in clay. *(continued)*										
R1	62/72		167											Run 1 164'-170' bgs TCR=86% SCR=73% MCR=33%
			168	LIMESTONE, gray (10YR 5/1), strong, massive.										
			169											
			170											
R2	22/24		171											Run 2 170'-172'bgs TCR=92% SCR=92% MCR=66%
			172											
			173	SHALE, greenish gray (5G 5/1), with pyrite, weak.										
R3	32/36		174											Run 3 172'-175' bgs TCR=88% SCR=88% MCR=82%
			175											
			176	LIMESTONE, gray (10YR 5/1), interbedded with shale laminations, strong.										
			177											
			178											
			179											
R4	18/120		180											Run 4 175'-185' bgs TCR=98% SCR=98% MCR=89%
			181											
			182											
			183											
			184	SHALE, greenish gray (5G 5/1), weak.										
			185	LIMESTONE, gray (10YR 5/1), strong.										
			186											
			187	SHALE, grayish green (5G 4/2), weak.										
			188											
			189	LIMESTONE, gray (10YR 5/1), strong.										
			190											

Boring Number MW-301 Page 9 of 9

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
R5	16/120		191	LIMESTONE, gray (10YR 5/1), strong. *(continued)*										Run 5 185'-195' bgs TCR=97% SCR=93% MCR=84%
			192	SHALE, greenish gray (5G 5/1), clayey.										
			193											
			194	SANDSTONE, greenish gray (5G 6/1), strong, well cemented.										
			195											
			196											
			197	Very weak.										
R6	33/60		198											Run 6 195'-200' bgs TCR=55% SCR=47% MCR=13%
			199											
			200											
			201											
			202	End of Boring at 202 feet bgs. Boring reamed to 202' bgs prior to installation of MW-301.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Midland Landfill SCS#: 25215135.50	90-SDP-8-92P	MW-302

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Todd Schmalfeld Cascade Drilling	12/1/2015	12/3/2015	4.25'HSA /6"air rot/core

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
N/A	N/A	MW-302	Feet	759.5 Feet	8.5"/6" in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,929,605 N, 394,359 E S / C / N
NW 1/4 of SE 1/4 of Section 34, T 73 N, R 14 W
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0	TOPSOIL	TOPSOIL									
S1	20	2 3 5 8	1	FAT CLAY, dark gray (10YR 4/1), secondary color- Dark yellowish brown (10YR 4/4), organics, fill.						M				
			2											
S2	6	3 50	3	Weathered Shale	CH					M				
			4											
			5	SHALE, dark gray (10YR 4/1), moderate strength, massive.										
S3	18	6 17 44 50	6							M				
			7											
S4	16	3 15 26 28	8							M				
			9											
			10											
S5	5	6 50	11											
			12											
			13											
S6	12	2 50	14							S				Saturation @12.5 ft bgs.
			15											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm SCS Engineers
2830 Dairy Drive Madison, WI 53711

Tel: (608) 224-2830
Fax:

Boring Number MW-302

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			16	SHALE, dark gray (10YR 4/1), moderate strength, massive. *(continued)*										
			17											
S7			18	same as above, except black (2.5Y 2.5/1), clayey.						S				
			19											
			20											
			21											
			22											
S8			23							S				
			24											
			25											
			26											
			27											
S9			28	same as above, except dark gray (2.5Y 4/1), clayey.						S				
			29											
			30											
			31											
			32											
S10			33							S				
			34											
			35											
			36											
			37											
S11			38							S				
			39											
			40											

Boring Number MW-302

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			41	SHALE, dark gray (10YR 4/1), moderate strength, massive. *(continued)* same as above, except black (2.5Y 2.5/1).										
			42											
S12			43							S				
			44											
			45											
			46											
			47											
S13			48							S				
			49											
			50											
			51											
			52											
S14			53							S				
			54											
			55											
			56											
			57											
S15			58							S				
			59											
			60											
			61											
			62											
S16			63							S				a lot of water @ 62 ft bgs.
			64											
			65											

Boring Number MW-302 Page 4 of 7

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			66	SHALE, dark gray (10YR 4/1), moderate strength, massive. *(continued)*										
			67											
S17			68	Shale, black (2.5Y2.5/1), not as clayey as above.										
			69											
			70											
			71											
			72											
S18			73											
			74											
			75											
			76	same as above, except dark gray (2.5Y 4/1).										
			77											
S19			78											
			79											
			80											
			81											
			82											
S20			83											
			84											
			85											
			86											
			87											
S21			88											
			89											
			90											

Boring Number MW-302

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			90	SHALE, dark gray (10YR 4/1), moderate strength, massive. *(continued)*										
			91	same as above, except gray (2.5Y 5/1).										
S22			92											
			93											
			94											
			95											
			96	WEATHERED SHALE, greenish gray (5G 5/1), clayey.										
R1	24/36		97											Run 1 96'-99' bgs TCR=66% SCR=66% MCR=47%
			98	SHALE, greenish gray (5G 5/1), weak, massive.										
			99											
			100											
			101	SHALE, very dark brown (2.5YR 2.5/3), very weak.										
			102											
			103											
R2	02/120		104	SHALE, clayey, greenish gray (5G 5/1), very weak.										Run 2 99'-109' bgs TCR=85% SCR=77% MCR=52%
			105											
			106											
			107											
			108											
			109											
			110											
			111											
			112											
R3	68/72		113											Run 3 109'-117' bgs TCR=95% SCR=90%
			114											
			115											

Boring Number MW-302

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			116	SHALE, clayey, greenish gray (5G 5/1), very weak. *(continued)*										MCR=75%
			117											
R4	24/24		118											Run 4 117'-119' bgs TCR=100% SCR=100% MCR=92%
			119	not as clayey, weak.										
			120											
			121											
			122											
			123											
R5	16/120		124											Run 5 119'-129' bgs TCR=97% SCR=97% MCR=93%
			125											
			126											
			127											
			128											
			129	LIMESTONE, gray (10YR 6/1), interbedded with shale laminations, strong.										
			130											
			131											
			132											
			133											
R6	20/120		134											Run 6 129'-139' bgs TCR=100% SCR=100% MCR=95%
			135											
			136											
			137											
			138	SHALE, greenish gray (5G 5/1), weak.										
			139											
			140											

Boring Number MW-302 Page 7 of 7

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			141	LIMESTONE, gray (10YR 6/1), strong.										
			142	SHALE, greenish gray (5G 5/1), weak.										
			143											
R7	03/120		144											Run 7 139'-149' bgs TCR=88% SCR=85% MCR=74%
			145	SANDSTONE, greenish gray (5G 5/1), very weak, fine grained.										
			146											
			147											
			148											
			149											
			150											
			151											
R8	45/60		152											Run 8 149'-154' bgs TCR=75% SCR=75% MCR=57%
			153											
			154											
			155											
			156											
				End of Boring at 156.5 ft bgs. Boring reamed with air rotary prior to installation of MW-302.										

SCS ENGINEERS
Environmental Consultants and Contractors

SOIL BORING LOG INFORMATION

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
IPL-Ottumwa Midland Landfill SCS#: 25215135.50	90-SDP-8-92P	MW-303

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Don Carlson Team Services	4/11/2016	4/26/2016	4.25'HSA /6"air rot/core

Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
N/A	N/A	MW-303	Feet	759.9 Feet	8.5"/6" in

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,929,977 N, 394,335 E S / C / N
NW 1/4 of SE 1/4 of Section 34, T 73 N, R 14 W
Lat ° ' "
Long ° ' "
Local Grid Location ☐ N ☐ E Feet ☐ S Feet ☐ W

Facility ID	County	Civil Town/City/ or Village
	Wapello	Ottumwa

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1	TOPSOIL.	TOPSOIL									
S1	11	2 4 6	2	FAT CLAY, light gray (10YR 7/1).	CH					M				
S2	16	2 3 16	3							M				
			4	SHALE, Gray (10YR 6/1), very weak, massive, clayey.										
S3	0	50/5	5											No return-refusal.
			6											
			7	Same as above except, dark gray (10YR 4/1).										
S4			8											
			9											
			10											
			11											
S5			12											
			13											
			14											
			15											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm SCS Engineers
2830 Dairy Drive Madison, WI 53711

Tel: (608) 224-2830
Fax:

Boring Number MW-303 Page 2 of 7

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			16	SHALE, Gray (10YR 6/1), very weak, massive, clayey. *(continued)*										
			16	Same as above except, black (10YR 3/1).										
S6			17											
			18											
			19											
			20	Same as above except, light gray (10YR 1/1).										
			21											
S7			22											
			23											
			24											
			25	Same as above except, gray (10YR 6/1).										
			26											
S8			27											
			28											
			29											
			30	Same as above except, light gray (10YR 7/1).										
			31											
S9			32											Cave-in 32' to 45' bgs.
			33											
			34											
			35	Same as above except, gray (10YR 6/1).										
			36											
S10			37											
			38											
			39											
			40											

Boring Number MW-303

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			40	SHALE, Gray (10YR 6/1), very weak, massive, clayey. *(continued)*										
			41											
			42											
S11			43											38'-45' no return. need to add water.
			44											
			45	Same as above except, dark gray (10YR 4/1), clayey.										
			46											
			47											
S12			48											
			49											
			50											
			51											
			52											
S13			53											
			54											
			55	Same as above except, black (10YR 2/1), less clayey.										
			56											
			57											
S14			58											Borehole producing a lot of water.
			59											
			60											
			61											
			62											
S15			63											
			64											
			65											

Boring Number MW-303

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			66	SHALE, Gray (10YR 6/1), very weak, massive, clayey. *(continued)*										
			67	Same as above except, black (10YR 2/1) and gray (10YR 6/1), laminated.										
S16			68											
			69											
			70											
			71											
			72											
S17			73											
			74											
			75											
			76											
			77											
S18			78											
			79											
			80	Same as above except, gray (10YR 6/1), clayey.										
			81											
			82											
S19			83											Sulfur smell.
			84											
			85	Same as above except, gray (10YR 6/1), black (10YR 2/1), Reddish brown (5YR 4/3).										
			86											
			87											
S20			88											
			89											
			90											

Boring Number MW-303 Page 5 of 7

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			90	SHALE, Gray (10YR 6/1), very weak, massive, clayey. *(continued)*										
			91	Same as above except, black (10YR 2/1), reddish brown (5YR 4/3), dark greenish gray (5GY 4/1).										
S21			92											
			93											
			94											
			95											
			96											
S22			97											
			98											
			99											
			100											
			101	Same as above with laminations.										
			102											
S23			103											Sulfur smell.
			104											
			105	SHALE, black (10YR 2/1), reddish brown (5YR 4/3), dark greenish gray (5G 4/1), clayey.										
			106											
			107											
S24			108											
			109											
			110	Same as above except, black (10YR 3/1), pale brown (10YR 6/3), reddish brown (5YR 4/3), Dark Greenish Gray (5GY 4/1), clayey.										
			111											
			112											
S25			113											
			114	Same as above except, limestone fragments are encountered.										
			115											

Boring Number MW-303 Page 6 of 7

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			116	SHALE, Gray (10YR 6/1), very weak, massive, clayey. *(continued)*										
			117	LIMESTONE, dark greenish gray (5G 4/1), clayey, clay is pale brown (10YR 6/3) and reddish brown (5YR 4/3), shale fragments, shale is black (10YR 3/1).										
S26			118											Air rotary drilling complete.
			119											
			120	SHALE, greensih gray (5GY 6/1), strong, massive, clayey.										
R1	8/12		121											Run 1 120'-121'. Run 1 TCR=66% SCR=66% MCR=42%
R2	12/12		122	LIMESTONE, gray (10YR 6/1), interbedded with shale laminations, strong, shells.										Run 2 121'-122'. Run 2 TCR=100% SCR=100% MCR=77%.
			123											
R3	36/36		124	SHALE, greenish gray (5GY 6/1), shells, very weak, clayey, massive.										Run 3 122'-125'. Run 3 TCR=100% SCR=100% MCR=92%.
			125											
			126	LIMESTONE, gray (10YR 5/1), strong.										
			127											
			128	SHALE, greenish gray (5GY 6/1), weak.										
			129	LIMESTONE, gray (10YR 5/1), strong, interbedded with shale laminations.										
			130											
R4	100/120		131											Run 4 125.5'-135.5'. Run4 TCR=83% SCR=83% MCR= 76%.
			132											
			133											
			134											
			135											
			136	SHALE, dark greenish gray (5GY 4/1), clayey, weak, interbedded with limestone-gray (10YR 5/1).										
			137											
R5	59/60		138											Run 5 135.5'-140.5'. TCR= 99% SCR=94% MCR= 75%.
			139											
			140											

Boring Number MW-303 Page 7 of 7

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Vane Shear	Soil Properties: Standard Penetration	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			141	SANDSTONE, greenish gray (5GY 6/1), very weak, fine grained.										
			142											
			143											
			144											
			145											
R6	87/120		146											Run 6 140.5'-150.5'. Run 6 TCR=73% SCR=69% MCR=59%.
			147											
			148											
			149	SHALE, dark greenish gray (5GY 4/1), clayey, weak, interbedded with limestone-gray (10YR 5/1).										
			150											
				End of boring at 150.5 ft bgs. Boring reamed with 6" rotary before installation of MW-303.										

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Ottumwa Midland Landfill Permit No.: 38223

Well or Piezometer No: MW-102M

Dates Started: August 20, 2012 Date Completed: August 27, 2012

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft):

Specify corner of site: NE

Distance & direction along boundary: 29 S

Distance & direction from boundary to wall: 7 W

Elevations (± 0.01 ft MSL):

Ground Surface: 795.50

Top of protective casing: 798.23

Top of well casing: 798.03

Benchmark elevation: 820.39

Benchmark description: Brass cap in concrete, 408 ft N of MW-20

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Boart Longyear
901D Grossman Drive
Schofield, WI 54476

Name of Driller: Paul Dickinson

Drilling Method: HSA, Air Hammer, NQ3 Core

Drilling Fluid: Air, Water

Bore Hole Diameter: 10.5/6.0 in

Soil Sampling Method: Split spoon, screen chips, core

Depth of Boring: 153 ft

C. MONITORING WELL INSTALLATION

Casing material: Flush threaded PVC schedule 80

Length of casing: 152.1

Outside casing diameter: 2.4 in

Inside casing diameter: 1.9 in

Casing joint type: Flush Threaded

Casing/screen joint type: Flush Threaded

Screen material: Sch 80 PVC

Screen opening size: 0.01 in

Screen length: 5 ft

Depth of well: 147.9 ft

Filter Pack:

Material: Red Flint Filter Sand

Grain size: #40

Volume: 1.5 ft^3

Seal (minimum 3 ft length above filter pack):

Material: 3/8 inch bentonite chips

Placement method: Gravity

Volume: 0.7 ft^3

Backfill (if different from seal):

Material: Bentonite Slurry

Placement method: Tremie pumped

Volume: 40.1 ft^3

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: bentonite & concrete

Protective cap:

Material: Aluminum

Vented: ☑ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: plastic with rubber gasket

Vented: ☑ Yes ☐ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 100.81 Stabilization Time: 1 week

Well development method: Surged & bailed with bailer and pump

Average depth of frostline: 3 feet

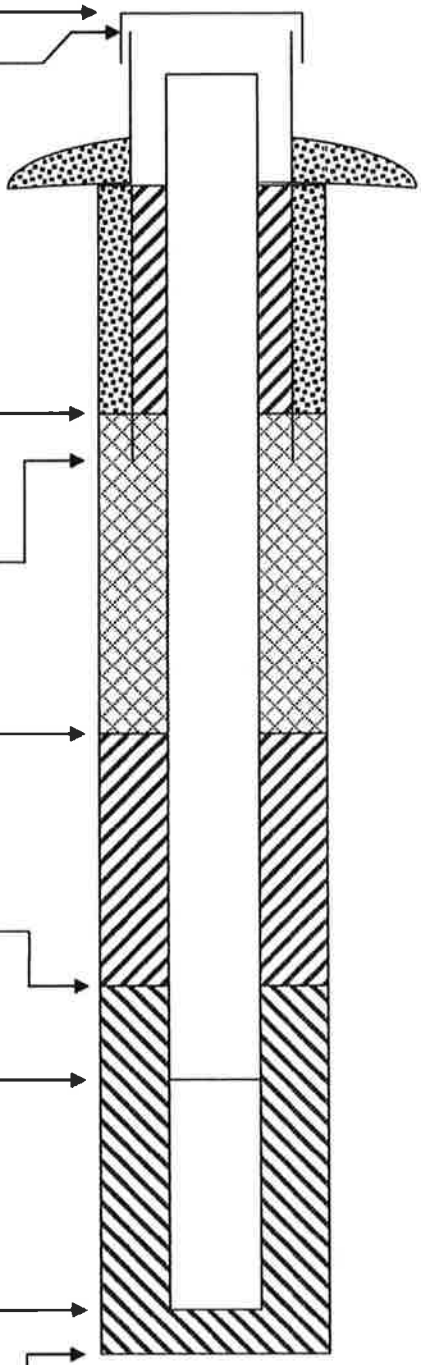
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



TOP OF PROTECTIVE CASING
ELEVATION 798.33
TOP OF WELL CASING
ELEVATION 798.03

GROUND SURFACE
ELEVATION 795.50

TOP OF BACKFILL
BASE OF CONCRETE PLUG
AND BENTONITE GROUT
ELEVATION 791.50
DEPTH 4.0

BASE OF PROTECTIVE CASING
ELEVATION 790.95
DEPTH 4.5

BASE OF BACKFILL
TOP OF SEAL
ELEVATION 659.50
DEPTH 136

TOP OF FILTER PACK
BASE OF SEAL
ELEVATION 654.50
DEPTH 141.0

TOP OF SCREEN
ELEVATION 652.65
DEPTH 142.9

BOTTOM OF SCREEN
ELEVATION 647.65
DEPTH 147.9 ft

BASE OF FILTER PACK
ELEVATION 643.50
DEPTH 152.0 ft

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Ottumwa Midland Landfill Permit No.: 38230

Well or Piezometer No: MW-122M

Dates Started: December 6, 2012 Date Completed: December 9, 2012

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft):

Specify corner of site: NW

Distance & direction along boundary: 553 S

Distance & direction from boundary to wall: 462 E

Elevations (± 0.01 ft MSL):

Ground Surface: 790.74

Top of protective casing: 792.94

Top of well casing: 792.70

Benchmark elevation: 820.39

Benchmark description: Brass cap in concrete, 408 ft N of MW-20

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Boart Longyear
901D Grossman Drive
Schofield, WI 54476

Name of Driller: Paul Dickinson

Drilling Method: Rotary, HSA

Drilling Fluid: Air

Bore Hole Diameter: 10.5" to 10', 6" below 10'

Soil Sampling Method: Split spoon, screen air rotary chips

Depth of Boring: 154 ft

C. MONITORING WELL INSTALLATION

Casing material: Flush threaded PVC schedule 80

Length of casing: 155.3

Outside casing diameter: 2.4 in

Inside casing diameter: 1.89 in

Casing joint type: Flush Threaded

Casing/screen joint type: Flush Threaded

Screen material: PVC

Screen opening size: 0.01 in

Screen length: 5 ft

Depth of well: 152.8 ft

Filter Pack:

Material: Red Flint Filter Sand

Grain size: #40

Volume: 1.5 ft^3

Seal (minimum 3 ft length above filter pack):

Material: 3/8 inch bentonite chips

Placement method: Gravity

Volume: 0.67 ft^3

Backfill (if different from seal):

Material: Bentonite Slurry / 3/8" Chips

Placement method: Tremie Pumped / Gravity

Volume: 400 gal. Slurry / 6 ft^3 Chips

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: bentonite & concrete

Protective cap:

Material: aluminum

Vented: ☒ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: plastic with rubber gasket

Vented: ☒ Yes ☐ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 68.81 Stabilization Time: 1 week

Well development method: Surged & bailed with bailer and pump

Average depth of frostline: 3 feet

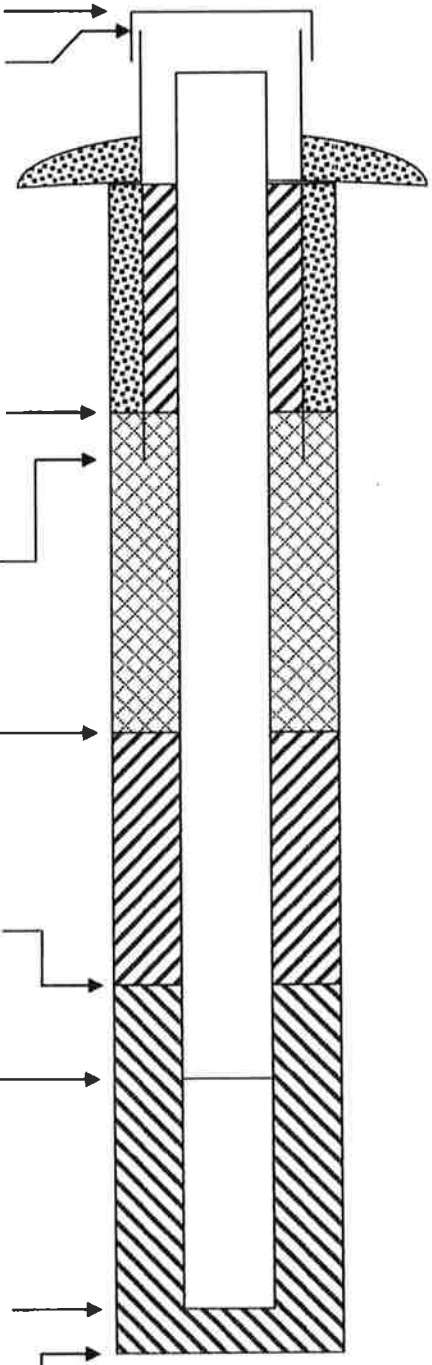
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



TOP OF PROTECTIVE CASING
ELEVATION 792.94
TOP OF WELL CASING
ELEVATION 792.70

GROUND SURFACE
ELEVATION 790.74

TOP OF BACKFILL
BASE OF CONCRETE PLUG
AND BENTONITE GROUT
ELEVATION 786.74
DEPTH 4.0

BASE OF PROTECTIVE CASING
ELEVATION 785.94
DEPTH 4.8

BASE OF BACKFILL
TOP OF SEAL
ELEVATION 651.24
DEPTH 139.5 ft

TOP OF FILTER PACK
BASE OF SEAL
ELEVATION 646.24
DEPTH 144.5 ft

TOP OF SCREEN
ELEVATION 642.94
DEPTH 147.8 ft

BOTTOM OF SCREEN
ELEVATION 637.94
DEPTH 152.8 ft

BASE OF FILTER PACK
ELEVATION 636.74
DEPTH 154.0 ft

Appendix C

Laboratory Reports

C1 April 2021 Detection Monitoring

eurofins | Environment Testing America

ANALYTICAL REPORT

Eurofins TestAmerica, Cedar Falls
3019 Venture Way
Cedar Falls, IA 50613
Tel: (319)277-2401

Laboratory Job ID: 310-204550-1
Client Project/Site: Ottumwa Midland LF 25221073

For:
SCS Engineers
2830 Dairy Drive
Madison, Wisconsin 53718

Attn: Meghan Blodgett

Sandra Fredrick

Authorized for release by:
4/28/2021 3:17:46 PM

Sandie Fredrick, Project Manager II
(920)261-1660
sandra.fredrick@eurofinset.com

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Case Narrative

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-204550-1

Job ID: 310-204550-1

Laboratory: Eurofins TestAmerica, Cedar Falls

Narrative

Job Narrative
310-204550-1

Comments
No additional comments.

Receipt
The samples were received on 4/16/2021 5:00 PM. Unless otherwise noted below, the samples arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was 2.9º C.

HPLC/IC
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Metals
Method 3010A: The reference method requires samples to be preserved to a pH of <2. The following samples were received with insufficient preservation at a pH of >2: MW-102M (310-204550-4) and MW-122M (310-204550-5). The sample(s) was preserved to the appropriate pH in the laboratory.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

General Chemistry
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Sample Summary

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-204550-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Asset ID
310-204550-1	MW-301	Water	04/12/21 12:50	04/16/21 17:00	
310-204550-2	MW-302	Water	04/12/21 15:50	04/16/21 17:00	
310-204550-3	MW-303	Water	04/12/21 14:45	04/16/21 17:00	
310-204550-4	MW-102M	Water	04/15/21 09:40	04/16/21 17:00	
310-204550-5	MW-122M	Water	04/15/21 08:50	04/16/21 17:00	
310-204550-6	Field Blank	Water	04/12/21 13:00	04/16/21 17:00	

Detection Summary

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-204550-1

Client Sample ID: MW-301 — Lab Sample ID: 310-204550-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	28		5.0	2.2	mg/L	5		9056A	Total/NA
Fluoride	0.73		0.50	0.28	mg/L	5		9056A	Total/NA
Sulfate	530		20	9.8	mg/L	20		9056A	Total/NA
Boron	790		100	58	ug/L	1		6020A	Total/NA
Calcium	160		0.50	0.19	mg/L	1		6020A	Total/NA
Total Dissolved Solids	1300		30	26	mg/L	1		SM 2540C	Total/NA
pH	6.6	HF	0.1	0.1	SU	1		SM 4500 H+ B	Total/NA
Ground Water Elevation	687.25				ft	1		Field Sampling	Total/NA
Oxidation Reduction Potential	-79.6				millivolts	1		Field Sampling	Total/NA
Oxygen, Dissolved, Client Supplied	0.46				mg/L	1		Field Sampling	Total/NA
pH, Field	6.62				SU	1		Field Sampling	Total/NA
Specific Conductance, Field	1875				umhos/cm	1		Field Sampling	Total/NA
Temperature, Field	13.0				Degrees C	1		Field Sampling	Total/NA
Turbidity, Field	4.60				NTU	1		Field Sampling	Total/NA

Client Sample ID: MW-302 — Lab Sample ID: 310-204550-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	6.6		5.0	2.2	mg/L	5		9056A	Total/NA
Fluoride	1.1		0.50	0.28	mg/L	5		9056A	Total/NA
Sulfate	64		5.0	2.5	mg/L	5		9056A	Total/NA
Boron	820		100	58	ug/L	1		6020A	Total/NA
Calcium	58		0.50	0.19	mg/L	1		6020A	Total/NA
Total Dissolved Solids	620		30	26	mg/L	1		SM 2540C	Total/NA
pH	6.7	HF	0.1	0.1	SU	1		SM 4500 H+ B	Total/NA
Ground Water Elevation	686.26				ft	1		Field Sampling	Total/NA
Oxidation Reduction Potential	-74.2				millivolts	1		Field Sampling	Total/NA
Oxygen, Dissolved, Client Supplied	0.28				mg/L	1		Field Sampling	Total/NA
pH, Field	7.13				SU	1		Field Sampling	Total/NA
Specific Conductance, Field	1079				umhos/cm	1		Field Sampling	Total/NA
Temperature, Field	13.2				Degrees C	1		Field Sampling	Total/NA
Turbidity, Field	127				NTU	1		Field Sampling	Total/NA

Client Sample ID: MW-303 — Lab Sample ID: 310-204550-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	7.6		5.0	2.2	mg/L	5		9056A	Total/NA
Fluoride	0.74		0.50	0.28	mg/L	5		9056A	Total/NA
Sulfate	260		5.0	2.5	mg/L	5		9056A	Total/NA
Boron	730		100	58	ug/L	1		6020A	Total/NA
Calcium	100		0.50	0.19	mg/L	1		6020A	Total/NA
Total Dissolved Solids	850		30	26	mg/L	1		SM 2540C	Total/NA
pH	7.0	HF	0.1	0.1	SU	1		SM 4500 H+ B	Total/NA
Ground Water Elevation	689.05				ft	1		Field Sampling	Total/NA
Oxidation Reduction Potential	-64.6				millivolts	1		Field Sampling	Total/NA
Oxygen, Dissolved, Client Supplied	0.38				mg/L	1		Field Sampling	Total/NA
pH, Field	6.80				SU	1		Field Sampling	Total/NA
Specific Conductance, Field	1431				umhos/cm	1		Field Sampling	Total/NA
Temperature, Field	14.2				Degrees C	1		Field Sampling	Total/NA
Turbidity, Field	168				NTU	1		Field Sampling	Total/NA

This Detection Summary does not include radiochemical test results.

Detection Summary

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-204550-1

Client Sample ID: MW-102M — Lab Sample ID: 310-204550-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	14		5.0	2.2	mg/L	5		9056A	Total/NA
Fluoride	4.3		0.50	0.28	mg/L	5		9056A	Total/NA
Sulfate	330		5.0	2.5	mg/L	5		9056A	Total/NA
Boron	1600		100	58	ug/L	1		6020A	Total/NA
Calcium	43		0.50	0.19	mg/L	1		6020A	Total/NA
Total Dissolved Solids	1500		150	130	mg/L	1		SM 2540C	Total/NA
pH	8.0	HF	0.1	0.1	SU	1		SM 4500 H+ B	Total/NA
Ground Water Elevation	710.95				ft	1		Field Sampling	Total/NA
Oxidation Reduction Potential	164.0				millivolts	1		Field Sampling	Total/NA
Oxygen, Dissolved, Client Supplied	5.24				mg/L	1		Field Sampling	Total/NA
pH, Field	7.85				SU	1		Field Sampling	Total/NA
Specific Conductance, Field	2145				umhos/cm	1		Field Sampling	Total/NA
Temperature, Field	11.5				Degrees C	1		Field Sampling	Total/NA
Turbidity, Field	196				NTU	1		Field Sampling	Total/NA

Client Sample ID: MW-122M — Lab Sample ID: 310-204550-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	8.0		5.0	2.2	mg/L	5		9056A	Total/NA
Fluoride	0.30	J	0.50	0.28	mg/L	5		9056A	Total/NA
Sulfate	8700		100	49	mg/L	100		9056A	Total/NA
Boron	5100		400	230	ug/L	4		6020A	Total/NA
Calcium	410		0.50	0.19	mg/L	1		6020A	Total/NA
Total Dissolved Solids	14000		300	260	mg/L	1		SM 2540C	Total/NA
pH	6.7	HF	0.1	0.1	SU	1		SM 4500 H+ B	Total/NA
Ground Water Elevation	720.52				ft	1		Field Sampling	Total/NA
Oxidation Reduction Potential	159.2				millivolts	1		Field Sampling	Total/NA
Oxygen, Dissolved, Client Supplied	5.03				mg/L	1		Field Sampling	Total/NA
pH, Field	6.78				SU	1		Field Sampling	Total/NA
Specific Conductance, Field	13983				umhos/cm	1		Field Sampling	Total/NA
Temperature, Field	9.0				Degrees C	1		Field Sampling	Total/NA
Turbidity, Field	-				NTU	1		Field Sampling	Total/NA

Client Sample ID: Field Blank — Lab Sample ID: 310-204550-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Boron	77	J	100	58	ug/L	1		6020A	Total/NA
Calcium	0.26	J	0.50	0.19	mg/L	1		6020A	Total/NA
pH	6.0	HF	0.1	0.1	SU	1		SM 4500 H+ B	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-204550-1

Client Sample ID: MW-301

Date Collected: 04/12/21 12:50
Date Received: 04/16/21 17:00

Lab Sample ID: 310-204550-1

Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	28		5.0	2.2	mg/L			04/23/21 18:04	5
Fluoride	0.73		0.50	0.28	mg/L			04/23/21 18:04	5
Sulfate	530		20	9.8	mg/L			04/26/21 11:55	20

Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	790		100	58	ug/L		04/22/21 08:11	04/23/21 16:45	1
Calcium	160		0.50	0.19	mg/L		04/22/21 08:11	04/23/21 16:45	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	1300		30	26	mg/L			04/19/21 09:05	1
pH	6.6	HF	0.1	0.1	SU			04/16/21 17:02	1

Method: Field Sampling - Field Sampling

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ground Water Elevation	687.25				ft			04/12/21 12:50	1
Oxidation Reduction Potential	-79.6				millivolts			04/12/21 12:50	1
Oxygen, Dissolved, Client Supplied	0.46				mg/L			04/12/21 12:50	1
pH, Field	6.62				SU			04/12/21 12:50	1
Specific Conductance, Field	1875				umhos/cm			04/12/21 12:50	1
Temperature, Field	13.0				Degrees C			04/12/21 12:50	1
Turbidity, Field	4.60				NTU			04/12/21 12:50	1

Client Sample Results

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-204550-1

Client Sample ID: MW-302

Date Collected: 04/12/21 15:50
Date Received: 04/16/21 17:00

Lab Sample ID: 310-204550-2

Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	6.6		5.0	2.2	mg/L			04/23/21 18:20	5
Fluoride	1.1		0.50	0.28	mg/L			04/23/21 18:20	5
Sulfate	64		5.0	2.5	mg/L			04/23/21 18:20	5

Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	820		100	58	ug/L		04/22/21 08:11	04/23/21 16:51	1
Calcium	58		0.50	0.19	mg/L		04/22/21 08:11	04/23/21 16:51	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	620		30	26	mg/L			04/19/21 09:05	1
pH	6.7	HF	0.1	0.1	SU			04/16/21 19:41	1

Method: Field Sampling - Field Sampling

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ground Water Elevation	686.26				ft			04/12/21 15:50	1
Oxidation Reduction Potential	-74.2				millivolts			04/12/21 15:50	1
Oxygen, Dissolved, Client Supplied	0.28				mg/L			04/12/21 15:50	1
pH, Field	7.13				SU			04/12/21 15:50	1
Specific Conductance, Field	1079				umhos/cm			04/12/21 15:50	1
Temperature, Field	13.2				Degrees C			04/12/21 15:50	1
Turbidity, Field	127				NTU			04/12/21 15:50	1

Client Sample Results

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-204550-1

Client Sample ID: MW-303

Date Collected: 04/12/21 14:45
Date Received: 04/16/21 17:00

Lab Sample ID: 310-204550-3

Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	7.6		5.0	2.2	mg/L			04/23/21 18:35	5
Fluoride	0.74		0.50	0.28	mg/L			04/23/21 18:35	5
Sulfate	260		5.0	2.5	mg/L			04/23/21 18:35	5

Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	730		100	58	ug/L		04/22/21 08:11	04/23/21 16:53	1
Calcium	100		0.50	0.19	mg/L		04/22/21 08:11	04/23/21 16:53	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	850		30	26	mg/L			04/19/21 09:05	1
pH	7.0	HF	0.1	0.1	SU			04/16/21 19:40	1

Method: Field Sampling - Field Sampling

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ground Water Elevation	689.05				ft			04/12/21 14:45	1
Oxidation Reduction Potential	-64.6				millivolts			04/12/21 14:45	1
Oxygen, Dissolved, Client Supplied	0.38				mg/L			04/12/21 14:45	1
pH, Field	6.80				SU			04/12/21 14:45	1
Specific Conductance, Field	1431				umhos/cm			04/12/21 14:45	1
Temperature, Field	14.2				Degrees C			04/12/21 14:45	1
Turbidity, Field	168				NTU			04/12/21 14:45	1

Client Sample Results

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-204550-1

Client Sample ID: MW-102M

Date Collected: 04/15/21 09:40
Date Received: 04/16/21 17:00

Lab Sample ID: 310-204550-4

Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	14		5.0	2.2	mg/L			04/23/21 18:51	5
Fluoride	4.3		0.50	0.28	mg/L			04/23/21 18:51	5
Sulfate	330		5.0	2.5	mg/L			04/23/21 18:51	5

Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	1600		100	58	ug/L		04/22/21 08:11	04/23/21 16:56	1
Calcium	43		0.50	0.19	mg/L		04/22/21 08:11	04/23/21 16:56	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	1500		150	130	mg/L			04/20/21 13:51	1
pH	8.0	HF	0.1	0.1	SU			04/16/21 19:37	1

Method: Field Sampling - Field Sampling

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ground Water Elevation	710.95				ft			04/15/21 09:40	1
Oxidation Reduction Potential	164.0				millivolts			04/15/21 09:40	1
Oxygen, Dissolved, Client Supplied	5.24				mg/L			04/15/21 09:40	1
pH, Field	7.85				SU			04/15/21 09:40	1
Specific Conductance, Field	2145				umhos/cm			04/15/21 09:40	1
Temperature, Field	11.5				Degrees C			04/15/21 09:40	1
Turbidity, Field	196				NTU			04/15/21 09:40	1

Client Sample Results

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-204550-1

Client Sample ID: MW-122M

Date Collected: 04/15/21 08:50
Date Received: 04/16/21 17:00

Lab Sample ID: 310-204550-5

Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	8.0		5.0	2.2	mg/L			04/23/21 19:07	5
Fluoride	0.30	J	0.50	0.28	mg/L			04/23/21 19:07	5
Sulfate	8700		100	49	mg/L			04/26/21 12:45	100

Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	5100		400	230	ug/L		04/22/21 08:11	04/26/21 12:06	4
Calcium	410		0.50	0.19	mg/L		04/22/21 08:11	04/23/21 16:59	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	14000		300	260	mg/L			04/20/21 13:51	1
pH	6.7	HF	0.1	0.1	SU			04/16/21 19:36	1

Method: Field Sampling - Field Sampling

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ground Water Elevation	720.52				ft			04/15/21 08:50	1
Oxidation Reduction Potential	159.2				millivolts			04/15/21 08:50	1
Oxygen, Dissolved, Client Supplied	5.03				mg/L			04/15/21 08:50	1
pH, Field	6.78				SU			04/15/21 08:50	1
Specific Conductance, Field	13983				umhos/cm			04/15/21 08:50	1
Temperature, Field	9.0				Degrees C			04/15/21 08:50	1
Turbidity, Field	-				NTU			04/15/21 08:50	1

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-204550-1

Client Sample ID: Field Blank

Date Collected: 04/12/21 13:00
Date Received: 04/16/21 17:00

Lab Sample ID: 310-204550-6

Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<0.43		1.0	0.43	mg/L			04/23/21 19:53	1
Fluoride	<0.055		0.10	0.055	mg/L			04/23/21 19:53	1
Sulfate	<0.49		1.0	0.49	mg/L			04/23/21 19:53	1

Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	**77**	**J**	100	58	ug/L		04/22/21 08:11	04/23/21 17:01	1
Calcium	**0.26**	**J**	0.50	0.19	mg/L		04/22/21 08:11	04/23/21 17:01	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	<26		30	26	mg/L			04/19/21 09:05	1
pH	**6.0**	**HF**	0.1	0.1	SU			04/16/21 19:47	1

Definitions/Glossary

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-204550-1

Qualifiers

HPLC/IC

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

General Chemistry

Qualifier	Qualifier Description
HF	Field parameter with a holding time of 15 minutes. Test performed by laboratory at client's request.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Method: 9056A - Anions, Ion Chromatography

Lab Sample ID: MB 310-314219/3
Matrix: Water
Analysis Batch: 314219

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<0.43		1.0	0.43	mg/L			04/23/21 12:37	1
Fluoride	<0.055		0.10	0.055	mg/L			04/23/21 12:37	1
Sulfate	<0.49		1.0	0.49	mg/L			04/23/21 12:37	1

Lab Sample ID: LCS 310-314219/4
Matrix: Water
Analysis Batch: 314219

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	10.0	9.26		mg/L		93	90 - 110
Fluoride	2.00	2.11		mg/L		106	90 - 110
Sulfate	10.0	10.1		mg/L		101	90 - 110

Method: 6020A - Metals (ICP/MS)

Lab Sample ID: MB 310-313542/1-A
Matrix: Water
Analysis Batch: 313877

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 313542

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	<58		100	58	ug/L		04/22/21 08:10	04/23/21 15:02	1
Calcium	<0.19		0.50	0.19	mg/L		04/22/21 08:10	04/23/21 15:02	1

Lab Sample ID: LCS 310-313542/2-A
Matrix: Water
Analysis Batch: 313877

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 313542

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Boron	200	198		ug/L		99	80 - 120
Calcium	2.00	1.81		mg/L		91	80 - 120

Lab Sample ID: 310-204550-1 DU
Matrix: Water
Analysis Batch: 313877

Client Sample ID: MW-301
Prep Type: Total/NA
Prep Batch: 313542

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Boron	790		804		ug/L		2	20
Calcium	160		160		mg/L		0.1	20

Method: SM 2540C - Solids, Total Dissolved (TDS)

Lab Sample ID: MB 310-313155/1
Matrix: Water
Analysis Batch: 313155

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	<26		30	26	mg/L			04/19/21 09:05	1

Method: SM 2540C - Solids, Total Dissolved (TDS) (Continued)

Lab Sample ID: LCS 310-313155/2
Matrix: Water
Analysis Batch: 313155

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Total Dissolved Solids			1000	982		mg/L		98	90 - 110		

Lab Sample ID: 310-204550-1 DU
Matrix: Water
Analysis Batch: 313155

Client Sample ID: MW-301
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Total Dissolved Solids	1300			1250		mg/L				0.2	20

Lab Sample ID: MB 310-313365/1
Matrix: Water
Analysis Batch: 313365

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	<26		30	26	mg/L			04/20/21 13:51	1

Lab Sample ID: LCS 310-313365/2
Matrix: Water
Analysis Batch: 313365

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Total Dissolved Solids			1000	962		mg/L		96	90 - 110		

Method: SM 4500 H+ B - pH

Lab Sample ID: LCS 310-313064/59
Matrix: Water
Analysis Batch: 313064

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
pH			7.00	7.1		SU		101	98 - 102		

Lab Sample ID: LCS 310-313078/1
Matrix: Water
Analysis Batch: 313078

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
pH			7.00	7.0		SU		101	98 - 102		

QC Association Summary

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-204550-1

HPLC/IC

Analysis Batch: 314219

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-204550-1	MW-301	Total/NA	Water	9056A	
310-204550-1	MW-301	Total/NA	Water	9056A	
310-204550-2	MW-302	Total/NA	Water	9056A	
310-204550-3	MW-303	Total/NA	Water	9056A	
310-204550-4	MW-102M	Total/NA	Water	9056A	
310-204550-5	MW-122M	Total/NA	Water	9056A	
310-204550-5	MW-122M	Total/NA	Water	9056A	
310-204550-6	Field Blank	Total/NA	Water	9056A	
MB 310-314219/3	Method Blank	Total/NA	Water	9056A	
LCS 310-314219/4	Lab Control Sample	Total/NA	Water	9056A	

Metals

Prep Batch: 313542

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-204550-1	MW-301	Total/NA	Water	3010A	
310-204550-2	MW-302	Total/NA	Water	3010A	
310-204550-3	MW-303	Total/NA	Water	3010A	
310-204550-4	MW-102M	Total/NA	Water	3010A	
310-204550-5	MW-122M	Total/NA	Water	3010A	
310-204550-6	Field Blank	Total/NA	Water	3010A	
MB 310-313542/1-A	Method Blank	Total/NA	Water	3010A	
LCS 310-313542/2-A	Lab Control Sample	Total/NA	Water	3010A	
310-204550-1 DU	MW-301	Total/NA	Water	3010A	

Analysis Batch: 313877

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-204550-1	MW-301	Total/NA	Water	6020A	313542
310-204550-2	MW-302	Total/NA	Water	6020A	313542
310-204550-3	MW-303	Total/NA	Water	6020A	313542
310-204550-4	MW-102M	Total/NA	Water	6020A	313542
310-204550-5	MW-122M	Total/NA	Water	6020A	313542
310-204550-6	Field Blank	Total/NA	Water	6020A	313542
MB 310-313542/1-A	Method Blank	Total/NA	Water	6020A	313542
LCS 310-313542/2-A	Lab Control Sample	Total/NA	Water	6020A	313542
310-204550-1 DU	MW-301	Total/NA	Water	6020A	313542

Analysis Batch: 314022

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-204550-5	MW-122M	Total/NA	Water	6020A	313542

General Chemistry

Analysis Batch: 313064

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-204550-1	MW-301	Total/NA	Water	SM 4500 H+ B	
LCS 310-313064/59	Lab Control Sample	Total/NA	Water	SM 4500 H+ B	

Analysis Batch: 313078

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-204550-2	MW-302	Total/NA	Water	SM 4500 H+ B	
310-204550-3	MW-303	Total/NA	Water	SM 4500 H+ B	

General Chemistry (Continued)

Analysis Batch: 313078 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-204550-4	MW-102M	Total/NA	Water	SM 4500 H+ B	
310-204550-5	MW-122M	Total/NA	Water	SM 4500 H+ B	
310-204550-6	Field Blank	Total/NA	Water	SM 4500 H+ B	
LCS 310-313078/1	Lab Control Sample	Total/NA	Water	SM 4500 H+ B	

Analysis Batch: 313155

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-204550-1	MW-301	Total/NA	Water	SM 2540C	
310-204550-2	MW-302	Total/NA	Water	SM 2540C	
310-204550-3	MW-303	Total/NA	Water	SM 2540C	
310-204550-6	Field Blank	Total/NA	Water	SM 2540C	
MB 310-313155/1	Method Blank	Total/NA	Water	SM 2540C	
LCS 310-313155/2	Lab Control Sample	Total/NA	Water	SM 2540C	
310-204550-1 DU	MW-301	Total/NA	Water	SM 2540C	

Analysis Batch: 313365

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-204550-4	MW-102M	Total/NA	Water	SM 2540C	
310-204550-5	MW-122M	Total/NA	Water	SM 2540C	
MB 310-313365/1	Method Blank	Total/NA	Water	SM 2540C	
LCS 310-313365/2	Lab Control Sample	Total/NA	Water	SM 2540C	

Field Service / Mobile Lab

Analysis Batch: 313728

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-204550-1	MW-301	Total/NA	Water	Field Sampling	
310-204550-2	MW-302	Total/NA	Water	Field Sampling	
310-204550-3	MW-303	Total/NA	Water	Field Sampling	
310-204550-4	MW-102M	Total/NA	Water	Field Sampling	
310-204550-5	MW-122M	Total/NA	Water	Field Sampling	

Lab Chronicle

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-204550-1

Client Sample ID: MW-301
Date Collected: 04/12/21 12:50
Date Received: 04/16/21 17:00

Lab Sample ID: 310-204550-1
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		5	314219	04/23/21 18:04	JNR	TAL CF
Total/NA	Analysis	9056A		20	314219	04/26/21 11:55	JNR	TAL CF
Total/NA	Prep	3010A			313542	04/22/21 08:11	JNR	TAL CF
Total/NA	Analysis	6020A		1	313877	04/23/21 16:45	SAD	TAL CF
Total/NA	Analysis	SM 2540C		1	313155	04/19/21 09:05	ARG	TAL CF
Total/NA	Analysis	SM 4500 H+ B		1	313064	04/16/21 17:02	AJW	TAL CF
Total/NA	Analysis	Field Sampling		1	313728	04/12/21 12:50	SLD	TAL CF

Client Sample ID: MW-302
Date Collected: 04/12/21 15:50
Date Received: 04/16/21 17:00

Lab Sample ID: 310-204550-2
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		5	314219	04/23/21 18:20	JNR	TAL CF
Total/NA	Prep	3010A			313542	04/22/21 08:11	JNR	TAL CF
Total/NA	Analysis	6020A		1	313877	04/23/21 16:51	SAD	TAL CF
Total/NA	Analysis	SM 2540C		1	313155	04/19/21 09:05	ARG	TAL CF
Total/NA	Analysis	SM 4500 H+ B		1	313078	04/16/21 19:41	GRS	TAL CF
Total/NA	Analysis	Field Sampling		1	313728	04/12/21 15:50	SLD	TAL CF

Client Sample ID: MW-303
Date Collected: 04/12/21 14:45
Date Received: 04/16/21 17:00

Lab Sample ID: 310-204550-3
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		5	314219	04/23/21 18:35	JNR	TAL CF
Total/NA	Prep	3010A			313542	04/22/21 08:11	JNR	TAL CF
Total/NA	Analysis	6020A		1	313877	04/23/21 16:53	SAD	TAL CF
Total/NA	Analysis	SM 2540C		1	313155	04/19/21 09:05	ARG	TAL CF
Total/NA	Analysis	SM 4500 H+ B		1	313078	04/16/21 19:40	GRS	TAL CF
Total/NA	Analysis	Field Sampling		1	313728	04/12/21 14:45	SLD	TAL CF

Client Sample ID: MW-102M
Date Collected: 04/15/21 09:40
Date Received: 04/16/21 17:00

Lab Sample ID: 310-204550-4
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		5	314219	04/23/21 18:51	JNR	TAL CF
Total/NA	Prep	3010A			313542	04/22/21 08:11	JNR	TAL CF
Total/NA	Analysis	6020A		1	313877	04/23/21 16:56	SAD	TAL CF
Total/NA	Analysis	SM 2540C		1	313365	04/20/21 13:51	SAS	TAL CF
Total/NA	Analysis	SM 4500 H+ B		1	313078	04/16/21 19:37	GRS	TAL CF
Total/NA	Analysis	Field Sampling		1	313728	04/15/21 09:40	SLD	TAL CF

Lab Chronicle

Client: SCS Engineers
Job ID: 310-204550-1
Project/Site: Ottumwa Midland LF 25221073

Client Sample ID: MW-122M
Lab Sample ID: 310-204550-5
Date Collected: 04/15/21 08:50
Matrix: Water
Date Received: 04/16/21 17:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		5	314219	04/23/21 19:07	JNR	TAL CF
Total/NA	Analysis	9056A		100	314219	04/26/21 12:45	JNR	TAL CF
Total/NA	Prep	3010A			313542	04/22/21 08:11	JNR	TAL CF
Total/NA	Analysis	6020A		1	313877	04/23/21 16:59	SAD	TAL CF
Total/NA	Prep	3010A			313542	04/22/21 08:11	JNR	TAL CF
Total/NA	Analysis	6020A		4	314022	04/26/21 12:06	SAD	TAL CF
Total/NA	Analysis	SM 2540C		1	313365	04/20/21 13:51	SAS	TAL CF
Total/NA	Analysis	SM 4500 H+ B		1	313078	04/16/21 19:36	GRS	TAL CF
Total/NA	Analysis	Field Sampling		1	313728	04/15/21 08:50	SLD	TAL CF

Client Sample ID: Field Blank
Lab Sample ID: 310-204550-6
Date Collected: 04/12/21 13:00
Matrix: Water
Date Received: 04/16/21 17:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		1	314219	04/23/21 19:53	JNR	TAL CF
Total/NA	Prep	3010A			313542	04/22/21 08:11	JNR	TAL CF
Total/NA	Analysis	6020A		1	313877	04/23/21 17:01	SAD	TAL CF
Total/NA	Analysis	SM 2540C		1	313155	04/19/21 09:05	ARG	TAL CF
Total/NA	Analysis	SM 4500 H+ B		1	313078	04/16/21 19:47	GRS	TAL CF

Laboratory References:

TAL CF = Eurofins TestAmerica, Cedar Falls, 3019 Venture Way, Cedar Falls, IA 50613, TEL (319)277-2401

Accreditation/Certification Summary

Client: SCS Engineers
Job ID: 310-204550-1
Project/Site: Ottumwa Midland LF 25221073

Laboratory: Eurofins TestAmerica, Cedar Falls

The accreditations/certifications listed below are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Iowa	State	007	12-01-21

Method Summary

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-204550-1

Method	Method Description	Protocol	Laboratory
9056A	Anions, Ion Chromatography	SW846	TAL CF
6020A	Metals (ICP/MS)	SW846	TAL CF
SM 2540C	Solids, Total Dissolved (TDS)	SM	TAL CF
SM 4500 H+ B	pH	SM	TAL CF
Field Sampling	Field Sampling	EPA	TAL CF
3010A	Preparation, Total Metals	SW846	TAL CF

Protocol References:

EPA = US Environmental Protection Agency

SM = "Standard Methods For The Examination Of Water And Wastewater"

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL CF = Eurofins TestAmerica, Cedar Falls, 3019 Venture Way, Cedar Falls, IA 50613, TEL (319)277-2401

eurofins | Environment Testing TestAmerica

310-204550 Chain of Custody

Cooler/Sample Receipt and Temperature

Client Information

Client: SCS

City/State: CITY Clive STATE IA Project: Ottumwa Midland LF

Receipt Information

Date/Time Received: DATE 04/16/21 TIME 1700 Received By:

Delivery Type: ☐ UPS ☐ FedEx ☐ FedEx Ground ☐ US Mail ☐ Spee-Dee
☒ Lab Courier ☐ Lab Field Services ☐ Client Drop-off ☐ Other:_____

Condition of Cooler/Containers

Sample(s) received in Cooler?	☒ Yes ☐ No	*If yes:* Cooler ID:	AC-14
Multiple Coolers?	~~☒ Yes~~ ☐ No	*If yes:* Cooler # ____ of 31	4-16-21 OK Sjt 4/16/21
Cooler Custody Seals Present?	☒ Yes ☐ No	*If yes:* Cooler custody seals intact?	☒ Yes ☐ No
Sample Custody Seals Present?	☐ Yes ☒ No	*If yes:* Sample custody seals intact?	☐ Yes ☐ No
Trip Blank Present?	☐ Yes ☒ No	*If yes:* Which VOA samples are in cooler?	↓

Temperature Record

Coolant: ☒ Wet ice ☐ Blue ice ☐ Dry ice ☐ Other:_____ ☐ NONE

Thermometer ID: 6 Correction Factor (°C): 0

Temp Blank Temperature – If no temp blank, or temp blank temperature above criteria, proceed to Sample Container Temperature

Uncorrected Temp (°C): 2.9 Corrected Temp (°C): 2.9

Sample Container Temperature

	CONTAINER 1	CONTAINER 2
Container(s) used:		
Uncorrected Temp (°C):		
Corrected Temp (°C):		

Exceptions Noted

1) If temperature exceeds criteria, was sample(s) received same day of sampling? ☐ Yes ☐ No
a) *If yes:* Is there evidence that the chilling process began? ☐ Yes ☐ No

2) If temperature is <0°C, are there obvious signs that the integrity of sample containers is compromised? (e.g., bulging septa, broken/cracked bottles, frozen solid?) ☐ Yes ☐ No

NOTE: If yes, contact PM before proceeding. If no, proceed with login

Additional Comments

Eurofins TestAmerica, Cedar Falls
3019 Venture Way
Cedar Falls, IA 50613
Phone: 319-277-2401 Fax: 319-277-2425

TestAmerica Des Moines SC
214

Chain of Custody Record

eurofins | Environment Testing America

Client Information	Sampler: Tanten Buszka	Lab PM: Fredrick, Sandie	Carrier Tracking No(s):	COC No: 310-59838-14130.1
Client Contact: Tanten Buszka	Phone: 269-993-0855	E-Mail: sandra.fredrick@eurofinset.com	State of Origin:	Page: Page 1 of 1
Company: SCS Engineers	PWSID:			Job #:
Address: 8450 Hickman Road Suite 27	Due Date Requested:			
City: Clive	TAT Requested (days):			
State, Zip: IA, 50325	Compliance Project: Δ Yes Δ No			
Phone: 269-993-0855	PO #: 25221073			
Email: tbuszka@scsengineers.com	WO #:			
Project Name: Ottumwa Midland LF 25221073	Project #: 31011020			
Site: OML	SSOW#:			

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	2540C_Calcd, SM4500_H+	6020A - B/Ca	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	D		
MW-301	4.12.21	12:50	G	Water	N	N	X	X		
MW-302	4.12.21	15:50	G	Water	N	N	X	X		
MW-303	4.12.21	14:45	G	Water	N	N	X	X		
MW-102M	4.15.21	9:40	G	Water	N	N	X	X		
MW-122M	4.15.21	8:50	G	Water	N	N	X	X		
Field Blank	4.12.21	13:00	G	Water	N	N	X	X		
				Water						

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☒ Disposal By Lab ☐ Archive For ____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Tanten Buszka	4.16.21 14:00	SCS		4/16 1700	
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

Ver: 11/01/2020

Eurofins TestAmerica, Cedar Falls
3019 Venture Way
Cedar Falls, IA 50613
Phone: 319-277-2401 Fax: 319-277-2425

Chain of Custody Record

TestAmerica Des Moines SC
214

eurofins | Environment Testing America

Client Information	Sampler: Tanten Buszka	Lab PM: Fredrick, Sandie	Carrier Tracking No(s):	COC No: 310-59838-14130.1
Client Contact: Tanten Buszka	Phone: 769-993-0855	E-Mail: sandra.fredrick@eurofinset.com	State of Origin:	Page: Page 1 of 1
Company: SCS Engineers	PWSID:			Job #:
Address: 8450 Hickman Road Suite 27	Due Date Requested:			
City: Clive	TAT Requested (days):			
State, Zip: IA, 50325	Compliance Project: Δ Yes Δ No			
Phone: 769-993-0855	PO #: 25221073			
Email: tbuszka@scsengineers.com	WO #:			
Project Name: Ottumwa Midland LF 25221073	Project #: 31011020			
Site: OML	SSOW#:			

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	2540C_Calcd, SM4500_H+	6020A - B/Ca	Total Number of containers	Special Instructions/Note:
Preservation Code:							N	D		
MW-301	4.12.21	12:50	G	Water	N	N	X	X		
MW-302	4.12.21	15:50	G	Water	N	N	X	X		
MW-303	4.12.21	14:45	G	Water	N	N	X	X		
MW-102M	4.15.21	9:40	G	Water	N	N	X	X		
MW-122M	4.15.21	8:50	G	Water	N	N	X	X		
Field Blank	4.12.21	13:00	G	Water	N	N	X	X		
				Water						

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by	Date/Time	Company	Received by	Date/Time	Company
Tanten Buszka	4.16.21 14:00	SCS	[signature]	4/16 1700	
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

Ver: 11/01/2020

Table 2. Sampling Points and Parameters - CCR Rule Sampling Program - Detection Monitoring
Groundwater Monitoring - Ottumwa Midland Landfill / SCS Engineers Project #25216073

	Parameter	MW-301	MW-302	MW-303	MW-102M	MW-122M	Field Blank	TOTAL
Appendix III Parameters	Boron	x	x	x	x	x	x	6
	Calcium	x	x	x	x	x	x	6
	Chloride	x	x	x	x	x	x	6
	Fluoride	x	x	x	x	x	x	6
	pH	x	x	x	x	x	x	6
	Sulfate	x	x	x	x	x	x	6
	TDS	x	x	x	x	x	x	6
Appendix IV Parameters	Antimony							0
	Arsenic							0
	Barium							0
	Beryllium							0
	Cadmium							0
	Chromium							0
	Cobalt							0
	Fluoride							0
	Lead							0
	Lithium							0
	Mercury							0
	Molybdenum							0
	Selenium							0
	Thallium							0
	Radium							0
Field Parameters	Groundwater Elevation	x	x	x	x	x		5
	Well Depth	x	x	x	x	x		5
	pH (field)	x	x	x	x	x		5
	Specific Conductance	x	x	x	x	x		5
	Dissolved Oxygen	x	x	x	x	x		5
	ORP	x	x	x	x	x		5
	Temperature	x	x	x	x	x		5
	Turbidity	x	x	x	x	x		5
	Color	x	x	x	x	x		5
	Odor	x	x	x	x	x		5

Notes: All samples are unfiltered (total).

I:\25216073.00\Data and Calculations\Field Notes\Field Work Requests\[Table_2_OML_CCR_Rule_Sampling_Det

Login Sample Receipt Checklist

Client: SCS Engineers

Job Number: 310-204550-1

Login Number: 204550
List Number: 1
Creator: Ramos, Eric F

List Source: Eurofins TestAmerica, Cedar Falls

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Groundwater Monitoring Results - Field Parameters
Ottumwa Midland Landfill / SCS Engineers Project #25221073.00
April 2021

Sample	Date	Groundwater Elevation (ft. amsl)	Temperature (Deg. C)	pH (Std. Units)	DO (mg/L)	Specific Conductivity (µmhos/cm)	ORP (mV)	Turbidity (NTU)
MW-301	4/12/2021 - 12:50	687.25	13.0	6.62	0.46	1,875	-79.6	4.60
MW-302	4/12/2021 - 15:50	686.26	13.2	7.13	0.28	1,079	-74.2	127
MW-303	4/12/2021 - 14:45	689.05	14.2	6.80	0.38	1,431	-64.6	168
MW-102M	4/15/2021 - 09:40	710.95	11.5	7.85	5.24	2,145	164.0	196
MW-122M	4/15/2021 - 08:50	720.52	9.0	6.78	5.03	13,983	159.2	NM

Abbreviations:
amsl = above mean sea level
mg/L = milligrams per liter
µmhos/cm = microSiemens per centimeter
NM = not measured.

Laboratory Notes/Qualifiers:
none

Created by: AJR Date: 8/15/2019
Last revision by: JR Date: 4/22/2021
Checked by: NDK Date: 4/22/2021

C:\Users\FredrickS\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\4NCCUHIK\[2104_OML_GW_Field Data.xlsx]GW Field Data

C2 October 2021 Detection Monitoring

eurofins | Environment Testing America

ANALYTICAL REPORT

Eurofins TestAmerica, Cedar Falls
3019 Venture Way
Cedar Falls, IA 50613
Tel: (319)277-2401

Laboratory Job ID: 310-217018-1
Client Project/Site: Ottumwa Midland LF 25221073

For:
SCS Engineers
2830 Dairy Drive
Madison, Wisconsin 53718

Attn: Meghan Blodgett

Authorized for release by:
10/23/2021 6:51:16 PM

Sandie Fredrick, Project Manager II
(920)261-1660
sandra.fredrick@eurofinset.com

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Case Narrative

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-217018-1

Job ID: 310-217018-1

Laboratory: Eurofins TestAmerica, Cedar Falls

Narrative

Job Narrative
310-217018-1

Comments
No additional comments.

Receipt
The samples were received on 10/8/2021 4:50 PM. Unless otherwise noted below, the samples arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was 4.4º C.

HPLC/IC
Method 9056A: The following samples were diluted due to the nature of the sample matrix: MW-301 (310-217018-1), MW-303 (310-217018-3) and MW-122M (310-217018-5). Elevated reporting limits (RLs) are provided.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Metals
Method 3010A: The reference method requires samples to be preserved to a pH of <2. The following samples were received with insufficient preservation at a pH of >2: MW-102M (310-217018-4) and MW-122M (310-217018-5). The sample(s) was preserved to the appropriate pH in the laboratory.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

General Chemistry
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Sample Summary

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-217018-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
310-217018-1	MW-301	Water	10/05/21 11:28	10/08/21 16:50
310-217018-2	MW-302	Water	10/05/21 09:44	10/08/21 16:50
310-217018-3	MW-303	Water	10/05/21 08:40	10/08/21 16:50
310-217018-4	MW-102M	Water	10/05/21 12:12	10/08/21 16:50
310-217018-5	MW-122M	Water	10/05/21 14:40	10/08/21 16:50
310-217018-6	Field Blank	Water	10/05/21 00:00	10/08/21 16:50

Detection Summary

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-217018-1

Client Sample ID: MW-301 — Lab Sample ID: 310-217018-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	29		5.0	2.2	mg/L	5		9056A	Total/NA
Sulfate	590		10	4.9	mg/L	10		9056A	Total/NA
Boron	700		100	58	ug/L	1		6020A	Total/NA
Calcium	150		0.50	0.19	mg/L	1		6020A	Total/NA
Total Dissolved Solids	1200		50	26	mg/L	1		SM 2540C	Total/NA
pH	6.8	HF	0.1	0.1	SU	1		SM 4500 H+ B	Total/NA
Dissolved Oxygen, Field	0.35				mg/L	1		Field Sampling	Total/NA
Ground Water Elevation	686.87				ft	1		Field Sampling	Total/NA
Oxidation Reduction Potential	-66.1				millivolts	1		Field Sampling	Total/NA
pH, Field	6.71				SU	1		Field Sampling	Total/NA
Specific Conductance, Field	1717				umhos/cm	1		Field Sampling	Total/NA
Temperature, Field	13.8				Degrees C	1		Field Sampling	Total/NA
Turbidity, Field	32.10				NTU	1		Field Sampling	Total/NA

Client Sample ID: MW-302 — Lab Sample ID: 310-217018-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	7.1		5.0	2.2	mg/L	5		9056A	Total/NA
Fluoride	0.50		0.50	0.28	mg/L	5		9056A	Total/NA
Sulfate	70		5.0	2.5	mg/L	5		9056A	Total/NA
Boron	740		100	58	ug/L	1		6020A	Total/NA
Calcium	52		0.50	0.19	mg/L	1		6020A	Total/NA
Total Dissolved Solids	400		250	130	mg/L	1		SM 2540C	Total/NA
pH	7.6	HF	0.1	0.1	SU	1		SM 4500 H+ B	Total/NA
Dissolved Oxygen, Field	0.35				mg/L	1		Field Sampling	Total/NA
Ground Water Elevation	685.85				ft	1		Field Sampling	Total/NA
Oxidation Reduction Potential	-66.5				millivolts	1		Field Sampling	Total/NA
pH, Field	7.20				SU	1		Field Sampling	Total/NA
Specific Conductance, Field	993				umhos/cm	1		Field Sampling	Total/NA
Temperature, Field	13.5				Degrees C	1		Field Sampling	Total/NA
Turbidity, Field	67.10				NTU	1		Field Sampling	Total/NA

Client Sample ID: MW-303 — Lab Sample ID: 310-217018-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	8.3		5.0	2.2	mg/L	5		9056A	Total/NA
Fluoride	0.39	J	0.50	0.28	mg/L	5		9056A	Total/NA
Sulfate	270		5.0	2.5	mg/L	5		9056A	Total/NA
Boron	630		100	58	ug/L	1		6020A	Total/NA
Calcium	92		0.50	0.19	mg/L	1		6020A	Total/NA
Total Dissolved Solids	820		50	26	mg/L	1		SM 2540C	Total/NA
pH	7.3	HF	0.1	0.1	SU	1		SM 4500 H+ B	Total/NA
Dissolved Oxygen, Field	0.48				mg/L	1		Field Sampling	Total/NA
Ground Water Elevation	686.84				ft	1		Field Sampling	Total/NA
Oxidation Reduction Potential	-55.0				millivolts	1		Field Sampling	Total/NA
pH, Field	6.76				SU	1		Field Sampling	Total/NA
Specific Conductance, Field	1287				umhos/cm	1		Field Sampling	Total/NA
Temperature, Field	13.8				Degrees C	1		Field Sampling	Total/NA
Turbidity, Field	79.60				NTU	1		Field Sampling	Total/NA

This Detection Summary does not include radiochemical test results.

Detection Summary

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-217018-1

Client Sample ID: MW-102M — Lab Sample ID: 310-217018-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	16		5.0	2.2	mg/L	5		9056A	Total/NA
Fluoride	2.9		0.50	0.28	mg/L	5		9056A	Total/NA
Sulfate	360		5.0	2.5	mg/L	5		9056A	Total/NA
Boron	1300		100	58	ug/L	1		6020A	Total/NA
Calcium	71		0.50	0.19	mg/L	1		6020A	Total/NA
Total Dissolved Solids	1300		250	130	mg/L	1		SM 2540C	Total/NA
pH	7.9	HF	0.1	0.1	SU	1		SM 4500 H+ B	Total/NA
Dissolved Oxygen, Field	2.32				mg/L	1		Field Sampling	Total/NA
Ground Water Elevation	714.85				ft	1		Field Sampling	Total/NA
Oxidation Reduction Potential	82.2				millivolts	1		Field Sampling	Total/NA
pH, Field	7.81				SU	1		Field Sampling	Total/NA
Specific Conductance, Field	2041				umhos/cm	1		Field Sampling	Total/NA
Temperature, Field	13.5				Degrees C	1		Field Sampling	Total/NA
Turbidity, Field	28.10				NTU	1		Field Sampling	Total/NA

Client Sample ID: MW-122M — Lab Sample ID: 310-217018-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	8.7		5.0	2.2	mg/L	5		9056A	Total/NA
Sulfate	8800		100	49	mg/L	100		9056A	Total/NA
Boron	5500		400	230	ug/L	4		6020A	Total/NA
Calcium	440		0.50	0.19	mg/L	1		6020A	Total/NA
Total Dissolved Solids	12000		1300	650	mg/L	1		SM 2540C	Total/NA
pH	7.0	HF	0.1	0.1	SU	1		SM 4500 H+ B	Total/NA
Dissolved Oxygen, Field	0.84				mg/L	1		Field Sampling	Total/NA
Ground Water Elevation	717.76				ft	1		Field Sampling	Total/NA
Oxidation Reduction Potential	-5.9				millivolts	1		Field Sampling	Total/NA
pH, Field	7.18				SU	1		Field Sampling	Total/NA
Specific Conductance, Field	13044				umhos/cm	1		Field Sampling	Total/NA
Temperature, Field	13.3				Degrees C	1		Field Sampling	Total/NA
Turbidity, Field	29				NTU	1		Field Sampling	Total/NA

Client Sample ID: Field Blank — Lab Sample ID: 310-217018-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloride	0.49	J	1.0	0.43	mg/L	1		9056A	Total/NA
Sulfate	0.51	J	1.0	0.49	mg/L	1		9056A	Total/NA
pH	4.7	HF	0.1	0.1	SU	1		SM 4500 H+ B	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-217018-1

Client Sample ID: MW-301

Date Collected: 10/05/21 11:28
Date Received: 10/08/21 16:50

Lab Sample ID: 310-217018-1

Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	29		5.0	2.2	mg/L			10/13/21 08:32	5
Fluoride	<0.28		0.50	0.28	mg/L			10/13/21 08:32	5
Sulfate	590		10	4.9	mg/L			10/13/21 16:30	10

Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	700		100	58	ug/L		10/15/21 09:00	10/21/21 21:23	1
Calcium	150		0.50	0.19	mg/L		10/15/21 09:00	10/21/21 21:23	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	1200		50	26	mg/L			10/11/21 15:55	1
pH	6.8	HF	0.1	0.1	SU			10/08/21 22:54	1

Method: Field Sampling - Field Sampling

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Dissolved Oxygen, Field	0.35				mg/L			10/05/21 11:28	1
Ground Water Elevation	686.87				ft			10/05/21 11:28	1
Oxidation Reduction Potential	-66.1				millivolts			10/05/21 11:28	1
pH, Field	6.71				SU			10/05/21 11:28	1
Specific Conductance, Field	1717				umhos/cm			10/05/21 11:28	1
Temperature, Field	13.8				Degrees C			10/05/21 11:28	1
Turbidity, Field	32.10				NTU			10/05/21 11:28	1

Client Sample Results

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-217018-1

Client Sample ID: MW-302

Date Collected: 10/05/21 09:44
Date Received: 10/08/21 16:50

Lab Sample ID: 310-217018-2

Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	7.1		5.0	2.2	mg/L			10/13/21 08:47	5
Fluoride	0.50		0.50	0.28	mg/L			10/13/21 08:47	5
Sulfate	70		5.0	2.5	mg/L			10/13/21 08:47	5

Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	740		100	58	ug/L		10/15/21 09:00	10/21/21 14:09	1
Calcium	52		0.50	0.19	mg/L		10/15/21 09:00	10/21/21 14:09	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	400		250	130	mg/L			10/11/21 15:55	1
pH	7.6	HF	0.1	0.1	SU			10/08/21 22:58	1

Method: Field Sampling - Field Sampling

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Dissolved Oxygen, Field	0.35				mg/L			10/05/21 09:44	1
Ground Water Elevation	685.85				ft			10/05/21 09:44	1
Oxidation Reduction Potential	-66.5				millivolts			10/05/21 09:44	1
pH, Field	7.20				SU			10/05/21 09:44	1
Specific Conductance, Field	993				umhos/cm			10/05/21 09:44	1
Temperature, Field	13.5				Degrees C			10/05/21 09:44	1
Turbidity, Field	67.10				NTU			10/05/21 09:44	1

Client Sample Results

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-217018-1

Client Sample ID: MW-303

Date Collected: 10/05/21 08:40
Date Received: 10/08/21 16:50

Lab Sample ID: 310-217018-3

Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	8.3		5.0	2.2	mg/L			10/13/21 09:03	5
Fluoride	0.39	J	0.50	0.28	mg/L			10/13/21 09:03	5
Sulfate	270		5.0	2.5	mg/L			10/13/21 09:03	5

Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	630		100	58	ug/L		10/15/21 09:00	10/21/21 21:26	1
Calcium	92		0.50	0.19	mg/L		10/15/21 09:00	10/21/21 21:26	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	820		50	26	mg/L			10/11/21 15:55	1
pH	7.3	HF	0.1	0.1	SU			10/08/21 23:04	1

Method: Field Sampling - Field Sampling

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Dissolved Oxygen, Field	0.48				mg/L			10/05/21 08:40	1
Ground Water Elevation	686.84				ft			10/05/21 08:40	1
Oxidation Reduction Potential	-55.0				millivolts			10/05/21 08:40	1
pH, Field	6.76				SU			10/05/21 08:40	1
Specific Conductance, Field	1287				umhos/cm			10/05/21 08:40	1
Temperature, Field	13.8				Degrees C			10/05/21 08:40	1
Turbidity, Field	79.60				NTU			10/05/21 08:40	1

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-217018-1

Client Sample ID: MW-102M

Date Collected: 10/05/21 12:12
Date Received: 10/08/21 16:50

Lab Sample ID: 310-217018-4

Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	16		5.0	2.2	mg/L			10/13/21 09:18	5
Fluoride	2.9		0.50	0.28	mg/L			10/13/21 09:18	5
Sulfate	360		5.0	2.5	mg/L			10/13/21 09:18	5

Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	1300		100	58	ug/L		10/15/21 09:00	10/21/21 21:30	1
Calcium	71		0.50	0.19	mg/L		10/15/21 09:00	10/21/21 21:30	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	1300		250	130	mg/L			10/11/21 15:55	1
pH	7.9	HF	0.1	0.1	SU			10/08/21 23:05	1

Method: Field Sampling - Field Sampling

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Dissolved Oxygen, Field	2.32				mg/L			10/05/21 12:12	1
Ground Water Elevation	714.85				ft			10/05/21 12:12	1
Oxidation Reduction Potential	82.2				millivolts			10/05/21 12:12	1
pH, Field	7.81				SU			10/05/21 12:12	1
Specific Conductance, Field	2041				umhos/cm			10/05/21 12:12	1
Temperature, Field	13.5				Degrees C			10/05/21 12:12	1
Turbidity, Field	28.10				NTU			10/05/21 12:12	1

Client Sample Results

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-217018-1

Client Sample ID: MW-122M

Date Collected: 10/05/21 14:40
Date Received: 10/08/21 16:50

Lab Sample ID: 310-217018-5

Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**8.7**		5.0	2.2	mg/L			10/13/21 09:34	5
Fluoride	<0.28		0.50	0.28	mg/L			10/13/21 09:34	5
Sulfate	**8800**		100	49	mg/L			10/13/21 17:17	100

Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	**5500**		400	230	ug/L		10/15/21 09:00	10/23/21 02:05	4
Calcium	**440**		0.50	0.19	mg/L		10/15/21 09:00	10/21/21 21:33	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	**12000**		1300	650	mg/L			10/11/21 15:55	1
pH	**7.0**	**HF**	0.1	0.1	SU			10/08/21 23:06	1

Method: Field Sampling - Field Sampling

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Dissolved Oxygen, Field	**0.84**				mg/L			10/05/21 14:40	1
Ground Water Elevation	**717.76**				ft			10/05/21 14:40	1
Oxidation Reduction Potential	**-5.9**				millivolts			10/05/21 14:40	1
pH, Field	**7.18**				SU			10/05/21 14:40	1
Specific Conductance, Field	**13044**				umhos/cm			10/05/21 14:40	1
Temperature, Field	**13.3**				Degrees C			10/05/21 14:40	1
Turbidity, Field	**29**				NTU			10/05/21 14:40	1

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-217018-1

Client Sample ID: Field Blank

Date Collected: 10/05/21 00:00
Date Received: 10/08/21 16:50

Lab Sample ID: 310-217018-6

Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**0.49**	**J**	1.0	0.43	mg/L			10/13/21 16:14	1
Fluoride	<0.055		0.10	0.055	mg/L			10/13/21 16:14	1
Sulfate	**0.51**	**J**	1.0	0.49	mg/L			10/13/21 16:14	1

Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	<58		100	58	ug/L		10/15/21 09:00	10/21/21 21:37	1
Calcium	<0.19		0.50	0.19	mg/L		10/15/21 09:00	10/21/21 21:37	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	<26		50	26	mg/L			10/11/21 15:55	1
pH	**4.7**	**HF**	0.1	0.1	SU			10/08/21 23:09	1

Definitions/Glossary

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-217018-1

Qualifiers

HPLC/IC

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Metals

Qualifier	Qualifier Description
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.

General Chemistry

Qualifier	Qualifier Description
HF	Field parameter with a holding time of 15 minutes. Test performed by laboratory at client's request.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Method: 9056A - Anions, Ion Chromatography

Lab Sample ID: MB 310-331686/3
Matrix: Water
Analysis Batch: 331686

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<0.43		1.0	0.43	mg/L			10/12/21 20:22	1
Fluoride	<0.055		0.10	0.055	mg/L			10/12/21 20:22	1
Sulfate	<0.49		1.0	0.49	mg/L			10/12/21 20:22	1

Lab Sample ID: LCS 310-331686/4
Matrix: Water
Analysis Batch: 331686

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	10.0	9.88		mg/L		99	90 - 110
Fluoride	2.00	2.11		mg/L		106	90 - 110
Sulfate	10.0	10.3		mg/L		103	90 - 110

Method: 6020A - Metals (ICP/MS)

Lab Sample ID: MB 310-331648/1-A
Matrix: Water
Analysis Batch: 332515

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 331648

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	<58		100	58	ug/L		10/15/21 09:00	10/21/21 14:02	1
Calcium	<0.19		0.50	0.19	mg/L		10/15/21 09:00	10/21/21 14:02	1

Lab Sample ID: LCS 310-331648/2-A
Matrix: Water
Analysis Batch: 332515

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 331648

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Boron	200	201		ug/L		100	80 - 120
Calcium	2.00	1.93		mg/L		96	80 - 120

Lab Sample ID: 310-217018-2 MS
Matrix: Water
Analysis Batch: 332515

Client Sample ID: MW-302
Prep Type: Total/NA
Prep Batch: 331648

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Boron	740		200	945		ug/L		104	75 - 125
Calcium	52		2.00	54.1	4	mg/L		123	75 - 125

Lab Sample ID: 310-217018-2 MSD
Matrix: Water
Analysis Batch: 332515

Client Sample ID: MW-302
Prep Type: Total/NA
Prep Batch: 331648

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Boron	740		200	944		ug/L		103	75 - 125	0	20
Calcium	52		2.00	53.3	4	mg/L		85	75 - 125	1	20

Method: SM 2540C - Solids, Total Dissolved (TDS)

Lab Sample ID: MB 310-331240/1
Matrix: Water
Analysis Batch: 331240

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	<26		50	26	mg/L			10/11/21 15:55	1

Lab Sample ID: LCS 310-331240/2
Matrix: Water
Analysis Batch: 331240

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Total Dissolved Solids			1000	920		mg/L		92	90 - 110		

Method: SM 4500 H+ B - pH

Lab Sample ID: LCS 310-331071/1
Matrix: Water
Analysis Batch: 331071

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
pH			7.00	7.0		SU		101	98 - 102		

QC Association Summary

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-217018-1

HPLC/IC

Analysis Batch: 331686

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-217018-1	MW-301	Total/NA	Water	9056A	
310-217018-1	MW-301	Total/NA	Water	9056A	
310-217018-2	MW-302	Total/NA	Water	9056A	
310-217018-3	MW-303	Total/NA	Water	9056A	
310-217018-4	MW-102M	Total/NA	Water	9056A	
310-217018-5	MW-122M	Total/NA	Water	9056A	
310-217018-5	MW-122M	Total/NA	Water	9056A	
310-217018-6	Field Blank	Total/NA	Water	9056A	
MB 310-331686/3	Method Blank	Total/NA	Water	9056A	
LCS 310-331686/4	Lab Control Sample	Total/NA	Water	9056A	

Metals

Prep Batch: 331648

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-217018-1	MW-301	Total/NA	Water	3010A	
310-217018-2	MW-302	Total/NA	Water	3010A	
310-217018-3	MW-303	Total/NA	Water	3010A	
310-217018-4	MW-102M	Total/NA	Water	3010A	
310-217018-5	MW-122M	Total/NA	Water	3010A	
310-217018-6	Field Blank	Total/NA	Water	3010A	
MB 310-331648/1-A	Method Blank	Total/NA	Water	3010A	
LCS 310-331648/2-A	Lab Control Sample	Total/NA	Water	3010A	
310-217018-2 MS	MW-302	Total/NA	Water	3010A	
310-217018-2 MSD	MW-302	Total/NA	Water	3010A	

Analysis Batch: 332515

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-217018-2	MW-302	Total/NA	Water	6020A	331648
MB 310-331648/1-A	Method Blank	Total/NA	Water	6020A	331648
LCS 310-331648/2-A	Lab Control Sample	Total/NA	Water	6020A	331648
310-217018-2 MS	MW-302	Total/NA	Water	6020A	331648
310-217018-2 MSD	MW-302	Total/NA	Water	6020A	331648

Analysis Batch: 332606

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-217018-1	MW-301	Total/NA	Water	6020A	331648
310-217018-3	MW-303	Total/NA	Water	6020A	331648
310-217018-4	MW-102M	Total/NA	Water	6020A	331648
310-217018-5	MW-122M	Total/NA	Water	6020A	331648
310-217018-6	Field Blank	Total/NA	Water	6020A	331648

Analysis Batch: 332690

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-217018-5	MW-122M	Total/NA	Water	6020A	331648

General Chemistry

Analysis Batch: 331071

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-217018-1	MW-301	Total/NA	Water	SM 4500 H+ B	
310-217018-2	MW-302	Total/NA	Water	SM 4500 H+ B	

General Chemistry (Continued)

Analysis Batch: 331071 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-217018-3	MW-303	Total/NA	Water	SM 4500 H+ B	
310-217018-4	MW-102M	Total/NA	Water	SM 4500 H+ B	
310-217018-5	MW-122M	Total/NA	Water	SM 4500 H+ B	
310-217018-6	Field Blank	Total/NA	Water	SM 4500 H+ B	
LCS 310-331071/1	Lab Control Sample	Total/NA	Water	SM 4500 H+ B	

Analysis Batch: 331240

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-217018-1	MW-301	Total/NA	Water	SM 2540C	
310-217018-2	MW-302	Total/NA	Water	SM 2540C	
310-217018-3	MW-303	Total/NA	Water	SM 2540C	
310-217018-4	MW-102M	Total/NA	Water	SM 2540C	
310-217018-5	MW-122M	Total/NA	Water	SM 2540C	
310-217018-6	Field Blank	Total/NA	Water	SM 2540C	
MB 310-331240/1	Method Blank	Total/NA	Water	SM 2540C	
LCS 310-331240/2	Lab Control Sample	Total/NA	Water	SM 2540C	

Field Service / Mobile Lab

Analysis Batch: 331625

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
310-217018-1	MW-301	Total/NA	Water	Field Sampling	
310-217018-2	MW-302	Total/NA	Water	Field Sampling	
310-217018-3	MW-303	Total/NA	Water	Field Sampling	
310-217018-4	MW-102M	Total/NA	Water	Field Sampling	
310-217018-5	MW-122M	Total/NA	Water	Field Sampling	

Lab Chronicle

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-217018-1

Client Sample ID: MW-301

Lab Sample ID: 310-217018-1
Date Collected: 10/05/21 11:28
Matrix: Water
Date Received: 10/08/21 16:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		5	331686	10/13/21 08:32	JNR	TAL CF
Total/NA	Analysis	9056A		10	331686	10/13/21 16:30	JNR	TAL CF
Total/NA	Prep	3010A			331648	10/15/21 09:00	ACM2	TAL CF
Total/NA	Analysis	6020A		1	332606	10/21/21 21:23	SAP	TAL CF
Total/NA	Analysis	SM 2540C		1	331240	10/11/21 15:55	ARG	TAL CF
Total/NA	Analysis	SM 4500 H+ B		1	331071	10/08/21 22:54	JMH	TAL CF
Total/NA	Analysis	Field Sampling		1	331625	10/05/21 11:28	SLD	TAL CF

Client Sample ID: MW-302

Lab Sample ID: 310-217018-2
Date Collected: 10/05/21 09:44
Matrix: Water
Date Received: 10/08/21 16:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		5	331686	10/13/21 08:47	JNR	TAL CF
Total/NA	Prep	3010A			331648	10/15/21 09:00	ACM2	TAL CF
Total/NA	Analysis	6020A		1	332515	10/21/21 14:09	SAP	TAL CF
Total/NA	Analysis	SM 2540C		1	331240	10/11/21 15:55	ARG	TAL CF
Total/NA	Analysis	SM 4500 H+ B		1	331071	10/08/21 22:58	JMH	TAL CF
Total/NA	Analysis	Field Sampling		1	331625	10/05/21 09:44	SLD	TAL CF

Client Sample ID: MW-303

Lab Sample ID: 310-217018-3
Date Collected: 10/05/21 08:40
Matrix: Water
Date Received: 10/08/21 16:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		5	331686	10/13/21 09:03	JNR	TAL CF
Total/NA	Prep	3010A			331648	10/15/21 09:00	ACM2	TAL CF
Total/NA	Analysis	6020A		1	332606	10/21/21 21:26	SAP	TAL CF
Total/NA	Analysis	SM 2540C		1	331240	10/11/21 15:55	ARG	TAL CF
Total/NA	Analysis	SM 4500 H+ B		1	331071	10/08/21 23:04	JMH	TAL CF
Total/NA	Analysis	Field Sampling		1	331625	10/05/21 08:40	SLD	TAL CF

Client Sample ID: MW-102M

Lab Sample ID: 310-217018-4
Date Collected: 10/05/21 12:12
Matrix: Water
Date Received: 10/08/21 16:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		5	331686	10/13/21 09:18	JNR	TAL CF
Total/NA	Prep	3010A			331648	10/15/21 09:00	ACM2	TAL CF
Total/NA	Analysis	6020A		1	332606	10/21/21 21:30	SAP	TAL CF
Total/NA	Analysis	SM 2540C		1	331240	10/11/21 15:55	ARG	TAL CF
Total/NA	Analysis	SM 4500 H+ B		1	331071	10/08/21 23:05	JMH	TAL CF
Total/NA	Analysis	Field Sampling		1	331625	10/05/21 12:12	SLD	TAL CF

Lab Chronicle

Client: SCS Engineers
Job ID: 310-217018-1
Project/Site: Ottumwa Midland LF 25221073

Client Sample ID: MW-122M
Lab Sample ID: 310-217018-5
Date Collected: 10/05/21 14:40
Matrix: Water
Date Received: 10/08/21 16:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		5	331686	10/13/21 09:34	JNR	TAL CF
Total/NA	Analysis	9056A		100	331686	10/13/21 17:17	JNR	TAL CF
Total/NA	Prep	3010A			331648	10/15/21 09:00	ACM2	TAL CF
Total/NA	Analysis	6020A		1	332606	10/21/21 21:33	SAP	TAL CF
Total/NA	Prep	3010A			331648	10/15/21 09:00	ACM2	TAL CF
Total/NA	Analysis	6020A		4	332690	10/23/21 02:05	SAP	TAL CF
Total/NA	Analysis	SM 2540C		1	331240	10/11/21 15:55	ARG	TAL CF
Total/NA	Analysis	SM 4500 H+ B		1	331071	10/08/21 23:06	JMH	TAL CF
Total/NA	Analysis	Field Sampling		1	331625	10/05/21 14:40	SLD	TAL CF

Client Sample ID: Field Blank
Lab Sample ID: 310-217018-6
Date Collected: 10/05/21 00:00
Matrix: Water
Date Received: 10/08/21 16:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		1	331686	10/13/21 16:14	JNR	TAL CF
Total/NA	Prep	3010A			331648	10/15/21 09:00	ACM2	TAL CF
Total/NA	Analysis	6020A		1	332606	10/21/21 21:37	SAP	TAL CF
Total/NA	Analysis	SM 2540C		1	331240	10/11/21 15:55	ARG	TAL CF
Total/NA	Analysis	SM 4500 H+ B		1	331071	10/08/21 23:09	JMH	TAL CF

Laboratory References:

TAL CF = Eurofins TestAmerica, Cedar Falls, 3019 Venture Way, Cedar Falls, IA 50613, TEL (319)277-2401

Accreditation/Certification Summary

Client: SCS Engineers
Job ID: 310-217018-1
Project/Site: Ottumwa Midland LF 25221073

Laboratory: Eurofins TestAmerica, Cedar Falls

The accreditations/certifications listed below are applicable to this report.

Authority	Program	Identification Number	Expiration Date
Iowa	State	007	12-01-21

Method Summary

Client: SCS Engineers
Project/Site: Ottumwa Midland LF 25221073

Job ID: 310-217018-1

Method	Method Description	Protocol	Laboratory
9056A	Anions, Ion Chromatography	SW846	TAL CF
6020A	Metals (ICP/MS)	SW846	TAL CF
SM 2540C	Solids, Total Dissolved (TDS)	SM	TAL CF
SM 4500 H+ B	pH	SM	TAL CF
Field Sampling	Field Sampling	EPA	TAL CF
3010A	Preparation, Total Metals	SW846	TAL CF

Protocol References:

EPA = US Environmental Protection Agency

SM = "Standard Methods For The Examination Of Water And Wastewater"

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL CF = Eurofins TestAmerica, Cedar Falls, 3019 Venture Way, Cedar Falls, IA 50613, TEL (319)277-2401

eurofins | Environment Testing TestAmerica

310-217018 Chain of Custody

Cooler/Sample Receipt and Temperature Log Form

Client Information

Client: SCS Engineers

City/State: CITY Clive STATE IA | Project:

Receipt Information

Date/Time Received: DATE 10/08/2021 TIME 1650 | Received By: TB

Delivery Type: ☐ UPS ☐ FedEx ☐ FedEx Ground ☐ US Mail ☐ Spee-Dee
☒ Lab Courier ☐ Lab Field Services ☐ Client Drop-off ☐ Other:_____

Condition of Cooler/Containers

Sample(s) received in Cooler?	☒ Yes	☐ No	*If yes:* Cooler ID:
Multiple Coolers?	☐ Yes	☒ No	*If yes:* Cooler # _____ of _____
Cooler Custody Seals Present?	☐ Yes	☒ No	*If yes:* Cooler custody seals intact? ☐ Yes ☐ No
Sample Custody Seals Present?	☐ Yes	☒ No	*If yes:* Sample custody seals intact? ☐ Yes ☐ No
Trip Blank Present?	☐ Yes	☒ No	*If yes:* Which VOA samples are in cooler? ↓

Temperature Record

Coolant: ☒ Wet ice ☐ Blue ice ☐ Dry ice ☐ Other:_____ ☐ NONE

Thermometer ID: 0 | Correction Factor (°C): 0

• **Temp Blank Temperature** – If no temp blank, or temp blank temperature above criteria, proceed to Sample Container Temperature

Uncorrected Temp (°C): — | Corrected Temp (°C): —

• **Sample Container Temperature**

	CONTAINER 1	CONTAINER 2
Container(s) used:	250ml Nitric	
Uncorrected Temp (°C):	4.4	
Corrected Temp (°C):	4.4	

Exceptions Noted

1) If temperature exceeds criteria, was sample(s) received same day of sampling? ☐ Yes ☐ No
   a) *If yes:* Is there evidence that the chilling process began? ☐ Yes ☐ No

2) If temperature is <0°C, are there obvious signs that the integrity of sample containers is compromised? (e.g., bulging septa, broken/cracked bottles, frozen solid?) ☐ Yes ☐ No

NOTE: If yes, contact PM before proceeding. If no, proceed with login

Additional Comments

MW-122M arrived empty

Document: CF-LG-WI-002
Revision: 25
Date: 06/17/2019

Eurofins TestAmerica, Cedar Falls

General temperature criteria is 0 to 6°C
Bacteria temperature criteria is 0 to 10°C

Eurofins TestAmerica, Cedar Falls
3019 Venture Way
Cedar Falls, IA 50613
Phone (319) 277-2401 Phone (319) 277-2425

Chain of Custody Record

TestAmerica Des Moines SC
214

eurofins | Environment Testing America

Client Information	Sampler: Rosa Cruz	Lab PM: Fredrick, Sandie	Carrier Tracking No(s):	COC No: 310-64462-14130.1
Client Contact: Rosa Cruz	Phone: 608-509-8245	E-Mail: sandra.fredrick@eurofinset.com	State of Origin:	Page: Page 1 of 1
Company: SCS Engineers	PWSID:			Job #:

Address: 8450 Hickman Road Suite 27	Due Date Requested:
City: Clive	TAT Requested (days):
State, Zip: IA, 50325	Compliance Project: Δ Yes Δ No
Phone:	PO #: 25221073
Email: rcruz@scsengineers.com	WO #:
Project Name: Ottumwa Midland LF 25221073	Project #: 31011020
Site:	SSOW#:

Analysis Requested

Preservation Codes:
A - HCL; B - NaOH; C - Zn Acetate; D - Nitric Acid; E - NaHSO4; F - MeOH; G - Amchlor; H - Ascorbic Acid; I - Ice; J - DI Water; K - EDTA; L - EDA; M - Hexane; N - None; O - AsNaO2; P - Na2O4S; Q - Na2SO3; R - Na2S2O3; S - H2SO4; T - TSP Dodecahydrate; U - Acetone; V - MCAA; W - pH 4-5; Z - other (specify)
Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	TDS / pH / Chloride/Fluoride/Sulfate	6020A - B/Ca	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	D		
MW-301	10-05-21	11:28	G	Water			X	X		ran out of
MW-302	10-05-21	9:44	G	Water			X	X		water for 122M
MW-303	10-05-21	8:40	G	Water			X	X		
MW-102M	Grab	12:12	10-5-21	Water			X	X		
MW-122M	10-05-21	14:40	G	Water			X			
Field Blank				Water						
				Water						

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment

Relinquished by: Rosa Cruz	Date/Time: 10-08-21 14:00	Company	Received by	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by: JK	Date/Time: 10-8-21 1650	Company

Custody Seals Intact: Δ Yes Δ No | Custody Seal No.: | Cooler Temperature(s) °C and Other Remarks:

Ver: 01/16/2019

10/23/2021

Table 2. Sampling Points and Parameters - CCR Rule Sampling Program
Groundwater Monitoring - Ottumwa Midland Landfill / SCS Engineers Project #25216073

	Parameter	MW-301	MW-302	MW-303	MW-102M	MW-122M	Field Blank	TOTAL
Appendix III Parameters	Boron	x	x	x	x	x	x	6
	Calcium	x	x	x	x	x	x	6
	Chloride	x	x	x	x	x	x	6
	Fluoride	x	x	x	x	x	x	6
	pH	x	x	x	x	x	x	6
	Sulfate	x	x	x	x	x	x	6
	TDS	x	x	x	x	x	x	6
Appendix IV Parameters	Antimony	x	x	x	x	x	x	6
	Arsenic	x	x	x	x	x	x	6
	Barium	x	x	x	x	x	x	6
	Beryllium	x	x	x	x	x	x	6
	Cadmium	x	x	x	x	x	x	6
	Chromium	x	x	x	x	x	x	6
	Cobalt	x	x	x	x	x	x	6
	Fluoride	x	x	x	x	x	x	6
	Lead	x	x	x	x	x	x	6
	Lithium	x	x	x	x	x	x	6
	Mercury	x	x	x	x	x	x	6
	Molybdenum	x	x	x	x	x	x	6
	Selenium	x	x	x	x	x	x	6
	Thallium	x	x	x	x	x	x	6
	Radium	x	x	x	x	x	x	6
Field Parameters	Groundwater Elevation	x	x	x	x	x		5
	Well Depth	x	x	x	x	x		5
	pH (field)	x	x	x	x	x		5
	Specific Conductance	x	x	x	x	x		5
	Dissolved Oxygen	x	x	x	x	x		5
	ORP	x	x	x	x	x		5
	Temperature	x	x	x	x	x		5
	Turbidity	x	x	x	x	x		5
	Color	x	x	x	x	x		5
	Odor	x	x	x	x	x		5

Notes: All samples are unfiltered (total).

I:\25216073.00\Deliverables\Sampling & Analysis Plan\[Table_2_OML_CCR_Rule_Sampling.xls]Sheet1

Login Sample Receipt Checklist

Client: SCS Engineers

Job Number: 310-217018-1

Login Number: 217018
List Number: 1
Creator: Kizer, Preston V

List Source: Eurofins TestAmerica, Cedar Falls

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	False	Recieved an empty container for MW-122M
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Groundwater Monitoring Results - Field Parameters
Ottumwa Midland Landfill / SCS Engineers Project #25221073.00
October 2021

Sample	Date	Groundwater Elevation (ft. amsl)	Temperature (Deg. C)	pH (Std. Units)	DO (mg/L)	Specific Conductivity (µmhos/cm)	ORP (mV)	Turbidity (NTU)
MW-301	10/5/2021	686.87	13.8	6.71	0.35	1,717	-66.1	32.10
MW-302	10/5/2021	685.85	13.5	7.20	0.35	993	-66.5	67.10
MW-303	10/5/2021	686.84	13.8	6.76	0.48	1,287	-55.0	79.60
MW-102M	10/5/2021	714.85	13.5	7.81	2.32	2,041	82.2	28.10
MW-122M	10/5/2021	717.76	13.3	7.18	0.84	13,044	-5.9	29

Abbreviations:
amsl = above mean sea level
mg/L = milligrams per liter
µmhos/cm = microSiemens per centimeter
NM = not measured.

Laboratory Notes/Qualifiers:
none

Created by: NDK Date: 10/11/2021
Last revision by: REO Date: 10/11/2021
Checked by: NDK Date: 10/11/2021

C:\Users\FredrickS\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\MXWI32ZD\[2110_OML_GW_Field Data.xlsx]GW Field Data

Appendix D

Historical Monitoring Results

Single Location

Name: IPL - Ottumwa Midland Landfill

Location ID: MW-102M
Number of Sampling Dates: 19

Parameter Name	Units	5/4/2016	6/22/2016	6/23/2016	8/10/2016	10/25/2016	10/26/2016	1/18/2017	4/20/2017	6/21/2017	8/22/2017	11/8/2017	4/17/2018	10/16/2018	4/18/2019	10/15/2019	5/21/2020	10/7/2020	4/15/2021	10/5/2021
Boron	ug/L	1510	1440	--	1480	--	1420	1480	1460	1410	1440	1480	1550	1340	1400	1500	1500	1600	1600	1300
Calcium	mg/L	45.9	147	--	129	--	31.5	23.6	26	67.7	79.7	10.4	25.3	12.9	51	14	38	150	43	71
Chloride	mg/L	16.3	13.8	--	13.4	--	13	12.3	12.5	12.8	13.1	12.3	13.5	13.6	14	15	16	14	14	16
Fluoride	mg/L	4.2	4.2	--	4.4	--	4.6	4.1	4	4.6	4.5	4.6	4.5	4.7	5.7	4.5	5	5.3	4.3	2.9
Field pH	Std. Units	8.09	7.68	--	--	--	--	7.62	7.35	7.64	6.89	8.16	8.34	7.8	8.55	7.81	7.82	8.29	7.85	7.81
Sulfate	mg/L	378	350	--	354	--	384	415	348	356	358	335	352	384	340	350	350	350	330	360
Total Dissolved Solids	mg/L	1670	1530	--	1620	--	1420	1530	1620	1480	1400	1410	1540	1500	1700	1400	3700	1700	1500	1300
Antimony	ug/L	0.38	0.19	--	0.17	--	0.51	0.26	0.1	0.21	0.16	--	--	--	--	--	--	--	--	--
Arsenic	ug/L	0.64	0.68	--	0.78	--	0.9	0.89	0.92	0.9	0.9	--	--	--	--	--	--	--	--	--
Barium	ug/L	48.5	39.5	--	55.4	--	28.2	21.1	28.4	37.2	31	--	--	--	--	--	--	--	--	--
Beryllium	ug/L	0.74	1.4	--	1.1	--	0.37	0.19	0.34	0.54	0.41	--	--	--	--	--	--	--	--	--
Cadmium	ug/L	<0.029	0.12	--	0.078	--	0.11	<0.029	0.046	0.063	0.062	--	--	--	--	--	--	--	--	--
Chromium	ug/L	20.5	17.9	--	27.1	--	11.8	2.8	8.7	16	9.6	--	--	--	--	--	--	--	--	--
Cobalt	ug/L	3.5	4.5	--	7.3	--	2.4	0.74	1.7	2.1	2.5	--	--	--	--	--	--	--	--	--
Lead	ug/L	3.1	3.6	--	3.8	--	1.7	0.87	1.4	2.2	1.8	--	--	--	--	--	--	--	--	--
Lithium	ug/L	46.7	80.7	--	52.3	--	75.4	71.8	73.6	52.7	54	--	--	--	--	--	--	--	--	--
Mercury	ug/L	<0.039	<0.039	--	<0.039	--	<0.039	<0.039	<0.046	<0.046	<0.046	--	--	--	--	--	--	--	--	--
Molybdenum	ug/L	21.7	10.3	--	20.9	--	11.7	10.6	10.8	11.1	9.5	--	--	--	--	--	--	--	--	--
Selenium	ug/L	0.42	1	--	1.4	--	0.31	0.24	0.4	0.49	0.43	--	--	--	--	--	--	--	--	--
Thallium	ug/L	<0.5	<0.5	--	<0.5	--	<0.5	<0.5	0.04	0.084	0.067	--	--	--	--	--	--	--	--	--
Total Radium	pCi/L	2.64	--	1.66	1.17	--	0.814	0.567	1.57	1.12	0.594	--	--	--	--	--	--	--	--	--
Radium-226	pCi/L	-0.058	--	0.58	0.144	--	0.444	0.209	0.754	0.285	0.368	--	--	--	--	--	--	--	--	--
Radium-228	pCi/L	2.64	--	1.08	1.03	--	0.37	0.358	0.816	0.832	0.226	--	--	--	--	--	--	--	--	--
pH at 25 Degrees C	Std. Units	7.9	7.9	--	7.9	--	7.8	8.1	7.9	8	8	7.8	8	8	8.2	7.9	7.9	8.1	8	7.9
Collected By		--	--	--	0	--	--	0	0	0	0	--	--	--	--	--	--	--	--	--
Groundwater Elevation	feet	728.73	718.74	--	730.49	716.94	--	717.91	717.8	714.83	713.23	713.53	717.38	717.05	717.97	715.5	717.61	712.05	710.95	714.85
Field Oxidation Potential	mV	128.2	-102.4	--	--	--	--	--	--	--	--	219.9	-77.8	-104.7	--	--	21.2	22	164	82.2
Field Specific Conductance	umhos/cm	2197	2037	--	--	--	--	--	--	--	2751	2085	2113	0	--	--	2260	2123	2145	2041
Field Temperature	deg C	14	14.2	--	--	--	--	--	--	--	13.4	12.9	10.1	12.9	--	--	13.1	14.5	11.5	13.5
Oxygen, Dissolved	mg/L	0.79	3.06	--	--	--	--	--	--	--	--	0.73	4.51	2.14	--	--	1.59	5.11	5.24	--
Turbidity	NTU	350.9	614.3	--	--	--	--	--	--	--	--	--	--	--	--	--	297	--	196	28.1
Dissolved Oxygen	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.32

Single Location

Name: IPL - Ottumwa Midland Landfill

Location ID: MW-122M
Number of Sampling Dates: 20

Parameter Name	Units	5/4/2016	5/5/2016	6/22/2016	6/23/2016	8/10/2016	10/25/2016	10/26/2016	1/18/2017	4/20/2017	6/21/2017	8/22/2017	11/8/2017	4/17/2018	10/16/2018	4/17/2019	10/15/2019	5/21/2020	10/7/2020	4/15/2021	10/5/2021
Boron	ug/L	--	3140	--	1720	4550	--	4060	4720	4480	4710	4980	5220	5560	4580	5500	4100	5100	4100	5100	5500
Calcium	mg/L	--	599	--	312	419	--	415	386	382	386	386	383	402	366	400	400	430	430	410	440
Chloride	mg/L	--	16.4	--	21.9	11.8	--	8.2	8.3	8	7.8	7.8	7.2	8	8.6	8.8	10	9	8.3	8	8.7
Fluoride	mg/L	--	1.1	--	0.89	0.74	--	0.48	<0.027	0.88	1.1	0.6	0.5	<0.063	<0.19	0.7	<0.23	0.23	<0.23	0.3	<0.28
Field pH	Std. Units	--	6.97	--	6.68	--	--	--	6.06	--	6.42	6.32	6.16	6.65	6.31	7.34	6.6	6.91	7	6.78	7.18
Sulfate	mg/L	--	8260	--	5330	8950	--	8600	9680	14300	17500	9190	9440	10400	<0.24	8300	8400	9800	8700	8700	8800
Total Dissolved Solids	mg/L	--	11500	--	7430	14200	--	13200	14100	18100	12800	14300	13400	14400	13300	13000	13000	16000	14000	14000	12000
Antimony	ug/L	--	0.36	--	1	0.26	--	0.29	0.12	<0.079	<0.13	<0.13	--	--	--	--	--	--	--	--	--
Arsenic	ug/L	--	<0.52	--	<0.52	<0.21	--	<0.52	0.11	0.19	<0.26	<0.26	--	--	--	--	--	--	--	--	--
Barium	ug/L	--	31.5	--	17.9	14.5	--	16.8	11.8	13	11.2	10.3	--	--	--	--	--	--	--	--	--
Beryllium	ug/L	--	<0.4	--	<0.24	<0.16	--	<0.24	<0.4	0.054	<0.035	<0.058	--	--	--	--	--	--	--	--	--
Cadmium	ug/L	--	<0.14	--	<0.14	<0.058	--	<0.14	<0.029	<0.053	<0.089	<0.089	--	--	--	--	--	--	--	--	--
Chromium	ug/L	--	<1.7	--	<1.7	<0.68	--	1.3	0.51	0.26	<0.27	0.56	--	--	--	--	--	--	--	--	--
Cobalt	ug/L	--	5.3	--	6.5	3.5	--	6	2.1	1.4	1.2	0.96	--	--	--	--	--	--	--	--	--
Lead	ug/L	--	<0.96	--	<0.96	<0.39	--	<1.9	<0.19	0.22	<0.16	<0.16	--	--	--	--	--	--	--	--	--
Lithium	ug/L	--	450	--	332	601	--	544	679	643	640	667	--	--	--	--	--	--	--	--	--
Mercury	ug/L	--	<0.039	--	<0.039	<0.039	--	<0.039	<0.039	<0.046	<0.046	<0.046	--	--	--	--	--	--	--	--	--
Molybdenum	ug/L	--	2.6	--	2.6	0.57	--	0.58	0.15	2.1	0.6	0.43	--	--	--	--	--	--	--	--	--
Selenium	ug/L	--	<0.92	--	<0.92	<0.37	--	<0.92	<0.18	0.33	<0.43	<0.43	--	--	--	--	--	--	--	--	--
Thallium	ug/L	--	<2.5	--	<2.5	<1	--	<5	<0.5	<0.11	<0.18	<0.18	--	--	--	--	--	--	--	--	--
Total Radium	pCi/L	--	2.12	--	1.25	2.26	--	1.83	1.07	1.1	1.55	1.09	--	--	--	--	--	--	--	--	--
Radium-226	pCi/L	--	0.157	--	0.56	0.75	--	0.392	0.32	0.796	0.333	0.559	--	--	--	--	--	--	--	--	--
Radium-228	pCi/L	--	1.96	--	0.691	1.51	--	1.44	0.752	0.305	1.22	0.532	--	--	--	--	--	--	--	--	--
pH at 25 Degrees C	Std. Units	--	6.5	--	6.7	6.1	--	6.2	6.1	6.4	6.2	6	6.2	6.4	6.4	6.6	6.7	7	6.9	6.7	7
Collected By		--	--	--	--	0	--	--	0	0	0	0	--	--	--	--	--	--	--	--	--
Groundwater Elevation	feet	729.27	--	725.67	--	710.32	724.61	--	742.02	724.04	723.51	722.02	720.52	723.25	723.36	723.43	708.94	724.23	718.39	720.52	717.76
Field Oxidation Potential	mV	--	34.3	--	-50.7	--	--	--	--	--	--	-7.7	195.4	-61.1	-53.5	--	--	-4.4	-28.2	159.2	-5.9
Field Specific Conductance	umhos/cm	--	3025	--	8161	--	--	--	--	--	--	--	13375	13773	0	--	--	14090	13603	13983	13044
Field Temperature	deg C	--	16.1	--	14.9	--	--	--	--	--	--	16.2	13.1	13.4	11.8	--	--	13	13.6	9	13.3
Oxygen, Dissolved	mg/L	--	1.92	--	2.29	--	--	--	--	--	--	--	0.49	0.36	1.48	--	--	0.61	0.56	5.03	--
Turbidity	NTU	--	212.1	--	-46.36	--	--	--	--	--	--	--	--	--	--	--	--	2.31	--	0	29
Dissolved Oxygen	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.84

Single Location

Name: IPL - Ottumwa Midland Landfill

Location ID: MW-301

Number of Sampling Dates: 17

Parameter Name	Units	5/4/2016	6/22/2016	8/9/2016	10/26/2016	1/17/2017	4/20/2017	6/20/2017	8/22/2017	11/7/2017	4/17/2018	10/15/2018	4/16/2019	10/15/2019	5/26/2020	10/6/2020	4/12/2021	10/5/2021
Boron	ug/L	2280	1860	1770	1410	1310	1040	1040	994	1010	854	784	660	600	660	770	790	700
Calcium	mg/L	596	472	479	393	337	224	202	158	161	131	135	110	100	120	180	160	150
Chloride	mg/L	42.4	112	46.6	43.4	32.6	58	38.9	40.8	28.9	33.9	26.9	45	46	61	24	28	29
Fluoride	mg/L	0.68	0.38	0.55	0.72	0.77	0.72	0.93	0.78	0.77	0.87	0.84	0.85	0.85	0.77	0.67	0.73	<0.28
Field pH	Std. Units	6.44	6.62	7.81	6.33	6.31	6.15	6.73	6.51	6.56	7.09	6.59	7.1	6.67	5.67	7.22	6.62	6.71
Sulfate	mg/L	5160	5370	4050	2630	1780	1170	1180	902	926	638	837	360	310	390	620	530	590
Total Dissolved Solids	mg/L	6260	5380	5810	4030	2830	1990	2060	1870	1760	1400	1550	970	860	1100	1400	1300	1200
Antimony	ug/L	<0.58	<0.12	<0.12	<0.058	0.089	<0.026	0.058	0.04	--	--	--	--	--	--	--	--	--
Arsenic	ug/L	<1	0.84	0.29	0.3	0.64	0.56	0.42	0.56	--	--	--	--	--	--	--	--	--
Barium	ug/L	28.1	26.6	24.2	32.1	41.5	41	47.1	45.7	--	--	--	--	--	--	--	--	--
Beryllium	ug/L	<0.8	<0.24	<0.16	<0.08	<0.08	<0.012	<0.012	<0.012	--	--	--	--	--	--	--	--	--
Cadmium	ug/L	<0.29	<0.058	<0.058	<0.029	<0.029	<0.018	<0.018	0.04	--	--	--	--	--	--	--	--	--
Chromium	ug/L	<3.4	<0.68	<0.68	0.46	0.5	0.31	0.16	0.2	--	--	--	--	--	--	--	--	--
Cobalt	ug/L	<5	<1	<1	<0.5	<0.5	0.21	0.22	0.17	--	--	--	--	--	--	--	--	--
Lead	ug/L	<1.9	<0.96	<0.39	<0.19	<0.19	0.046	0.038	0.091	--	--	--	--	--	--	--	--	--
Lithium	ug/L	274	268	195	171	156	110	111	114	--	--	--	--	--	--	--	--	--
Mercury	ug/L	<0.039	<0.039	<0.039	<0.039	<0.039	<0.046	<0.046	<0.046	--	--	--	--	--	--	--	--	--
Molybdenum	ug/L	4.6	2	2.1	2.9	2.9	6.3	5.3	6.5	--	--	--	--	--	--	--	--	--
Selenium	ug/L	<1.8	<0.37	<0.37	<0.18	<0.18	<0.086	<0.086	0.12	--	--	--	--	--	--	--	--	--
Thallium	ug/L	<5	<2.5	<1	<0.5	<0.5	<0.036	0.076	0.068	--	--	--	--	--	--	--	--	--
Total Radium	pCi/L	1.99	0.285	1.89	1.68	1.96	1.34	1.56	1.5	--	--	--	--	--	--	--	--	--
Radium-226	pCi/L	0.565	0.071	0.606	0.66	0.44	0.855	0.734	0.6	--	--	--	--	--	--	--	--	--
Radium-228	pCi/L	1.42	0.214	1.28	1.02	1.52	0.488	0.829	0.896	--	--	--	--	--	--	--	--	--
pH at 25 Degrees C	Std. Units	6.2	6.2	6.2	6.2	6.2	6.9	6.4	6.4	6.4	6.8	7.5	6.8	7	7.3	6.9	6.6	6.8
Collected By		--	--	0	--	0	0	0	0	--	--	0	--	--	--	--	--	--
Groundwater Elevation	feet	686.46	686.4	686.19	683.7	685.57	685.72	685.88	684.96	684.5	684.85	684.58	686.38	686.56	687.29	686.8	687.25	686.87
Field Oxidation Potential	mV	-58.5	-49.7	-53	-79.4	-57.8	-49.8	-63.1	-20.6	144.3	-102.8	88.2	-50.2	-58.4	-57.8	-105.9	-79.6	-66.1
Field Specific Conductance	umhos/cm	7267	5132	5607	4377	3607	2631	2384	3187	2395	1910	2112	1603	1512	1546	1820	1875	1717
Field Temperature	deg C	13.4	14.3	13.9	13.5	13.1	13	13.8	13.9	13.4	13	13.6	13.87	13.68	15.8	14.5	13	13.8
Oxygen, Dissolved	mg/L	0.27	0.14	0.1	0.55	0.19	0.18	0.16	0.11	0.37	0.16	0.2	1.27	0.4	0.41	0.25	0.46	--
Turbidity	NTU	2.86	3.34	1.05	0.92	0.63	1.12	2.69	0.99	1.91	1.13	4.91	8.88	4.75	21.8	21.4	4.6	32.1
Dissolved Oxygen	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.35

Single Location

Name: IPL - Ottumwa Midland Landfill

Location ID: MW-302
Number of Sampling Dates: 17

Parameter Name	Units	5/4/2016	6/22/2016	8/10/2016	10/26/2016	1/17/2017	4/19/2017	6/20/2017	8/22/2017	11/7/2017	4/17/2018	10/15/2018	4/16/2019	10/15/2019	5/21/2020	10/6/2020	4/12/2021	10/5/2021
Boron	ug/L	853	796	802	784	824	777	767	783	848	834	752	760	780	780	870	820	740
Calcium	mg/L	72.1	56.6	48.8	42.8	42.9	41	46.1	50.2	74	77.3	66.9	44	68	41	65	58	52
Chloride	mg/L	9.2	8.1	7.5	6	7.7	8	8	8.5	7.8	8.6	9.2	10	7.3	8.9	7.2	6.6	7.1
Fluoride	mg/L	1.1	1	0.98	1	0.97	1	1.1	1	1.2	1	1.1	1.5	1.2	1	1.1	1.1	0.5
Field pH	Std. Units	7.38	7.76	9.55	7.22	7.23	7.6	7.29	7.12	7.41	7.8	7.25	7.49	7.21	7.05	7.14	7.13	7.2
Sulfate	mg/L	201	133	102	78.9	76.7	76.7	79.3	77.2	77.5	79.3	80.9	83	73	79	73	64	70
Total Dissolved Solids	mg/L	784	715	671	644	639	671	656	672	607	690	708	690	680	930	700	620	400
Antimony	ug/L	0.12	0.15	0.095	<0.058	0.1	<0.026	0.094	0.056	--	--	--	--	--	--	--	--	--
Arsenic	ug/L	0.19	0.39	0.28	0.24	0.31	0.23	0.25	0.38	--	--	--	--	--	--	--	--	--
Barium	ug/L	39.3	45.4	50	54	57.2	48.9	49.9	47.5	--	--	--	--	--	--	--	--	--
Beryllium	ug/L	0.22	0.16	<0.08	<0.08	<0.08	0.051	0.084	0.15	--	--	--	--	--	--	--	--	--
Cadmium	ug/L	<0.029	<0.029	<0.029	<0.029	<0.029	<0.018	0.018	<0.018	--	--	--	--	--	--	--	--	--
Chromium	ug/L	5.5	6.2	1.9	1.8	1.4	1.4	2.2	2.9	--	--	--	--	--	--	--	--	--
Cobalt	ug/L	1.1	1.1	<0.5	<0.5	<0.5	0.24	0.38	0.66	--	--	--	--	--	--	--	--	--
Lead	ug/L	1.1	0.9	0.32	0.26	0.26	0.25	0.36	0.54	--	--	--	--	--	--	--	--	--
Lithium	ug/L	81.1	81.2	75.9	79.8	80.8	79.6	78.5	82	--	--	--	--	--	--	--	--	--
Mercury	ug/L	<0.039	<0.039	<0.039	<0.039	<0.039	<0.046	<0.046	<0.046	--	--	--	--	--	--	--	--	--
Molybdenum	ug/L	0.32	0.49	0.31	0.18	0.24	0.2	0.17	0.24	--	--	--	--	--	--	--	--	--
Selenium	ug/L	0.19	0.39	<0.18	<0.18	<0.18	<0.086	0.21	0.21	--	--	--	--	--	--	--	--	--
Thallium	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.036	0.065	0.089	--	--	--	--	--	--	--	--	--
Total Radium	pCi/L	0.874	0.677	1.17	1.17	1.57	1.65	1.54	2.6	--	--	--	--	--	--	--	--	--
Radium-226	pCi/L	0.412	-0.066	0.426	0.505	0.525	0.872	0.987	1.74	--	--	--	--	--	--	--	--	--
Radium-228	pCi/L	0.462	0.677	0.744	0.663	1.04	0.777	0.549	0.863	--	--	--	--	--	--	--	--	--
pH at 25 Degrees C	Std. Units	7.3	7.1	7.3	7.4	7.6	7.5	7.6	7.4	7.2	7.6	7.5	7.4	7.5	7.5	7.6	6.7	7.6
Collected By		--	--	0	--	0	0	0	0	--	--	0	--	--	--	--	--	--
Groundwater Elevation	feet	685.8	685.79	685.48	684.94	685.68	684.73	684.76	683.89	683.38	683.87	683.52	685.35	685.44	686.25	685.86	686.26	685.85
Field Oxidation Potential	mV	-153.3	-114.6	-100.7	-126.7	-109.6	-64	-66.8	-96.2	112.3	-138.7	-103.6	8.13	-56.4	-83.4	-169.4	-74.2	-66.5
Field Specific Conductance	umhos/cm	1326	1132	1102	1075	1081	1081	1018	1429	1079	1091	1102	1168	1067	1129	1025	1079	993
Field Temperature	deg C	13.6	14	13.9	13.5	12.9	14	14	13.7	13.1	12.7	13.4	13.63	14.26	13.1	13.5	13.2	13.5
Oxygen, Dissolved	mg/L	0.08	0.09	0.1	0.66	0.29	0.17	0.22	0.11	0.3	0.3	0.22	1.59	0.75	1.06	0.28	0.28	--
Turbidity	NTU	170.8	167.5	74.76	29.05	43.07	39.01	58.63	77.96	202.4	200.6	131.5	44.2	102.8	12.5	136	127	67.1
Dissolved Oxygen	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.35

Single Location

Name: IPL - Ottumwa Midland Landfill

Location ID: MW-303
Number of Sampling Dates: 19

Parameter Name	Units	5/4/2016	6/22/2016	8/9/2016	10/26/2016	1/17/2017	4/19/2017	7/19/2017	8/22/2017	11/7/2017	4/17/2018	10/16/2018	4/16/2019	6/6/2019	10/15/2019	5/26/2020	6/29/2020	10/6/2020	4/12/2021	10/5/2021
Boron	ug/L	3510	2430	1640	1100	955	800	755	737	738	738	661	850	--	760	770	--	740	730	630
Calcium	mg/L	686	462	250	157	116	97.4	87.7	94	94.9	103	90.5	150	--	120	120	--	100	100	92
Chloride	mg/L	13.5	11.5	8.7	7.5	7.1	6.9	7.2	7.3	6.9	7.3	7.4	8.1	8	7.5	8.5	6.9	7.3	7.6	8.3
Fluoride	mg/L	0.68	0.47	0.9	0.87	0.86	0.86	0.86	0.85	0.77	0.8	0.84	<0.23	--	0.87	0.81	--	0.88	0.74	0.39
Field pH	Std. Units	6.24	6.93	7.84	6.66	6.69	7.12	7.1	6.71	6.96	7.32	6.87	6.97	6.71	6.76	6.21	6.74	7.01	6.8	6.76
Sulfate	mg/L	6230	4690	1950	780	497	329	255	287	232	262	310	600	--	390	440	--	230	260	270
Total Dissolved Solids	mg/L	9540	7120	2750	1500	1080	931	809	868	783	839	891	1300	--	1100	1100	--	840	850	820
Antimony	ug/L	<0.58	<0.058	<0.12	<0.058	0.082	<0.026	0.042	0.041	--	--	--	--	--	--	--	--	--	--	--
Arsenic	ug/L	<1	0.3	<0.21	0.13	0.2	0.24	0.59	0.53	--	--	--	--	--	--	--	--	--	--	--
Barium	ug/L	55.8	47.6	19.3	13.4	11.7	11.9	12.8	13.1	--	--	--	--	--	--	--	--	--	--	--
Beryllium	ug/L	1.2	<0.24	0.16	0.11	0.099	0.13	0.24	0.24	--	--	--	--	--	--	--	--	--	--	--
Cadmium	ug/L	<0.29	<0.029	<0.058	0.037	<0.029	<0.018	0.019	0.026	--	--	--	--	--	--	--	--	--	--	--
Chromium	ug/L	22.1	3.1	2.7	2.6	1.1	2.6	5.1	4.5	--	--	--	--	--	--	--	--	--	--	--
Cobalt	ug/L	12.7	1.6	1.2	1	<0.5	1.1	2.5	2.1	--	--	--	--	--	--	--	--	--	--	--
Lead	ug/L	5.7	1.6	0.51	0.57	0.3	0.57	1	1.2	--	--	--	--	--	--	--	--	--	--	--
Lithium	ug/L	289	270	126	102	96.5	92.4	90.8	92.8	--	--	--	--	--	--	--	--	--	--	--
Mercury	ug/L	<0.039	<0.039	<0.039	<0.039	<0.039	<0.046	<0.046	<0.046	--	--	--	--	--	--	--	--	--	--	--
Molybdenum	ug/L	3	0.38	0.69	0.43	0.29	0.3	0.26	0.29	--	--	--	--	--	--	--	--	--	--	--
Selenium	ug/L	<1.8	0.38	<0.37	<0.18	<0.18	0.26	0.4	0.42	--	--	--	--	--	--	--	--	--	--	--
Thallium	ug/L	<5	<2.5	<1	<0.5	<0.5	<0.036	0.049	0.048	--	--	--	--	--	--	--	--	--	--	--
Total Radium	pCi/L	10.6	7.5	3.59	2.18	1.47	1.82	1.33	0.803	--	--	--	--	--	--	--	--	--	--	--
Radium-226	pCi/L	2.51	2.96	1.26	0.634	0.199	0.481	0.273	0.559	--	--	--	--	--	--	--	--	--	--	--
Radium-228	pCi/L	8.08	4.54	2.33	1.55	1.27	1.34	1.06	0.244	--	--	--	--	--	--	--	--	--	--	--
pH at 25 Degrees C	Std. Units	6.2	6.2	6.4	6.6	6.9	7	7	6.9	6.8	7.2	7.1	6.8	--	7	7.3	--	7.2	7	7.3
Collected By		--	--	0	--	0	0	0	0	--	--	--	--	--	--	--	--	--	--	--
Groundwater Elevation	feet	686.04	687.72	687.77	685.56	685.6	685.51	684.92	684.7	684.26	684.68	684.33	686.13	686.05	686.08	687.14	687.36	686.35	689.05	686.84
Field Oxidation Potential	mV	-50	-49.5	-76.7	-102.1	-93.5	-56.6	-83.6	-72.6	125.7	-103.8	-117.7	-20	-40	-55.6	-30	-53.3	-137.3	-64.6	-55
Field Specific Conductance	umhos/cm	8206	6426	3419	2120	1681	1451	1300	1836	1307	1358	0	2209	1331	1628	1963	1739	1262	1431	1287
Field Temperature	deg C	14	14	14	13.7	13	13.7	14.5	14	13.2	13.3	13.5	14.07	16.7	15.44	14.4	16.1	13.9	14.2	13.8
Oxygen, Dissolved	mg/L	0.16	0.11	0.08	0.46	0.16	0.17	0.5	0.31	0.45	0.38	0.41	1.41	0.42	0.43	2.31	0.49	0.3	0.38	--
Turbidity	NTU	677.5	160.2	169.9	84.13	113.7	120.3	179.4	161.5	258.2	248	61.64	99.2	169.9	27.9	57.1	59	240	168	79.6
Dissolved Oxygen	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.48

Appendix E

Statistical Evaluation

January 12, 2021
File No. 25220073.00

TECHNICAL MEMORANDUM

SUBJECT: Statistical Evaluation of Groundwater Monitoring Results – UPL Update
Ottumwa Midland Landfill, CCR Units, October 2020

PREPARED BY: Nicole Kron

CHECKED BY: Sherren Clark

STATISTICAL METHOD

Groundwater monitoring data for the Ottumwa Midland Landfill (OML) CCR units is evaluated in accordance with 40 CFR 257.93(f)(3), using a prediction interval procedure, in which an interval for each constituent is established from the distribution of the background data, and the level of each constituent in each compliance well is compared to the upper prediction limit.

Statistical evaluation is performed using commercially available software (*Sanitas for Groundwater*© or similar) in general accordance with the USEPA's *Unified Guidance for Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities* dated March 2009 (Unified Guidance) (USEPA, 2009) and generally accepted procedures.

The OML monitoring data includes two background monitoring wells, MW-102M and MW-122M, and three compliance monitoring wells, MW-301, MW-302, and MW-303. The statistical analysis includes intrawell evaluation for chloride and Interwell evaluation for the remaining Appendix III parameters.

The initial Interwell UPLs were calculated based on nine rounds of background monitoring performed up to the initiation of compliance monitoring for the existing CCR units at OML, from May 2016 through November 2017. In the November 2017 and April 2018 detection monitoring events, interwell SSIs for chloride were identified for compliance well MW-301. These SSIs were attributed to natural variation in ASDs completed for these two events. Following the completion of the April 2018 ASD, dated October 31, 2018, the statistical method for evaluating chloride data at the three compliance monitoring wells was 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.

As part of the evaluation of the October 2020 monitoring results, the background data set for the UPL calculations is being updated. The updated interwell background dataset will include data from the background wells collected through October 2020. The updated intrawell background dataset for chloride will include data collected through April 2020. This memo addresses updated UPLs for Appendix III parameters.

TIME SERIES PLOTS

Time series plots are prepared for the required monitoring parameters to show the concentration variations over time. Time series graphs are included in **Attachment 1**.

OUTLIER ANALYSIS - INTERWELL

An outlier analysis is performed for background monitoring results. A statistical outlier is a value that is extremely different from the other values in the data set. The Sanitas outlier tests identify data points that do not fit the distribution of the rest of the data set and determine if they differ significantly from the rest of the data. The outlier analysis performed in Sanitas includes the following steps:

1) Run normality test (Shapiro Wilk/Francia).

2) If normally distributed, run USEPA's 1989 Outlier Test to identify suspected outliers.
   a) If number of background samples is less than or equal to 25, run Dixon's test for suspected outliers.
   b) If number of background samples is more than 25, run Rosner's test for suspected outliers.

3) If not normally distributed, run Tukey's test for outliers.

4) Review data flagged as possible outliers to evaluate whether they should be removed from the background data set. Also review time series plots for possible outliers that were not picked up in the statistical evaluation (e.g., outlier test may not identify outliers when two values are similar to each other, but very different from all other data).

Results identified as statistical outliers are checked for possible lab instrument failure, field collection problems, or data entry errors; however, outliers may exist naturally in the data if there is an extremely wide inherent or temporal variability in the data. The Unified Guidance states that unless a likely error can be identified, the outlier should not be removed.

For the October 2020 sampling event, the following background values from background wells MW-102M and MW-122M were identified as potential outliers for the interwell analysis and handled as described:

- **Boron (MW-122M).** One low result from the June 2016 event was flagged as a statistical outlier. This result was not removed from the dataset because there was no known explanation for the lower result and it appeared to be within the range of potential natural variation relative to the other observed boron concentrations.

- **Calcium (MW-122M).** Two results from the May and June 2016 events were flagged as statistical outliers. The May 2016 result was removed because it was the first sampling event, was higher than all subsequent results, and may represent conditions before the water quality at the well stabilized after installation. The June 2016 result was not removed from the dataset because there was no known explanation for the low result and the result appeared to be within the range of potential natural variation relative to the other observed calcium concentrations.

- **Sulfate (MW-122M).** Two results from the June 2017 and October 2018 events were flagged as statistical outliers. The high result (June 2017) was not removed from the dataset because there was no known explanation for the high result, the April 2017 result was also higher than typical values, and the high result appeared to be within the range of potential natural variation relative to the other observed sulfate concentrations. The low result was removed as an outlier because it was below detection, which appears very unlikely to be a valid result based on other detections, and may represent a sampling or laboratory error.

- **Total Dissolved Solids (MW-102M).** One high result from the May 2020 event was flagged as a statistical outlier. This result was not removed from the dataset because there was no known explanation for the higher results and it appeared to be within the range of potential natural variation relative to the other observed Total Dissolved Solids (TDS) concentrations.

- **Total Dissolved Solids (MW-122M).** Two results from the June 2016 and April 2017 events were flagged as statistical outliers. The results were not removed from the dataset because there was no known explanation for low and high results. Also, the high result appeared to be within the range of potential natural variation relative to the other observed TDS concentrations.

The outlier analysis is included in **Attachment 2.**

OUTLIERS ANALYSIS - INTRAWELL

An outlier analysis is performed for background monitoring results at the compliance wells when intrawell prediction limits are calculated for constituents. A statistical outlier is a value that is extremely different from the other values in the data set. The outlier analysis performed in Sanitas using the same steps noted above.

For the October 2020 sampling event, the following background values were identified as potential chloride outliers in the compliance monitoring wells (MW-301, MW-302, and MW-303) and handled as described:

- **MW-301.** One high result from the June 2016 event was flagged as a statistical outlier. This result was removed from the dataset because this results appeared to be outside the range of likely natural variation relative to the observed chloride concentrations at MW-301.

- **MW-303.** One high result from the May 2016 event was initially flagged by Sanitas as a statistical outlier. This result was removed from the dataset because it was the first sample from the newly installed well and exceeded subsequent observed chloride concentrations at MW-303. The second sample from this well (June 2016) was not initially flagged as an outlier, but was flagged as an outlier when the analysis was rerun after removing the May 2016 result. This result was also removed from the dataset for the prediction limit analysis.

Outlier analysis of chloride results from the compliance wells is included in **Attachment 2.**

BACKGROUND UPDATE

The background data pool was updated in accordance with the Unified Guidance, which recommends updating background every 2 to 3 years for semiannual sampling. Prior to expanding the interwell data pool, the original interwell background data set (5/2016 through 11/2017) and the data to be added (4/2018 through 10/2020) were compared. For the intrawell analysis of chloride, the previous intrawell background data set (5/2016 through 4/2018) and the data to be added (10/2018 through 4/2020) were compared. The Unified Guidance states that recently collected measurements from the background wells can be added to the existing pool if a Student's t-test or Wilcoxon rank-sum test finds no significant difference between the two groups at the 1% level of significance.

The Sanitas background group comparison for the OML background data sets, included in Attachment 3, indicated no signficant difference at the 1% level; therefore, the more recent data can be added to the background pool. The comparison uses Welch's t-test for normally distributed data and the Mann-Whitney test for non-normal data. (Note: The Sanitas output labels the earlier background dataset as "Background" and the later background dataset as "Compliance," but all data shown is proposed background data.)

INTERWELL PREDICTION LIMITS

Interwell prediction limits were calculated for Appendix III parameters except for chloride. Interwell prediction limits are calculated using background data from the upgradient monitoring wells (MW-122M and MW-102M) for each monitored constituent, with outliers removed as noted above. The prediction limit analysis performed in Sanitas includes the following steps:

1) If 100% of the background values are non-detect, the Double Quanitification rule applies and no prediction limit is calculated.

2) If 50% or more of results are non-detect, then a non-parametric prediction limit is calculated.

3) If fewer than 50% of the results are non-detect, run normality test (Shapiro Wilk/Francia) to assess whether the data fit a normal distribution or can be transformed to fit a normal distribution (e.g., lognormal).

4) If normal or transformed normal, calculate parametric prediction limit.

5) If not normal or transformed normal, calculate non-parametric prediction limit.

Consistent with the Unified Guidance, parametric prediction limits are calculated based on a 1-of-2 retesting protocol and a 10 percent site-wide false positive rate. Sanitas establishes the per-test significance level based on user inputs of the number of events per year, number of constituents being evaluated, and number of compliance wells. For the October 2020 event, the following values were used:

Parameter	Value	Comments
Evaluations per year	2	Spring and Fall events
Constituents analyzed	7	Total of 7 constituents analyzed
Compliance wells	3	MW-301, MW-302, MW-303

Non-parametric prediction limits are also based on a 1-of-2 retesting protocol. The non-parametric limit is the highest value in the background dataset, which provides an alpha value (false positive rate) similar to that used for the parametric analysis.

For evaluation of parameters with less than 100 percent non-detects in the background sampling, the non-detects were adjusted using the Kaplan-Meier technique, unless the non-detects represent less than 15 percent of the total samples, in which case one-half of the detection limit was used.

Interwell prediction limit analysis results are included in **Attachment 4**.

INTRAWELL PREDICTION LIMITS

Interwell prediction limits were calculated for chloride. Intrawell prediction limits are calculated using background data from the compliance monitoring wells (MW-301, MW-302, and MW303) for each monitored constituent, with outliers removed as noted above. For this evaluation of October 2020 results, background results from May 2016 through April 2020 were included to calculate the intrawell prediction limits. The intrawell prediction limit analysis performed in Sanitas includes the same steps noted above.

Intrawell prediction limit analysis results are included in **Attachment 4**.

NDK/SCC

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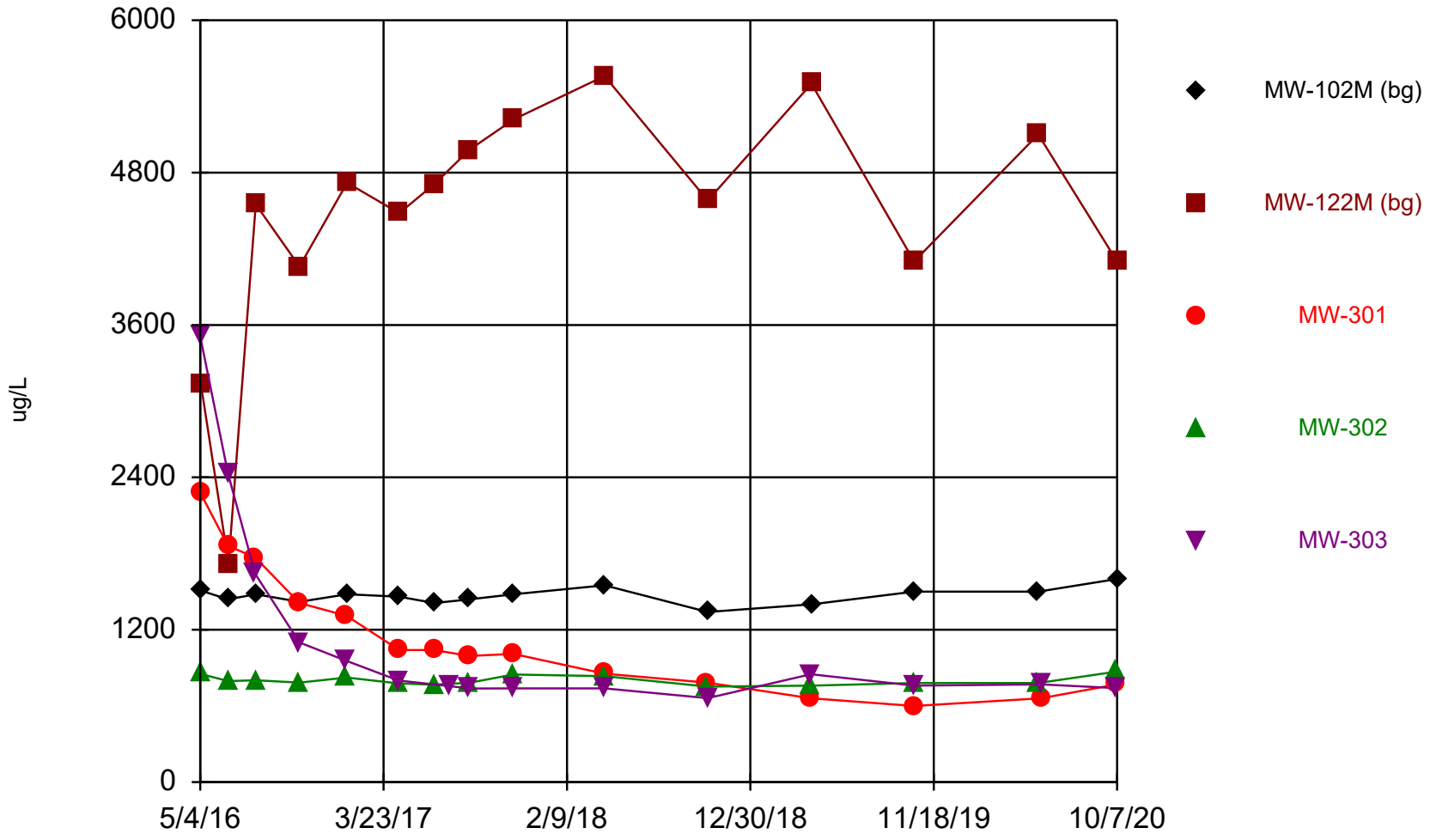
Attachment 1

Times Series Graphs

Boron



Time Series Analysis Run 12/4/2020 6:43 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

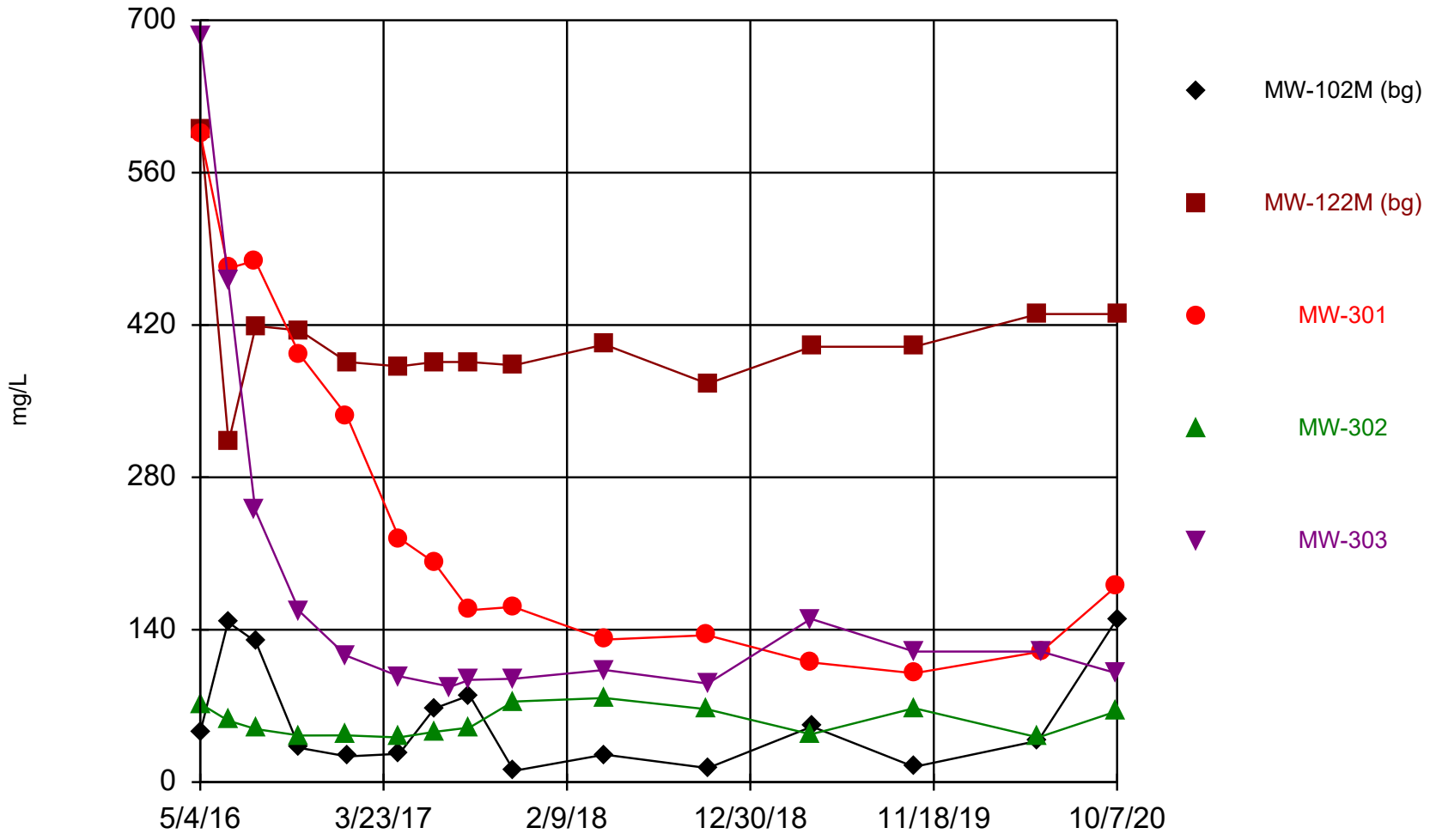
Time Series

Constituent: Boron (ug/L) Analysis Run 12/4/2020 6:45 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M (bg)	MW-122M (bg)	MW-301	MW-302	MW-303
5/4/2016	1510		2280	853	3510
5/5/2016		3140			
6/22/2016	1440		1860	796	2430
6/23/2016		1720			
8/9/2016			1770		1640
8/10/2016	1480	4550		802	
10/26/2016	1420	4060	1410	784	1100
1/17/2017			1310	824	955
1/18/2017	1480	4720			
4/19/2017				777	800
4/20/2017	1460	4480	1040		
6/20/2017			1040	767	
6/21/2017	1410	4710			
7/19/2017					755
8/22/2017	1440	4980	994	783	737
11/7/2017			1010	848	738
11/8/2017	1480	5220			
4/17/2018	1550	5560	854	834	738
10/15/2018			784	752	
10/16/2018	1340	4580			661
4/16/2019			660	760	850
4/17/2019		5500			
4/18/2019	1400				
10/15/2019	1500	4100	600	780	760
5/21/2020	1500	5100		780	
5/26/2020			660		770
10/6/2020			770	870	740
10/7/2020	1600	4100			

Calcium



Time Series Analysis Run 12/4/2020 6:43 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

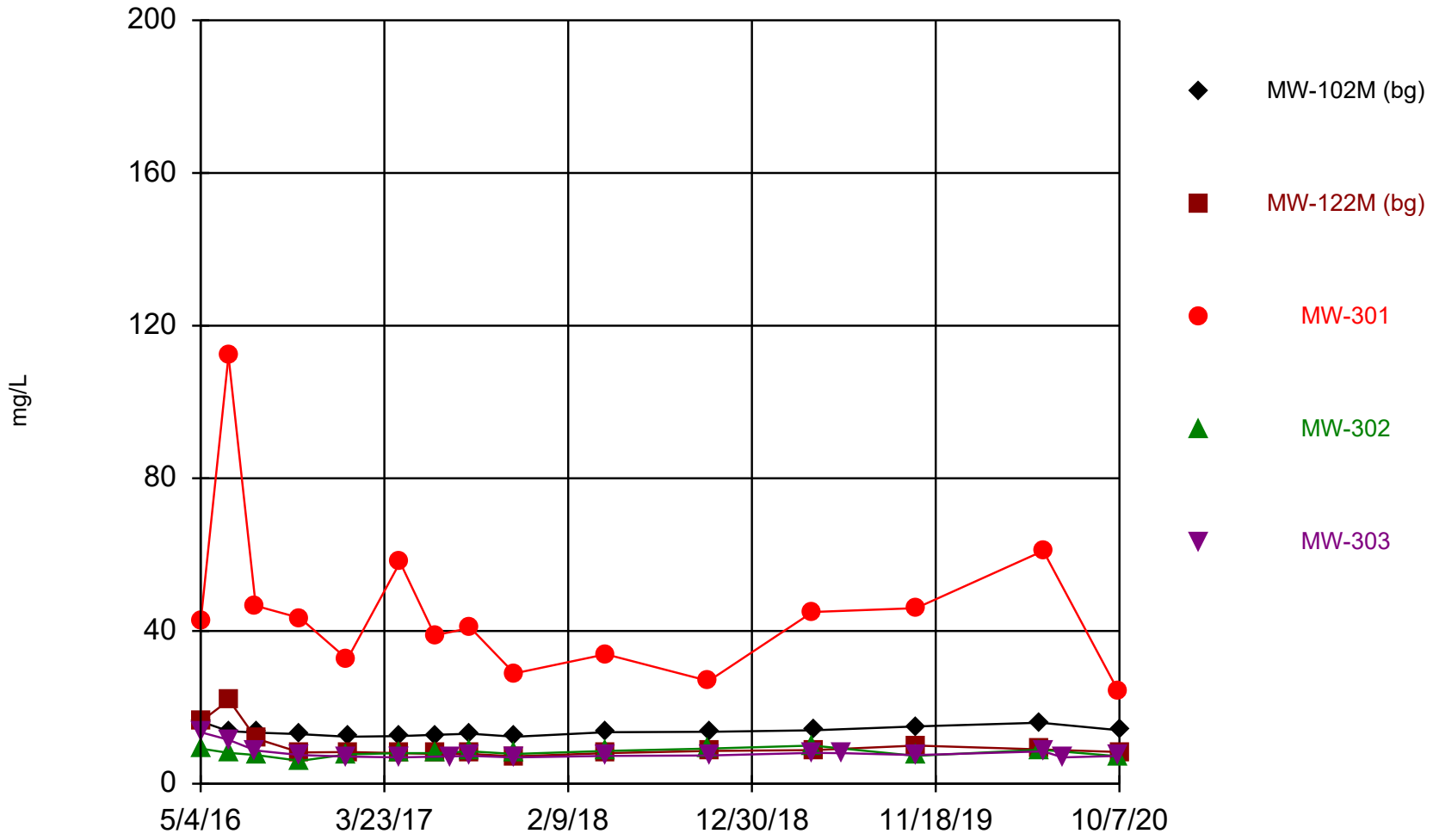
Time Series

Constituent: Calcium (mg/L) Analysis Run 12/4/2020 6:45 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M (bg)	MW-122M (bg)	MW-301	MW-302	MW-303
5/4/2016	45.9		596	72.1	686
5/5/2016		599			
6/22/2016	147		472	56.6	462
6/23/2016		312			
8/9/2016			479		250
8/10/2016	129	419		48.8	
10/26/2016	31.5	415	393	42.8	157
1/17/2017			337	42.9	116
1/18/2017	23.6	386			
4/19/2017				41	97.4
4/20/2017	26	382	224		
6/20/2017			202	46.1	
6/21/2017	67.7	386			
7/19/2017					87.7
8/22/2017	79.7	386	158	50.2	94
11/7/2017			161	74	94.9
11/8/2017	10.4	383			
4/17/2018	25.3	402	131	77.3	103
10/15/2018			135	66.9	
10/16/2018	12.9	366			90.5
4/16/2019			110	44	150
4/17/2019		400			
4/18/2019	51				
10/15/2019	14	400	100	68	120
5/21/2020	38	430		41	
5/26/2020			120		120
10/6/2020			180	65	100
10/7/2020	150	430			

Chloride



Time Series Analysis Run 12/4/2020 6:44 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

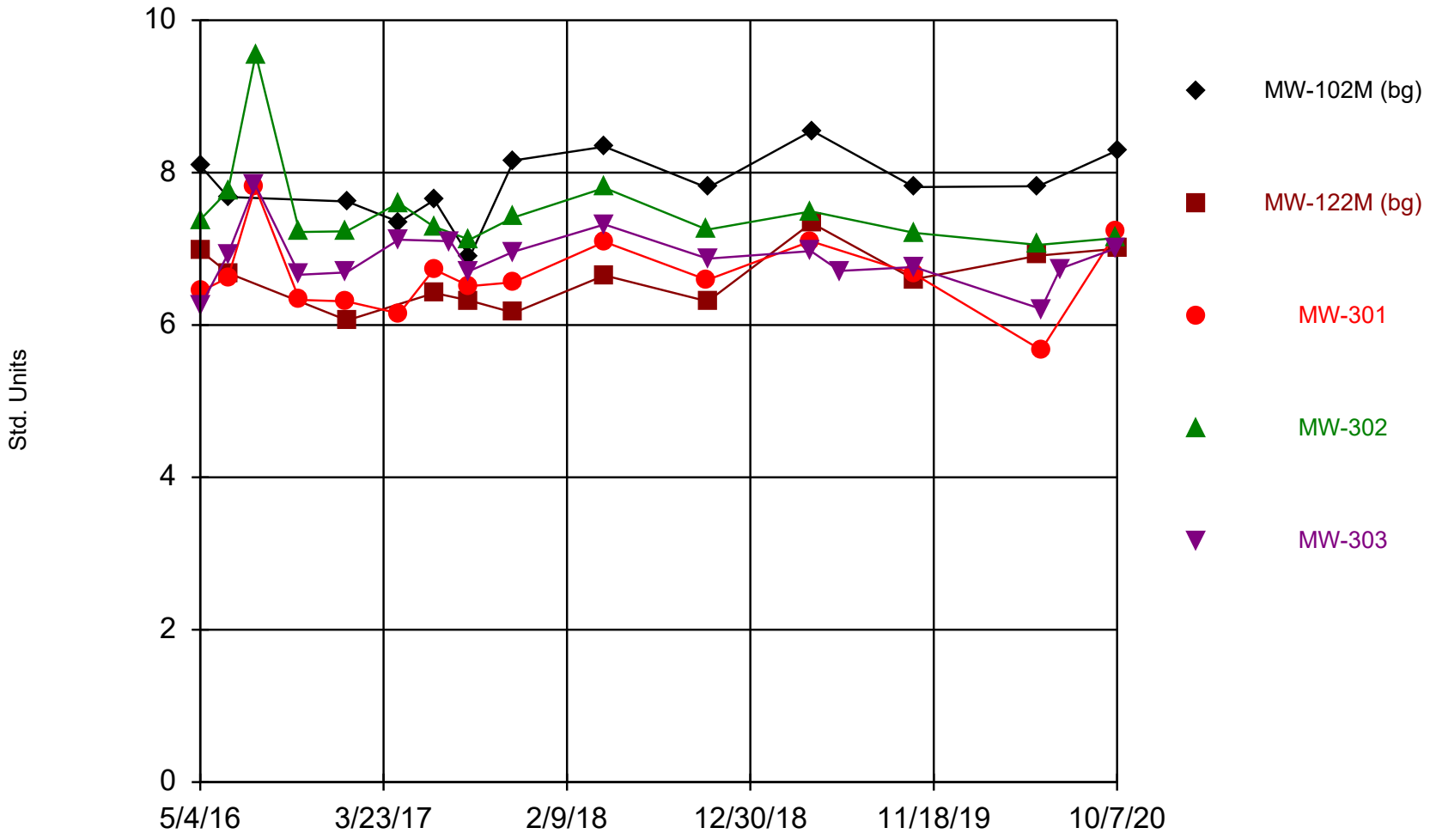
Time Series

Constituent: Chloride (mg/L) Analysis Run 12/4/2020 6:45 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M (bg)	MW-122M (bg)	MW-301	MW-302	MW-303
5/4/2016	16.3		42.4	9.2	13.5
5/5/2016		16.4			
6/22/2016	13.8		112	8.1	11.5
6/23/2016		21.9			
8/9/2016			46.6		8.7
8/10/2016	13.4	11.8		7.5	
10/26/2016	13	8.2	43.4	6	7.5
1/17/2017			32.6	7.7	7.1
1/18/2017	12.3	8.3			
4/19/2017				8	6.9
4/20/2017	12.5	8	58		
6/20/2017			38.9	8	
6/21/2017	12.8	7.8			
7/19/2017					7.2
8/22/2017	13.1	7.8	40.8	8.5	7.3
11/7/2017			28.9	7.8	6.9
11/8/2017	12.3	7.2			
4/17/2018	13.5	8	33.9	8.6	7.3
10/15/2018			26.9	9.2	
10/16/2018	13.6	8.6			7.4
4/16/2019			45	10	8.1
4/17/2019		8.8			
4/18/2019	14				
6/6/2019					8
10/15/2019	15	10	46	7.3	7.5
5/21/2020	16	9		8.9	
5/26/2020			61		8.5
6/29/2020					6.9
10/6/2020			24	7.2	7.3
10/7/2020	14	8.3			

Field pH



Time Series Analysis Run 12/4/2020 6:44 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Time Series

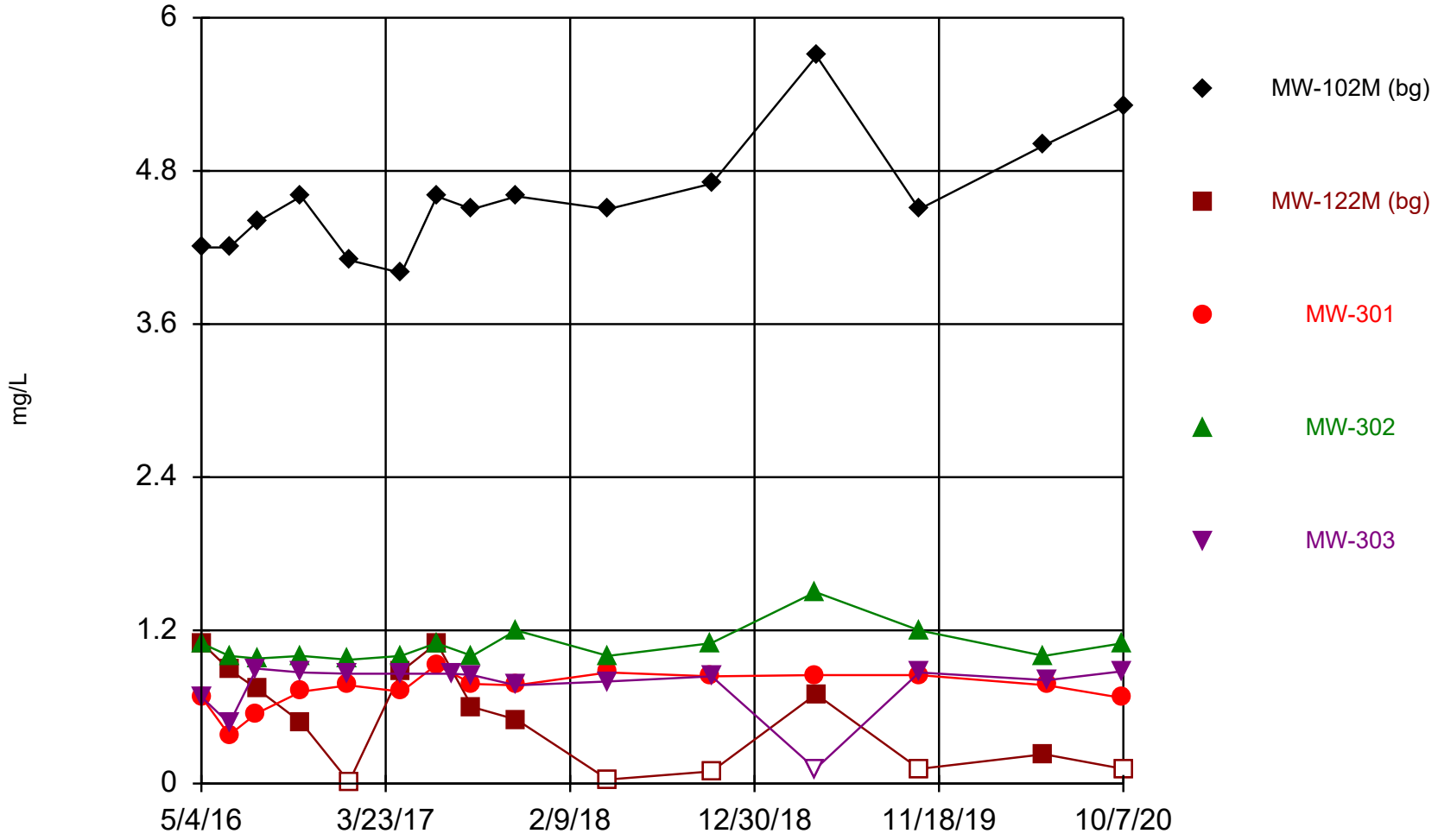
Constituent: Field pH (Std. Units) Analysis Run 12/4/2020 6:45 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M (bg)	MW-122M (bg)	MW-301	MW-302	MW-303
5/4/2016	8.09		6.44	7.38	6.24
5/5/2016		6.97			
6/22/2016	7.68		6.62	7.76	6.93
6/23/2016		6.68			
8/9/2016			7.81		7.84
8/10/2016				9.55	
10/26/2016			6.33	7.22	6.66
1/17/2017			6.31	7.23	6.69
1/18/2017	7.62	6.06			
4/19/2017				7.6	7.12
4/20/2017	7.35		6.15		
6/20/2017			6.73	7.29	
6/21/2017	7.64	6.42			
7/19/2017					7.1
8/22/2017	6.89	6.32	6.51	7.12	6.71
11/7/2017			6.56	7.41	6.96
11/8/2017	8.16	6.16			
4/17/2018	8.34	6.65	7.09	7.8	7.32
10/15/2018			6.59	7.25	
10/16/2018	7.8	6.31			6.87
4/16/2019			7.1	7.49	6.97
4/17/2019		7.34			
4/18/2019	8.55				
6/6/2019					6.71
10/15/2019	7.81	6.6	6.67	7.21	6.76
5/21/2020	7.82	6.91		7.05	
5/26/2020			5.67		6.21
6/29/2020					6.74
10/6/2020			7.22	7.14	7.01
10/7/2020	8.29	7			

Hollow symbols indicate censored values.

Fluoride



Time Series Analysis Run 12/4/2020 6:44 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Time Series

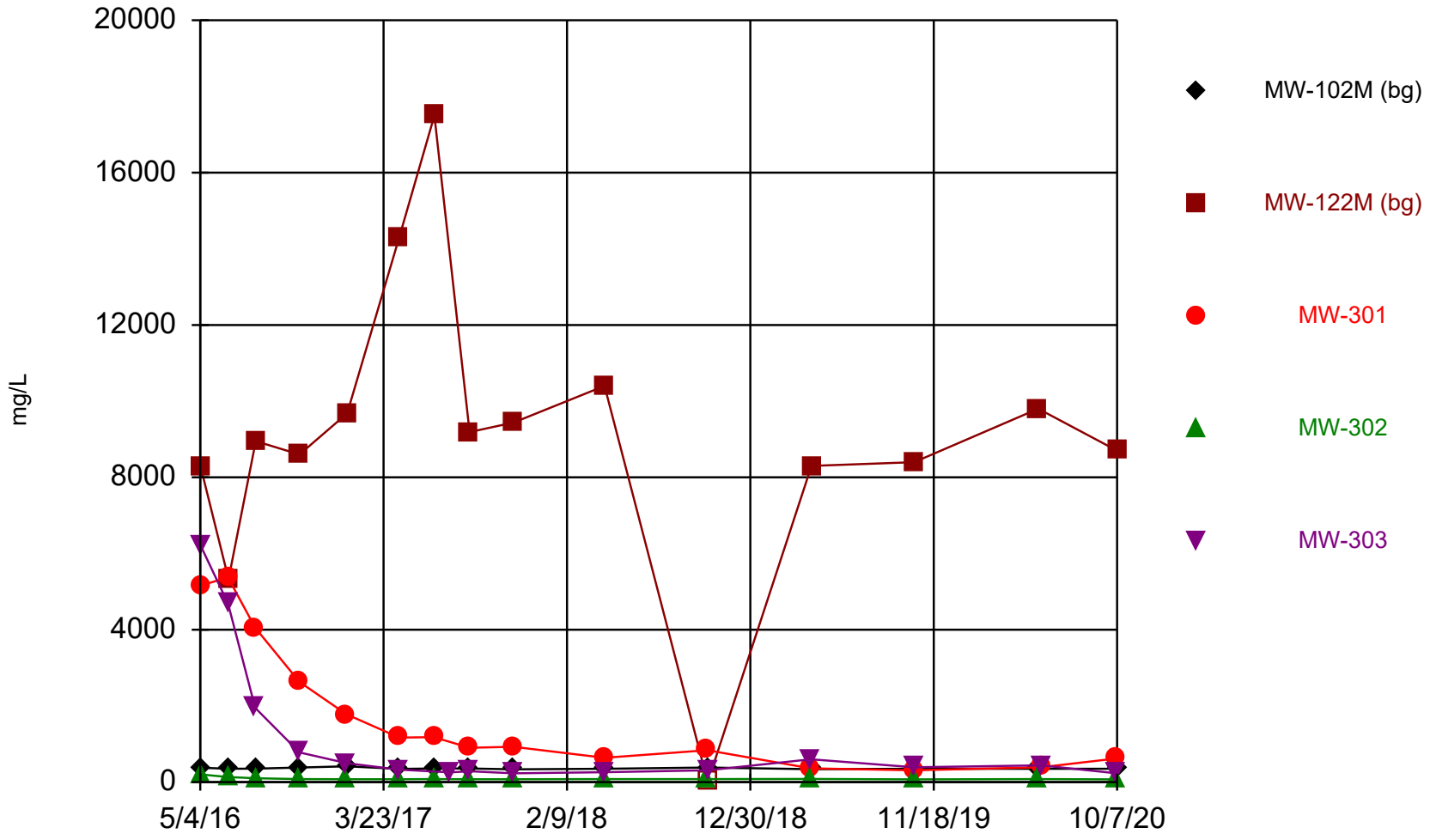
Constituent: Fluoride (mg/L) Analysis Run 12/4/2020 6:45 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M (bg)	MW-122M (bg)	MW-301	MW-302	MW-303
5/4/2016	4.2		0.68	1.1	0.68
5/5/2016		1.1			
6/22/2016	4.2		0.38	1	0.47
6/23/2016		0.89			
8/9/2016			0.55		0.9
8/10/2016	4.4	0.74		0.98	
10/26/2016	4.6	0.48	0.72	1	0.87
1/17/2017			0.77	0.97	0.86
1/18/2017	4.1	<0.027 (U)			
4/19/2017				1	0.86
4/20/2017	4	0.88	0.72		
6/20/2017			0.93	1.1	
6/21/2017	4.6	1.1			
7/19/2017					0.86
8/22/2017	4.5	0.6	0.78	1	0.85
11/7/2017			0.77	1.2	0.77
11/8/2017	4.6	0.5			
4/17/2018	4.5	<0.063 (U)	0.87	1	0.8
10/15/2018			0.84	1.1	
10/16/2018	4.7	<0.19 (U)			0.84
4/16/2019			0.85	1.5	<0.23 (U)
4/17/2019		0.7			
4/18/2019	5.7				
10/15/2019	4.5	<0.23 (U)	0.85	1.2	0.87
5/21/2020	5	0.23 (J)		1	
5/26/2020			0.77		0.81
10/6/2020			0.67	1.1	0.88
10/7/2020	5.3	<0.23 (U)			

Hollow symbols indicate censored values.

Sulfate



Time Series Analysis Run 12/4/2020 6:44 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

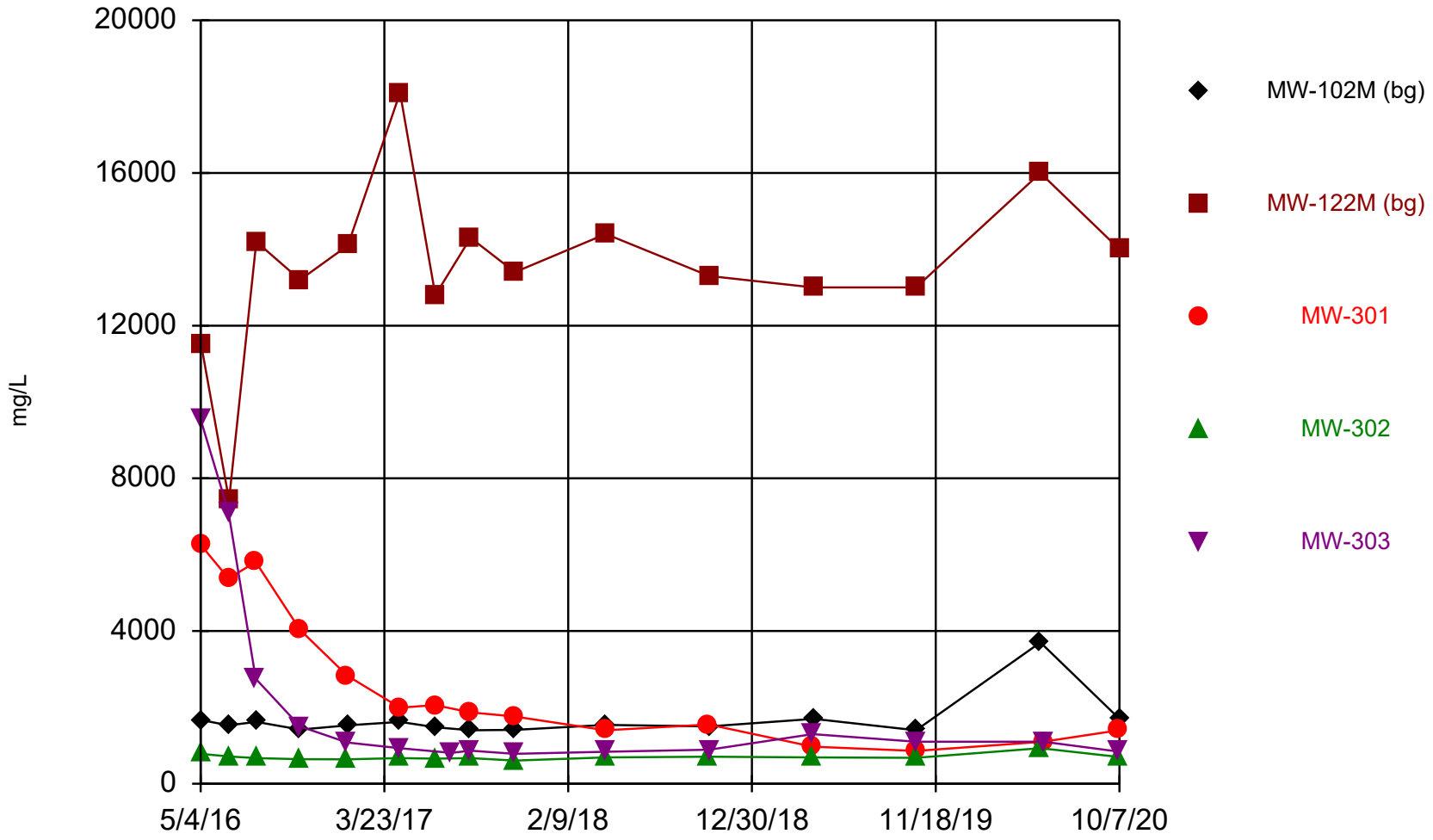
Time Series

Constituent: Sulfate (mg/L) Analysis Run 12/4/2020 6:45 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M (bg)	MW-122M (bg)	MW-301	MW-302	MW-303
5/4/2016	378		5160	201	6230
5/5/2016		8260			
6/22/2016	350		5370	133	4690
6/23/2016		5330			
8/9/2016			4050		1950
8/10/2016	354	8950		102	
10/26/2016	384	8600	2630	78.9	780
1/17/2017			1780	76.7	497
1/18/2017	415	9680			
4/19/2017				76.7	329
4/20/2017	348	14300	1170		
6/20/2017			1180	79.3	
6/21/2017	356	17500			
7/19/2017					255 (255)
8/22/2017	358	9190	902	77.2	287
11/7/2017			926	77.5	232
11/8/2017	335	9440			
4/17/2018	352	10400	638	79.3	262
10/15/2018			837	80.9	
10/16/2018	384	<0.24 (U)			310
4/16/2019			360	83	600
4/17/2019		8300			
4/18/2019	340				
10/15/2019	350	8400	310	73	390
5/21/2020	350	9800		79	
5/26/2020			390		440
10/6/2020			620	73	230
10/7/2020	350	8700			

Total Dissolved Solids



Time Series Analysis Run 12/4/2020 6:44 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Time Series

Constituent: Total Dissolved Solids (mg/L) Analysis Run 12/4/2020 6:45 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M (bg)	MW-122M (bg)	MW-301	MW-302	MW-303
5/4/2016	1670		6260	784	9540
5/5/2016		11500			
6/22/2016	1530		5380	715	7120
6/23/2016		7430			
8/9/2016			5810		2750
8/10/2016	1620	14200		671	
10/26/2016	1420	13200	4030	644	1500
1/17/2017			2830	639	1080
1/18/2017	1530	14100			
4/19/2017				671	931
4/20/2017	1620	18100	1990		
6/20/2017			2060	656	
6/21/2017	1480	12800			
7/19/2017					809
8/22/2017	1400	14300	1870	672	868
11/7/2017			1760	607	783
11/8/2017	1410	13400			
4/17/2018	1540	14400	1400	690	839
10/15/2018			1550	708	
10/16/2018	1500	13300			891
4/16/2019			970	690	1300
4/17/2019		13000			
4/18/2019	1700				
10/15/2019	1400	13000	860	680	1100
5/21/2020	3700	16000		930	
5/26/2020			1100		1100
10/6/2020			1400	700	840
10/7/2020	1700	14000			

Attachment 2

Outlier Analysis

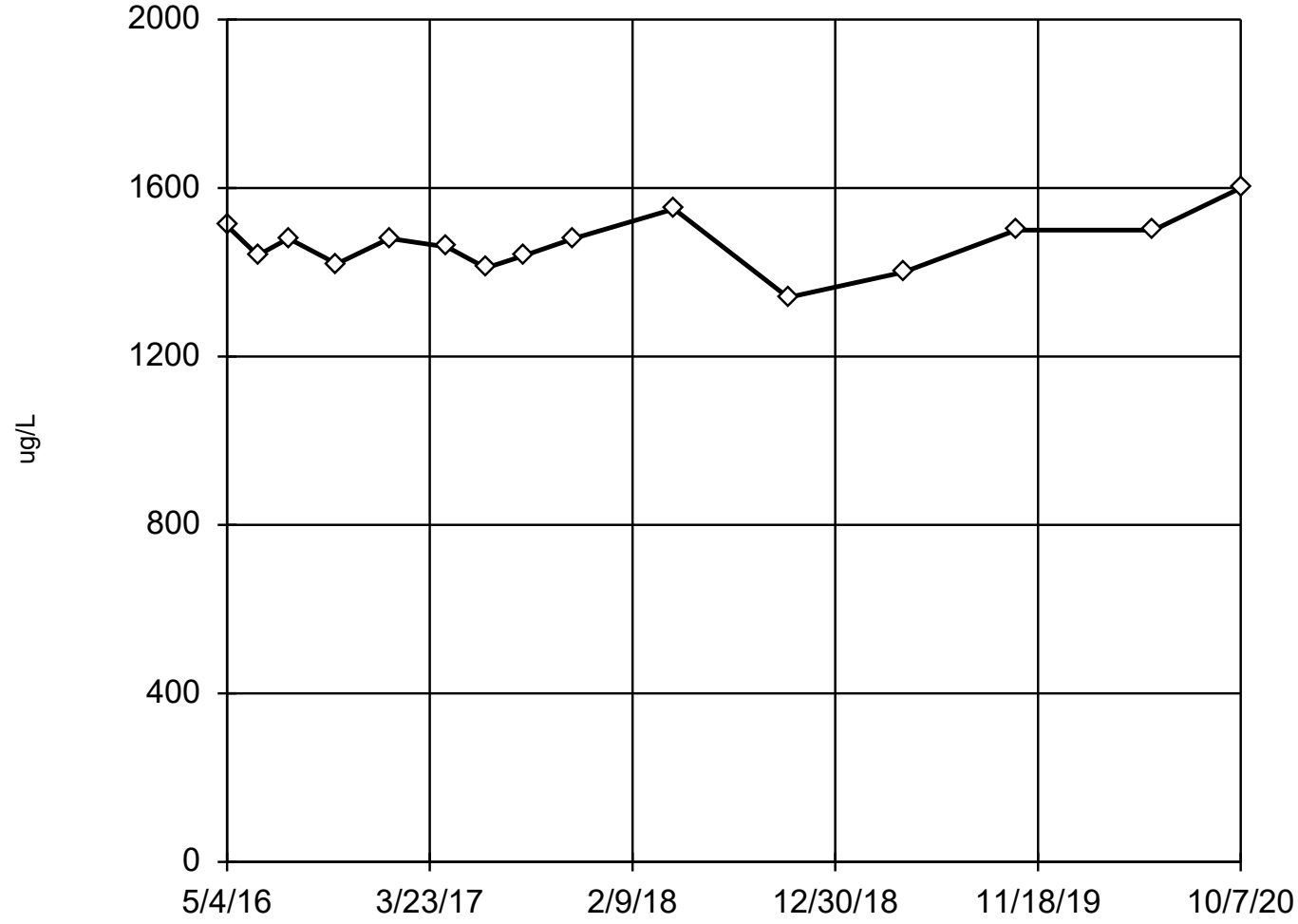
Outlier Analysis

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020 Printed 12/31/2020, 12:27 AM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Boron (ug/L)	MW-102M (bg)	No	n/a	n/a	EPA 1989	0.05	15	1467	63.64	normal	ShapiroWilk
Boron (ug/L)	**MW-122M (bg)**	**Yes**	**1720**	**6/23/2016**	**Dixon`s**	**0.05**	**15**	**4435**	**976.9**	**normal**	**ShapiroWilk**
Calcium (mg/L)	MW-102M (bg)	No	n/a	n/a	EPA 1989	0.05	15	56.8	48.39	ln(x)	ShapiroWilk
Calcium (mg/L)	**MW-122M (bg)**	**Yes**	**599,312**	**5/5/2016,...**	**Dixon`s**	**0.05**	**15**	**406.4**	**60.64**	**normal**	**ShapiroWilk**
Field pH (Std. Units)	MW-102M (bg)	No	n/a	n/a	EPA 1989	0.05	13	7.849	0.4453	normal	ShapiroWilk
Field pH (Std. Units)	MW-122M (bg)	No	n/a	n/a	EPA 1989	0.05	12	6.618	0.3844	normal	ShapiroWilk
Fluoride (mg/L)	MW-102M (bg)	No	n/a	n/a	EPA 1989	0.05	15	4.593	0.4527	ln(x)	ShapiroWilk
Fluoride (mg/L)	MW-122M (bg)	No	n/a	n/a	Dixon`s	0.05	15	0.5307	0.3625	normal	ShapiroWilk
Sulfate (mg/L)	MW-102M (bg)	No	n/a	n/a	NP (nrm)	NaN	15	360.3	21.03	unknown	ShapiroWilk
Sulfate (mg/L)	**MW-122M (bg)**	**Yes**	**17500,0.12**	**6/21/2017...**	**NP (nrm)**	**NaN**	**15**	**9123**	**3775**	**unknown**	**ShapiroWilk**
Total Dissolved Solids (mg/L)	**MW-102M (bg)**	**Yes**	**3700**	**5/21/2020**	**Dixon`s**	**0.05**	**15**	**1681**	**568.4**	**normal**	**ShapiroWilk**
Total Dissolved Solids (mg/L)	**MW-122M (bg)**	**Yes**	**18100,7430**	**4/20/2017...**	**Dixon`s**	**0.05**	**15**	**13515**	**2267**	**normal**	**ShapiroWilk**

EPA Screening (suspected outliers for Dixon's Test)

MW-102M (bg)



n = 15

Dixon's will not be run.
No suspect values identified or unable to establish suspect values.
Mean 1467, std. dev. 63.64, critical Tn 2.409

Normality test used:
Shapiro Wilk@alpha = 0.1
Calculated = 0.9821
Critical = 0.901
The distribution was found to be normally distrib-uted.

Constituent: Boron Analysis Run 12/31/2020 12:26 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

EPA 1989 Outlier Screening

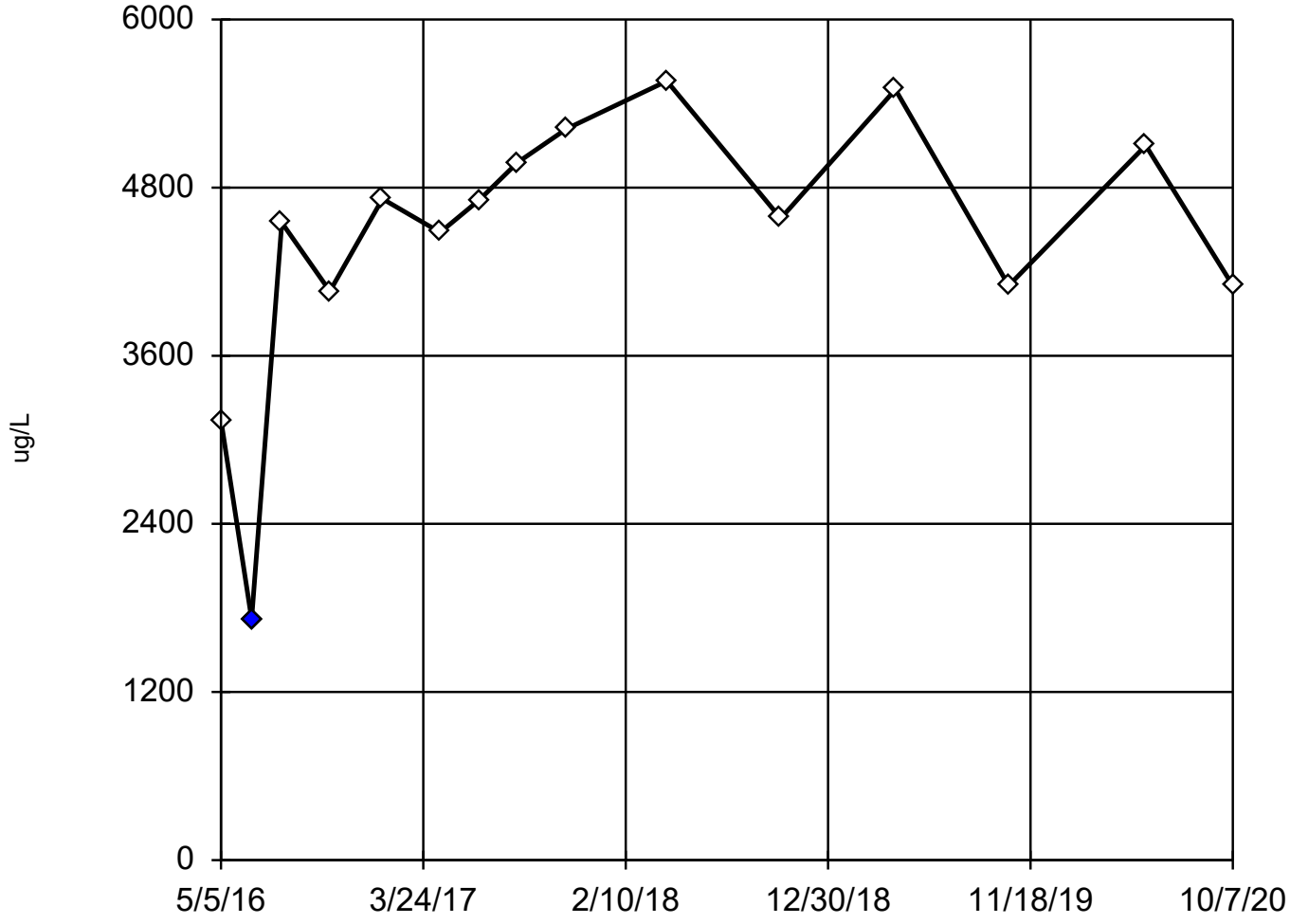
Constituent: Boron (ug/L) Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M (bg)
5/4/2016	1510
6/22/2016	1440
8/10/2016	1480
10/26/2016	1420
1/18/2017	1480
4/20/2017	1460
6/21/2017	1410
8/22/2017	1440
11/8/2017	1480
4/17/2018	1550
10/16/2018	1340
4/18/2019	1400
10/15/2019	1500
5/21/2020	1500
10/7/2020	1600

Dixon's Outlier Test

MW-122M (bg)



n = 15

Statistical outlier is drawn as solid.
Testing for 2 low outliers.
Mean = 4435.
Std. Dev. = 976.9.
3140: c = 0.4615
tabl = 0.525.
Alpha = 0.05.
1720: c = 0.6686
tabl = 0.525.
Alpha = 0.05.

Normality test used:
Shapiro Wilk@alpha = 0.1
Calculated = 0.9525
Critical = 0.895
The distribution, after removal of suspect value, was found to be normally distributed.

Constituent: Boron Analysis Run 12/31/2020 12:26 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Dixon's Outlier Test

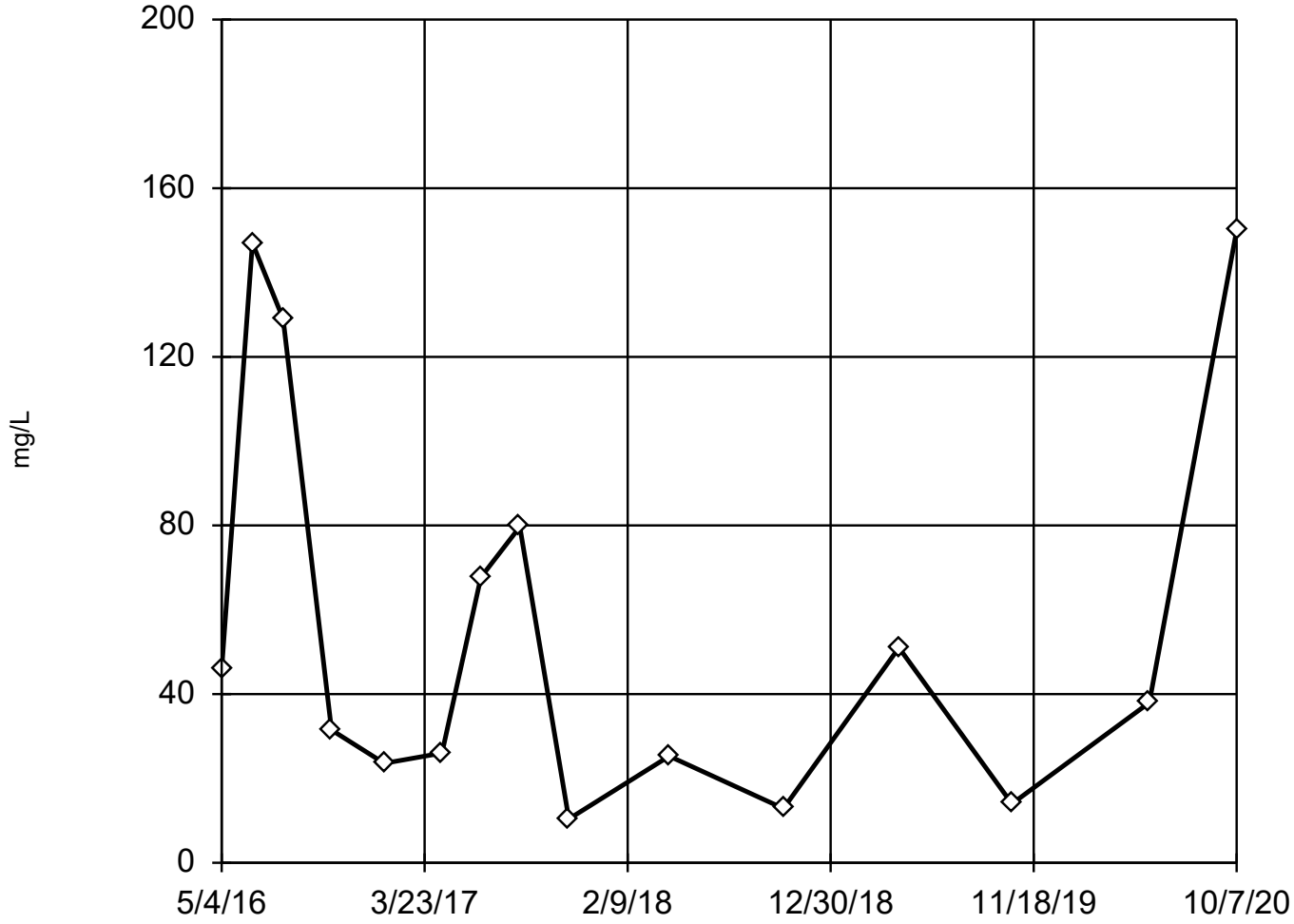
Constituent: Boron (ug/L) Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-122M (bg)
5/5/2016	3140
6/23/2016	1720 (O)
8/10/2016	4550
10/26/2016	4060
1/18/2017	4720
4/20/2017	4480
6/21/2017	4710
8/22/2017	4980
11/8/2017	5220
4/17/2018	5560
10/16/2018	4580
4/17/2019	5500
10/15/2019	4100
5/21/2020	5100
10/7/2020	4100

EPA Screening (suspected outliers for Dixon's Test)

MW-102M (bg)



n = 15

Dixon's will not be run.
No suspect values identified or unable to establish suspect values.
Mean 56.8, std. dev. 48.39, critical Tn 2.409

Normality test used:
Shapiro Wilk@alpha = 0.1
Calculated = 0.9507
Critical = 0.901 (after natural log transformation)
The distribution was found to be log-normal.

Constituent: Calcium Analysis Run 12/31/2020 12:26 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

EPA 1989 Outlier Screening

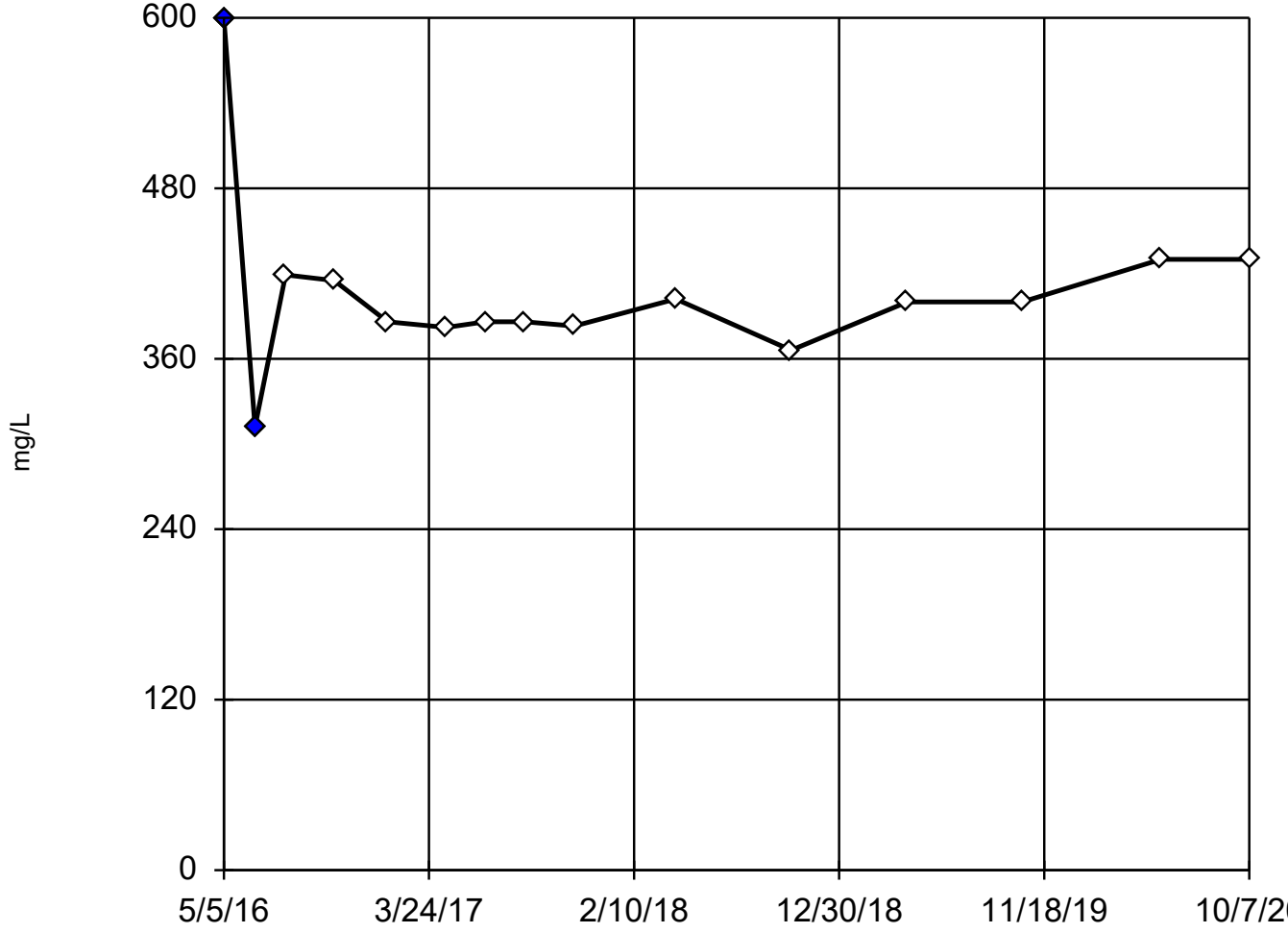
Constituent: Calcium (mg/L) Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M (bg)
5/4/2016	45.9
6/22/2016	147
8/10/2016	129
10/26/2016	31.5
1/18/2017	23.6
4/20/2017	26
6/21/2017	67.7
8/22/2017	79.7
11/8/2017	10.4
4/17/2018	25.3
10/16/2018	12.9
4/18/2019	51
10/15/2019	14
5/21/2020	38
10/7/2020	150

Dixon's Outlier Test

MW-122M (bg)



n = 15

Statistical outliers are drawn as solid.
Testing for 1 high and 1 low outliers.
Mean = 406.4.
Std. Dev. = 60.64.
599: c = 0.7788
tabl = 0.525.
312: c = 0.5932
tabl = 0.525.
Alpha = 0.05.

Normality test used:
Shapiro Wilk@alpha = 0.1
Calculated = 0.9323
Critical = 0.889
The distribution, after removal of suspect values, was found to be normally distributed.

Constituent: Calcium Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Dixon's Outlier Test

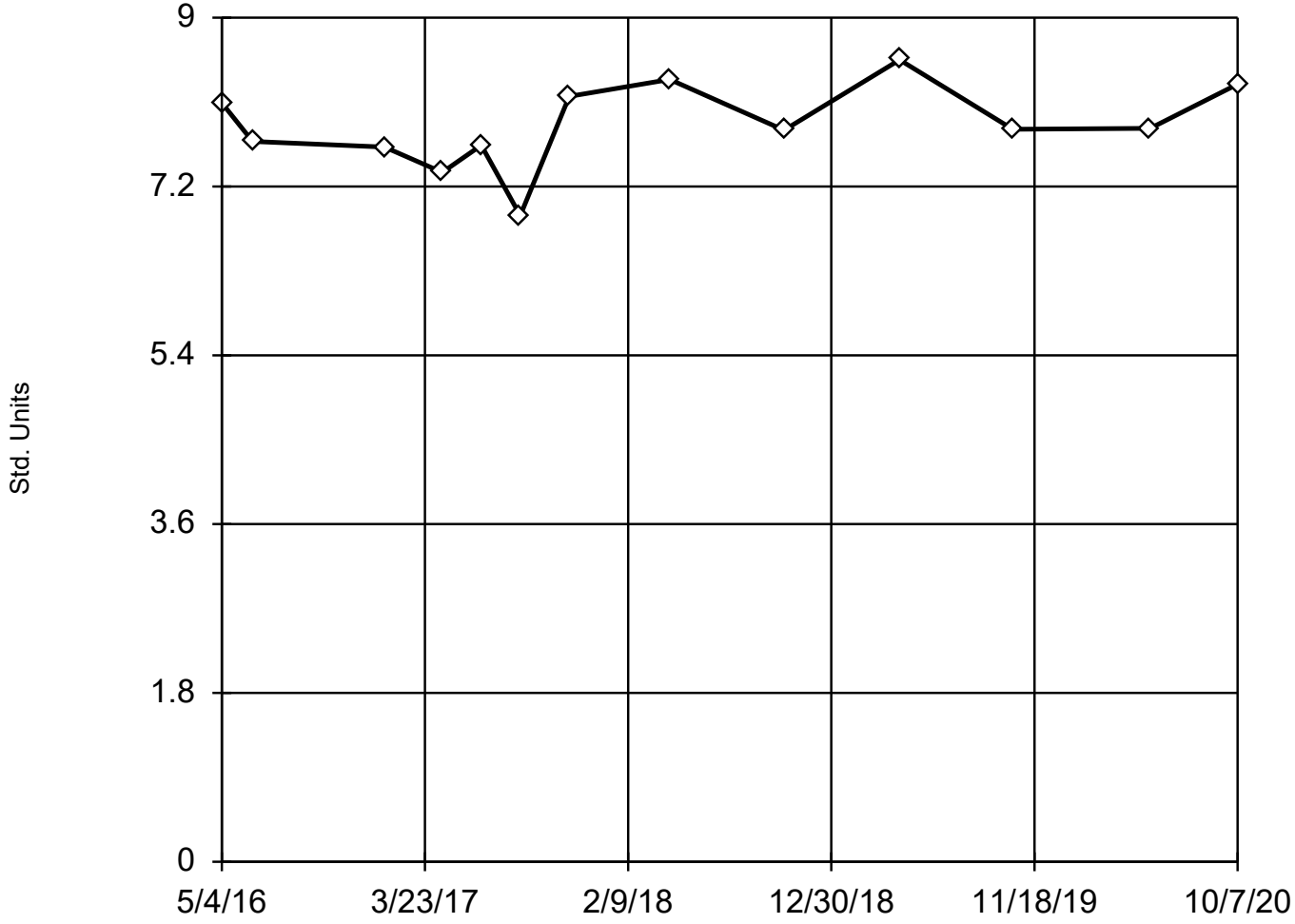
Constituent: Calcium (mg/L) Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-122M (bg)
5/5/2016	599 (O)
6/23/2016	312 (O)
8/10/2016	419
10/26/2016	415
1/18/2017	386
4/20/2017	382
6/21/2017	386
8/22/2017	386
11/8/2017	383
4/17/2018	402
10/16/2018	366
4/17/2019	400
10/15/2019	400
5/21/2020	430
10/7/2020	430

EPA Screening (suspected outliers for Dixon's Test)

MW-102M (bg)



n = 13

Dixon's will not be run.
No suspect values identified or unable to establish suspect values.
Mean 7.849, std. dev. 0.4453, critical Tn 2.331

Normality test used:
Shapiro Wilk@alpha = 0.1
Calculated = 0.9648
Critical = 0.889
The distribution was found to be normally distrib-uted.

Constituent: Field pH Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

EPA 1989 Outlier Screening

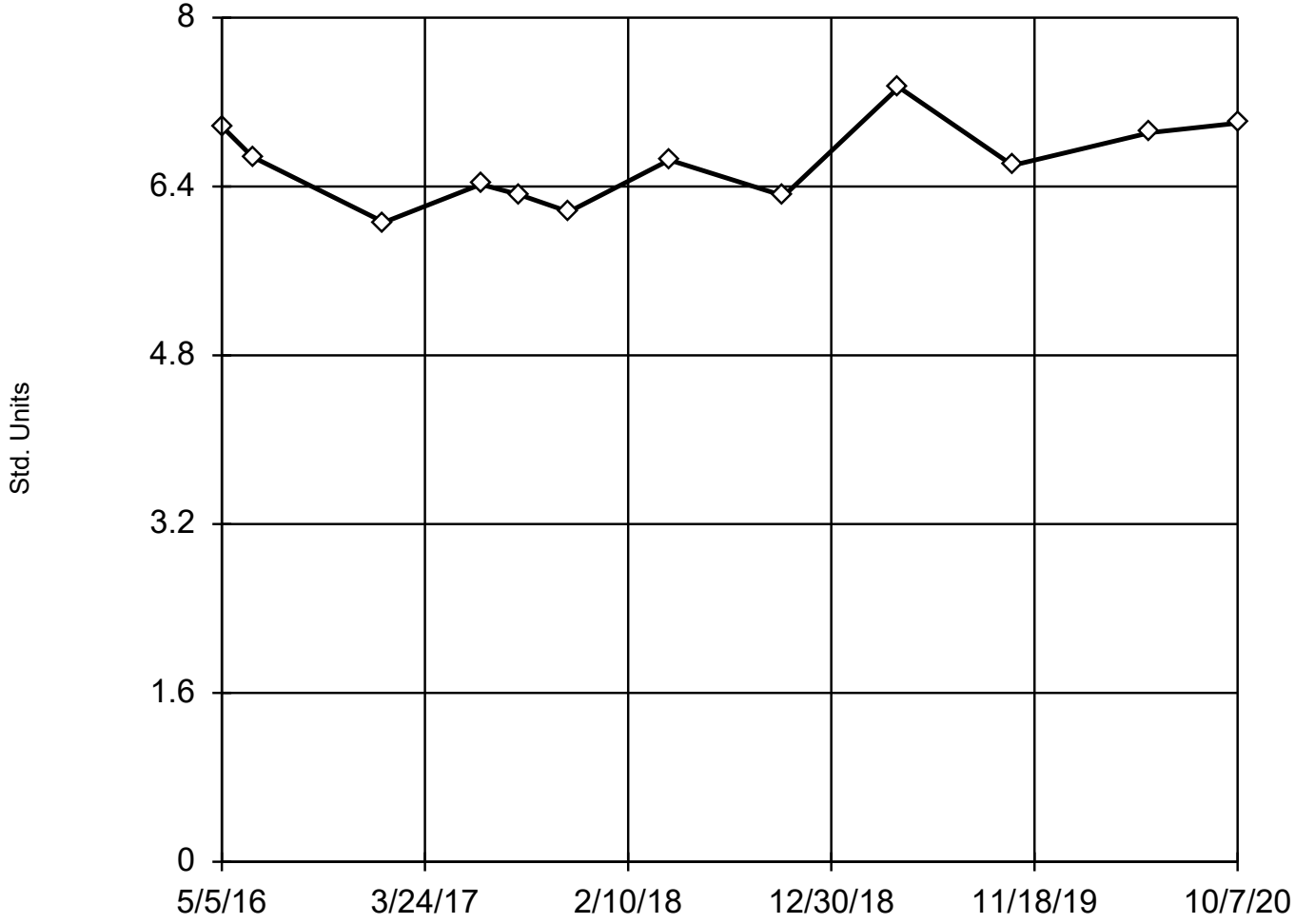
Constituent: Field pH (Std. Units) Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M (bg)
5/4/2016	8.09
6/22/2016	7.68
1/18/2017	7.62
4/20/2017	7.35
6/21/2017	7.64
8/22/2017	6.89
11/8/2017	8.16
4/17/2018	8.34
10/16/2018	7.8
4/18/2019	8.55
10/15/2019	7.81
5/21/2020	7.82
10/7/2020	8.29

EPA Screening (suspected outliers for Dixon's Test)

MW-122M (bg)



n = 12

Dixon's will not be run.
No suspect values identified or unable to establish suspect values.
Mean 6.618, std. dev. 0.3844, critical Tn 2.285

Normality test used:
Shapiro Wilk@alpha = 0.1
Calculated = 0.9675
Critical = 0.883
The distribution was found to be normally distrib-uted.

Constituent: Field pH Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

EPA 1989 Outlier Screening

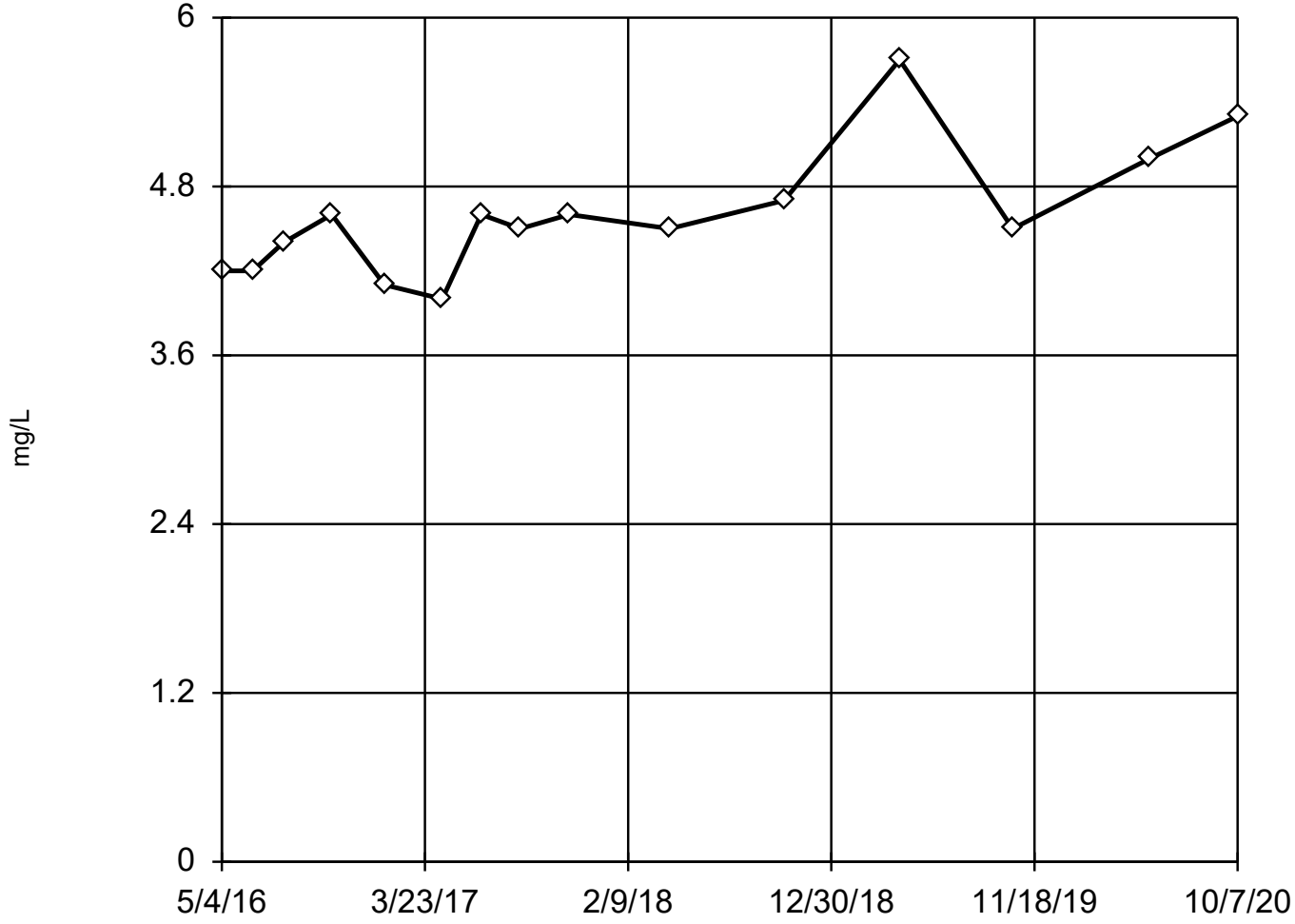
Constituent: Field pH (Std. Units) Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-122M (bg)
5/5/2016	6.97
6/23/2016	6.68
1/18/2017	6.06
6/21/2017	6.42
8/22/2017	6.32
11/8/2017	6.16
4/17/2018	6.65
10/16/2018	6.31
4/17/2019	7.34
10/15/2019	6.6
5/21/2020	6.91
10/7/2020	7

EPA Screening (suspected outliers for Dixon's Test)

MW-102M (bg)



n = 15

Dixon's will not be run.
No suspect values identified or unable to establish suspect values.
Mean 4.593, std. dev. 0.4527, critical Tn 2.409

Normality test used:
Shapiro Wilk@alpha = 0.1
Calculated = 0.9239
Critical = 0.901 (after natural log transformation)
The distribution was found to be log-normal.

Constituent: Fluoride Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

EPA 1989 Outlier Screening

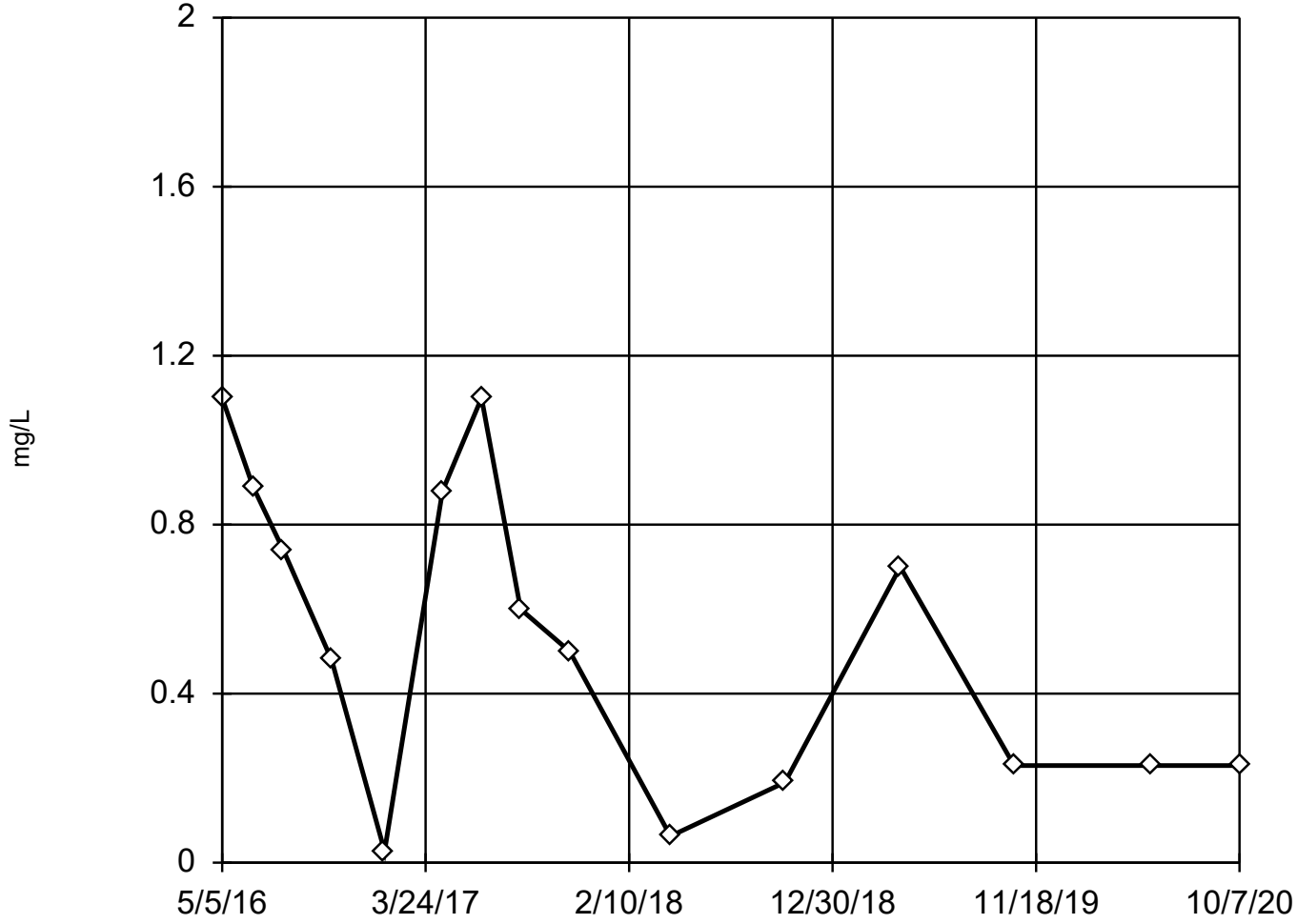
Constituent: Fluoride (mg/L) Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M (bg)
5/4/2016	4.2
6/22/2016	4.2
8/10/2016	4.4
10/26/2016	4.6
1/18/2017	4.1
4/20/2017	4
6/21/2017	4.6
8/22/2017	4.5
11/8/2017	4.6
4/17/2018	4.5
10/16/2018	4.7
4/18/2019	5.7
10/15/2019	4.5
5/21/2020	5
10/7/2020	5.3

Dixon's Outlier Test

MW-122M (bg)



n = 15

No statistical outliers.
Testing for 1 low outlier.
Mean = 0.5307.
Std. Dev. = 0.3625.
<0.027 (U): c = 0.1889
tabl = 0.525.
Alpha = 0.05.

Normality test used:
Shapiro Wilk@alpha = 0.1
Calculated = 0.93
Critical = 0.895
The distribution was found to be normally distrib-uted.

Constituent: Fluoride Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Dixon's Outlier Test

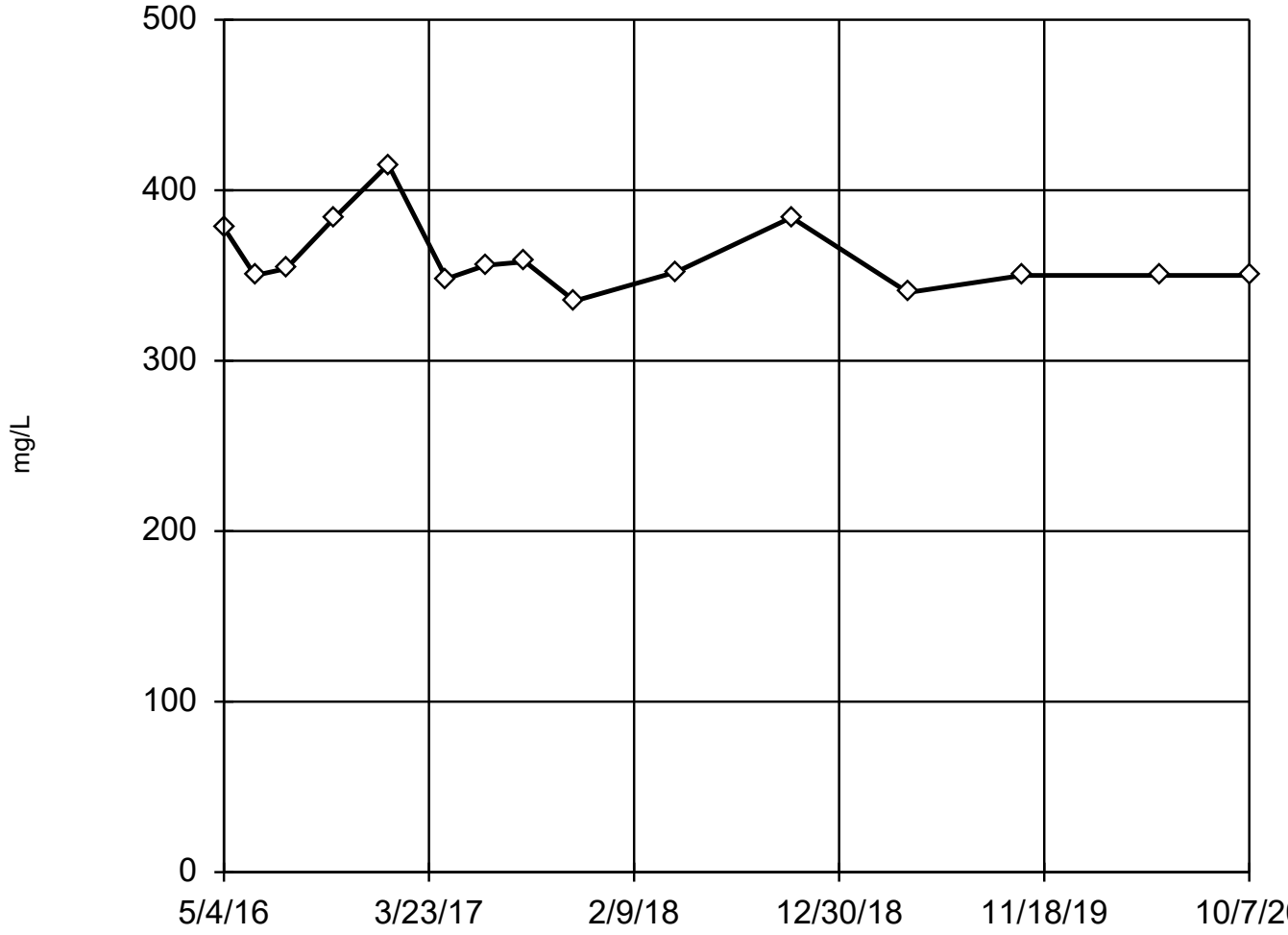
Constituent: Fluoride (mg/L) Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-122M (bg)
5/5/2016	1.1
6/23/2016	0.89
8/10/2016	0.74
10/26/2016	0.48
1/18/2017	<0.027 (U)
4/20/2017	0.88
6/21/2017	1.1
8/22/2017	0.6
11/8/2017	0.5
4/17/2018	<0.063 (U)
10/16/2018	<0.19 (U)
4/17/2019	0.7
10/15/2019	<0.23 (U)
5/21/2020	0.23 (J)
10/7/2020	<0.23 (U)

Tukey's Outlier Screening

MW-102M (bg)



n = 15

No outliers found.
Tukey's method used in lieu of parametric test because the Shapiro Wilk normality test failed at the 0.1 alpha level.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 476.2, low cutoff = 277.8, based on IQR multiplier of 3.

Constituent: Sulfate Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Tukey's Outlier Screening

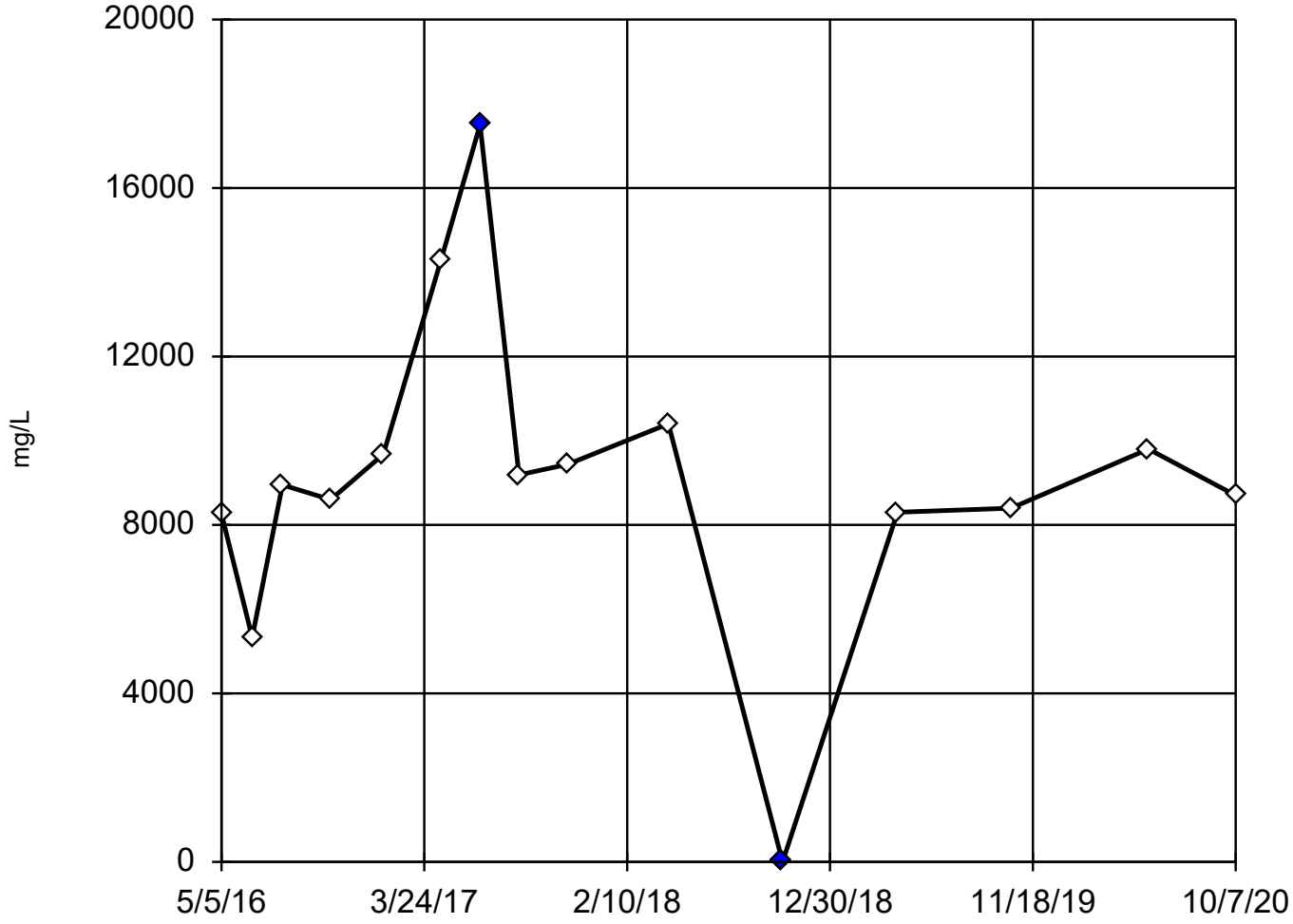
Constituent: Sulfate (mg/L) Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M (bg)
5/4/2016	378
6/22/2016	350
8/10/2016	354
10/26/2016	384
1/18/2017	415
4/20/2017	348
6/21/2017	356
8/22/2017	358
11/8/2017	335
4/17/2018	352
10/16/2018	384
4/18/2019	340
10/15/2019	350
5/21/2020	350
10/7/2020	350

Tukey's Outlier Screening

MW-122M (bg)



n = 15

Outliers are drawn as solid.
Tukey's method used in lieu of parametric test because the Shapiro Wilk normality test failed at the 0.1 alpha level.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

High cutoff = 14300, low cutoff = 3800, based on IQR multiplier of 3.

Constituent: Sulfate Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Tukey's Outlier Screening

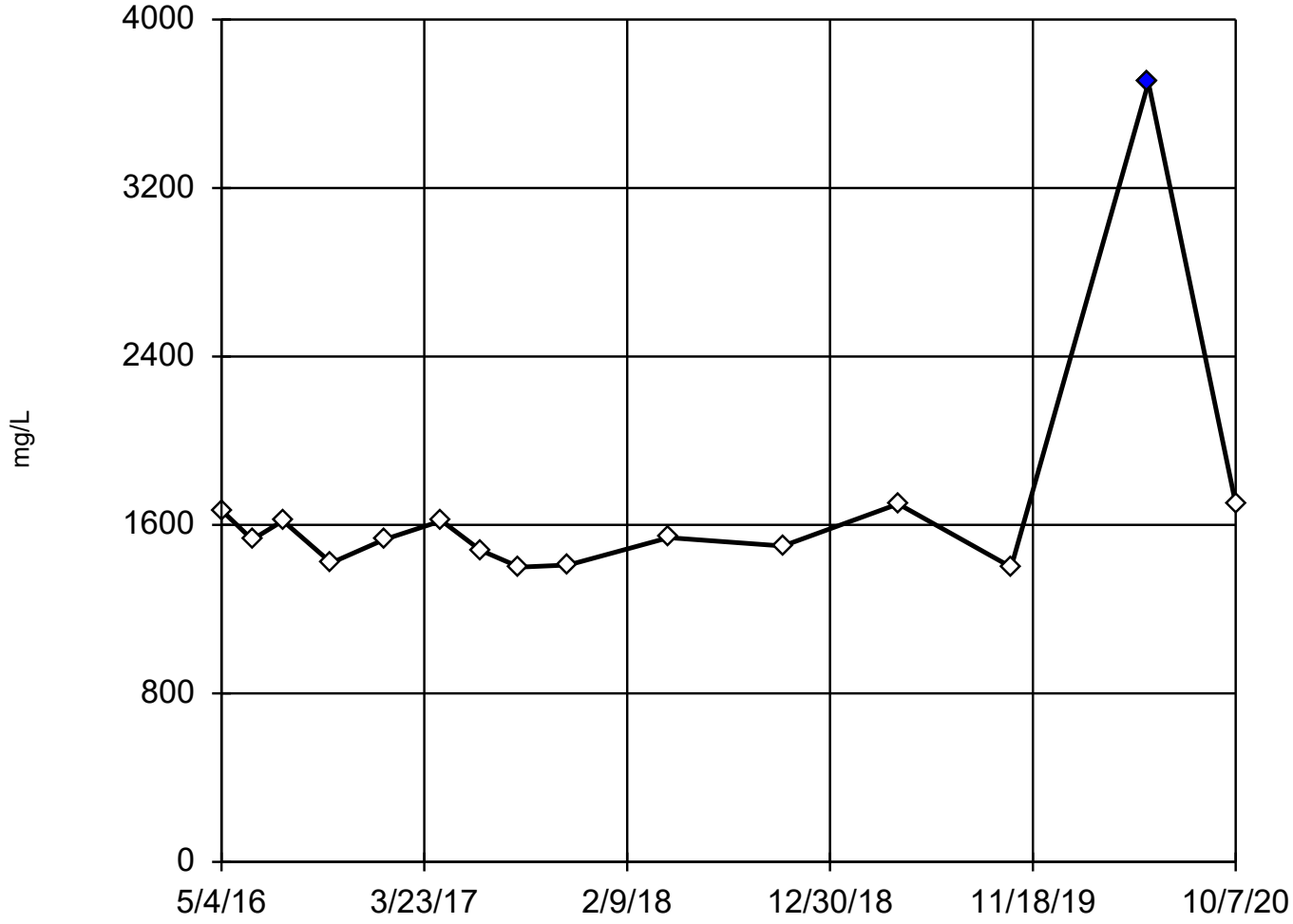
Constituent: Sulfate (mg/L) Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-122M (bg)
5/5/2016	8260
6/23/2016	5330
8/10/2016	8950
10/26/2016	8600
1/18/2017	9680
4/20/2017	14300
6/21/2017	17500 (O)
8/22/2017	9190
11/8/2017	9440
4/17/2018	10400
10/16/2018	<0.24 (UO)
4/17/2019	8300
10/15/2019	8400
5/21/2020	9800
10/7/2020	8700

Dixon's Outlier Test

MW-102M (bg)



n = 15

Statistical outlier is drawn as solid.
Testing for 1 high outlier.
Mean = 1681.
Std. Dev. = 568.4.
3700: c = 0.8734
tabl = 0.525.
Alpha = 0.05.

Normality test used:
Shapiro Wilk@alpha = 0.1
Calculated = 0.9087
Critical = 0.895
The distribution, after removal of suspect value, was found to be normally distributed.

Constituent: Total Dissolved Solids Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Dixon's Outlier Test

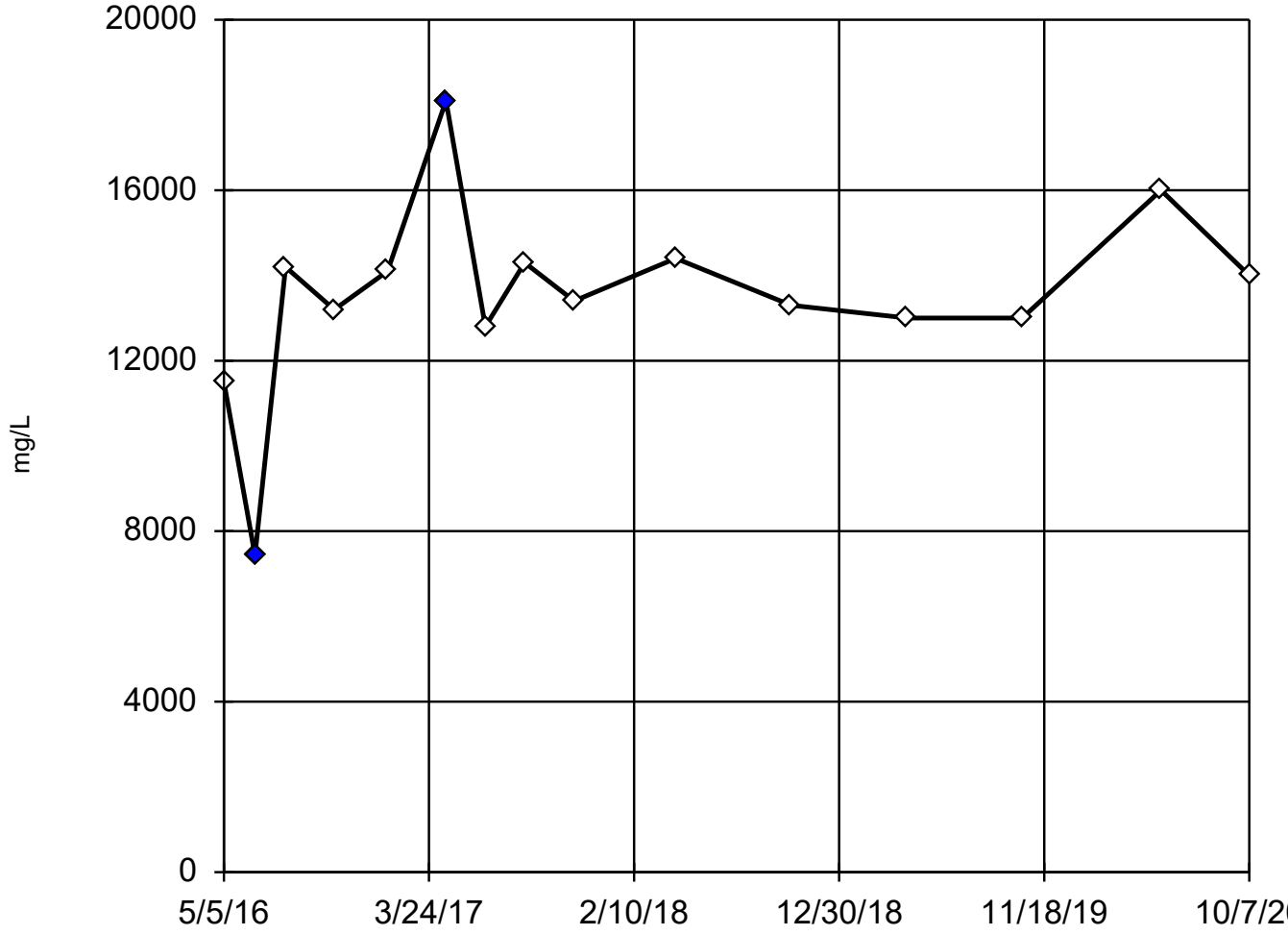
Constituent: Total Dissolved Solids (mg/L) Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M (bg)
5/4/2016	1670
6/22/2016	1530
8/10/2016	1620
10/26/2016	1420
1/18/2017	1530
4/20/2017	1620
6/21/2017	1480
8/22/2017	1400
11/8/2017	1410
4/17/2018	1540
10/16/2018	1500
4/18/2019	1700
10/15/2019	1400
5/21/2020	3700 (O)
10/7/2020	1700

Dixon's Outlier Test

MW-122M (bg)



n = 15

Statistical outliers are drawn as solid.
Testing for 1 high and 1 low outliers.
Mean = 13515.
Std. Dev. = 2267.
18100: c = 0.6981
tabl = 0.525.
7430: c = 0.7704
tabl = 0.525.
Alpha = 0.05.

Normality test used:
Shapiro Wilk@alpha = 0.1
Calculated = 0.9447
Critical = 0.889
The distribution, after removal of suspect values, was found to be normally distributed.

Constituent: Total Dissolved Solids Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Dixon's Outlier Test

Constituent: Total Dissolved Solids (mg/L) Analysis Run 12/31/2020 12:27 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-122M (bg)
5/5/2016	11500
6/23/2016	7430 (O)
8/10/2016	14200
10/26/2016	13200
1/18/2017	14100
4/20/2017	18100 (O)
6/21/2017	12800
8/22/2017	14300
11/8/2017	13400
4/17/2018	14400
10/16/2018	13300
4/17/2019	13000
10/15/2019	13000
5/21/2020	16000
10/7/2020	14000

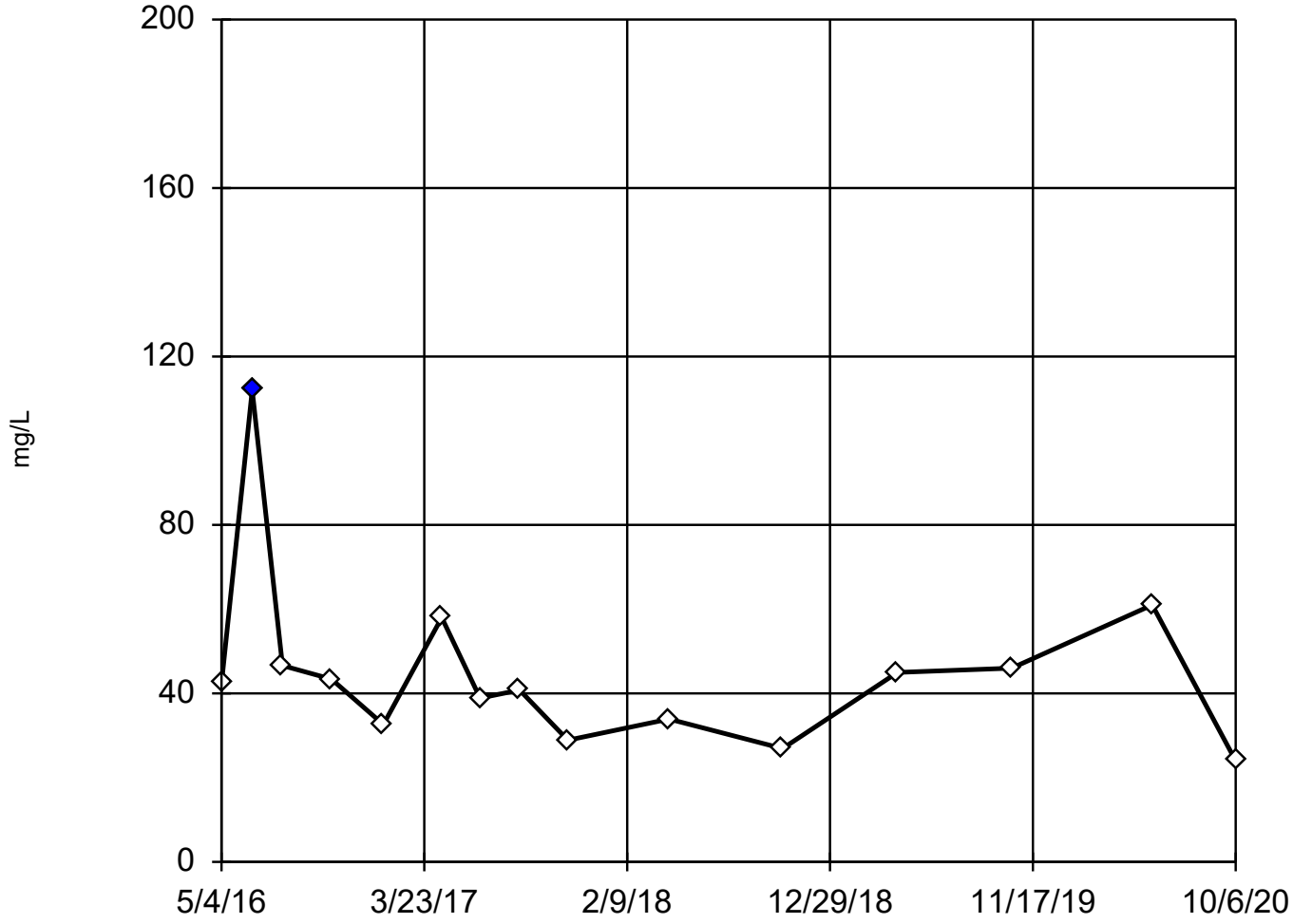
Outlier Analysis

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020 Printed 12/4/2020, 7:07 PM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Chloride (mg/L)	**MW-301**	**Yes**	**112**	**6/22/2016**	**Dixon`s**	**0.05**	**15**	**45.36**	**21.19**	**normal**	**ShapiroWilk**
Chloride (mg/L)	MW-302	No	n/a	n/a	EPA 1989	0.05	15	8.133	0.9839	normal	ShapiroWilk
Chloride (mg/L)	**MW-303**	**Yes**	**13.5**	**5/4/2016**	**NP (nrm)**	**NaN**	**17**	**8.094**	**1.777**	**unknown**	**ShapiroWilk**

Dixon's Outlier Test

MW-301



n = 15

Statistical outlier is drawn as solid.
Testing for 1 high outlier.
Mean = 45.36.
Std. Dev. = 21.19.
112: c = 0.6498
tabl = 0.525.
Alpha = 0.05.

Normality test used:
Shapiro Wilk@alpha = 0.1
Calculated = 0.9589
Critical = 0.895
The distribution, after removal of suspect value, was found to be normally distributed.

Constituent: Chloride Analysis Run 12/4/2020 7:06 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

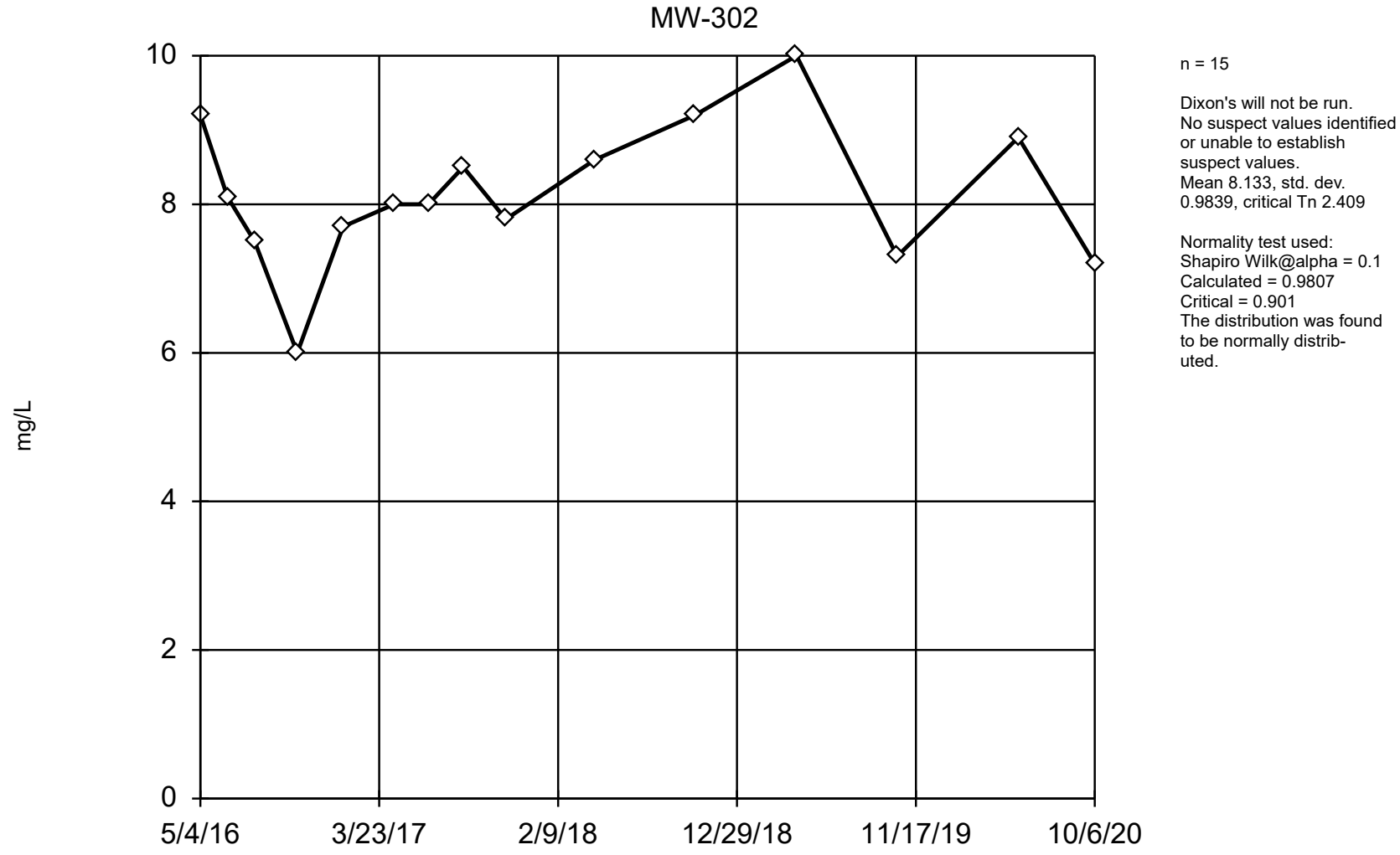
Dixon's Outlier Test

Constituent: Chloride (mg/L) Analysis Run 12/4/2020 7:07 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-301
5/4/2016	42.4
6/22/2016	112 (O)
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
4/17/2018	33.9
10/15/2018	26.9
4/16/2019	45
10/15/2019	46
5/26/2020	61
10/6/2020	24

EPA Screening (suspected outliers for Dixon's Test)



n = 15

Dixon's will not be run.
No suspect values identified or unable to establish suspect values.
Mean 8.133, std. dev. 0.9839, critical Tn 2.409

Normality test used:
Shapiro Wilk@alpha = 0.1
Calculated = 0.9807
Critical = 0.901
The distribution was found to be normally distrib-uted.

Constituent: Chloride Analysis Run 12/4/2020 7:06 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

EPA 1989 Outlier Screening

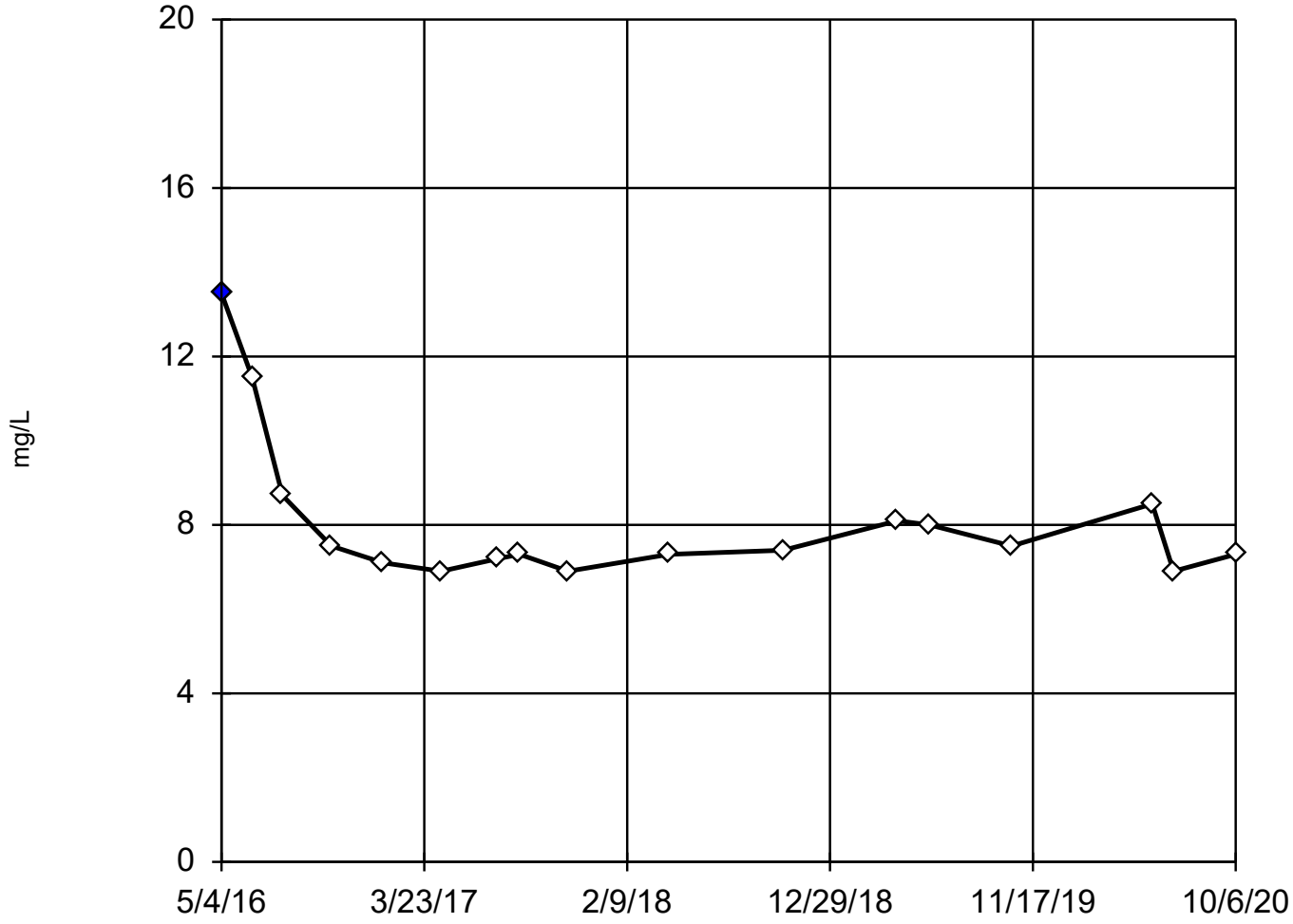
Constituent: Chloride (mg/L) Analysis Run 12/4/2020 7:07 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	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
4/17/2018	8.6
10/15/2018	9.2
4/16/2019	10
10/15/2019	7.3
5/21/2020	8.9
10/6/2020	7.2

Tukey's Outlier Screening

MW-303



n = 17

Outlier is drawn as solid.
Tukey's method used in lieu of parametric test because the Shapiro Wilk normality test failed at the 0.1 alpha level.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 12.97, low cutoff = 4.574, based on IQR multiplier of 3.

Constituent: Chloride Analysis Run 12/4/2020 7:06 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Tukey's Outlier Screening

Constituent: Chloride (mg/L) Analysis Run 12/4/2020 7:07 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-303
5/4/2016	13.5 (O)
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
4/17/2018	7.3
10/16/2018	7.4
4/16/2019	8.1
6/6/2019	8
10/15/2019	7.5
5/26/2020	8.5
6/29/2020	6.9
10/6/2020	7.3

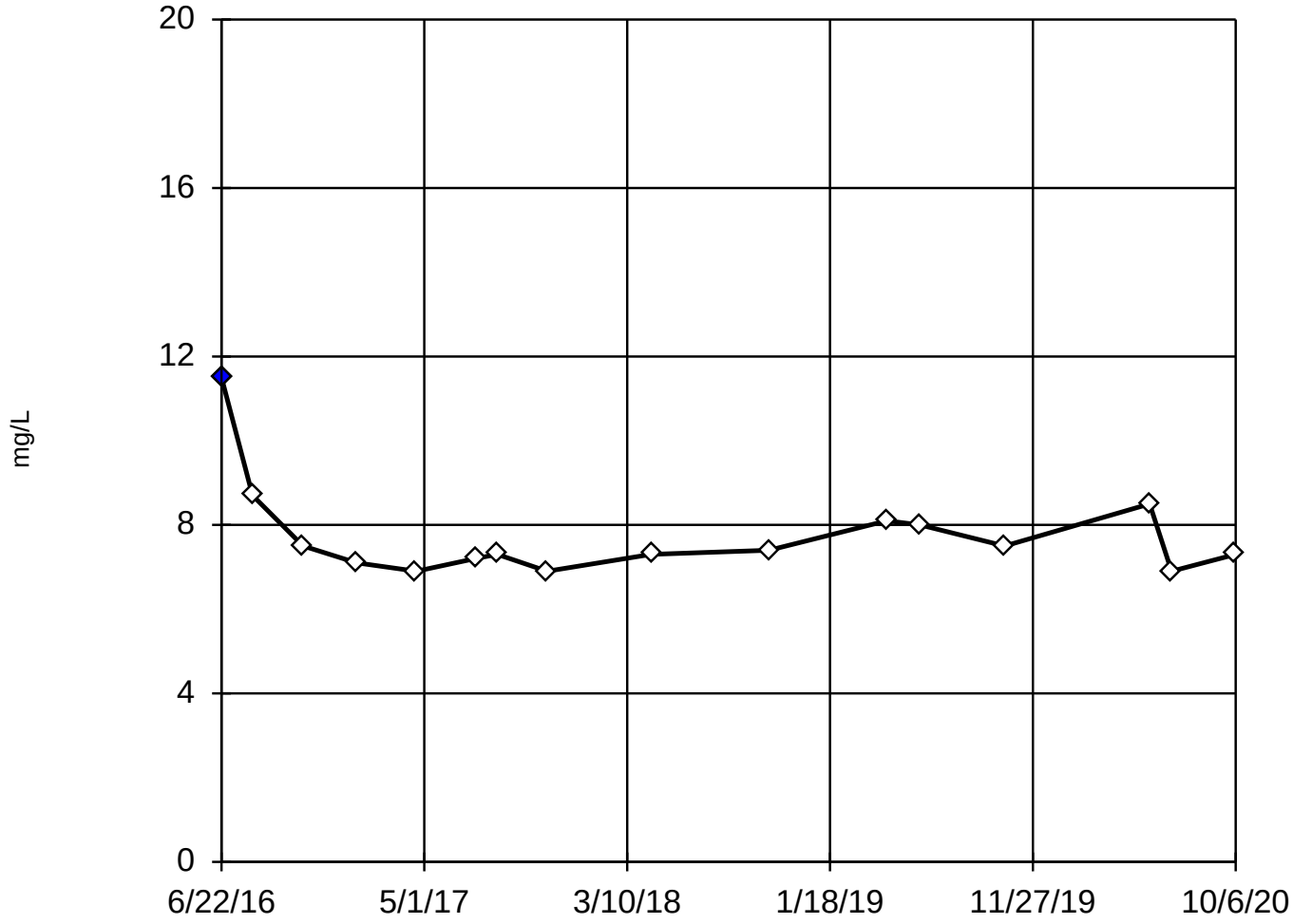
Outlier Analysis

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020 Printed 1/12/2021, 10:10 AM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Chloride (mg/L)	**MW-303**	**Yes**	**11.5**	**6/22/2016**	**NP (nrm)**	**NaN**	**16**	**7.756**	**1.139**	**unknown**	**ShapiroWilk**

Chloride

MW-303



n = 16

Outlier is drawn as solid.
Tukey's method used in lieu of parametric test because the Shapiro Wilk normality test failed at the 0.1 alpha level.

High cutoff = 10.75, low cutoff = 4.45, based on IQR multiplier of 3.

Tukey's Outlier Screening Analysis Run 1/12/2021 10:09 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Tukey's Outlier Screening

Constituent: Chloride (mg/L) Analysis Run 1/12/2021 10:10 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-303
5/4/2016	13.5 (X)
6/22/2016	11.5 (O)
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
4/17/2018	7.3
10/16/2018	7.4
4/16/2019	8.1
6/6/2019	8
10/15/2019	7.5
5/26/2020	8.5
6/29/2020	6.9
10/6/2020	7.3

Attachment 3

Welch's/Mann-Whitney Comparison

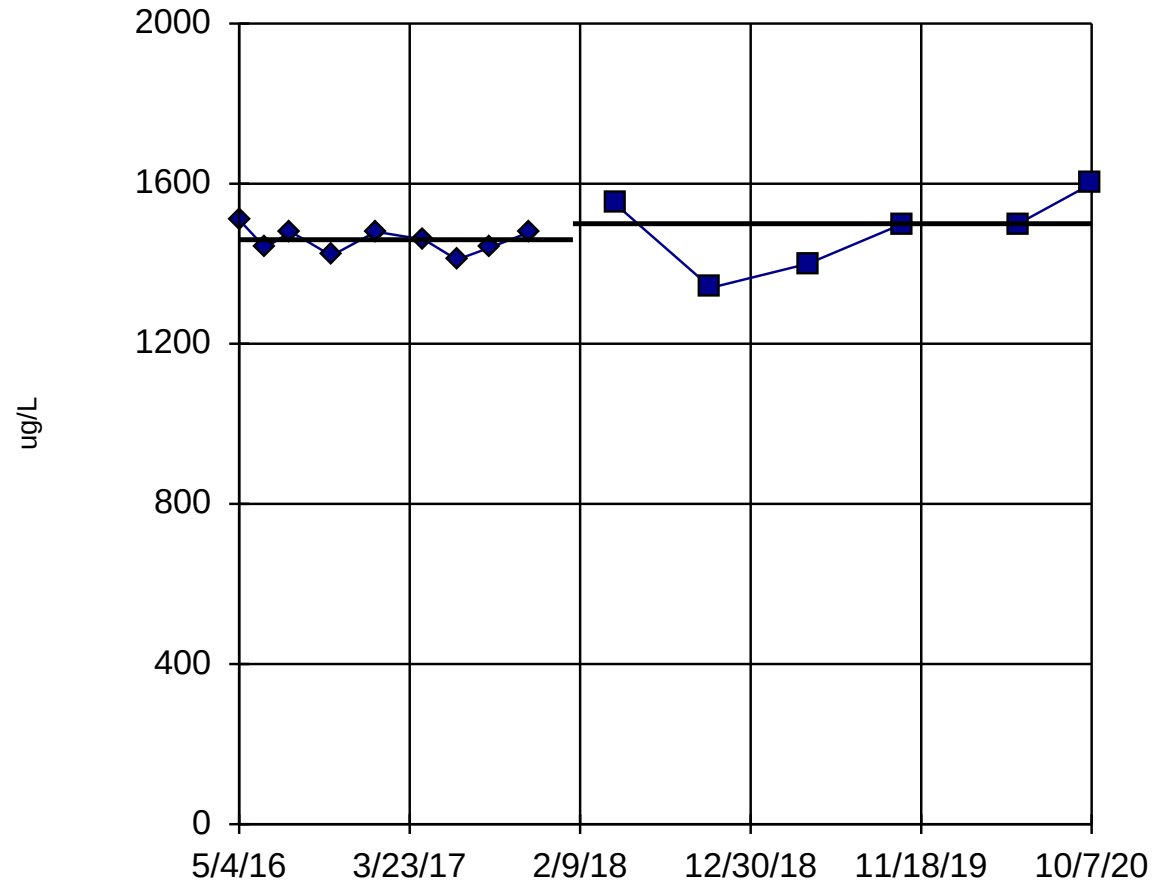
Welch's t-test/Mann-Whitney

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020 Printed 1/11/2021, 9:13 PM

Constituent	Well	Calc.	0.1	0.05	0.025	0.01	Alpha	Sig.	Bg. Wells	Method
Boron (ug/L)	MW-102M (bg)	0.5872	No	No	No	No	0.01	No	(intrawell)	Welch`s
Boron (ug/L)	MW-122M (bg)	1.403	Yes	No	No	No	0.01	No	(intrawell)	Welch`s
Calcium (mg/L)	MW-102M (bg)	-0....	No	No	No	No	0.01	No	(intrawell)	Welch`s
Calcium (mg/L)	MW-122M (bg)	0.5848	No	No	No	No	0.01	No	(intrawell)	Mann-W (normality)
Field pH (Std. Units)	MW-102M (bg)	2.21	Yes	Yes	Yes	No	0.01	No	(intrawell)	Welch`s
Field pH (Std. Units)	MW-122M (bg)	1.817	Yes	Yes	No	No	0.01	No	(intrawell)	Welch`s
Fluoride (mg/L)	MW-102M (bg)	2.813	Yes	Yes	Yes	No	0.01	No	(intrawell)	Welch`s
Fluoride (mg/L)	MW-122M (bg)	-2.951	No	No	No	No	0.01	No	(intrawell)	Welch`s
Sulfate (mg/L)	MW-102M (bg)	-0....	No	No	No	No	0.01	No	(intrawell)	Welch`s
Sulfate (mg/L)	MW-122M (bg)	-0....	No	No	No	No	0.01	No	(intrawell)	Welch`s
Total Dissolved Solids (mg/L)	MW-102M (bg)	1.12	No	No	No	No	0.01	No	(intrawell)	Welch`s
Total Dissolved Solids (mg/L)	MW-122M (bg)	0.6902	No	No	No	No	0.01	No	(intrawell)	Welch`s

Boron

MW-102M (bg)



background median = 1460

compliance median = 1500

t = 0.5872

Alpha	Table	Sig.
0.1	1.44	No
0.05	1.943	No
0.025	2.447	No
0.01	3.143	No

Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9475, critical = 0.829.

Welch's t-test Analysis Run 1/11/2021 9:06 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Welch's t-test

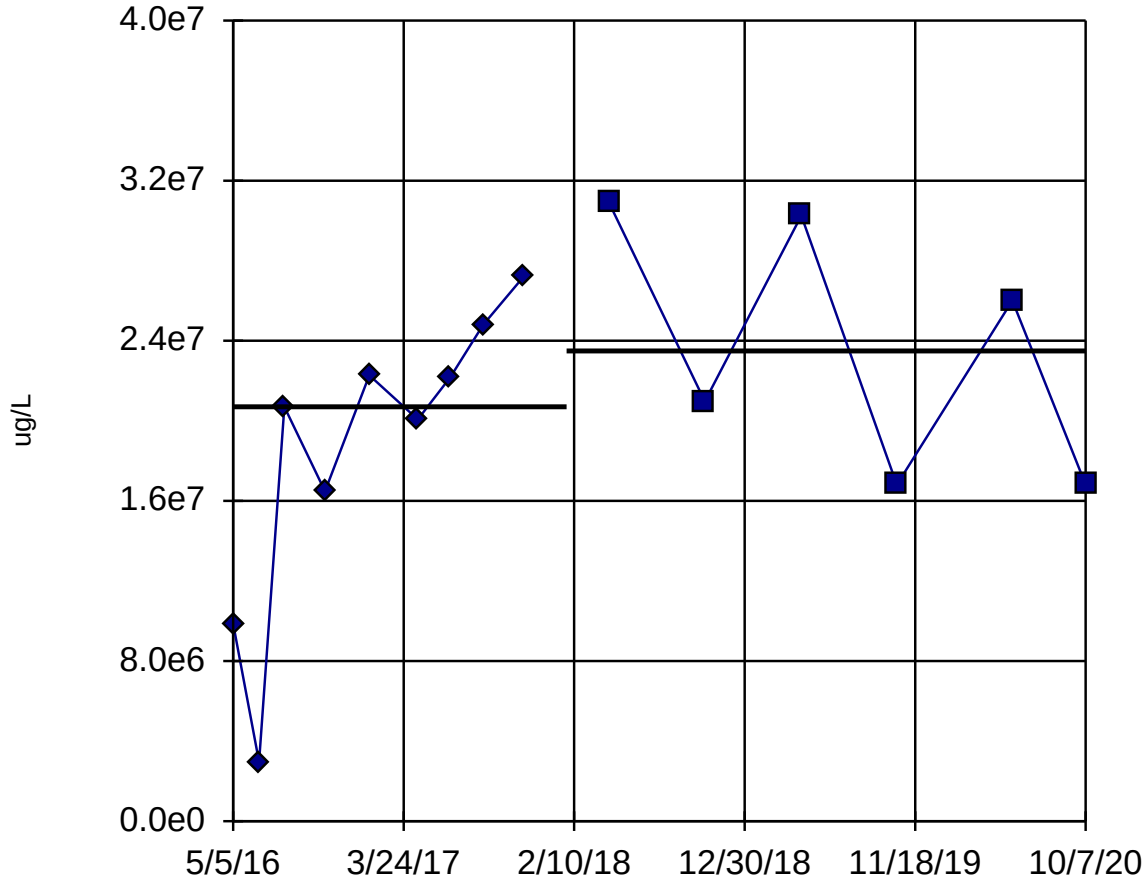
Constituent: Boron (ug/L) Analysis Run 1/11/2021 9:13 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M	MW-102M
5/4/2016	1510	
6/22/2016	1440	
8/10/2016	1480	
10/26/2016	1420	
1/18/2017	1480	
4/20/2017	1460	
6/21/2017	1410	
8/22/2017	1440	
11/8/2017	1480	
4/17/2018		1550
10/16/2018		1340
4/18/2019		1400
10/15/2019		1500
5/21/2020		1500
10/7/2020		1600

Boron

MW-122M (bg)



MW-122M background

MW-122M compliance

background median = 2.1e7

compliance median = 2.3e7

t = 1.403

Alpha	Table	Sig.
0.1	1.356	Yes
0.05	1.782	No
0.025	2.179	No
0.01	2.681	No

Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.8905 after square transformation, critical = 0.829.

Welch's t-test Analysis Run 1/11/2021 9:06 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Welch's t-test

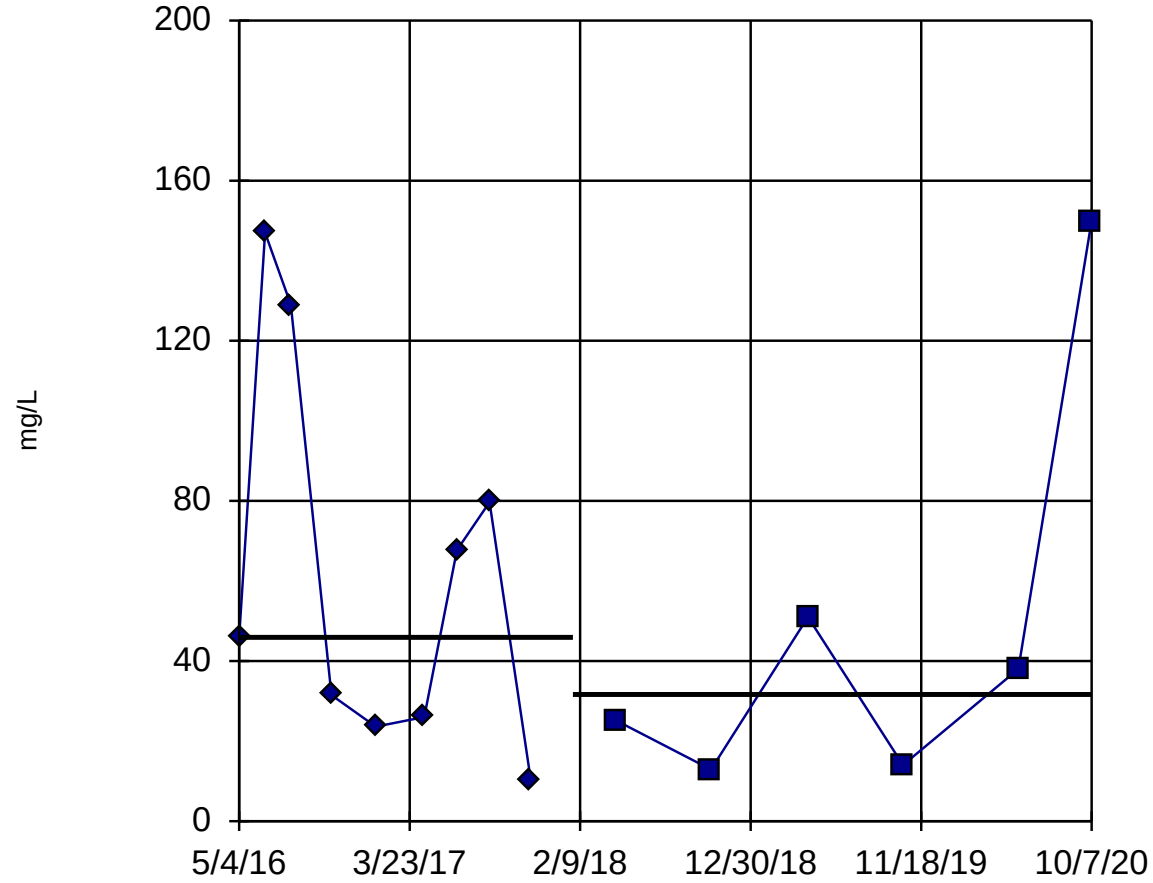
Constituent: Boron (ug/L) Analysis Run 1/11/2021 9:13 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-122M	MW-122M
5/5/2016	3140	
6/23/2016	1720	
8/10/2016	4550	
10/26/2016	4060	
1/18/2017	4720	
4/20/2017	4480	
6/21/2017	4710	
8/22/2017	4980	
11/8/2017	5220	
4/17/2018		5560
10/16/2018		4580
4/17/2019		5500
10/15/2019		4100
5/21/2020		5100
10/7/2020		4100

Calcium

MW-102M (bg)



◆ MW-102M background

■ MW-102M compliance

background median = 45.9

compliance median = 31.65

t = -0.5183

Alpha	Table	Sig.
0.1	1.372	No
0.05	1.812	No
0.025	2.228	No
0.01	2.764	No

Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.8861, critical = 0.829.

Welch's t-test Analysis Run 1/11/2021 9:06 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Welch's t-test

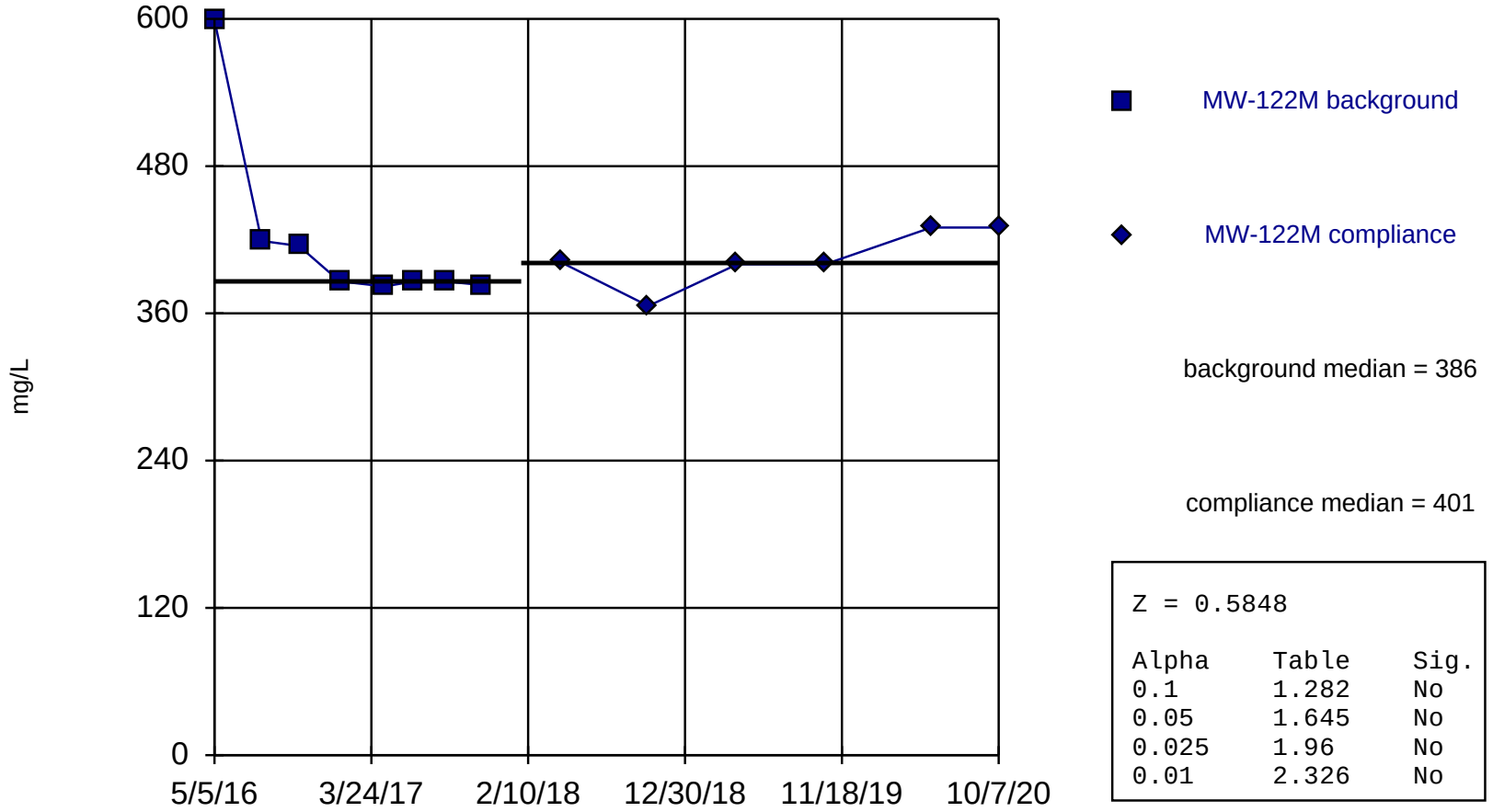
Constituent: Calcium (mg/L) Analysis Run 1/11/2021 9:13 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M	MW-102M
5/4/2016	45.9	
6/22/2016	147	
8/10/2016	129	
10/26/2016	31.5	
1/18/2017	23.6	
4/20/2017	26	
6/21/2017	67.7	
8/22/2017	79.7	
11/8/2017	10.4	
4/17/2018		25.3
10/16/2018		12.9
4/18/2019		51
10/15/2019		14
5/21/2020		38
10/7/2020		150

Calcium

MW-122M (bg)



Z = 0.5848		
Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Mann-Whitney (Wilcoxon Rank Sum) used in lieu of Welch's t-test because the Shapiro Wilk normality test showed the data to be non-normal at the 0.05 alpha level.

Mann-Whitney (Wilcoxon Rank Sum) Analysis Run 1/11/2021 9:06 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Mann-Whitney (Wilcoxon Rank Sum)

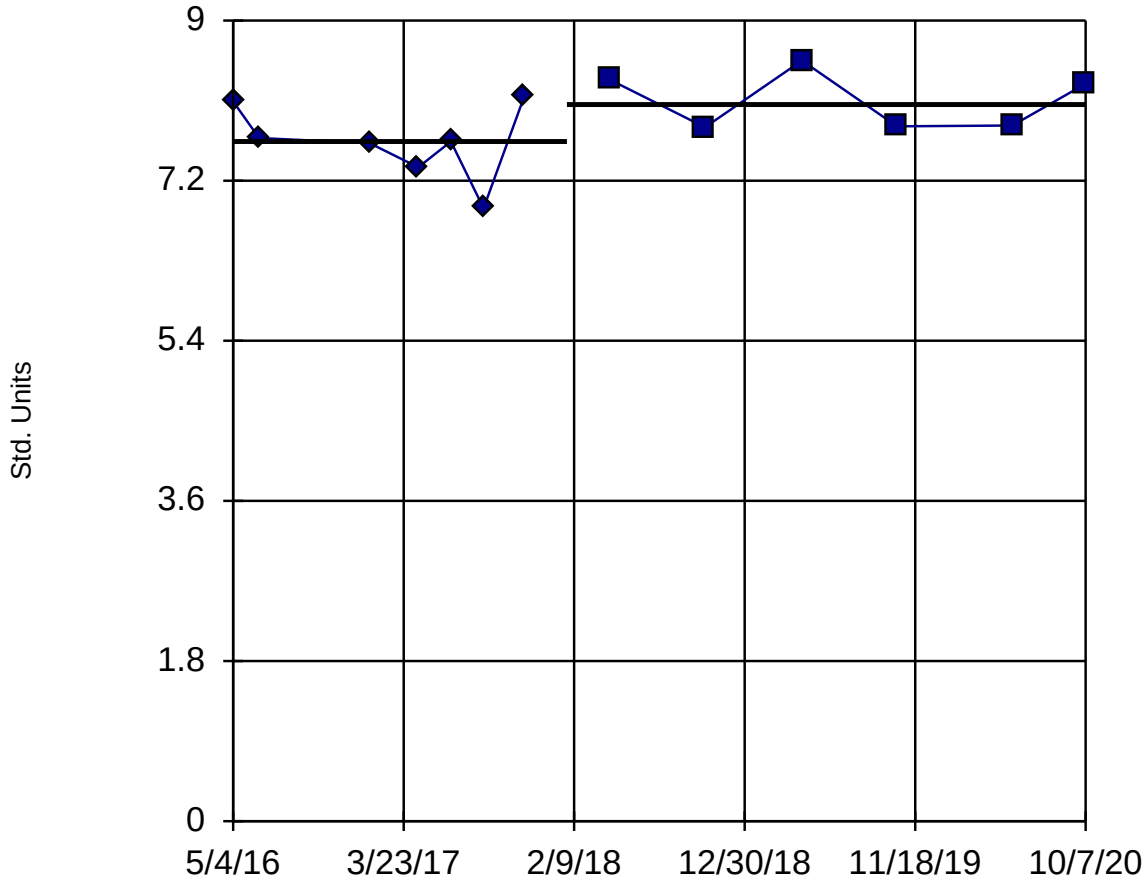
Constituent: Calcium (mg/L) Analysis Run 1/11/2021 9:13 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-122M	MW-122M
5/5/2016	599	
6/23/2016	312 (X)	
8/10/2016	419	
10/26/2016	415	
1/18/2017	386	
4/20/2017	382	
6/21/2017	386	
8/22/2017	386	
11/8/2017	383	
4/17/2018		402
10/16/2018		366
4/17/2019		400
10/15/2019		400
5/21/2020		430
10/7/2020		430

Field pH

MW-102M (bg)



MW-102M background

MW-102M compliance

background median = 7.64

compliance median = 8.055

t = 2.21

Alpha	Table	Sig.
0.1	1.363	Yes
0.05	1.796	Yes
0.025	2.201	Yes
0.01	2.718	No

Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9358, critical = 0.803.

Welch's t-test Analysis Run 1/11/2021 9:06 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Welch's t-test

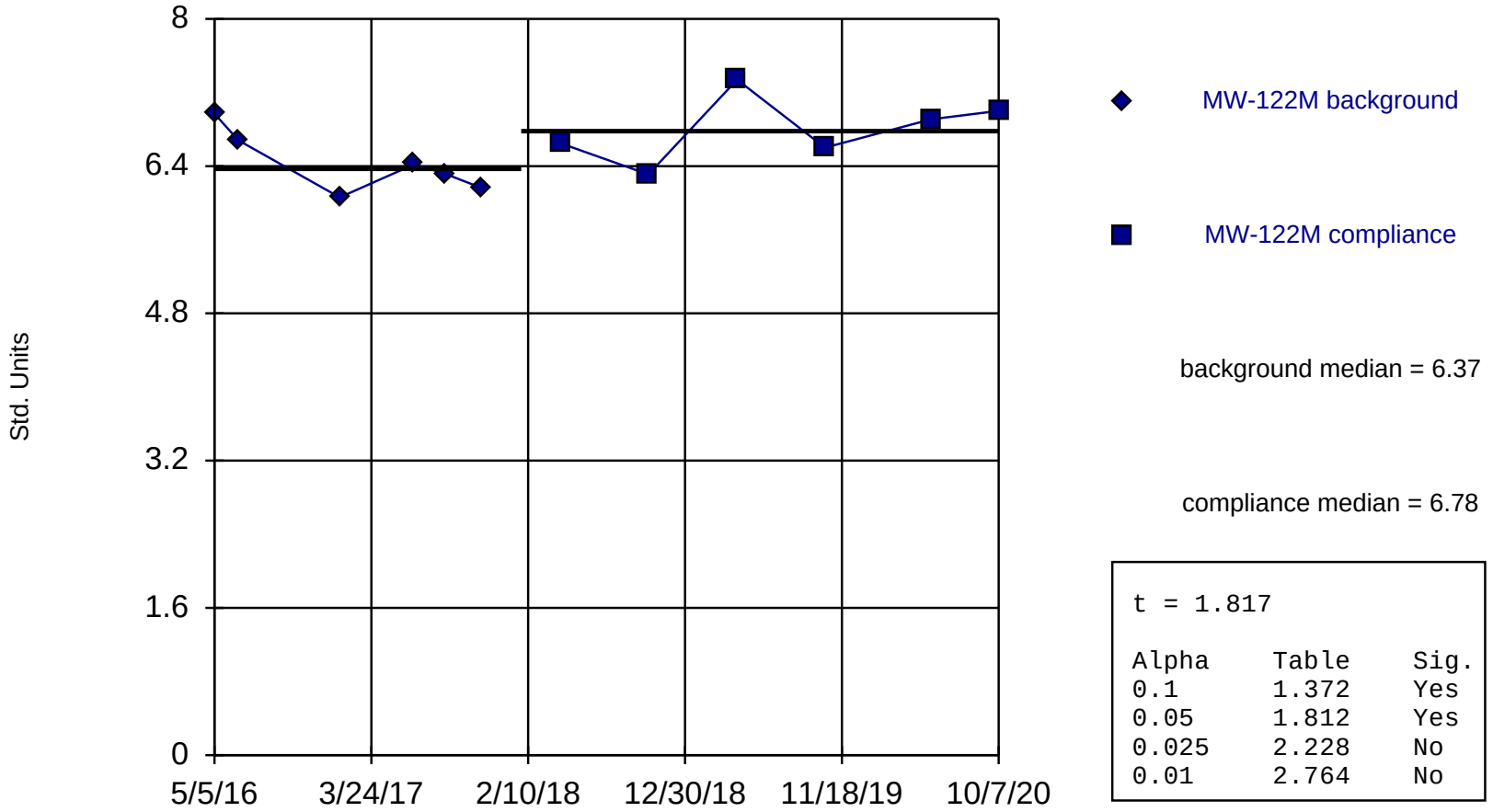
Constituent: Field pH (Std. Units) Analysis Run 1/11/2021 9:13 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M	MW-102M
5/4/2016	8.09	
6/22/2016	7.68	
1/18/2017	7.62	
4/20/2017	7.35	
6/21/2017	7.64	
8/22/2017	6.89	
11/8/2017	8.16	
4/17/2018		8.34
10/16/2018		7.8
4/18/2019		8.55
10/15/2019		7.81
5/21/2020		7.82
10/7/2020		8.29

Field pH

MW-122M (bg)



t = 1.817		
Alpha	Table	Sig.
0.1	1.372	Yes
0.05	1.812	Yes
0.025	2.228	No
0.01	2.764	No

Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9505, critical = 0.788.

Welch's t-test Analysis Run 1/11/2021 9:06 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Welch's t-test

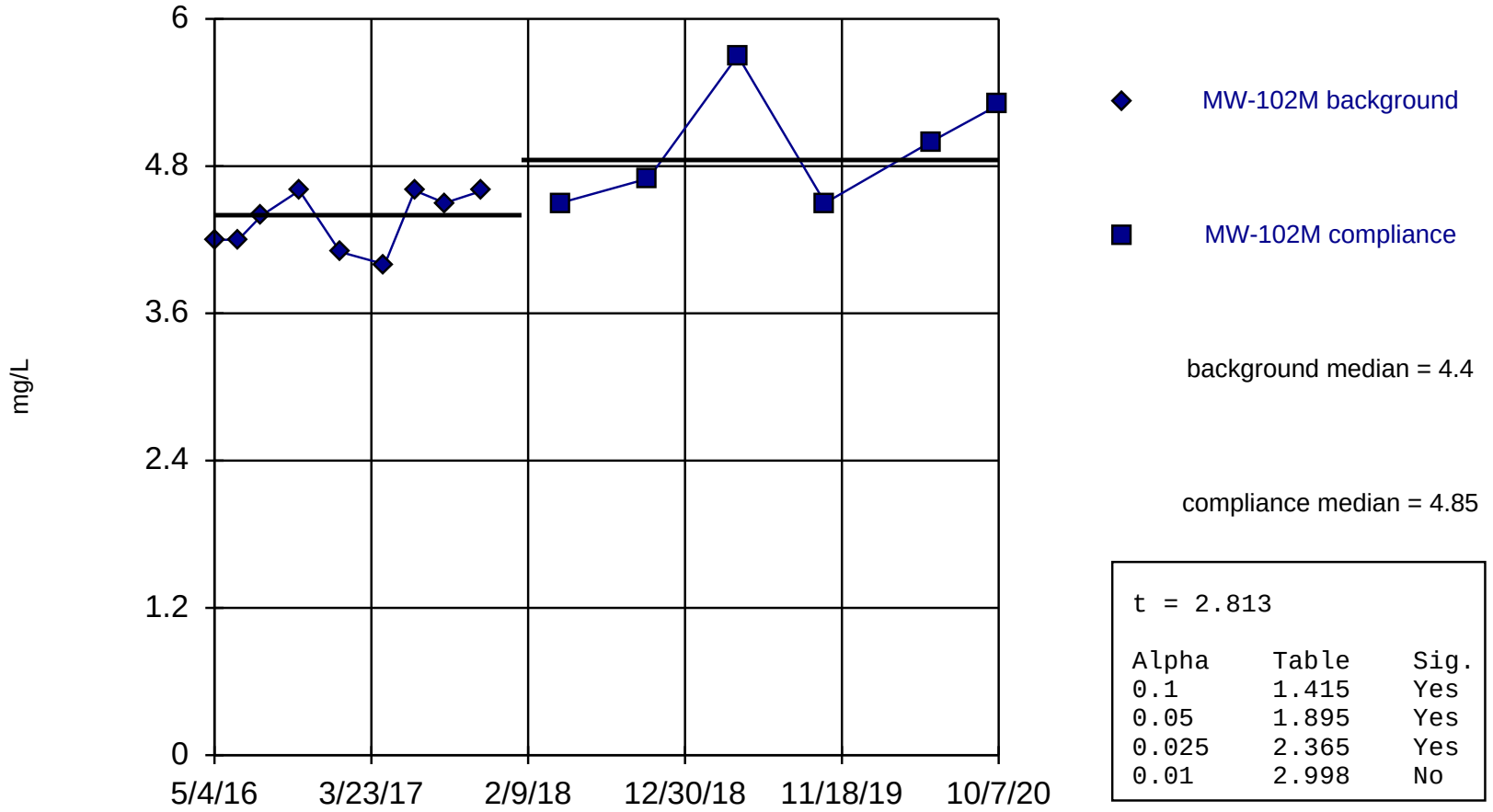
Constituent: Field pH (Std. Units) Analysis Run 1/11/2021 9:13 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-122M	MW-122M
5/5/2016	6.97	
6/23/2016	6.68	
1/18/2017	6.06	
6/21/2017	6.42	
8/22/2017	6.32	
11/8/2017	6.16	
4/17/2018		6.65
10/16/2018		6.31
4/17/2019		7.34
10/15/2019		6.6
5/21/2020		6.91
10/7/2020		7

Fluoride

MW-102M (bg)



background median = 4.4

compliance median = 4.85

t = 2.813

Alpha	Table	Sig.
0.1	1.415	Yes
0.05	1.895	Yes
0.025	2.365	Yes
0.01	2.998	No

Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.8775, critical = 0.829.

Welch's t-test Analysis Run 1/11/2021 9:06 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Welch's t-test

Constituent: Fluoride (mg/L) Analysis Run 1/11/2021 9:13 PM

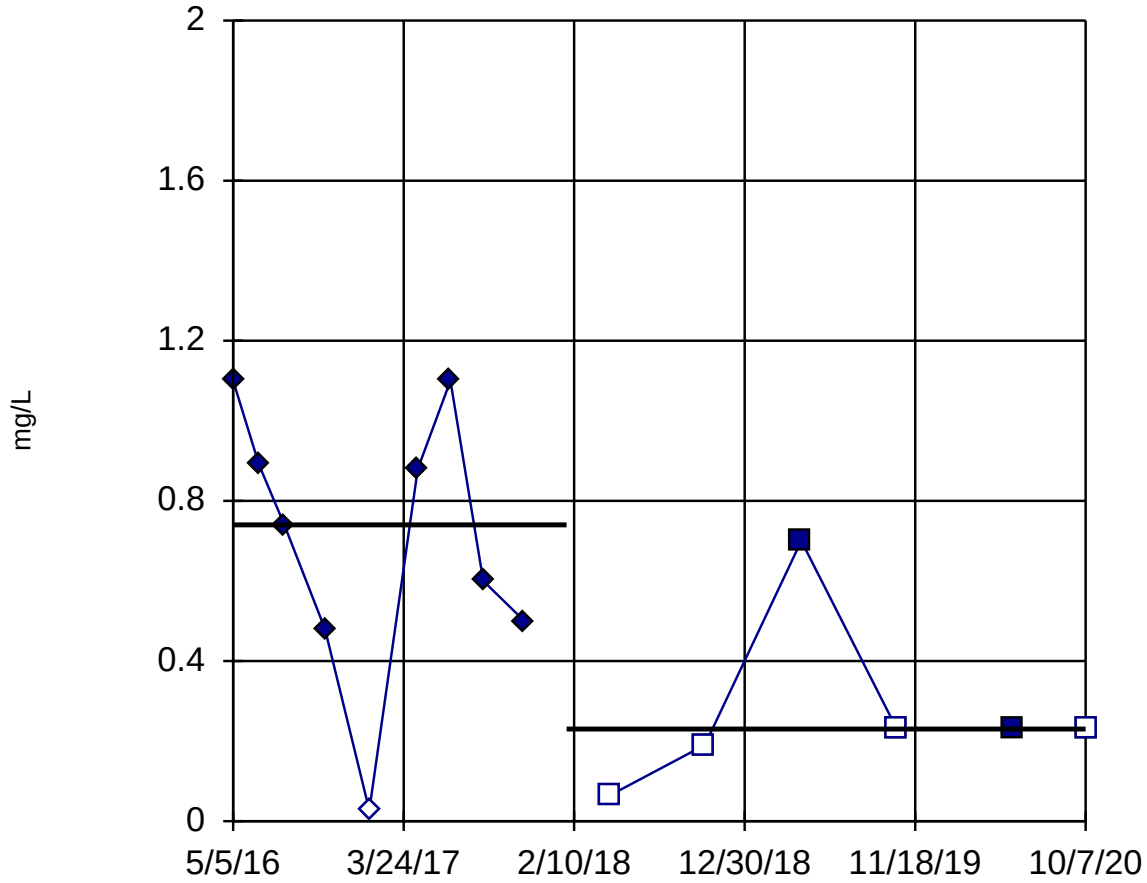
Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M	MW-102M
5/4/2016	4.2	
6/22/2016	4.2	
8/10/2016	4.4	
10/26/2016	4.6	
1/18/2017	4.1	
4/20/2017	4	
6/21/2017	4.6	
8/22/2017	4.5	
11/8/2017	4.6	
4/17/2018		4.5
10/16/2018		4.7
4/18/2019		5.7
10/15/2019		4.5
5/21/2020		5
10/7/2020		5.3

Hollow symbols indicate censored values.

Fluoride

MW-122M (bg)



MW-122M background

MW-122M compliance

background median = 0.74

compliance median = 0.23

t = -2.951

Alpha	Table	Sig.
0.1	1.35	No
0.05	1.771	No
0.025	2.16	No
0.01	2.65	No

Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9316, critical = 0.829.

Welch's t-test Analysis Run 1/11/2021 9:06 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Welch's t-test

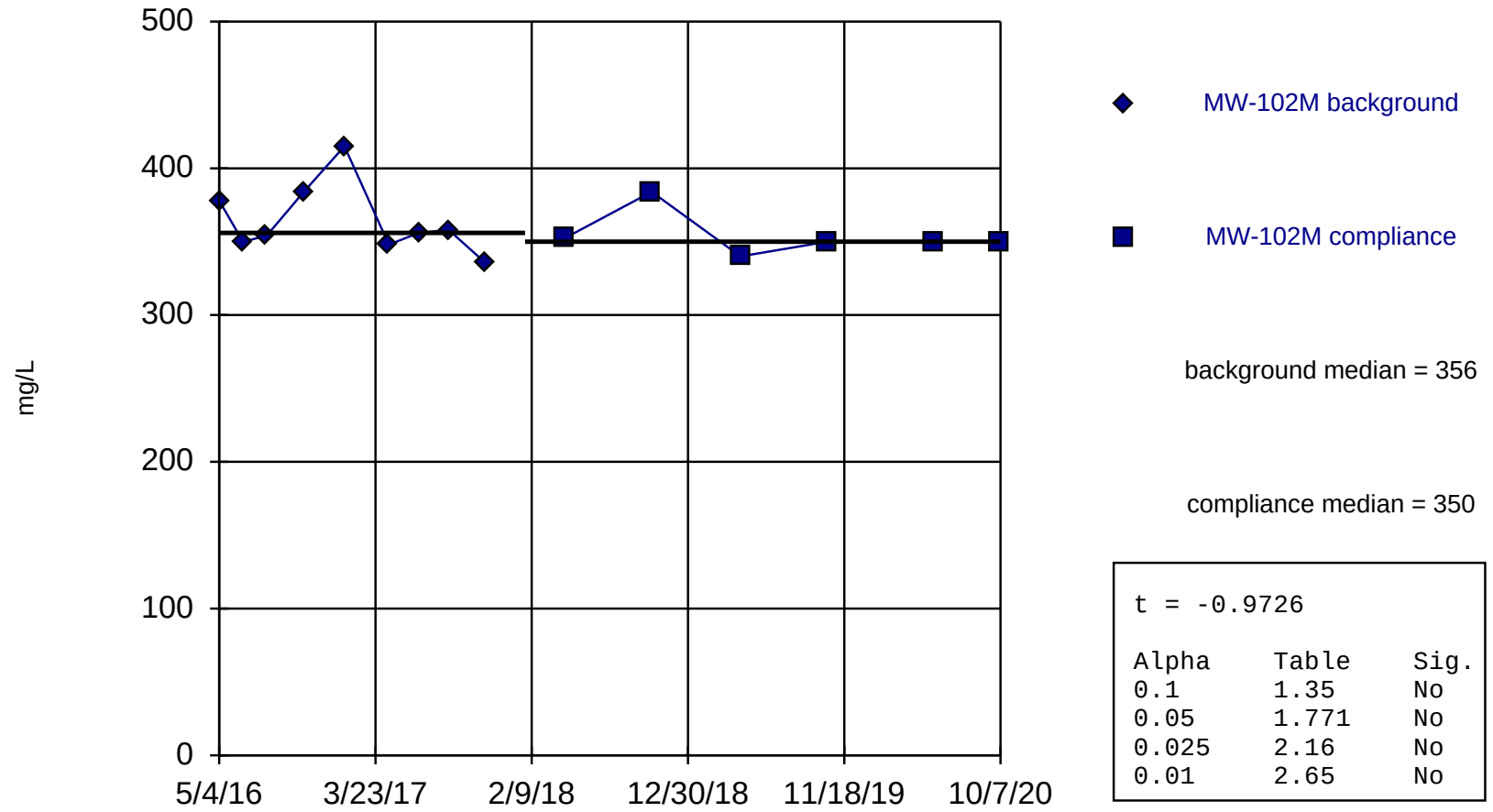
Constituent: Fluoride (mg/L) Analysis Run 1/11/2021 9:13 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-122M	MW-122M
5/5/2016	1.1	
6/23/2016	0.89	
8/10/2016	0.74	
10/26/2016	0.48	
1/18/2017	<0.027 (U)	
4/20/2017	0.88	
6/21/2017	1.1	
8/22/2017	0.6	
11/8/2017	0.5	
4/17/2018		<0.063 (U)
10/16/2018		<0.19 (U)
4/17/2019		0.7
10/15/2019		<0.23 (U)
5/21/2020		0.23 (J)
10/7/2020		<0.23 (U)

Sulfate

MW-102M (bg)



t = -0.9726		
Alpha	Table	Sig.
0.1	1.35	No
0.05	1.771	No
0.025	2.16	No
0.01	2.65	No

Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.8925, critical = 0.829.

Welch's t-test Analysis Run 1/11/2021 9:06 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Welch's t-test

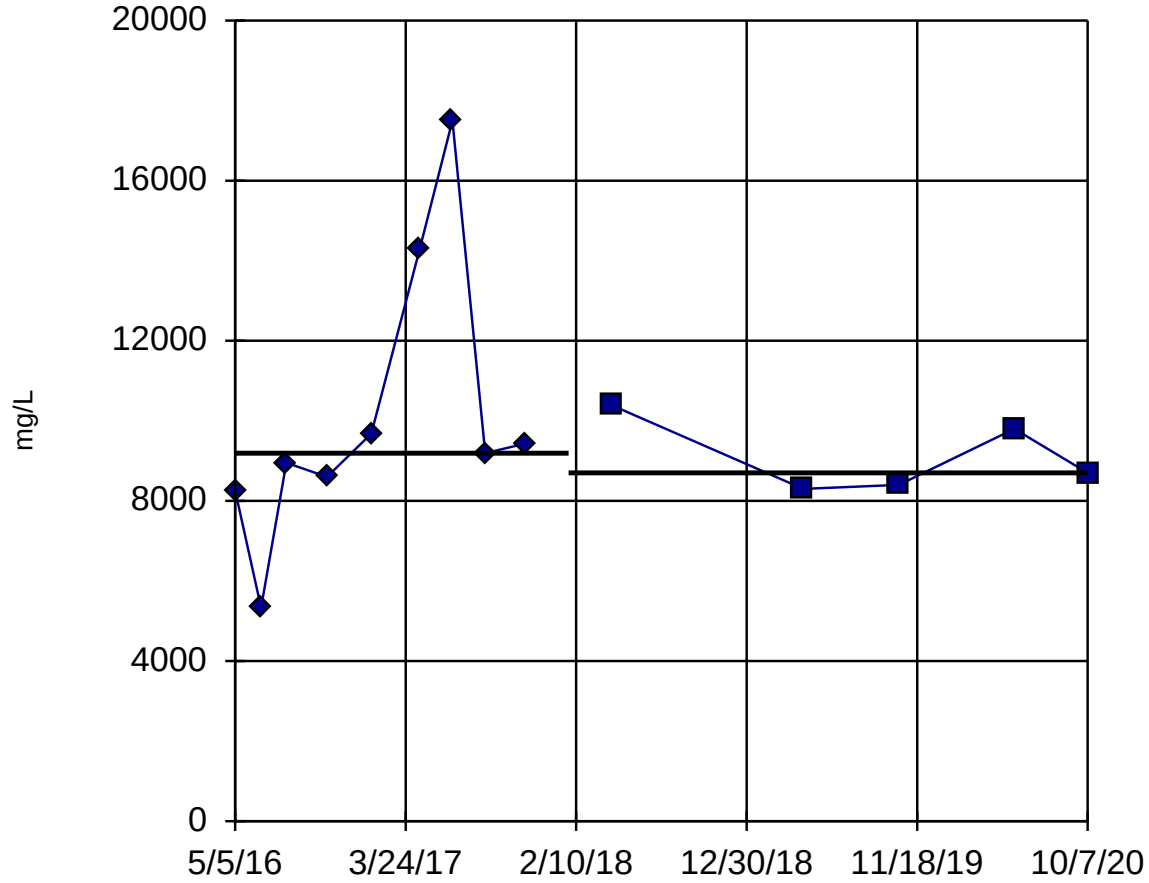
Constituent: Sulfate (mg/L) Analysis Run 1/11/2021 9:13 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M	MW-102M
5/4/2016	378	
6/22/2016	350	
8/10/2016	354	
10/26/2016	384	
1/18/2017	415	
4/20/2017	348	
6/21/2017	356	
8/22/2017	358	
11/8/2017	335	
4/17/2018		352
10/16/2018		384
4/18/2019		340
10/15/2019		350
5/21/2020		350
10/7/2020		350

Sulfate

MW-122M (bg)



◆ MW-122M background

■ MW-122M compliance

background median = 9190

compliance median = 8700

t = -0.8026

Alpha	Table	Sig.
0.1	1.372	No
0.05	1.812	No
0.025	2.228	No
0.01	2.764	No

Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.8507, critical = 0.829.

Welch's t-test Analysis Run 1/11/2021 9:06 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

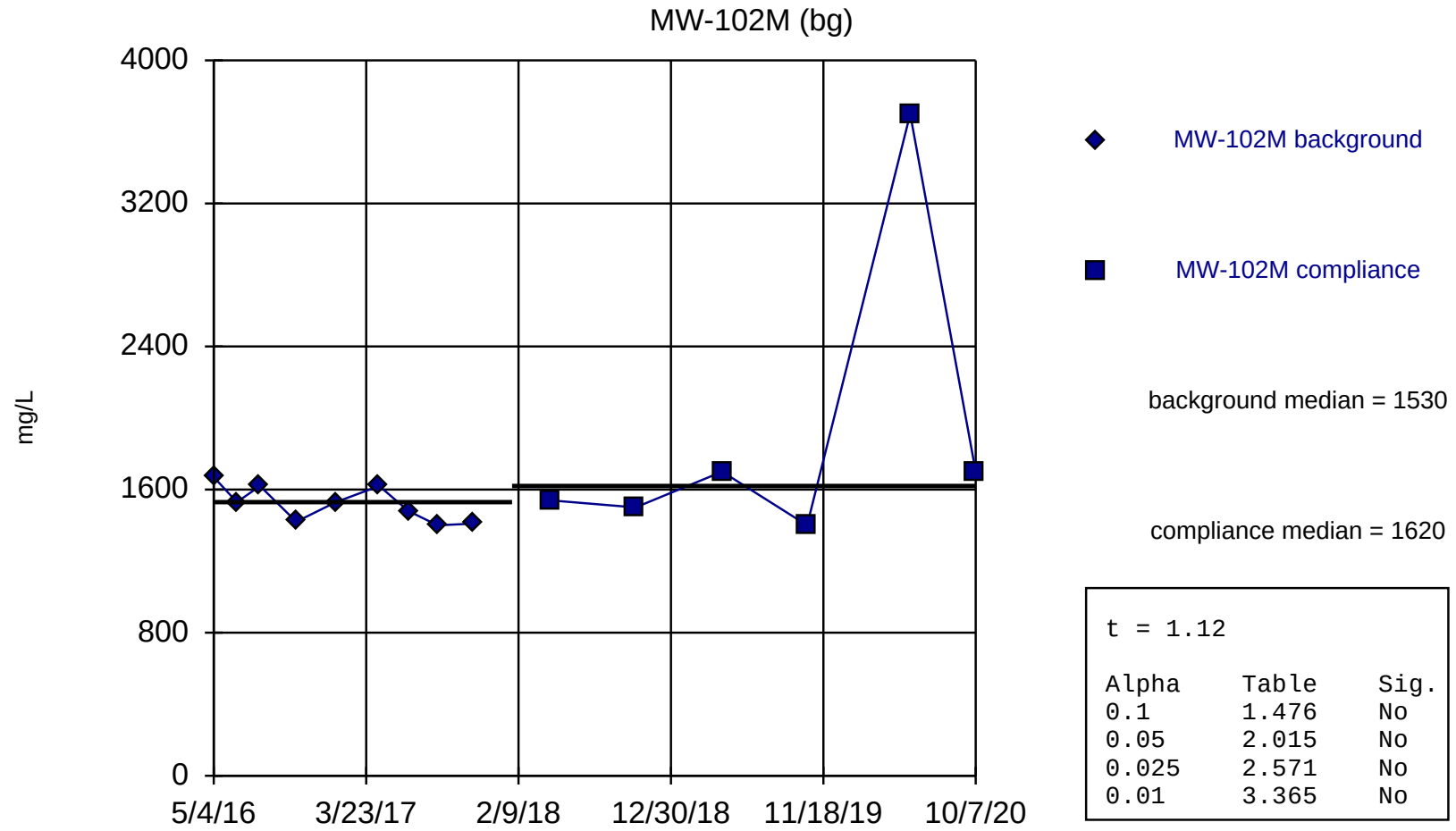
Welch's t-test

Constituent: Sulfate (mg/L) Analysis Run 1/11/2021 9:13 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-122M	MW-122M
5/5/2016	8260	
6/23/2016	5330	
8/10/2016	8950	
10/26/2016	8600	
1/18/2017	9680	
4/20/2017	14300	
6/21/2017	17500	
8/22/2017	9190	
11/8/2017	9440	
4/17/2018		10400
10/16/2018	<0.24 (UX)	
4/17/2019		8300
10/15/2019		8400
5/21/2020		9800
10/7/2020		8700

Total Dissolved Solids



t = 1.12		
Alpha	Table	Sig.
0.1	1.476	No
0.05	2.015	No
0.025	2.571	No
0.01	3.365	No

Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9113, critical = 0.829.

Welch's t-test Analysis Run 1/11/2021 9:06 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Welch's t-test

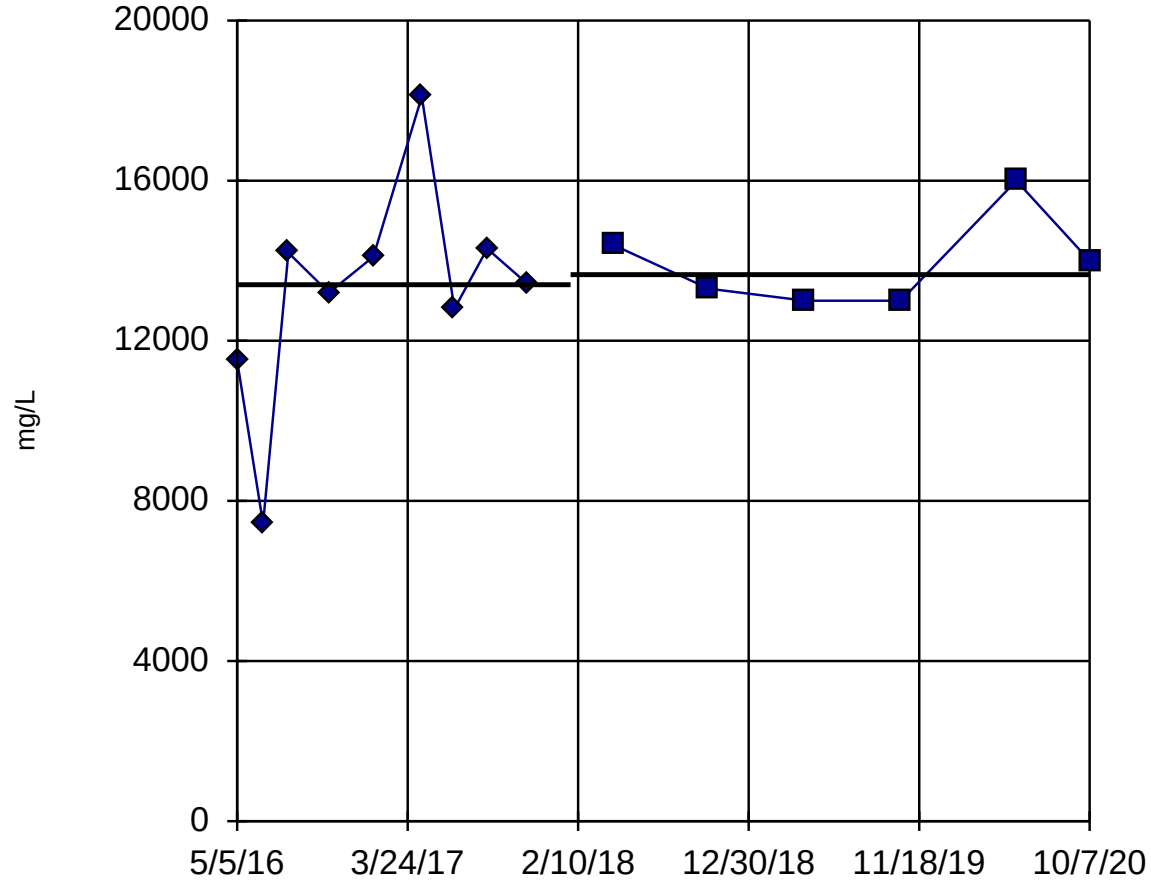
Constituent: Total Dissolved Solids (mg/L) Analysis Run 1/11/2021 9:13 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M	MW-102M
5/4/2016	1670	
6/22/2016	1530	
8/10/2016	1620	
10/26/2016	1420	
1/18/2017	1530	
4/20/2017	1620	
6/21/2017	1480	
8/22/2017	1400	
11/8/2017	1410	
4/17/2018		1540
10/16/2018		1500
4/18/2019		1700
10/15/2019		1400
5/21/2020		3700
10/7/2020		1700

Total Dissolved Solids

MW-122M (bg)



background median = 13400

compliance median = 13650

t = 0.6902

Alpha	Table	Sig.
0.1	1.363	No
0.05	1.796	No
0.025	2.201	No
0.01	2.718	No

Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.8996, critical = 0.829.

Welch's t-test Analysis Run 1/11/2021 9:06 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Welch's t-test

Constituent: Total Dissolved Solids (mg/L) Analysis Run 1/11/2021 9:13 PM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-122M	MW-122M
5/5/2016	11500	
6/23/2016	7430	
8/10/2016	14200	
10/26/2016	13200	
1/18/2017	14100	
4/20/2017	18100	
6/21/2017	12800	
8/22/2017	14300	
11/8/2017	13400	
4/17/2018		14400
10/16/2018		13300
4/17/2019		13000
10/15/2019		13000
5/21/2020		16000
10/7/2020		14000

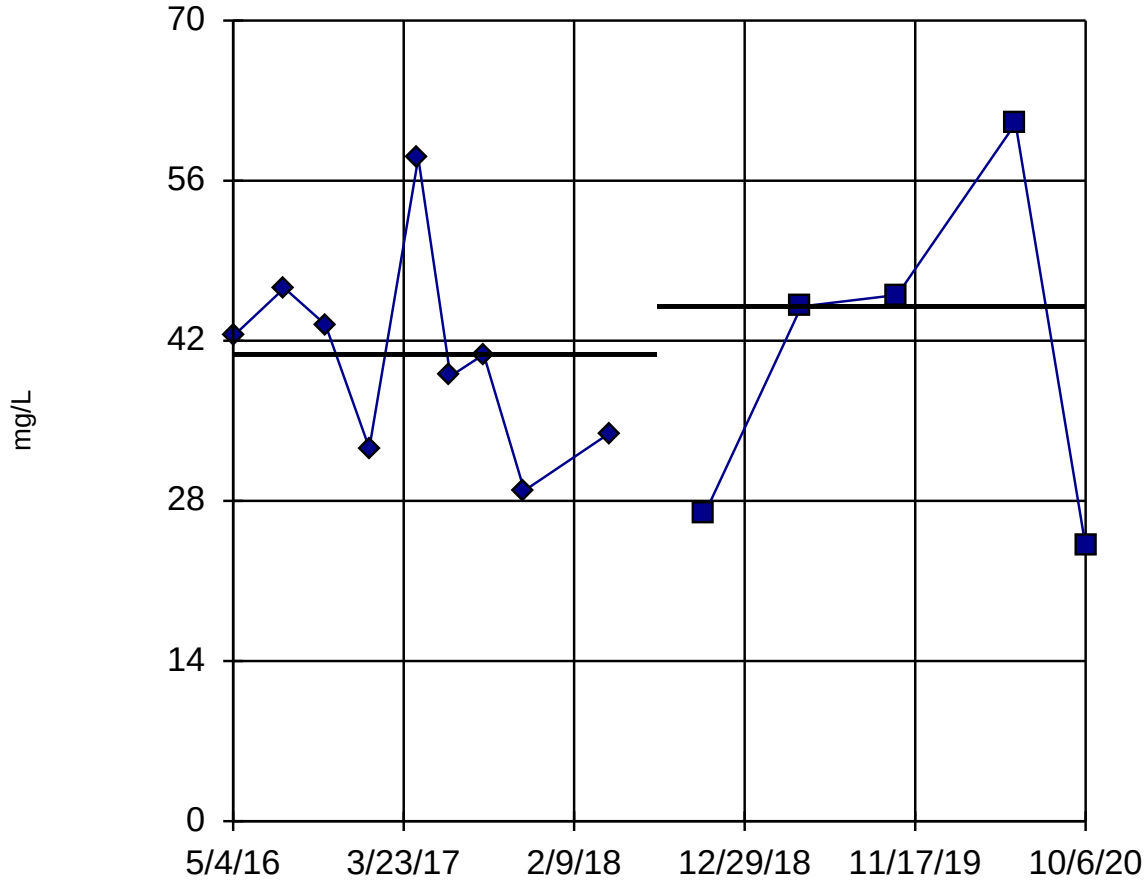
Welch's t-test/Mann-Whitney

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020 Printed 1/12/2021, 10:21 AM

Constituent	Well	Calc.	0.1	0.05	0.025	0.01	Alpha	Sig.	Bg. Wells	Method
Chloride (mg/L)	MW-301	-0....	No	No	No	No	0.01	No	(intrawell)	Welch`s
Chloride (mg/L)	MW-302	0.9502	No	No	No	No	0.01	No	(intrawell)	Welch`s
Chloride (mg/L)	MW-303 (bg)	1.283	Yes	No	No	No	0.01	No	(intrawell)	Mann-W (normality)

Chloride

MW-301



t = -0.004206		
Alpha	Table	Sig.
0.1	1.476	No
0.05	2.015	No
0.025	2.571	No
0.01	3.365	No

Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9531, critical = 0.829.

Welch's t-test Analysis Run 1/12/2021 10:19 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Welch's t-test

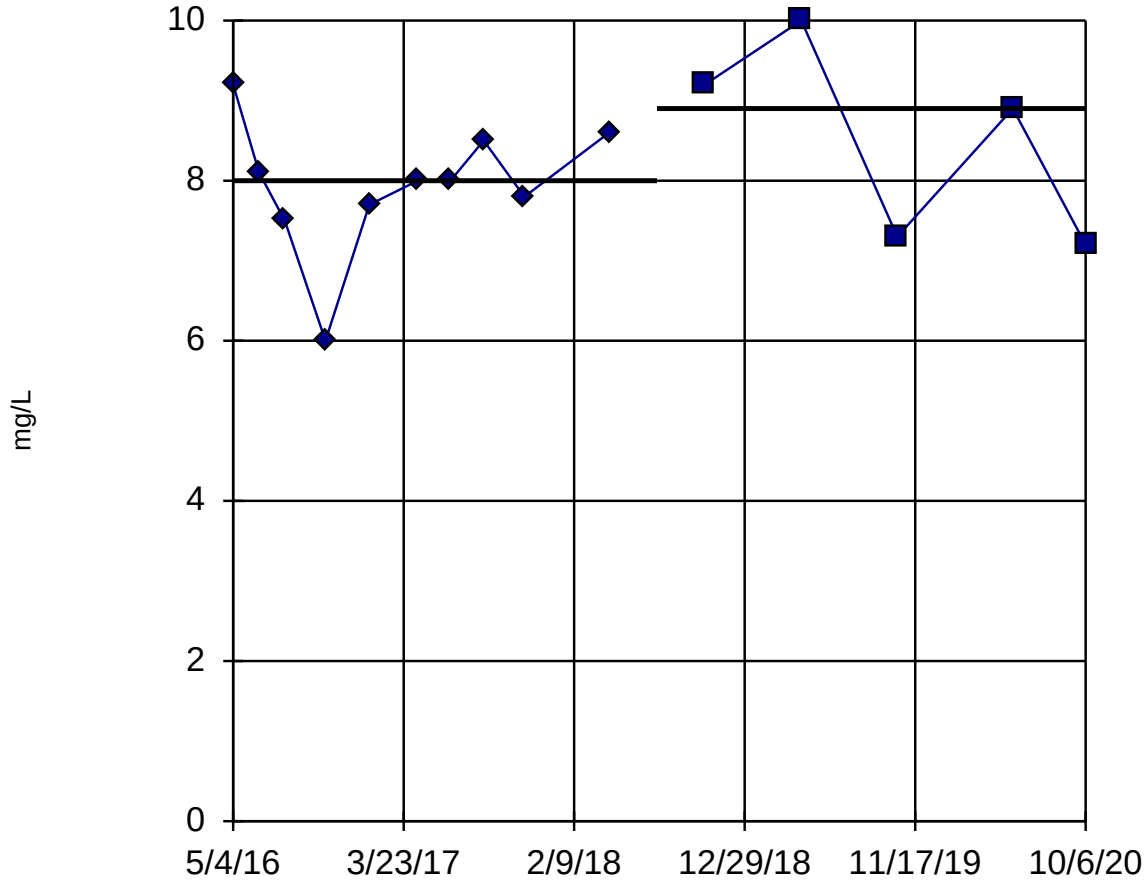
Constituent: Chloride (mg/L) Analysis Run 1/12/2021 10:21 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-301	MW-301
5/4/2016	42.4	
6/22/2016	112 (X)	
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	
4/17/2018	33.9	
10/15/2018		26.9
4/16/2019		45
10/15/2019		46
5/26/2020		61
10/6/2020		24

Chloride

MW-302



t = 0.9502

Alpha	Table	Sig.
0.1	1.44	No
0.05	1.943	No
0.025	2.447	No
0.01	3.143	No

Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9043, critical = 0.842.

Welch's t-test Analysis Run 1/12/2021 10:19 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Welch's t-test

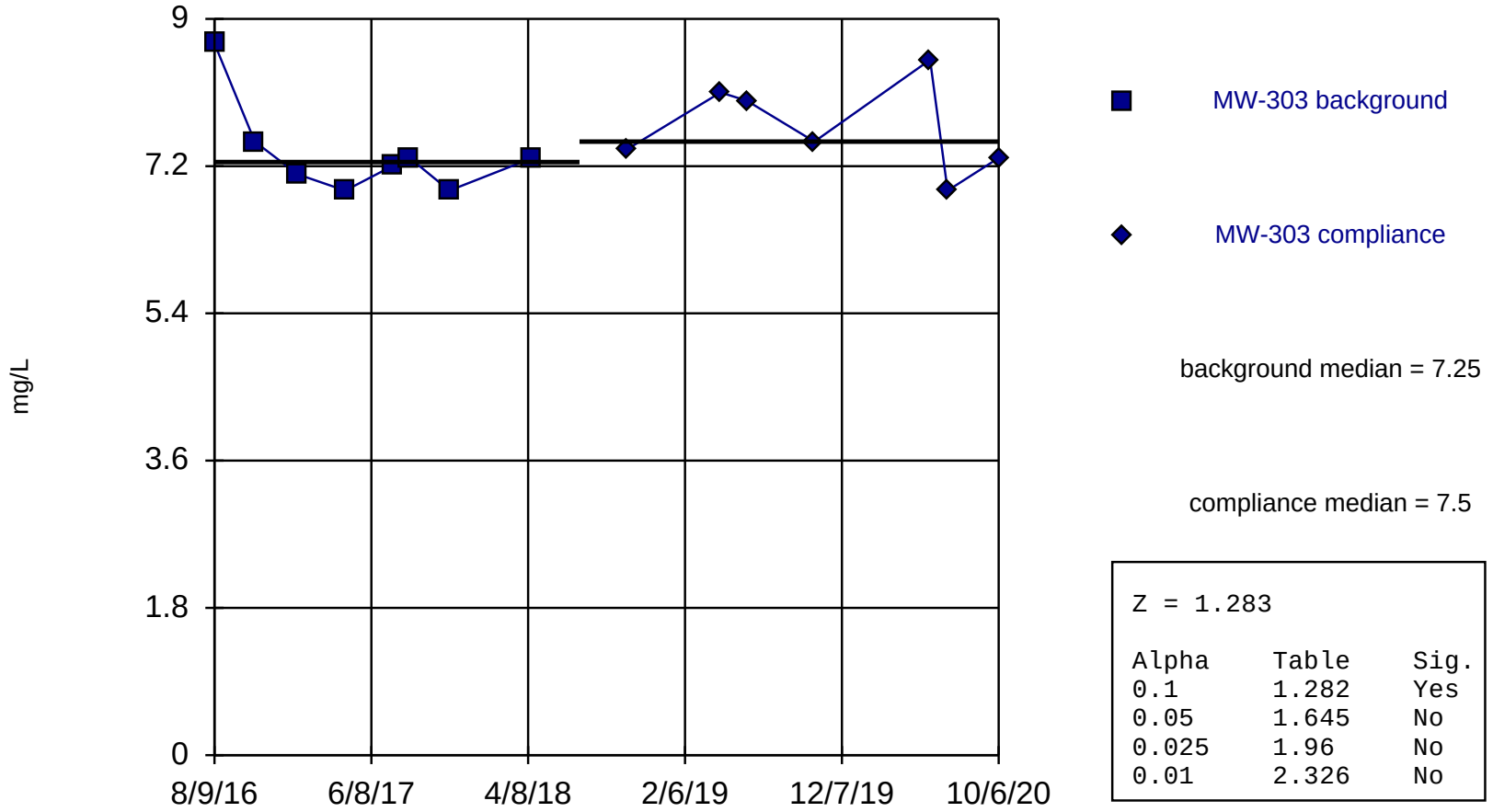
Constituent: Chloride (mg/L) Analysis Run 1/12/2021 10:21 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-302	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	
4/17/2018	8.6	
10/15/2018		9.2
4/16/2019		10
10/15/2019		7.3
5/21/2020		8.9
10/6/2020		7.2

Chloride

MW-303 (bg)



Z = 1.283		
Alpha	Table	Sig.
0.1	1.282	Yes
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Mann-Whitney (Wilcoxon Rank Sum) used in lieu of Welch's t-test because the Shapiro Wilk normality test showed the data to be non-normal at the 0.05 alpha level.

Mann-Whitney (Wilcoxon Rank Sum) Analysis Run 1/12/2021 10:19 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Mann-Whitney (Wilcoxon Rank Sum)

Constituent: Chloride (mg/L) Analysis Run 1/12/2021 10:21 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-303	MW-303
5/4/2016	13.5 (X)	
6/22/2016	11.5 (X)	
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	
4/17/2018	7.3	
10/16/2018		7.4
4/16/2019		8.1
6/6/2019		8
10/15/2019		7.5
5/26/2020		8.5
6/29/2020		6.9
10/6/2020		7.3

Attachment 4

Interwell Prediction Limit Analysis

Interwell Prediction Limit

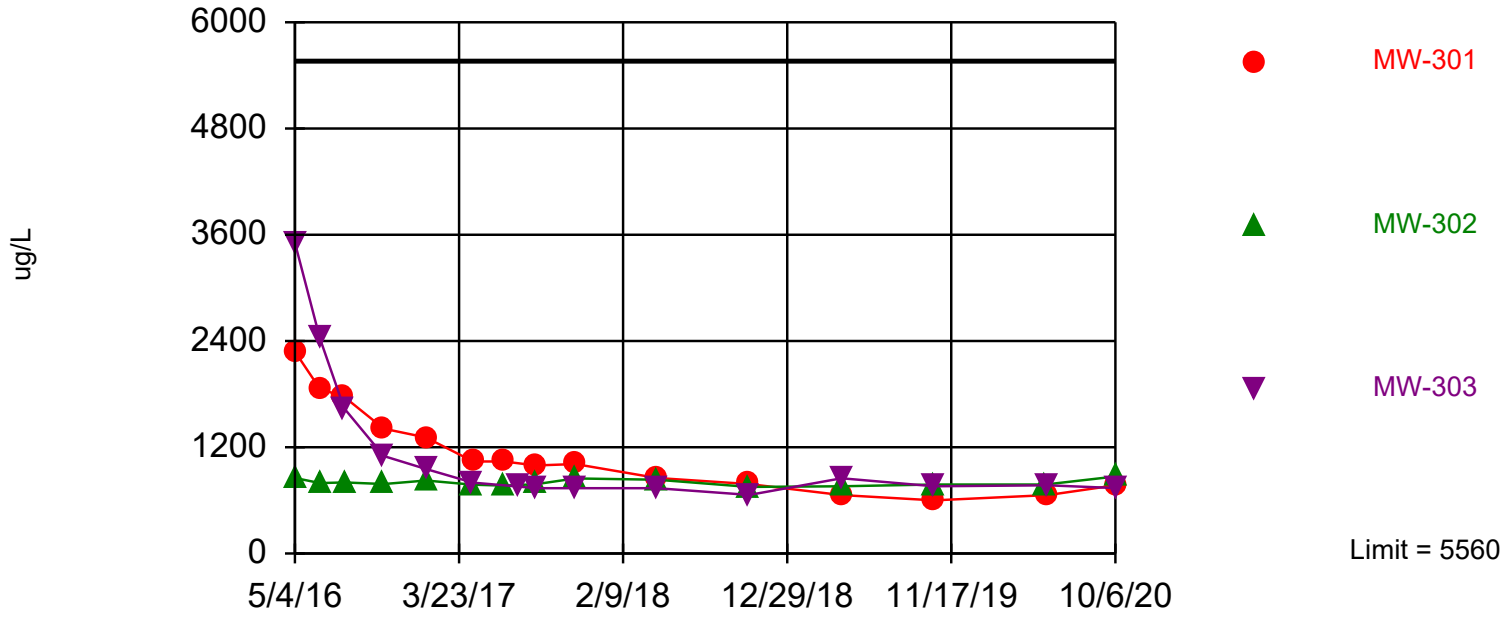
Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020 Printed 12/31/2020, 12:31 AM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Wells	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron (ug/L)	MW-301	5560	n/a	10/6/2020	770	No	30	MW-102M,MW-122M	n/a	n/a	0	n/a	n/a	0.00197	NP (normality) 1 of 2
Boron (ug/L)	MW-302	5560	n/a	10/6/2020	870	No	30	MW-102M,MW-122M	n/a	n/a	0	n/a	n/a	0.00197	NP (normality) 1 of 2
Boron (ug/L)	MW-303	5560	n/a	10/6/2020	740	No	30	MW-102M,MW-122M	n/a	n/a	0	n/a	n/a	0.00197	NP (normality) 1 of 2
Calcium (mg/L)	MW-301	599	n/a	10/6/2020	180	No	29	MW-102M,MW-122M	n/a	n/a	0	n/a	n/a	0.002128	NP (normality) 1 of 2
Calcium (mg/L)	MW-302	599	n/a	10/6/2020	65	No	29	MW-102M,MW-122M	n/a	n/a	0	n/a	n/a	0.002128	NP (normality) 1 of 2
Calcium (mg/L)	MW-303	599	n/a	10/6/2020	100	No	29	MW-102M,MW-122M	n/a	n/a	0	n/a	n/a	0.002128	NP (normality) 1 of 2
Field pH (Std. Units)	MW-301	8.63	n/a	10/6/2020	7.22	No	25	MW-102M,MW-122M	7.258	0.7489	0	None	No	0.002505	Param 1 of 2
Field pH (Std. Units)	MW-302	8.63	n/a	10/6/2020	7.14	No	25	MW-102M,MW-122M	7.258	0.7489	0	None	No	0.002505	Param 1 of 2
Field pH (Std. Units)	MW-303	8.63	n/a	10/6/2020	7.01	No	25	MW-102M,MW-122M	7.258	0.7489	0	None	No	0.002505	Param 1 of 2
Fluoride (mg/L)	MW-301	5.70	n/a	10/6/2020	0.67	No	30	MW-122M,MW-102M	n/a	n/a	16.67	n/a	n/a	0.00197	NP (normality) 1 of 2
Fluoride (mg/L)	MW-302	5.70	n/a	10/6/2020	1.1	No	30	MW-122M,MW-102M	n/a	n/a	16.67	n/a	n/a	0.00197	NP (normality) 1 of 2
Fluoride (mg/L)	MW-303	5.70	n/a	10/6/2020	0.88	No	30	MW-122M,MW-102M	n/a	n/a	16.67	n/a	n/a	0.00197	NP (normality) 1 of 2
Sulfate (mg/L)	MW-301	17500	n/a	10/6/2020	620	No	29	MW-102M,MW-122M	n/a	n/a	0	n/a	n/a	0.002128	NP (normality) 1 of 2
Sulfate (mg/L)	MW-302	17500	n/a	10/6/2020	73	No	29	MW-102M,MW-122M	n/a	n/a	0	n/a	n/a	0.002128	NP (normality) 1 of 2
Sulfate (mg/L)	MW-303	17500	n/a	10/6/2020	230	No	29	MW-102M,MW-122M	n/a	n/a	0	n/a	n/a	0.002128	NP (normality) 1 of 2
Total Dissolved Solids (mg/L)	MW-301	18100	n/a	10/6/2020	1400	No	30	MW-102M,MW-122M	n/a	n/a	0	n/a	n/a	0.00197	NP (normality) 1 of 2
Total Dissolved Solids (mg/L)	MW-302	18100	n/a	10/6/2020	700	No	30	MW-102M,MW-122M	n/a	n/a	0	n/a	n/a	0.00197	NP (normality) 1 of 2
Total Dissolved Solids (mg/L)	MW-303	18100	n/a	10/6/2020	840	No	30	MW-102M,MW-122M	n/a	n/a	0	n/a	n/a	0.00197	NP (normality) 1 of 2

Within Limit

Boron

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 30 background values. Annual per-constituent alpha = 0.01176. Individual comparison alpha = 0.00197 (1 of 2). Comparing 3 points to limit. Seasonality was not detected with 95% confidence.

Prediction Limit Analysis Run 12/31/2020 12:29 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Prediction Limit

Constituent: Boron (ug/L) Analysis Run 12/31/2020 12:31 AM

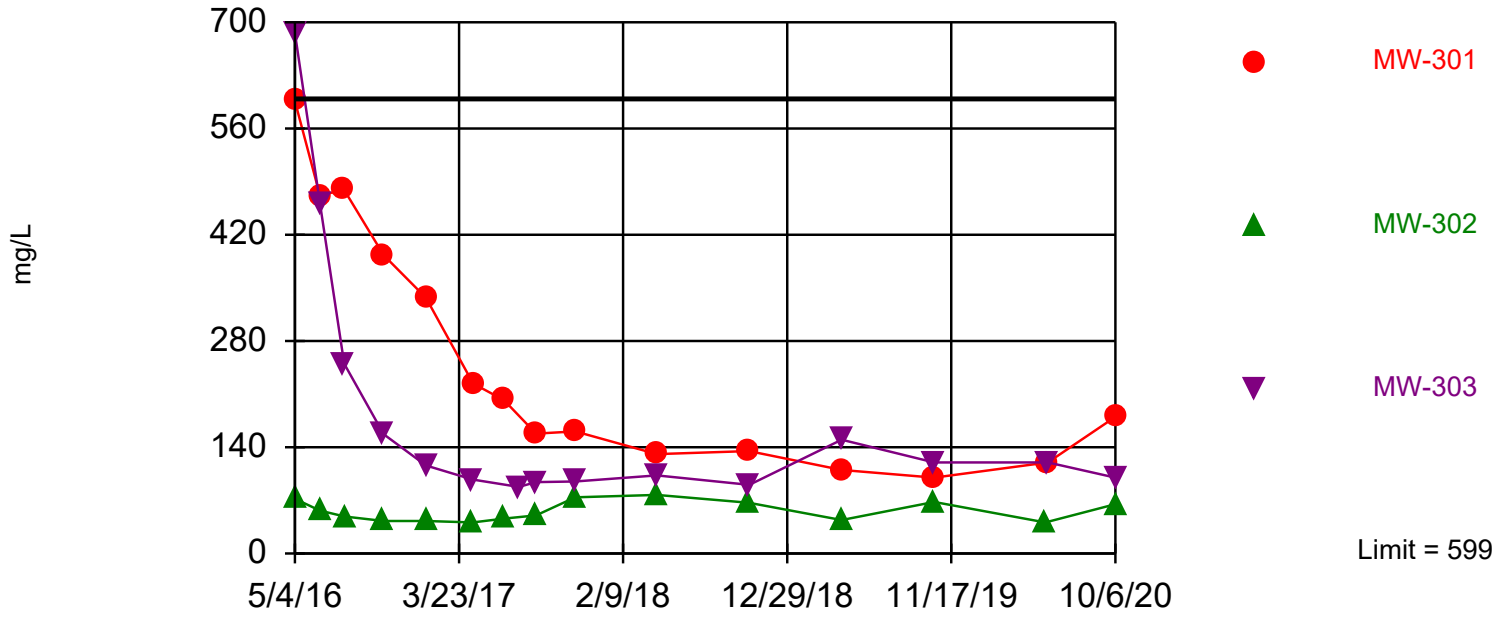
Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M (bg)	MW-303	MW-302	MW-301	MW-122M (bg)
5/4/2016	1510	3510	853	2280	
5/5/2016					3140
6/22/2016	1440	2430	796	1860	
6/23/2016					1720
8/9/2016		1640		1770	
8/10/2016	1480		802		4550
10/26/2016	1420	1100	784	1410	4060
1/17/2017		955	824	1310	
1/18/2017	1480				4720
4/19/2017		800	777		
4/20/2017	1460			1040	4480
6/20/2017			767	1040	
6/21/2017	1410				4710
7/19/2017		755			
8/22/2017	1440	737	783	994	4980
11/7/2017		738	848	1010	
11/8/2017	1480				5220
4/17/2018	1550	738	834	854	5560
10/15/2018			752	784	
10/16/2018	1340	661			4580
4/16/2019		850	760	660	
4/17/2019					5500
4/18/2019	1400				
10/15/2019	1500	760	780	600	4100
5/21/2020	1500		780		5100
5/26/2020		770		660	
10/6/2020		740	870	770	
10/7/2020	1600				4100

Within Limit

Calcium

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 29 background values. Annual per-constituent alpha = 0.0127. Individual comparison alpha = 0.002128 (1 of 2). Comparing 3 points to limit. Seasonality was not detected with 95% confidence.

Prediction Limit Analysis Run 12/31/2020 12:29 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Prediction Limit

Constituent: Calcium (mg/L) Analysis Run 12/31/2020 12:31 AM

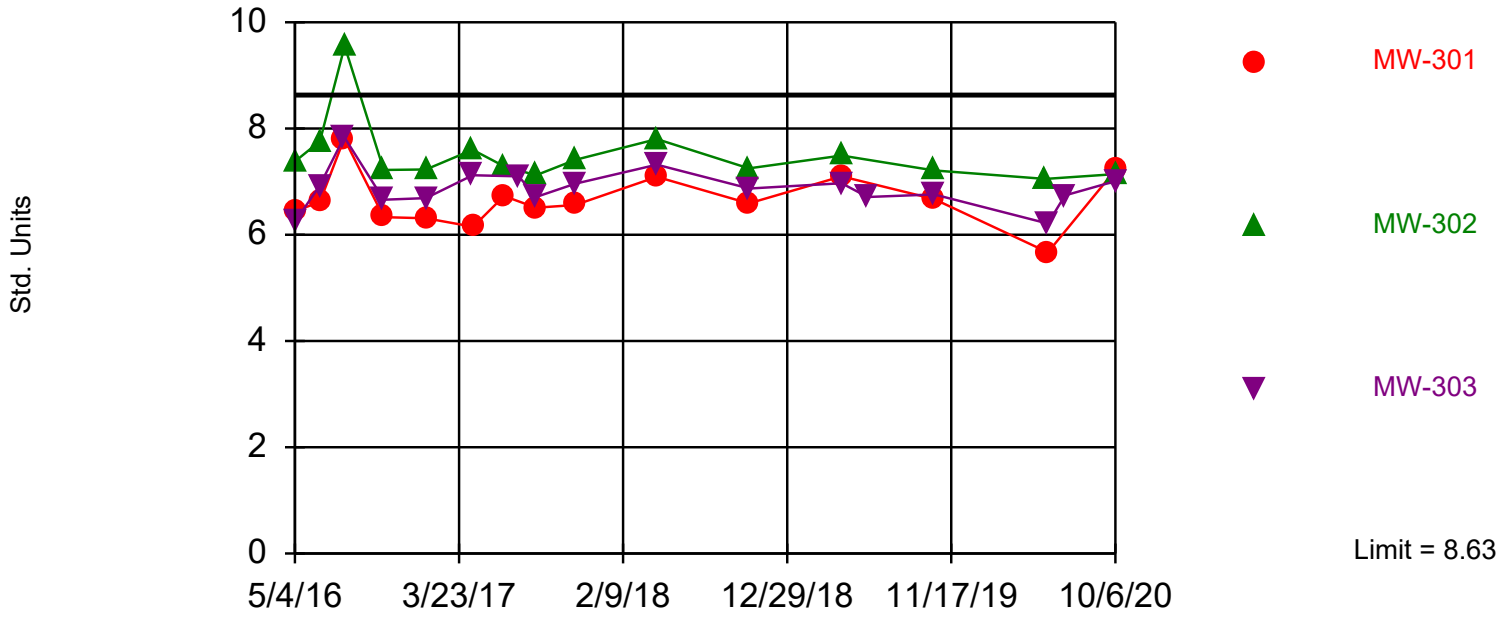
Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M (bg)	MW-301	MW-302	MW-303	MW-122M (bg)
5/4/2016	45.9	596	72.1	686	
5/5/2016					599
6/22/2016	147	472	56.6	462	
6/23/2016					312 (X)
8/9/2016		479		250	
8/10/2016	129		48.8		419
10/26/2016	31.5	393	42.8	157	415
1/17/2017		337	42.9	116	
1/18/2017	23.6				386
4/19/2017			41	97.4	
4/20/2017	26	224			382
6/20/2017		202	46.1		
6/21/2017	67.7				386
7/19/2017				87.7	
8/22/2017	79.7	158	50.2	94	386
11/7/2017		161	74	94.9	
11/8/2017	10.4				383
4/17/2018	25.3	131	77.3	103	402
10/15/2018		135	66.9		
10/16/2018	12.9			90.5	366
4/16/2019		110	44	150	
4/17/2019					400
4/18/2019	51				
10/15/2019	14	100	68	120	400
5/21/2020	38		41		430
5/26/2020		120		120	
10/6/2020		180	65	100	
10/7/2020	150				430

Within Limit

Field pH

Interwell Parametric



Background Data Summary: Mean=7.258, Std. Dev.=0.7489, n=25. Seasonality was not detected with 95% confidence. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9504, critical = 0.888. Kappa = 1.834 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.002505. Comparing 3 points to limit.

Prediction Limit Analysis Run 12/31/2020 12:29 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Prediction Limit

Constituent: Field pH (Std. Units) Analysis Run 12/31/2020 12:31 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

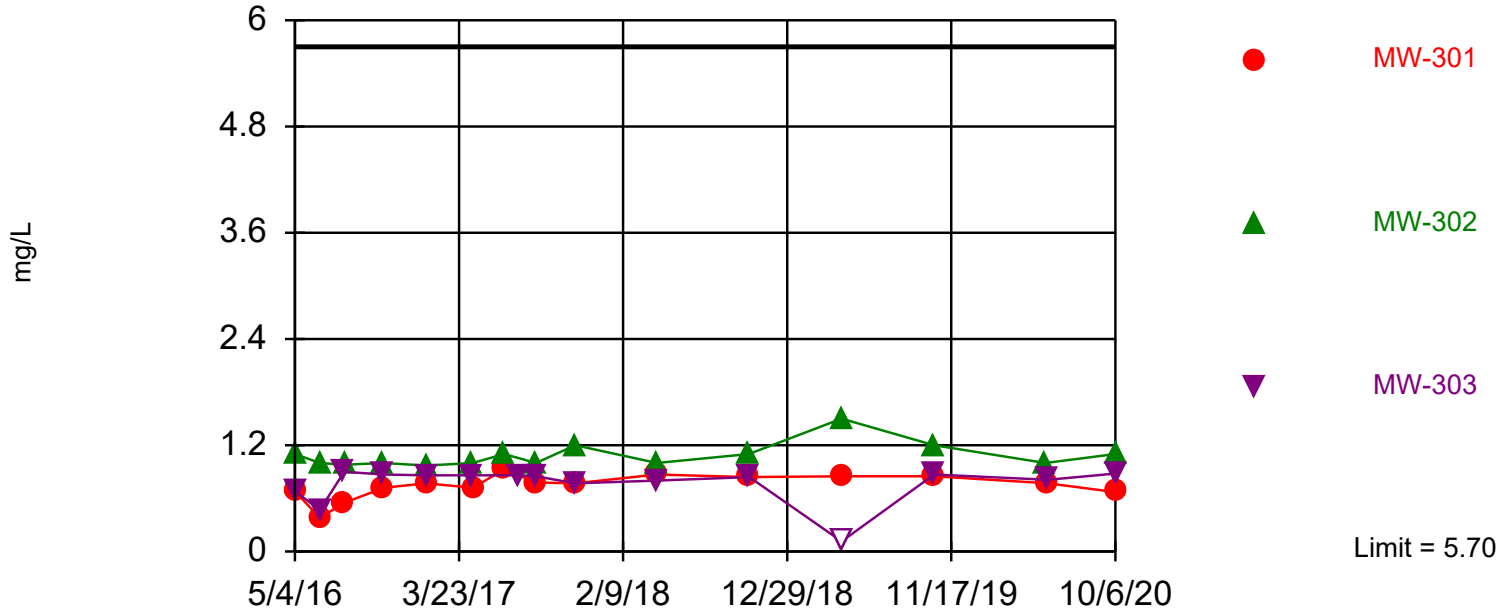
	MW-102M (bg)	MW-122M (bg)	MW-301	MW-302	MW-303
5/4/2016	8.09		6.44	7.38	6.24
5/5/2016		6.97			
6/22/2016	7.68		6.62	7.76	6.93
6/23/2016		6.68			
8/9/2016			7.81		7.84
8/10/2016				9.55	
10/26/2016			6.33	7.22	6.66
1/17/2017			6.31	7.23	6.69
1/18/2017	7.62	6.06			
4/19/2017				7.6	7.12
4/20/2017	7.35		6.15		
6/20/2017			6.73	7.29	
6/21/2017	7.64	6.42			
7/19/2017					7.1
8/22/2017	6.89	6.32	6.51	7.12	6.71
11/7/2017			6.56	7.41	6.96
11/8/2017	8.16	6.16			
4/17/2018	8.34	6.65	7.09	7.8	7.32
10/15/2018			6.59	7.25	
10/16/2018	7.8	6.31			6.87
4/16/2019			7.1	7.49	6.97
4/17/2019		7.34			
4/18/2019	8.55				
6/6/2019					6.71
10/15/2019	7.81	6.6	6.67	7.21	6.76
5/21/2020	7.82	6.91		7.05	
5/26/2020			5.67		6.21
6/29/2020					6.74
10/6/2020			7.22	7.14	7.01
10/7/2020	8.29	7			

Hollow symbols indicate censored values.

Within Limit

Fluoride

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 30 background values. 16.67% NDs. Annual per-constituent alpha = 0.01176. Individual comparison alpha = 0.00197 (1 of 2). Comparing 3 points to limit. Seasonality was not detected with 95% confidence.

Prediction Limit Analysis Run 12/31/2020 12:29 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Prediction Limit

Constituent: Fluoride (mg/L) Analysis Run 12/31/2020 12:31 AM

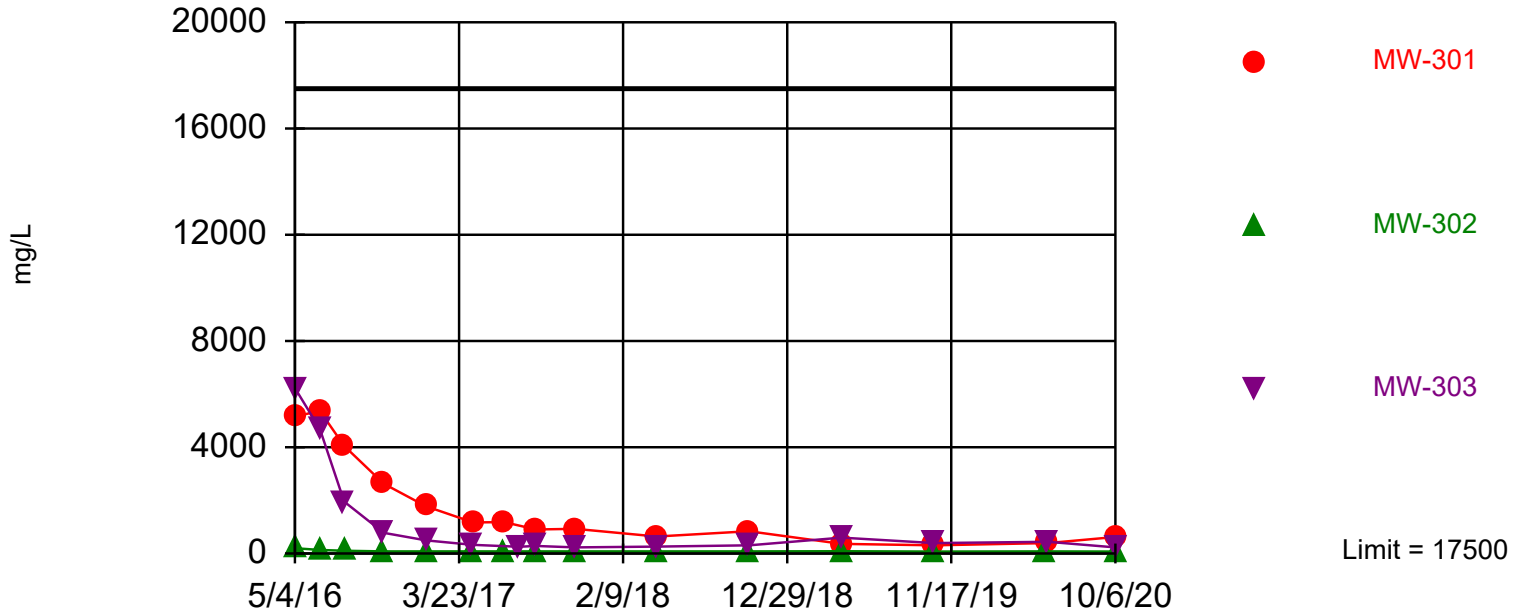
Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M (bg)	MW-303	MW-302	MW-301	MW-122M (bg)
5/4/2016	4.2	0.68	1.1	0.68	
5/5/2016					1.1
6/22/2016	4.2	0.47	1	0.38	
6/23/2016					0.89
8/9/2016		0.9		0.55	
8/10/2016	4.4		0.98		0.74
10/26/2016	4.6	0.87	1	0.72	0.48
1/17/2017		0.86	0.97	0.77	
1/18/2017	4.1				<0.027 (U)
4/19/2017		0.86	1		
4/20/2017	4			0.72	0.88
6/20/2017			1.1	0.93	
6/21/2017	4.6				1.1
7/19/2017		0.86			
8/22/2017	4.5	0.85	1	0.78	0.6
11/7/2017		0.77	1.2	0.77	
11/8/2017	4.6				0.5
4/17/2018	4.5	0.8	1	0.87	<0.063 (U)
10/15/2018			1.1	0.84	
10/16/2018	4.7	0.84			<0.19 (U)
4/16/2019		<0.23 (U)	1.5	0.85	
4/17/2019					0.7
4/18/2019	5.7				
10/15/2019	4.5	0.87	1.2	0.85	<0.23 (U)
5/21/2020	5		1		0.23 (J)
5/26/2020		0.81		0.77	
10/6/2020		0.88	1.1	0.67	
10/7/2020	5.3				<0.23 (U)

Within Limit

Sulfate

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 29 background values. Annual per-constituent alpha = 0.0127. Individual comparison alpha = 0.002128 (1 of 2). Comparing 3 points to limit. Seasonality was not detected with 95% confidence.

Prediction Limit Analysis Run 12/31/2020 12:29 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Prediction Limit

Constituent: Sulfate (mg/L) Analysis Run 12/31/2020 12:31 AM

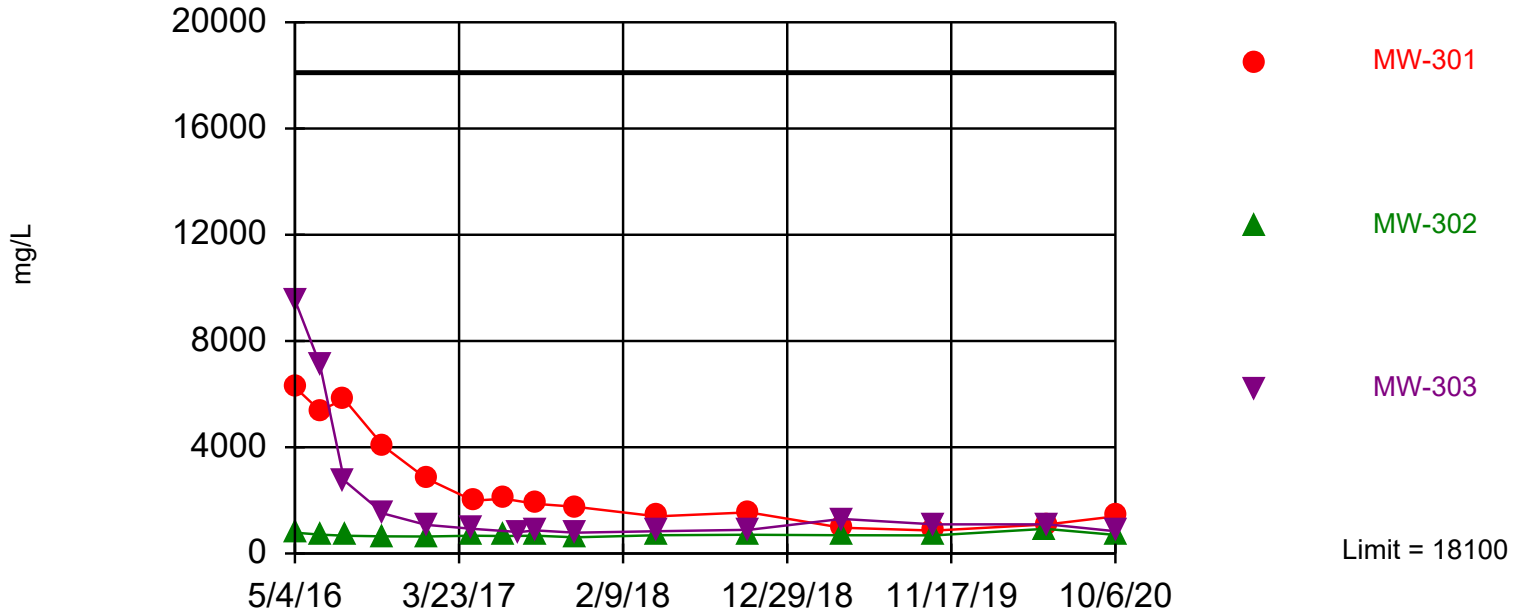
Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M (bg)	MW-301	MW-303	MW-302	MW-122M (bg)
5/4/2016	378	5160	6230	201	
5/5/2016					8260
6/22/2016	350	5370	4690	133	
6/23/2016					5330
8/9/2016		4050	1950		
8/10/2016	354			102	8950
10/26/2016	384	2630	780	78.9	8600
1/17/2017		1780	497	76.7	
1/18/2017	415				9680
4/19/2017			329	76.7	
4/20/2017	348	1170			14300
6/20/2017		1180		79.3	
6/21/2017	356				17500
7/19/2017			255 (255)		
8/22/2017	358	902	287	77.2	9190
11/7/2017		926	232	77.5	
11/8/2017	335				9440
4/17/2018	352	638	262	79.3	10400
10/15/2018		837		80.9	
10/16/2018	384		310		<0.24 (UX)
4/16/2019		360	600	83	
4/17/2019					8300
4/18/2019	340				
10/15/2019	350	310	390	73	8400
5/21/2020	350			79	9800
5/26/2020		390	440		
10/6/2020		620	230	73	
10/7/2020	350				8700

Within Limit

Total Dissolved Solids

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 30 background values. Annual per-constituent alpha = 0.01176. Individual comparison alpha = 0.00197 (1 of 2). Comparing 3 points to limit. Seasonality was not detected with 95% confidence.

Prediction Limit Analysis Run 12/31/2020 12:29 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Prediction Limit

Constituent: Total Dissolved Solids (mg/L) Analysis Run 12/31/2020 12:31 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-102M (bg)	MW-303	MW-302	MW-301	MW-122M (bg)
5/4/2016	1670	9540	784	6260	
5/5/2016					11500
6/22/2016	1530	7120	715	5380	
6/23/2016					7430
8/9/2016		2750		5810	
8/10/2016	1620		671		14200
10/26/2016	1420	1500	644	4030	13200
1/17/2017		1080	639	2830	
1/18/2017	1530				14100
4/19/2017		931	671		
4/20/2017	1620			1990	18100
6/20/2017			656	2060	
6/21/2017	1480				12800
7/19/2017		809			
8/22/2017	1400	868	672	1870	14300
11/7/2017		783	607	1760	
11/8/2017	1410				13400
4/17/2018	1540	839	690	1400	14400
10/15/2018			708	1550	
10/16/2018	1500	891			13300
4/16/2019		1300	690	970	
4/17/2019					13000
4/18/2019	1700				
10/15/2019	1400	1100	680	860	13000
5/21/2020	3700		930		16000
5/26/2020		1100		1100	
10/6/2020		840	700	1400	
10/7/2020	1700				14000

Attachment 5

Intrawell Prediction Limit Analysis

Intrawell Prediction Limit

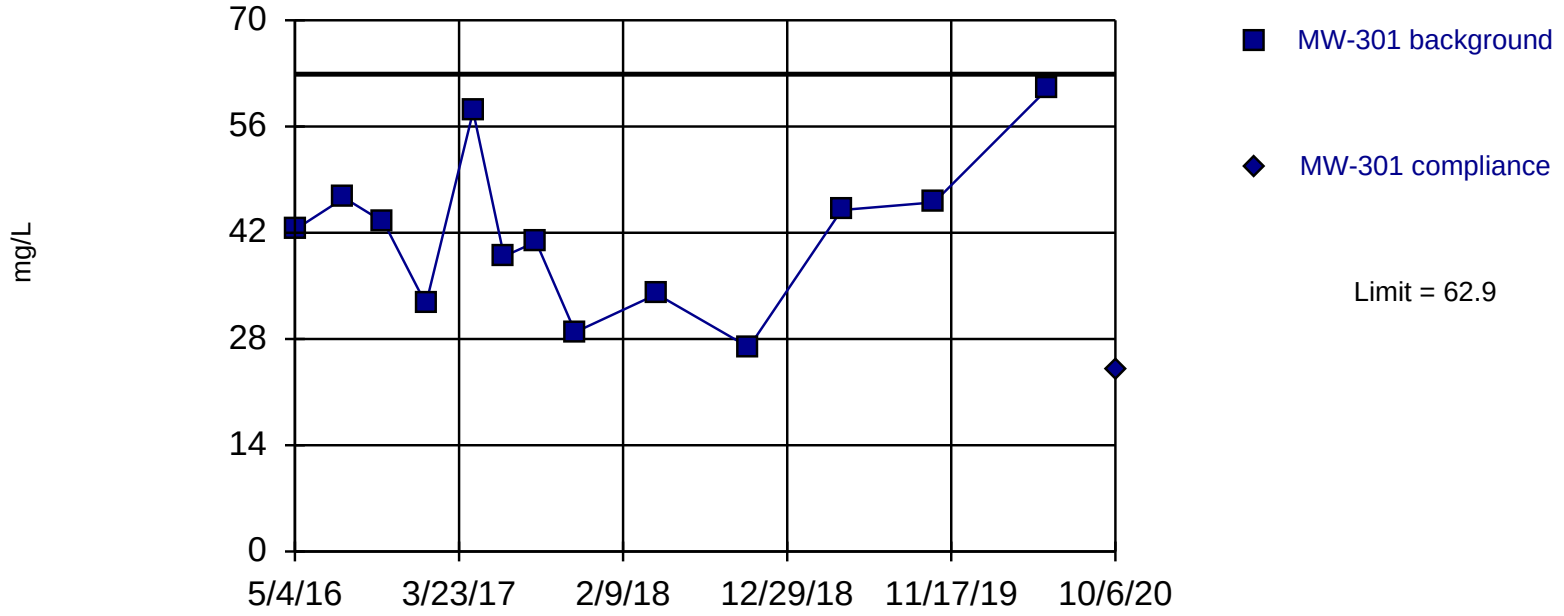
Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020 Printed 1/12/2021, 9:51 AM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Wells	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Chloride (mg/L)	MW-301	62.9	n/a	10/6/2020	24	No	13	n/a	41.88	10.12	0	None	No	0.002505	Param 1 of 2
Chloride (mg/L)	MW-302	10.2	n/a	10/6/2020	7.2	No	14	n/a	8.2	0.9853	0	None	No	0.002505	Param 1 of 2
Chloride (mg/L)	MW-303	8.72	n/a	10/6/2020	7.3	No	14	n/a	7.521	0.586	0	None	No	0.002505	Param 1 of 2

Within Limit

Chloride

Intrawell Parametric



Background Data Summary: Mean=41.88, Std. Dev.=10.12, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9513, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Prediction Limit Analysis Run 1/12/2021 9:31 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Prediction Limit

Constituent: Chloride (mg/L) Analysis Run 1/12/2021 9:51 AM

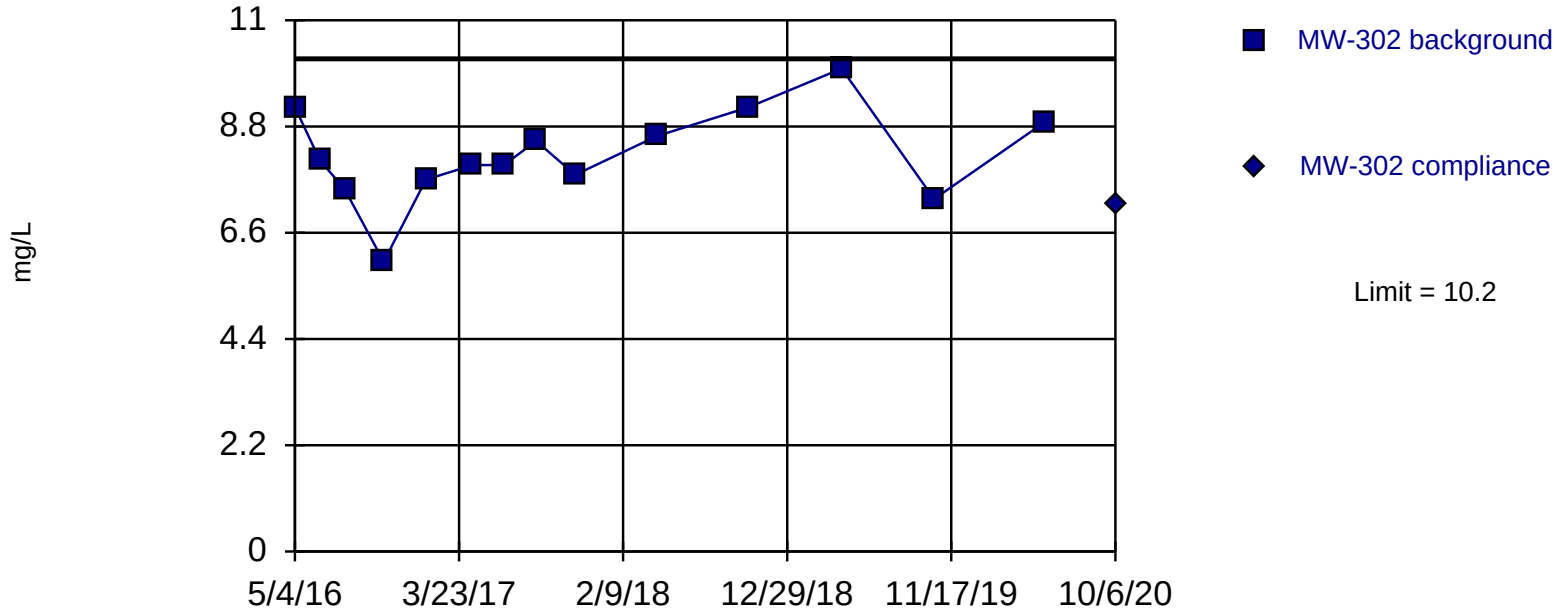
Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-301	MW-301
5/4/2016	42.4	
6/22/2016	112 (X)	
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	
4/17/2018	33.9	
10/15/2018	26.9	
4/16/2019	45	
10/15/2019	46	
5/26/2020	61	
10/6/2020		24

Within Limit

Chloride

Intrawell Parametric



Background Data Summary: Mean=8.2, Std. Dev.=0.9853, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9725, critical = 0.825. Kappa = 2.041 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Prediction Limit Analysis Run 1/12/2021 9:31 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Prediction Limit

Constituent: Chloride (mg/L) Analysis Run 1/12/2021 9:51 AM

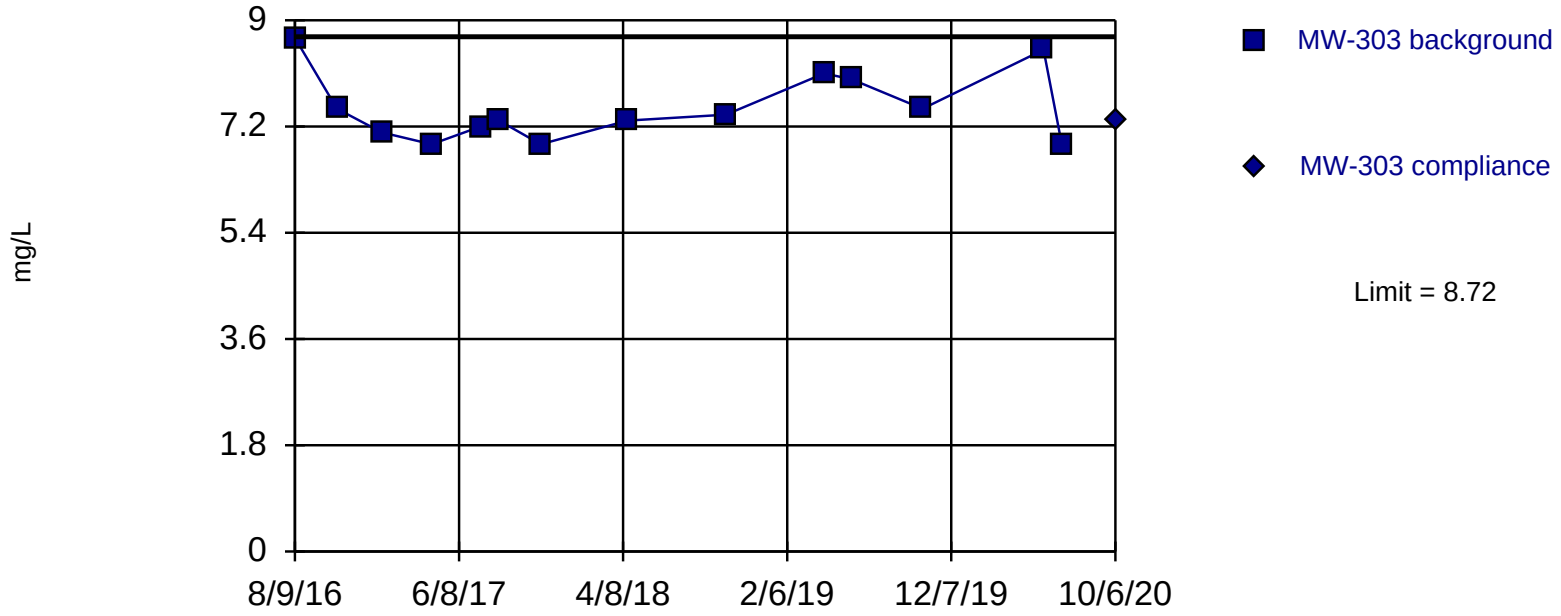
Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-302	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	
4/17/2018	8.6	
10/15/2018	9.2	
4/16/2019	10	
10/15/2019	7.3	
5/21/2020	8.9	
10/6/2020		7.2

Within Limit

Chloride

Intrawell Parametric



Background Data Summary: Mean=7.521, Std. Dev.=0.586, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.885, critical = 0.825. Kappa = 2.041 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505.

Prediction Limit Analysis Run 1/12/2021 9:31 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

Prediction Limit

Constituent: Chloride (mg/L) Analysis Run 1/12/2021 9:51 AM

Ottumwa-Midland Landfill Client: SCS Engineers Data: OML- Chempoint- input-Oct2020

	MW-303	MW-303
5/4/2016	13.5 (X)	
6/22/2016	11.5 (X)	
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	
4/17/2018	7.3	
10/16/2018	7.4	
4/16/2019	8.1	
6/6/2019	8	
10/15/2019	7.5	
5/26/2020	8.5	
6/29/2020	6.9	
10/6/2020		7.3