2019 Annual Groundwater Monitoring and Corrective Action Report

JH Campbell Power Plant
Dry Ash Landfill
West Olive, Michigan

January 2020

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Prepared For
Consumers Energy Company

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Executive Summary

On behalf of Consumers Energy, TRC has prepared this report for the JH Campbell (JHC) Dry Ash Landfill to cover the period of January 1, 2019 to December 31, 2019 and document the status of groundwater monitoring and corrective action for 2019 in accordance with §257.90(e).

Consumers Energy first reported the potential for statistically significant increases (SSIs) for Appendix III constituents in the *Annual Groundwater Monitoring Report, JH Campbell Power Plant, Dry Ash Landfill* (TRC, January 2018). The statistical evaluation of the Appendix III indicator parameters confirming SSIs over background were as follows:

- Boron at JHC-MW-15017, JHC-MW-15018, JHC-MW-15019, JHC-MW-15020, JHC-MW-15021, JHC-MW-15022, JHC-MW-15031, JHC-MW-15032, JHC-MW-15035, and JHC-MW-15037;
- Calcium at JHC-MW-15018, JHC-MW-15019, JHC-MW-15020, JHC-MW-15022, JHC-MW-15031, JHC-MW-15035, and JHC-MW-15037;
- Chloride at JHC-MW-15017, JHC-MW-15020, JHC-MW-15031;
- Sulfate at JHC-MW-15017, JHC-MW-15018, JHC-MW-15019, JHC-MW-15020, JHC-MW-15021, JHC-MW-15022, JHC-MW-15031, JHC-MW-15035, JHC-MW-15036, and JHC-MW-15037; and
- Total dissolved solids (TDS) at JHC-MW-15017, JHC-MW-15018, JHC-MW-15019, JHC-MW-15020, JHC-MW-15021, JHC-MW-15022, JHC-MW-15031, JHC-MW-15035, JHC-MW-15036, and JHC-MW-15037.

On April 25, 2018, Consumers Energy entered assessment monitoring upon determining that an Alternate Source Demonstration for the Appendix III constituents was not successful. After subsequent sampling for Appendix IV constituents, Consumers Energy compared the assessment monitoring data to the groundwater protection standards (GWPSs) to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs in accordance with §257.95. The four semiannual statistical evaluations performed to date, included those in the 2019 reporting period, have showed that no Appendix IV constituents were present at statistically significant levels above the GWPSs. Therefore, Consumers Energy remains in assessment monitoring and will not seek to initiate an assessment of corrective measures pursuant to 257.95(g)(3).

Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98. The next semiannual assessment monitoring events are tentatively scheduled for the second and fourth calendar quarter of 2020.

Section 1
Introduction

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule) (USEPA, April 2015 as amended. Standards for groundwater monitoring and corrective action codified in the CCR Rule (40 CFR 257.90 – 257.98), apply to the Consumers Energy Company (Consumers Energy) Dry Ash Landfill at the JH Campbell Power Plant Site (JHC Dry Ash Landfill). Pursuant to the CCR Rule, no later than January 31, 2018, and annually thereafter, the owner or operator of a CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with §257.90(e). On behalf of Consumers Energy, TRC has prepared this Annual Groundwater Monitoring Report for calendar year 2019 activities at the Dry Ash Landfill.

1.1 Program Summary

Consumers Energy first reported the potential for statistically significant increases (SSIs) for Appendix III constituents in the *Annual Groundwater Monitoring Report, JH Campbell Power Plant, Dry Ash Landfill CCR Unit* (TRC, January 2018). The statistical evaluation of the Appendix III indicator parameters confirming SSIs over background were as follows:

- Boron at JHC-MW-15017, JHC-MW-15018, JHC-MW-15019, JHC-MW-15020, JHC-MW-15021, JHC-MW-15022, JHC-MW-15031, JHC-MW-15032, JHC-MW-15035, and JHC-MW-15037;
- Calcium at JHC-MW-15018, JHC-MW-15019, JHC-MW-15020, JHC-MW-15022, JHC-MW-15031, JHC-MW-15035, and JHC-MW-15037;
- Chloride at JHC-MW-15017, JHC-MW-15020, JHC-MW-15031;
- Sulfate at JHC-MW-15017, JHC-MW-15018, JHC-MW-15019, JHC-MW-15020, JHC-MW-15021, JHC-MW-15022, JHC-MW-15031, JHC-MW-15035, JHC-MW-15036, and JHC-MW-15037; and
- Total dissolved solids (TDS) at JHC-MW-15017, JHC-MW-15018, JHC-MW-15019, JHC-MW-15020, JHC-MW-15021, JHC-MW-15022, JHC-MW-15031, JHC-MW-15035, JHC-MW-15036, and JHC-MW-15037.

As discussed in the *2018 Annual Groundwater Monitoring Report for the JH Campbell Power Plant Dry Ash Landfill CCR Unit* (TRC, January 2019) (2018 Annual Report) Consumers Energy initiated an Assessment Monitoring Program for the Dry Ash Landfill pursuant to §257.95 of the

CCR Rule that included sampling and analyzing groundwater within the groundwater monitoring system for all constituents listed in Appendix III and Appendix IV. On April 25, 2018, Consumers Energy entered assessment monitoring upon determining that an Alternate Source Demonstration for the Appendix III constituents was not successful.

In accordance with §257.93(h)(2) and within the compliance schedule clarified by the USEPA in April 2018, the first round of semiannual assessment monitoring data was statistically evaluated against the Groundwater Protection Standards (GWPSs) as reported on January 14, 2019 and placed in the operating record in accordance with §257.105(h)(8). This comparison showed that no Appendix IV constituents were present at statistically significant levels above the GWPSs. Therefore, Consumers Energy remained in assessment monitoring. The three subsequent assessment monitoring evaluations, including those in the 2019 reporting period, have also indicated that no Appendix IV constituents have been present in downgradient monitoring wells at statistically significant levels exceeding the GWPSs. Therefore, the Dry Ash Landfill monitoring system remained in assessment monitoring and has continued to be sampled for the Appendix III and Appendix IV constituents and statistically evaluated on a semiannual basis in accordance with §257.95. Assessment monitoring data that has been collected and evaluated in 2019, including assessment monitoring data from November 2018, are presented in this report.

1.2 Site Overview

The JH Campbell Plant is a coal fired power generation facility located in West Olive, Michigan, on the eastern shore of Lake Michigan. It is bordered by the Pigeon River on the south, 156th Avenue on the east, and Croswell Street to the north with Lakeshore Drive bisecting the site from north to south. The power generating plant consists of three coal fired electric generating units located on the western side of the site and the CCR disposal area is on the east side of the site, east of Lakeshore Drive. Figure 1 is a site location map showing the facility and the surrounding area.

Currently, there are no remaining active CCR surface impoundments at the JHC solid waste disposal facility. The CCR disposal area had contained two primary components: a system of wet ash ponds and a dry ash disposal facility (i.e., the JHC Dry Ash Landfill). The CCR surface impoundments located within the former wet ash pond area are Pond 1-2 Bottom Ash Ponds (Ponds 1-2), Pond 3 North and Pond 3 South Bottom Ash Pond (collectively Pond 3), and Pond A. All of these impoundments have been deactivated and decommissioned. The existing Dry Ash Landfill is a double-composite geomembrane lined landfill which is licensed and permitted for CCR disposal and includes two double-lined leachate and contact water retention ponds. Site features are shown on Figure 2.

Dry, moisture-conditioned CCR from the three coal fired electric generating units continues to be managed in the licensed Dry Ash Landfill which is regulated under Part 115 of the Natural

Resources and Environmental Protection Act (NREPA), PA 451 of 1994, as amended, and monitored in adherence to the facility's Michigan Department of Environment, Great Lakes, and Energy (EGLE)[1]-approved *Hydrogeological Monitoring Plan (HMP) for JH Campbell Ash Storage Facility, Consumers Power Company, Solid Waste Disposal Area, Coal Ash, Type III* (September 1996).

The surface impoundments in the wet ash pond areas (Pond 3 and Ponds 1-2) were decommissioned throughout 2017 and 2018 and replaced with concrete bottom ash treatment tanks, which became operational in July 2018. In addition, Pond A has been decommissioned with final cover placed in summer 2019. Groundwater monitoring is being conducted at Pond A during the post-closure period under the *Pond A Hydrogeological Monitoring Plan, JH Campbell Power Plant, West Olive, Michigan* (March 2019; Revised July 2019) (approved by the EGLE August 13, 2019), as well as in accordance with the RCRA CCR Rule.

Bottom ash is currently sluiced to the concrete tanks where it is dewatered. The settled and dewatered bottom ash is beneficially reused or managed at the Dry Ash Landfill. Sluice water decanted from the tanks flows through a permitted ditching system to the recirculation pond. Water in the recirculation pond is then discharged through a National Pollutant Discharge Elimination System (NPDES) permitted outfall and into Pigeon River.

The purpose of the dry ash disposal facility is to contain dry bottom and fly ash produced as a result of burning coal for power production. The facility consists of the existing CCR landfill Cells 1 through 5. The state permit also identifies Cells 6 through 9 for future construction and operation. Dry ash from all generating units is stored in silos until it is placed into the facility or is sold and shipped off site. At this time, the north faces of Cells 1 and 2 and the eastern face of Cell 2 have been closed along with Cell 3. Cell 4 is currently being filled with ash and partial cover has been constructed. Cell 5 was constructed in 2018 and put into service in 2019. Cells 6 through 9 have not yet been constructed.

This report focuses on the JHC Dry Ash Landfill, which includes Cell 5.

1.3 Geology/Hydrogeology

The upgradient/background wells are located to the north-northwest of the JHC Dry Ash Landfill. Groundwater is typically encountered around 30 to 35 feet below ground surface (ft bgs), except in the recently excavated areas of Bottom Ash Ponds 1-2 and Bottom Ash Pond 3 South where groundwater is now within 5 to 10 ft bgs due to grade changes, and generally flows to the south-southeast across the Dry Ash Landfill toward the Pigeon River. The subsurface

[1] Effective Monday, April 22, 2019, the Michigan Department of Environmental Quality (MDEQ) became known as the Michigan Department of Environment, Great Lakes, and Energy.

materials encountered at the JH Campbell site generally consist of approximately 40 to 60 feet of poorly graded, fine-grained lacustrine sand. A laterally extensive clay-rich till is generally encountered within approximately 40 to 60 ft bgs across the site that according to deep drilling logs conducted at the JH Campbell Power Plant (just west of the CCR units) is on the order of 80 feet thick and extends to the top of shale bedrock approximately 140 ft bgs.

Section 2
Groundwater Monitoring

2.1 Monitoring Well Network

In accordance with 40 CFR 257.91, Consumers Energy established a groundwater monitoring system for the JHC Dry Ash Landfill, which currently consists of 17 monitoring wells (6 background monitoring wells and 11 downgradient monitoring wells) that are screened in the uppermost aquifer. The monitoring well locations are shown on Figure 2. Six monitoring wells located north-northwest of the Dry Ash Landfill provide data on background groundwater quality that has not been affected by CCR management at the site (JHC-MW-15023 through JHC-MW-15028). Background groundwater quality data from these six background wells are additionally used for the CCR groundwater monitoring program at three other JH Campbell CCR units.

As shown on Figure 2, monitoring wells JHC-MW-15029 and JHC-MW-15030 are used for water level measurements only. Static water level data are collected at additional wells throughout the JH Campbell CCR units and used to construct a site-wide groundwater contour map; therefore, the following discussion includes a comprehensive summary of wells replaced and added in 2019:

2.1.1 Monitoring Well Replacement

Monitoring well JHC-MW-15008, located downgradient of Pond A, was decommissioned in June 2019 due to insufficient groundwater recharge as a result of the groundwater table re-equilibrating to a lower elevation subsequent to decommissioning Pond A. JHC-MW-15008R was installed in the vicinity of the decommissioned well JRW-MW-15008 to continue to evaluate groundwater downgradient of Pond A. Well decommissioning, installation, and construction are documented in Appendix A

2.2 November 2018 Assessment Groundwater Monitoring

As discussed in the 2018 Annual Report, the second 2018 semiannual monitoring event was conducted in November 2018, but laboratory analysis and data quality review were ongoing as of the writing of the 2018 Annual Report. A summary of the November 2018 assessment monitoring event was prepared under a separate cover and is included in Appendix B.

2.3 Semiannual Groundwater Monitoring

Per §257.95, all wells in the CCR unit monitoring program must be sampled at least semiannually. One semiannual event must include analysis for all constituents from Appendix III and Appendix IV constituents and one semiannual event may include analysis for those constituents in Appendix IV of the CCR Rule that were detected during prior sampling. In addition to the Appendix III and IV constituents, field parameters including dissolved oxygen, oxidation reduction potential, specific conductivity, temperature, and turbidity were collected at each well. Samples were collected and analyzed in accordance with the *JH Campbell Monitoring Program Sample Analysis Plan* (SAP) (ARCADIS, 2016).

2.3.1 Data Summary

The first semiannual groundwater assessment monitoring event for 2019 was performed on April 22 through April 26 and April 29, 2019 and the second semiannual groundwater assessment monitoring event for 2019 was performed on October 7 through October 11, 2019. Both events were performed by TRC personnel, and samples were analyzed by Eurofins TestAmerica Laboratories Inc. (TestAmerica) in accordance with the SAP. Static water elevation data were collected at all monitoring well locations. Groundwater samples were collected from the 6 background monitoring wells and 11 downgradient monitoring wells for the Appendix III and Appendix IV constituents and field parameters. A summary of the groundwater data collected during both the April 2019 event and October 2019 event are provided on Table 1 (static groundwater elevation data), Table 2 (field data), Table 3 (background analytical results), and Table 4 (Dry Ash Landfill analytical results).

2.3.2 Data Quality Review

Data from each round were evaluated for completeness, overall quality and usability, method-specified sample holding times, precision and accuracy, and potential sample contamination. The data were found to be complete and usable for the purposes of the CCR monitoring program. The data quality reviews are summarized in Appendix C.

2.3.3 Groundwater Flow Rate and Direction

Groundwater elevations measured across the Site during the April 2019 event and the October 2019 event are provided on Table 1. April 2019 and October 2019 groundwater elevations were used to construct the groundwater contour maps provided on Figure 3 and Figure 4, respectively. The average hydraulic gradient was calculated using the following well pairs: JHC-MW-15029/JHC-MW-15030, JHC-MW-15029/JHC-MW-15005, JHC-MW-15019/JHC-MW-15035 and JHC-MW-15023/JHC-MW-15037 (Figure 2). Using the mean hydraulic conductivity of 62 ft/day (ARCADIS, 2016) and an assumed effective

porosity of 0.4, the estimated average seepage velocity is approximately 0.66 ft/day or 240 ft/year for the April 2019 event, and approximately 0.66 ft/day or 239 ft/year for the October 2019 event.

The general groundwater flow direction is similar to that identified in previous monitoring rounds and continues to demonstrate that the downgradient wells are appropriately positioned to detect the presence of Appendix IV constituents that could potentially migrate from the Dry Ash Landfill.

Section 3
Statistical Evaluation

Assessment monitoring is continuing at the Dry Ash Landfill in accordance with §257.95. The following section summarizes the statistical approach applied to assess the 2019 groundwater data in accordance with the assessment monitoring program. The statistical evaluation details are provided in Appendix B (*November 2018 Assessment Monitoring Data Summary and Statistical Evaluation*), Appendix D (*June 2018 Statistical Evaluation of Initial Assessment Monitoring Sampling Event*), Appendix E (*April 2019 Assessment Monitoring Data Summary and Statistical Evaluation*), and Appendix F (*September 2019 Assessment Monitoring Data Summary and Statistical Evaluation*).

3.1 Establishing Groundwater Protection Standards

The Groundwater Protection Standards (GWPSs) are used to assess whether Appendix IV constituent concentrations are present in groundwater at unacceptable levels as a result of CCR Unit operations by statistically comparing concentrations in the downgradient wells to the GWPSs for each Appendix IV constituent. The calculation of the GWPSs is documented in the *Groundwater Protection Standards* technical memorandum included in Appendix C of the 2018 Annual Report (TRC, January 2019).

3.2 Data Comparison to Groundwater Protection Standards

Consistent with the *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (Unified Guidance) (USEPA, 2009), the preferred method for comparisons to a fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS. The statistical data comparison for the first (June 2018) and second (November 2018) semiannual assessment monitoring events (indicated that no Appendix IV constituents were present at statistically significant levels exceeding the GWPSs (Appendix B and D). Therefore, assessment monitoring continued in 2019.

The statistical data comparison for the third (April 2019) and fourth (September 2019) semiannual assessment monitoring events continue to indicate that no Appendix IV constituents were present at statistically significant levels exceeding the GWPSs (Appendix E and F).

Per §257.95(e), Consumers Energy can return to detection monitoring at the Dry Ash Landfill if the concentrations of all of the Appendix III and IV constituents are at or below background values for two consecutive events, using the statistical procedures included in §257.93(g). As

shown on Table 4, several Appendix III and Appendix IV constituents are above the background upper tolerance limits (UTLs). Therefore, Consumers Energy will continue semiannual assessment monitoring per §257.95(d).

Section 4
Corrective Action

There were no corrective actions needed or performed for the Dry Ash Landfill within the calendar year 2019. The semiannual assessment monitoring analysis completed to-date indicate that no Appendix IV constituents are present at statistically significant levels exceeding the GWPSs. Therefore, Consumers Energy has continued semiannual assessment monitoring at the Dry Ash Landfill per §257.95(d) and will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Section 5
Conclusions and Recommendations

Assessment monitoring groundwater samples are collected semiannually from the groundwater monitoring system wells and analyzed for Appendix III and Appendix IV constituents pursuant to §257.95(d). The semiannual assessment monitoring analysis completed to-date, as of the writing of this report, indicate that no Appendix IV constituents are present at statistically significant levels exceeding the GWPSs. Therefore, Consumers Energy has continued semiannual assessment monitoring at the Dry Ash Landfill.

Per §257.95(e), Consumers Energy can return to detection monitoring at the Dry Ash Landfill if the concentrations of all of the Appendix III and IV constituents are at or below background values for two consecutive events, using the statistical procedures included in §257.93(g). Several Appendix III and Appendix IV constituents remain above the background levels. Therefore, Consumers Energy will continue semiannual assessment monitoring per §257.95(d) and will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

The next semiannual monitoring events are tentatively scheduled for the second and fourth calendar quarter of 2020.

Section 6
References

ARCADIS. May 13, 2016. Summary of Monitoring Well Design, Installation, and Development – Existing CCR Landfill (Cells 1, 2, 3 and 4). JH Campbell Electric Generation Facility – West Olive, Michigan. Prepared for Consumers Energy Company.

ARCADIS. May 18, 2016. Electric Generation Facilities RCRA CCR Detection Monitoring Program. JH Campbell Monitoring Program Sample and Analysis Plan, West Olive, Michigan. Prepared for Consumers Energy Company.

Consumers Power Company. September 1996. Hydrogeological Monitoring Plan for JH Campbell Ash Storage Facility, Consumers Power Company, Solid Waste Disposal Area, Coal Ash, Type III

TRC Environmental Corporation. October 2017. Groundwater Statistical Evaluation Plan – JH Campbell Power Plant, Dry Ash Landfill, West Olive, Michigan. Prepared for Consumers Energy Company.

TRC Environmental Corporation. October 15, 2018. Groundwater Protection Standards, Consumers Energy, JH Campbell Site, Dry Ash Landfill CCR Unit, technical memorandum prepared for Consumers Energy Company.

TRC Environmental Corporation. January 2019. 2018 Annual Groundwater Monitoring Report, Consumers Energy, JH Campbell Site, Dry Ash Landfill CCR Unit, West Olive, Michigan. Prepared for Consumers Energy Company.

USEPA. 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance. Office of Conservation and Recovery. EPA 530/R-09-007.

USEPA. April 2015. 40 CFR Parts 257 and 261. Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule. 80 Federal Register 74 (April 17, 2015), pp. 21301-21501 (80 FR 21301).

USEPA. July 2018. 40 CFR Part 257. Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities; Amendments to the National Minimum Criteria (Phase One, Part One); Final Rule. 83 Federal Register 146 (July 30, 2018), pp. 36435-36456 (83 FR 36435).

USEPA. April 2018. Barnes Johnson (Office of Resource Conservation and Recovery) to James Roewer (c/o Edison Electric Institute) and Douglas Green, Margaret Fawal (Venable LLP). Re: Coal Combustion Residuals Rule Groundwater Monitoring

Requirements. April 30, 2018. United States Environmental Protection Agency, Washington, D.C. 20460. Office of Solid Waste and Emergency Response, now the Office of Land and Emergency Management.

Tables

Table 1

Summary of Groundwater Elevation Data – April 2019 - October 2019

JH Campbell – RCRA CCR Monitoring Program

West Olive, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Elevation (ft)			April 22, 2019		October 7, 2019	
							Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background										
JHC-MW-15023	617.01	619.98	Sand	603.0	to	593.0	15.40	604.58	15.85	604.13
JHC-MW-15024	613.79	616.62	Sand	606.8	to	596.8	10.55	606.07	11.15	605.47
JHC-MW-15025	614.14	617.17	Sand	607.1	to	597.1	9.64(2)	607.53	10.08	607.09
JHC-MW-15026	615.09	618.04	Sand	607.1	to	597.1	11.63	606.41	11.88	606.16
JHC-MW-15027	614.77	617.30	Sand	604.8	to	594.8	12.11	605.19	12.42	604.88
JHC-MW-15028	611.02	613.80	Sand	603.0	to	593.0	12.08	601.72	12.00	601.80
JHC-MW-15029	608.08	610.95	Sand	600.1	to	590.1	9.83	601.12	9.50	601.45
JHC-MW-15030	604.05	607.17	Sand	600.1	to	590.1	8.21	598.96	7.75	599.42
Pond 1N, 1S, 2N, 2S										
JHC-MW-15001	607.02	609.53	Sand	603.5	to	598.5	11.42	598.11	11.10	598.43
JHC-MW-15002	618.18	621.27	Sand	590.2	to	580.2	23.77	597.50	23.49	597.78
JHC-MW-15003	623.16	627.20	Sand	595.2	to	585.2	32.28	594.92	32.05	595.15
JHC-MW-15005	606.22	609.99	Sand	579.2	to	569.2	17.90	592.09	17.78	592.21
JHC-MW-18004	602.92	605.72	Sand	596.9	to	586.9	11.34	594.38	10.98	594.74
JHC-MW-18005	600.30	603.16	Sand	595.3	to	585.3	10.09	593.07	10.01	593.15
Pond 3N, 3S										
JHC-MW-15013	632.40	635.25	Sand	604.4	to	594.4	34.47	600.78	34.00	601.25
JHC-MW-15015	632.46	635.20	Sand	604.5	to	594.5	33.68	601.52	33.20	602.00
JHC-MW-15016	631.81	632.52	Sand	603.8	to	593.8	30.90	601.62	30.54	601.98
JHC-MW-18001	609.09	611.98	Sand	603.1	to	593.1	11.03	600.95	10.62	601.36
JHC-MW-18002	605.53	608.93	Sand	602.0	to	592.0	8.27	600.66	7.94	600.99
JHC-MW-18003	605.36	608.78	Sand	601.9	to	591.9	8.26	600.52	7.80	600.98
Landfill										
JHC-MW-15017	613.69	616.61	Sand	603.7	to	593.7	13.71	602.90	13.58	603.03
JHC-MW-15018	614.26	617.02	Sand	604.3	to	594.3	14.43	602.59	14.43	602.59
JHC-MW-15019	609.81	612.86	Sand	603.8	to	593.8	10.80	602.06	11.00	601.86
JHC-MW-15022	620.92	623.79	Sand	597.9	to	587.9	27.51	596.28	27.72	596.07
JHC-MW-15031	632.94	635.87	Sand	599.9	to	589.9	42.03	593.84	42.35	593.52
JHC-MW-15032	611.32	614.29	Sand	598.3	to	588.3	15.61	598.68	15.71	598.58
JHC-MW-15033	618.08	620.99	Sand	602.1	to	592.1	20.22	600.77	20.42	600.57
JHC-MW-15034	612.90	615.97	Sand	601.9	to	591.9	14.38	601.59	14.15	601.82
JHC-MW-15035	632.53	634.28	Sand	599.5	to	589.5	39.32	594.96	39.78	594.50
JHC-MW-15036	617.94	618.34	Sand	597.9	to	587.9	25.62	592.72	25.90	592.44
JHC-MW-15037	614.28	616.06	Sand	591.3	to	586.3	24.20	591.86	24.35	591.71
Pond A										
JHC-MW-15006	624.74	627.58	Sand	599.7	to	589.7	33.66	593.92	34.00	593.58
JHC-MW-15007	624.82	627.70	Sand	602.8	to	592.8	33.98	593.72	34.29	593.41
JHC-MW-15008	632.43	635.30	Sand	604.4	to	594.4	Dry		Decommissioned	
JHC-MW-15008R(3)	632.32	634.67	Sand	597.3	to	587.3	NA	NA	41.98	592.69
JHC-MW-15009	632.33	635.32	Sand	602.3	to	592.3	41.60	593.72	42.28	593.04
JHC-MW-15010	632.55	635.57	Sand	602.6	to	592.6	41.10	594.47	41.90	593.67
JHC-MW-15011	627.71	630.83	Sand	600.7	to	590.7	37.85	592.98	37.85	592.98

Notes:

Survey conducted by Nederveld, November 2015, October 2018, December 2018, and August 2019.

Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).

TOC: Top of well casing.

--: Not measured

NR: Not recorded

NA: Not Applicable

(1): The static water level for PZ-24S was taken on April 24, 2019.

(2): The static water level for JHC-MW-15025 was taken on April 23, 2019.

(3): JHC-MW-15008R installed in June 2019.

Table 2

Summary of Field Parameter Results – April 2019 - October 2019

JH Campbell Dry Ash Landfill – RCRA CCR Monitoring Program

West Olive, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Background							
JHC-MW-15023	4/23/2019	2.21	79.5	5.9	106	8.8	10.0
	10/8/2019	0.49	106.0	6.2	97	10.4	4.8
JHC-MW-15024	4/23/2019	1.56	73.7	7.2	321	7.3	3.9
	10/8/2019	0.61	25.3	7.4	261	11.8	3.0
JHC-MW-15025	4/23/2019	7.47	70.1	6.7	140	6.8	14.6
	10/8/2019	2.15	9.8	8.1	370	11.7	2.2
JHC-MW-15026	4/22/2019	5.02	55.8	6.9	136	10.0	7.6
	10/7/2019	3.70	110.5	7.3	140	11.5	11.6
JHC-MW-15027	4/22/2019	5.99	61.0	6.5	79	9.1	8.9
	10/7/2019	4.75	134.6	6.3	70	11.4	3.5
JHC-MW-15028	4/22/2019	7.60	48.0	7.6	81	9.6	5.0
	10/7/2019	6.37	84.5	7.2	87	14.2	3.9
Dry Ash Landfill							
JHC-MW-15017	4/23/2019	3.39	66.1	6.1	877	9.3	5.8
	10/8/2019	1.00	135.0	6.3	654	14.3	0.8
JHC-MW-15018	4/23/2019	2.72	67.8	6.4	524	9.6	6.0
	10/8/2019	2.60	116.1	6.0	465	14.4	0.8
JHC-MW-15019	4/23/2019	6.30	79.0	6.5	315	8.6	5.5
	10/8/2019	4.81	140.3	6.4	281	15.8	0.4
JHC-MW-15022	4/24/2019	5.97	71.7	7.0	665	10.4	4.7
	10/9/2019	5.19	89.0	7.0	744	11.2	2.4
JHC-MW-15031	4/24/2019	1.33	51.9	6.9	480	13.4	3.3
	10/9/2019	0.69	97.0	6.9	471	13.4	0.5

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

SU - Standard units

umhos/cm - Micromhos per centimeter.

°C - Degrees Celcius

NTU - Nephelometric Turbidity Unit.

Table 2

Summary of Field Parameter Results – April 2019 - October 2019

JH Campbell Dry Ash Landfill – RCRA CCR Monitoring Program

West Olive, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Dry Ash Landfill							
JHC-MW-15032	4/24/2019	3.78	47.0	6.3	79	7.4	2.1
	10/8/2019	0.70	128.8	6.3	73	11.5	0.7
JHC-MW-15033	4/24/2019	4.68	65.6	6.7	84	8.8	8.5
	10/8/2019	2.18	100.3	6.9	100	11.1	0.6
JHC-MW-15034	4/24/2019	6.31	95.0	5.9	57	7.7	19.7
	10/8/2019	5.51	138.5	6.1	65	12.0	0.5
JHC-MW-15035	4/24/2019	1.20	60.3	7.2	615	15.2	11.1
	6/21/2019	0.56	49.0	7.1	474	15.9	1.6
	10/9/2019	0.43	69.0	7.2	600	14.8	3.8
JHC-MW-15036	4/24/2019	2.23	46.9	7.4	387	11.4	66.7
	10/8/2019	1.19	76.0	7.5	430	13.9	1.0
JHC-MW-15037	4/24/2019	3.65	55.0	7.3	463	11.4	4.9
	10/8/2019	2.10	70.5	7.3	669	12.0	2.0

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

SU - Standard units

umhos/cm - Micromhos per centimeter.

°C - Degrees Celcius

NTU - Nephelometric Turbidity Unit.

Table 3
Summary of Background Well Groundwater Sampling Results (Analytical): April 2019 - October 2019
JH Campbell Background – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	**JHC-MW-15023**		**JHC-MW-15024**		**JHC-MW-15025**		**JHC-MW-15026**		**JHC-MW-15027**		**JHC-MW-15028**	
					Sample Date:	4/23/2019	10/8/2019	4/23/2019	10/8/2019	4/23/2019	10/8/2019	4/22/2019	10/7/2019	4/22/2019	10/7/2019	4/22/2019	10/7/2019
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	Background													
Appendix III																			
Boron	ug/L	NC	500	500	7,200	54	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50
Calcium	mg/L	NC	NC	NC	500	9.5	9.5	29	29	13	23	12	13	7.4	7.9	10	10		
Chloride	mg/L	250**	250	250	500	3.1	3.7	30	13	11	35	8.8	5.4	2.0	< 2.0	< 2.0	< 2.0		
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000		
Sulfate	mg/L	250**	250	250	500	12	12	7.5	7.5	8.5	10	8.6	8.4	7.5	12	5.5	5.5		
Total Dissolved Solids	mg/L	500**	500	500	500	75	91	180	270	75	210	140	100	< 50	62	< 50	76		
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	**5.9**	**6.2**	7.2	7.4	6.7	8.1	6.9	7.3	6.5	**6.3**	7.6	7.2		
Appendix IV																			
Antimony	ug/L	6	6.0	6.0	130	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		
Arsenic	ug/L	10	10	10	10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		
Barium	ug/L	2,000	2,000	2,000	820	22	21	17	16	20	8.6	14	11	23	39	5.4	7.2		
Beryllium	ug/L	4	4.0	4.0	18	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		
Cadmium	ug/L	5	5.0	5.0	3.5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20		
Chromium	ug/L	100	100	100	11	< 1.0	1.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	3.6		
Cobalt	ug/L	NC	40	100	100	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0		
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000		
Lead	ug/L	NC	4.0	4.0	39	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		
Lithium	ug/L	NC	170	350	440	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10		
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20		
Molybdenum	ug/L	NC	73	210	3,200	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0		
Radium-226	pCi/L	NC	NC	NC	NC	0.108	< 0.147	< 0.0821	0.173	< 0.0726	< 0.124	< 0.0974	0.139	< 0.103	0.249	< 0.0933	0.125		
Radium-228	pCi/L	NC	NC	NC	NC	< 0.355	< 0.390	< 0.349	0.379	< 0.353	< 0.348	< 0.355	< 0.387	< 0.340	< 0.348	< 0.308	< 0.349		
Radium-226/228	pCi/L	5	NC	NC	NC	< 0.355	< 0.390	< 0.349	0.552	< 0.353	0.381	< 0.355	< 0.387	< 0.340	0.394	< 0.308	< 0.349		
Selenium	ug/L	50	50	50	5.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		
Thallium	ug/L	2	2.0	2.0	3.7	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0		

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR), April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 180 mg CaCO3/L as measured at surface water sample SW-01 collected on April 9, 2018 from the Pigeon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

Table 4
Summary of Groundwater Sampling Results (Analytical): April 2019 - October 2019
JH Campbell Dry Ash Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15017		JHC-MW-15018		JHC-MW-15019		JHC-MW-15022			JHC-MW-15031		JHC-MW-15032	
						Sample Date:	4/23/2019	10/8/2019	4/23/2019	10/8/2019	4/23/2019	10/8/2019	4/24/2019	6/21/2019	10/9/2019	4/24/2019	10/9/2019	4/24/2019	10/8/2019
Constituent	Unit	UTL	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient												
Appendix III																			
Boron	ug/L	51	NC	500	500	7,200	340	350	130	170	150	150	360	--	330	79	85	< 50	58
Calcium	mg/L	46	NC	NC	NC	500	81	77	58	48	45	34	110	--	130	59	57	9.4	7.9
Chloride	mg/L	43	250**	250	250	500	120	60	43	44	14	6.0	2.7	--	< 2.0	24	28	2.6	2.3
Fluoride	ug/L	1,000	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	14	250**	250	250	500	100	92	61	84	25	23	37	--	37	25	26	11	12
Total Dissolved Solids	mg/L	258	**500****	**500**	**500**	**500**	**520**	280	320	370	200	280	410	--	**540**	280	220	53	68
pH, Field	SU	4.8 - 9.2	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	**6.1**	**6.3**	**6.4**	**6.0**	6.5	**6.4**	7.0	7.1	7.0	6.9	6.9	**6.3**	**6.3**
Appendix IV																			
Antimony	ug/L	2	6	6.0	6.0	130	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	1	10	10	10	10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	35	2,000	2,000	2,000	820	70	47	80	130	46	58	23	--	26	14	17	8.3	7.9
Beryllium	ug/L	1	4	4.0	4.0	18	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	0.2	5	5.0	5.0	3.5	0.57	0.24	< 0.20	0.29	< 0.20	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	2	**100**	**100**	**100**	**11**	**12**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**82**	2.2(1)	5.9	5.4	1.9	< 1.0	< 1.0
Cobalt	ug/L	15	NC	40	100	100	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	--	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	1,000	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	1	NC	4.0	4.0	39	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	10	NC	170	350	440	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	0.2	2	2.0	2.0	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	5	NC	73	210	3,200	11	10	< 5.0	< 5.0	12	16	7.2	--	5.2	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NA	NC	NC	NC	NC	0.176	0.259	0.217	0.348	0.124	0.187	< 0.0968	--	0.190	0.102	0.199	< 0.118	0.157
Radium-228	pCi/L	NA	NC	NC	NC	NC	0.827	0.384	< 0.476	0.390	< 0.465	< 0.295	< 0.505	--	< 0.480	< 0.427	0.600	< 0.395	< 0.347
Radium-226/228	pCi/L	1.93	5	NC	NC	NC	1.00	0.643	< 0.476	0.739	< 0.465	0.327	< 0.505	--	< 0.480	0.466	0.798	< 0.395	0.427
Selenium	ug/L	5	50	50	50	**5.0**	**16**	**14**	**12**	**15**	**11**	**11**	**7.2**	--	**6.4**	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	2	2.0	2.0	3.7	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NC - no criteria.
-- - not analyzed.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR), April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 180 mg CaCO3/L as measured at surface water sample SW-01 collected on April 9, 2018 from the Pigeon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.
Indicates that the concentration in one or more wells exceeds the background level. If concentrations of all Appendix III and Appendix IV constituents are below the background level for two consecutive events, the unit may return to detection monitoring.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.
(1) - Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table 4
Summary of Groundwater Sampling Results (Analytical): April 2019 - October 2019
JH Campbell Dry Ash Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15033		JHC-MW-15034		JHC-MW-15035			JHC-MW-15036		JHC-MW-15037	
						Sample Date:	4/24/2019	10/8/2019	4/24/2019	10/8/2019	4/24/2019	6/21/2019	10/9/2019	4/24/2019	10/8/2019	4/24/2019	10/8/2019
Constituent	Unit	UTL	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient										
Appendix III																	
Boron	ug/L	51	NC	500	500	7,200	< 50	51	51	68	91	--	78	80	71	150	280
Calcium	mg/L	46	NC	NC	NC	500	10	11	5.4	5.4	98	--	84	50	55	73	110
Chloride	mg/L	43	250**	250	250	500	< 2.0	2.6	2.1	< 2.0	23	--	24	14	13	6.3	4.4
Fluoride	ug/L	1,000	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	14	250**	250	250	500	9.5	12	12	15	24	--	25	19	24	22	46
Total Dissolved Solids	mg/L	258	**500****	**500**	**500**	**500**	58	71	< 50	54	360	--	370	220	320	270	400
pH, Field	SU	4.8 - 9.2	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	6.7	6.9	**5.9**	**6.1**	7.2	7.1	7.2	7.4	7.5	7.3	7.3
Appendix IV																	
Antimony	ug/L	2	6	6.0	6.0	130	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	1	10	10	10	10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	35	2,000	2,000	2,000	820	< 5.0	5.4	5.5	6.5	17	--	16	8.4	9.4	9.7	14
Beryllium	ug/L	1	4	4.0	4.0	18	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	0.2	5	5.0	5.0	3.5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	2	**100**	**100**	**100**	**11**	< 1.0	< 1.0	1.2	< 1.0	**290**	1.8(1)	4.4	< 1.0	< 1.0	1.7	1.2
Cobalt	ug/L	15	NC	40	100	100	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	--	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	1,000	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	1	NC	4.0	4.0	39	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	10	NC	170	350	440	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	0.2	2	2.0	2.0	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	5	NC	73	210	3,200	< 5.0	< 5.0	< 5.0	< 5.0	11	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NA	NC	NC	NC	NC	< 0.0696	0.167	< 0.0948	0.133	< 0.101	--	0.203	< 0.0882	0.160	< 0.0813	0.232
Radium-228	pCi/L	NA	NC	NC	NC	NC	< 0.306	< 0.333	< 0.381	< 0.384	< 0.357	--	< 0.567	< 0.384	< 0.441	< 0.342	< 0.518
Radium-226/228	pCi/L	1.93	5	NC	NC	NC	< 0.306	< 0.333	< 0.381	< 0.384	< 0.357	--	< 0.567	< 0.384	0.442	0.403	< 0.518
Selenium	ug/L	5	50	50	50	**5.0**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0	< 1.0	1.9	3.8	**16**
Thallium	ug/L	2	2	2.0	2.0	3.7	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NC - no criteria.
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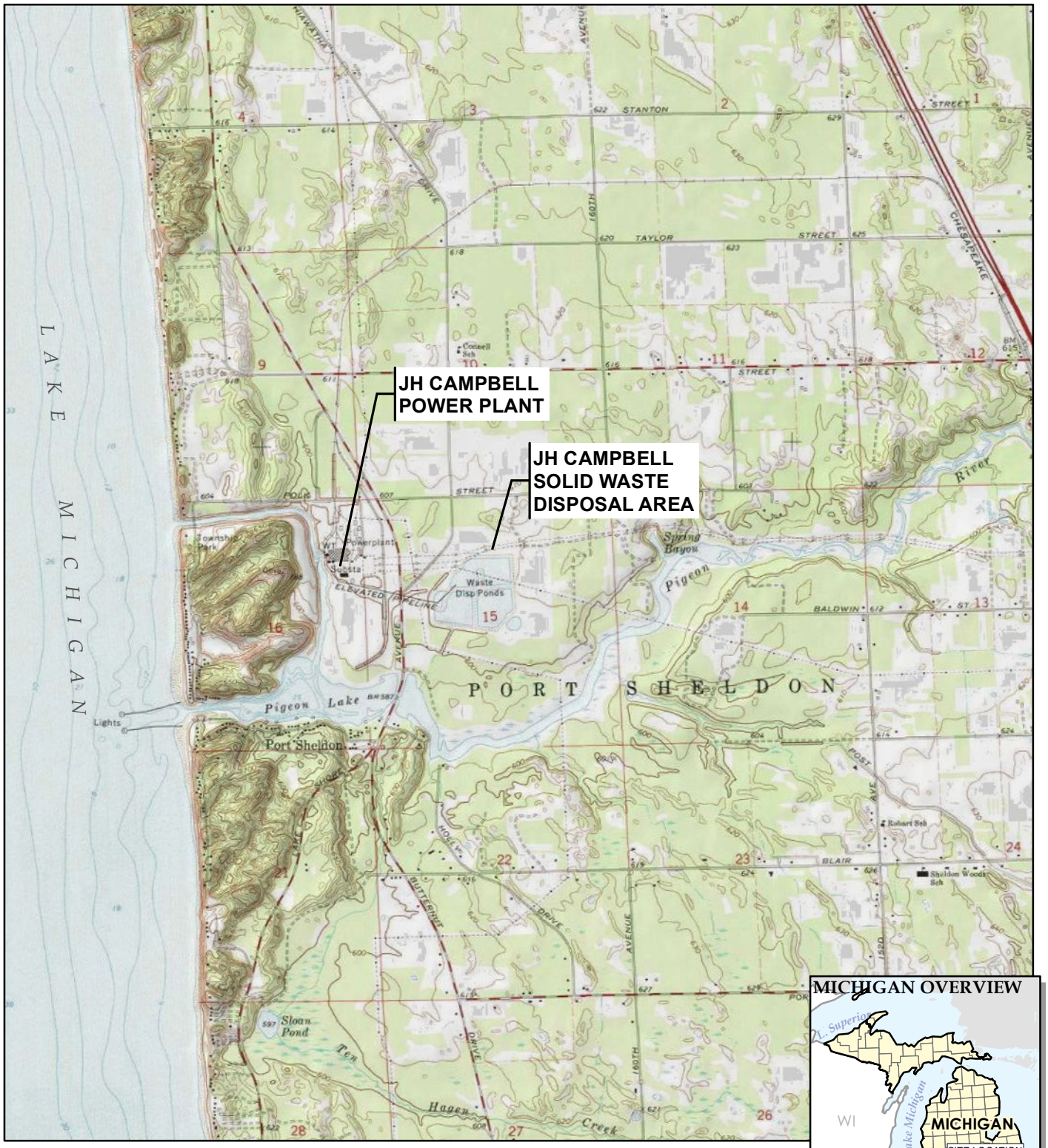
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR), April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 180 mg CaCO3/L as measured at surface water sample SW-01 collected on April 9, 2018 from the Pigeon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.
Indicates that the concentration in one or more wells exceeds the background level. If concentrations of all Appendix III and Appendix IV constituents are below the background level for two consecutive events, the unit may return to detection monitoring.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.
(1) - Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Figures



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

1 " = 3,000 '
1:36,000

0 3,000 6,000
FEET

TRC

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PROJECT:

CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:

SITE LOCATION MAP

DRAWN BY:	S. MAJOR
CHECKED BY:	B. YELEN
APPROVED BY:	S. HOLMSTROM
DATE:	JANUARY 2020
PROJ. NO.:	322174
FILE:	322174-001-022.mxd

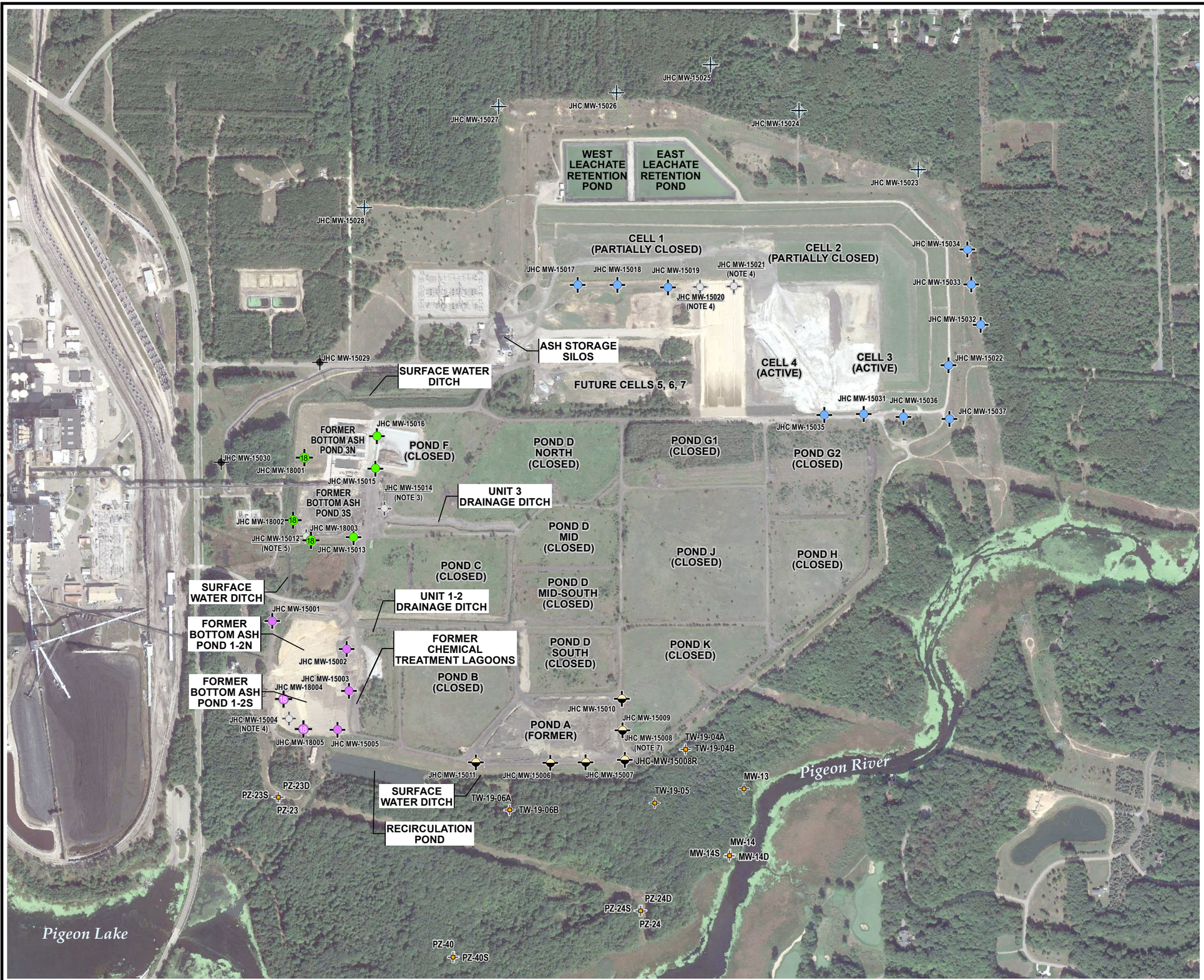
FIGURE 1

E:\ConsumersEnergy\CCR_GW\2017_269767\322174-001-022.mxd -- Saved By: SMAJOR on 1/24/2020, 08:49:03 AM

TRC - GIS

Plot Date: 1/24/2020, 08:54:43 AM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\322174-001-030.mxd

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0



LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADIENT LANDFILL MONITORING WELL
- DOWNGRADIENT POND A MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- DECOMMISSIONED MONITORING WELL
- NEW DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2018)
- NEW DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL (2018)
- NATURE AND EXTENT WELL

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH 12/07/2018.
3. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
4. MONITORING WELL DECOMMISSIONED JUNE 14, 2018.
5. MONITORING WELL DECOMMISSIONED OCTOBER 10, 2018.
6. JHC-MW-1800X MONITORING WELLS INSTALLED IN DECEMBER 2018.
7. MONITORING WELL DECOMMISSIONED JUNE 24, 2019.
8. JHC-MW-15008R AND TW-19-XX MONITORING WELLS INSTALLED IN JUNE 2019.

0 700 1,400 Feet

1 " = 700 '
1:8,400

PROJECT:
CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:
SITE PLAN
WITH CCR MONITORING WELL LOCATIONS

DRAWN BY:	S. MAJOR	PROJ NO.:	322174-001
CHECKED BY:	B. YELEN		
APPROVED BY:	S. HOLMSTROM		**FIGURE 2**
DATE:	JANUARY 2020		

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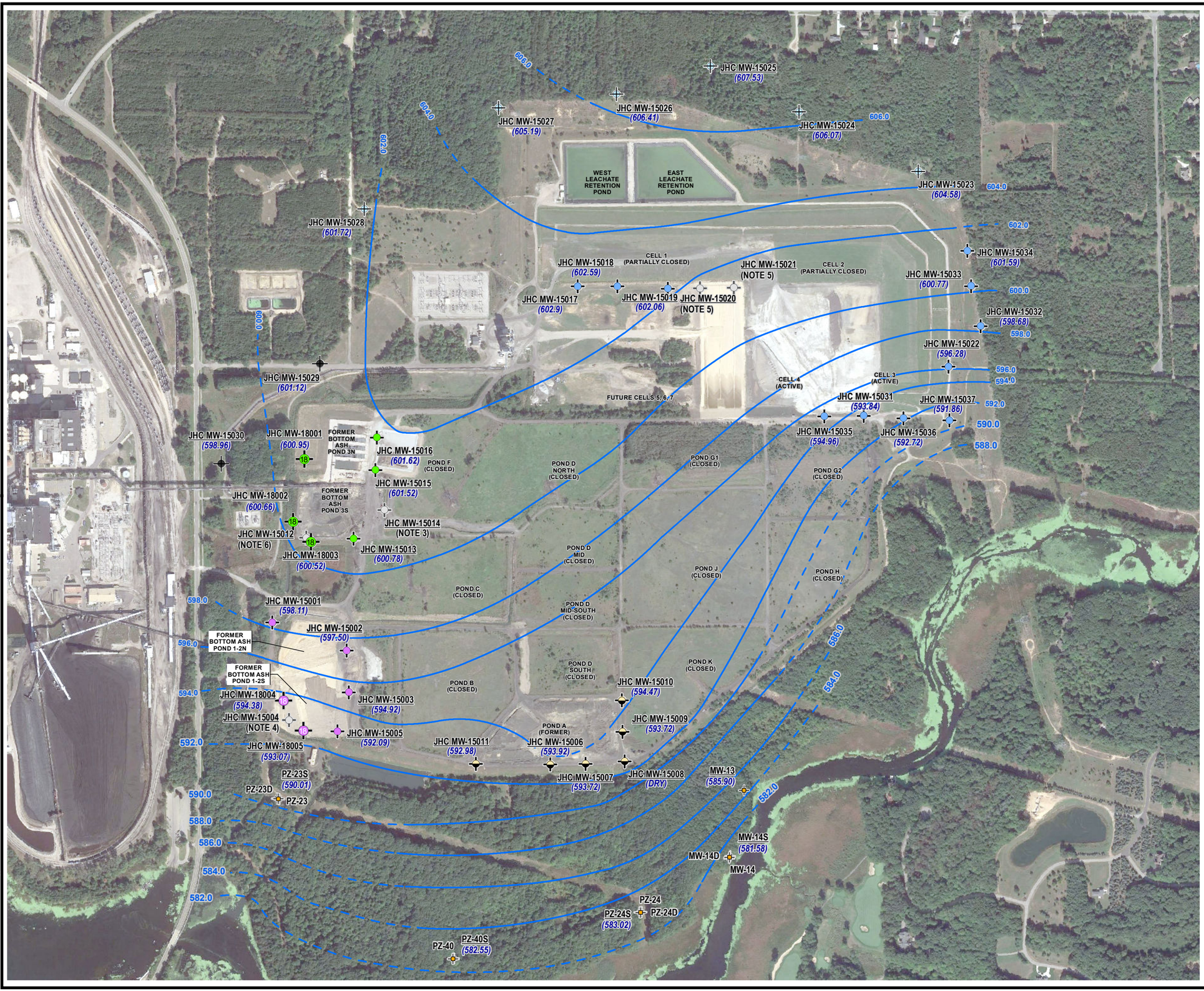
FILE NO.: 322174-001-030.mxd



LEGEND

- BACKGROUND MONITORING WELL
- DECOMMISSIONED MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADIENT LANDFILL MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- POND A MONITORING WELL
- NEW DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2018)
- NEW DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL (2018)
- NATURE AND EXTENT WELLS
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- *(600.97)* GROUNDWATER ELEVATION (FEET)

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH 12/07/2018.
3. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
4. MONITORING WELL DECOMMISSIONED JUNE 14, 2018.
5. MONITORING WELL DECOMMISSIONED OCTOBER 10, 2018.
6. JHC-MW-1800X MONITORING WELLS INSTALLED IN DECEMBER 2018.
7. GROUNDWATER ELEVATIONS DISPLAYED IN FEET RELATIVE TO THE NORTH AMERICAN VERTICAL DATUM OF 1988.

N

0 700 1,400 Feet

1 " = 700 '

1:8,400

PROJECT:
CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:
GROUNDWATER CONTOUR MAP APRIL 2019

DRAWN BY:	S. MAJOR	PROJ NO.:	322174-001
CHECKED BY:	B. YELEN		
APPROVED BY:	S. HOLMSTROM		**FIGURE 3**
DATE:	JANUARY 2020		

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FILE NO.: 322174-001-024.mxd

Plot Date: 12/8/2019, 16:11:01 PM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\322174-001-024.mxd
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0
TRC - GIS

TRC - GIS

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

Plot Date: 1/24/2020, 09:03:03 AM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\322174-001-029.mxd

WEST LEACHATE RETENTION POND
EAST LEACHATE RETENTION POND
CELL 1 (PARTIALLY CLOSED)
CELL 2 (PARTIALLY CLOSED)
CELL 4 (ACTIVE)
CELL 3 (ACTIVE)
FUTURE CELLS 5, 6, 7
POND F (CLOSED)
POND D NORTH (CLOSED)
POND G1 (CLOSED)
POND G2 (CLOSED)
POND D MID (CLOSED)
POND J (CLOSED)
POND H (CLOSED)
POND C (CLOSED)
POND D MID-SOUTH (CLOSED)
POND D SOUTH (CLOSED)
POND K (CLOSED)
POND B (CLOSED)
POND A (FORMER)
FORMER BOTTOM ASH POND 3N
FORMER BOTTOM ASH POND 3S
FORMER BOTTOM ASH POND 1-2N
FORMER BOTTOM ASH POND 1-2S
Pigeon Lake
Pigeon River

JHC-MW-15025 (607.09)
JHC-MW-15026 (606.16)
JHC-MW-15027 (604.88)
JHC-MW-15024 (605.47)
JHC-MW-15023 (604.13)
JHC-MW-15028 (601.80)
JHC-MW-15034 (601.82)
JHC-MW-15033 (600.57)
JHC MW-15021 (NOTE 4)
JHC-MW-15017 (603.03)
JHC-MW-15018 (602.59)
JHC-MW-15019 (601.86)
JHC MW-15020 (NOTE 4)
JHC-MW-15032 (598.58)
JHC-MW-15029 (601.45)
JHC-MW-15022 (596.07)
JHC-MW-15035 (594.50)
JHC-MW-15031 (593.52)
JHC-MW-15036 (592.44)
JHC-MW-15037 (591.71)
JHC-MW-15016 (601.98)
JHC-MW-18001 (601.36)
JHC-MW-15030 (599.42)
JHC-MW-15015 (602.00)
JHC-MW-18002 (600.99)
JHC-MW-15014 (NOTE 3)
JHC-MW-18003 (600.98)
JHC-MW-15013 (601.25)
JHC MW-15012 (NOTE 5)
JHC-MW-15001 (598.43)
JHC-MW-15002 (597.78)
JHC-MW-18004 (594.74)
JHC-MW-15003 (595.15)
JHC-MW-15010 (593.67)
JHC-MW-15004 (NOTE 4)
JHC-MW-18005 (593.15)
JHC-MW-15005 (592.21)
JHC-MW-15009 (593.04)
JHC-MW-15011 (592.98)
JHC-MW-15006 (593.58)
JHC-MW-15007 (593.41)
JHC-MW-15008R (592.69)
TW-19-04B
TW-19-04A (590.01)
JHC MW-15008 (NOTE 7)
MW-13 (Dry)
PZ-23D
PZ-23
PZ-23S (590.19)
TW-19-06B
TW-19-06A (590.26)
TW-19-05 (591.29)
MW-14S (579.64)
MW-14D
MW-14
PZ-24D
PZ-24
PZ-24S (583.02)
PZ-40S (583.66)
PZ-40

606.0 604.0 602.0 600.0 598.0 596.0 594.0 592.0 590.0 588.0 586.0 584.0 580.0

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADIENT LANDFILL MONITORING WELL
- DOWNGRADIENT POND A MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- DECOMMISSIONED MONITORING WELL
- NEW DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2018)
- NEW DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL (2018)
- NATURE AND EXTENT WELL
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- (600.97) GROUNDWATER ELEVATION (FEET) SHALLOW WELLS

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH 12/07/2018.
3. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
4. MONITORING WELL DECOMMISSIONED JUNE 14, 2018.
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7. MONITORING WELL DECOMMISSIONED JUNE 24, 2019.
8. JHC-MW-15008R AND TW-19-XX MONITORING WELLS INSTALLED IN JUNE 2019.

N

0 700 1,400 Feet

1 " = 700 '
1:8,400

PROJECT:
CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:
GROUNDWATER CONTOUR MAP OCTOBER 2019

DRAWN BY:	M. VAPHIADIS	PROJ NO.:	322174-001
CHECKED BY:	B. YELEN		
APPROVED BY:	S. HOLMSTROM		**FIGURE 4**
DATE:	JANUARY 2020		

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FILE NO.: 322174-001-029.mxd

Appendix A
Monitoring Well Installation & Decommissioning Logs

WELL CONSTRUCTION LOG

WELL NO. JHC MW-15008R

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
Consumers Energy Company: JH Campbell	6/24/19	6/25/19	322174.0002

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns Drilling	Direct Push/HSA	632.3	634.67	45.0	2/8

Boring Location: Southeast of Pond A.

N: 517558.9 E: 12636031.7

Personnel
Logged By - Paula Lancaster
Driller - Roger Christiansen

Drilling Equipment: Geoprobe 7822 DT

Civil Town/City/or Village:	County:	State:
West Olive	Ottawa	MI

Water Level Observations:
While Drilling: Date/Time 6/24/19 14:50 ▽ Depth (ft bgs) 38.8
After Drilling: Date/Time 6/25/19 08:45 ▼ Depth (ft bgs) 38.8

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
			0	**FILL** mostly ash and gravel.				
1 GP	66			**SAND** mostly fine sand, light yellowish brown (10YR 6/4), dry, loose.				Soil boring reamed to a depth of 47 feet below ground surface using 4.25 inch hollow stem augers prior to well installation.
				Changes to some gravel at 3.5 feet below ground surface. Changes to no gravel at 3.7 feet below ground surface. Changes to yellowish brown (10YR 5/4), moist at 3.8 feet below ground surface.				
2 GP	80		5					
				Changes to few to little gravel, brown (10YR 5/3) at 7.5 feet below ground surface.				
3 GP	100		10	Changes to no gravel, yellowish brown (10YR 5/6) at 10.0 feet below ground surface.	SP			
4 GP	100		15					
5 GP	70		20					

SOIL BORING WELL CONSTRUCTION LOG 322174.0002.0000.GPJ TRC_CORP_INCHES.GDT 10/11/19

Signature: Paula C Lancaster

Checked By: Jennifer Reed

Firm: TRC
1540 Eisenhower Place Ann Arbor, Michigan
734-971-7080
Fax 734-971-9022

WELL CONSTRUCTION LOG

WELL NO. JHC MW-15008R

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
6 GP	73			Changes to fine to medium sand, dark yellowish brown (10YR 6/6) at 27.0 feet below ground surface.	SP			
				Changes to brown (10YR 4/3) with staining at 28.25 feet below ground surface.				
				Changes to medium sand, few coarse sand, dark yellowish brown (10YR 4/6) at 28.6 feet below ground surface.				
			30	**SAND** mostly medium sand, little coarse sand, few fine sand, little fine gravel, dark yellowish brown (10YR 4/6), dry, loose.				
7 GP	73			Changes to mostly medium sand, few fine sand, few coarse sand, trace fine gravel at 32.5 feet below ground surface.				
				Changes to mostly fine sand, trace medium to coarse sand, light yellowish brown (10YR 6/4) at 34.0 feet below ground surface.				
			35					
8 GP	65							
					SW			
				Changes to mostly medium sand, trace to few coarse sand, trace fine gravel, wet at 39.25 feet below ground surface.				
			40	Changes to mostly fine to medium sand at 39.5 feet below ground surface.				
9 GP	65			Changes to mostly medium sand, trace coarse sand, trace fine sand, dark brown (10YR 4/6), loose at 40.0 feet below ground surface.				
			45					
10 AU	0			Soil boring blind drilled from 45.0 to 47.0 feet below ground surface using hollow stem augers.				
				End of boring at 47.0 feet below ground surface.				
			50					
			55					

SOIL BORING WELL CONSTRUCTION LOG 322174.0002.0000.GPJ TRC_CORP_INCHES.GDT 10/11/19

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC JHC RAP Area 2019 Work		WELL ID:	**JHC MW-15008R**
PROJ. NO: 322174.0002	DATE INSTALLED: 6/25/2019 INSTALLED BY: Stearns/P. Lancaster	CHECKED BY:	B. Yelen

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
634.67	2.4	TOP OF CASING
632.3	0.0	GROUND SURFACE
	2.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: BENTONITE SLURRY
		GROUT/BACKFILL METHOD: TREMIE
37.4	30.6	GROUT
		BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	33.1	BENTONITE SEAL
599.7	35.0	TOP OF SCREEN
		FILTER PACK MATERIAL: #5 WASHED SAND
10.0		
589.7	45.0	BOTTOM OF SCREEN
	NA	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NATURAL COLLAPSE
587.7	47.0	HOLE BOTTOM

RISER PIPE LENGTH

SCREEN LENGTH

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 8 IN. FROM 0 TO 47 FT.
____ IN. FROM ____ TO ____ FT.

SURF. CASING DIAMETER: 4 IN. FROM 0 TO 2.5 FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 1 HOURS

WATER REMOVED: 100 GALLONS

WATER ADDED: 5 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: Turbid

COLOR BEFORE: yellowish brown

CLARITY AFTER: None

COLOR AFTER: None

ODOR (IF PRESENT): None

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	45.00	T/PVC	6/25/2019	8:45
DTB AFTER DEVELOPING:	45.00	T/PVC	6/26/2019	9:35
SWL BEFORE DEVELOPING:	38.80	T/PVC	6/25/2019	8:45
SWL AFTER DEVELOPING:	38.70	T/PVC	6/26/2019	9:35
OTHER SWL:		T/PVC		
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER:

REVISED 11/2013

MONITORING WELL DECOMMISSIONING LOG

PROJECT NAME: Consumers Energy Company: JH Campbell		**MONITORING WELL ID:** JHC-MW-15008	
PROJECT NUMBER: 322174.0002	DATE: 06/24/2019	LOCATION: Southeast of Pond A.	LOCATION COORDINATES: N: 517560.39 E: 12636031.25
OBSERVED BY: Paula Lancaster			
DRILLING CONTRACTOR: STEARNS DRILLING			
CREW CHIEF: Roger Christiansen		TOP OF CASING ELEV.: 635.30	SURFACE ELEV.: 632.43

PROTECTIVE COVER TYPE:	☑ STICK-UP	☐ FLUSH MOUNT	☐ TRAF. BOX	☐ OTHER _____				
PROTECTIVE COVER DIAMETER:	☑ 4"	☐ 8"	☐ 9"	☐ 10"	☐ 12"	☐ OTHER _____		
WELL MATERIAL:	☑ PVC	☐ SS	☐ IRON	☐ GALVANIZED STEEL	☐ OTHER _____			
WELL CASING DIAMETER:	☐ 1"	☑ 2"	☐ 4"	☐ 6"	☐ 8"	☐ OTHER _____		
WELL SCREEN MATERIAL:	☑ PVC	☐ SS	☐ IRON	☐ GALVANIZED STEEL	☐ OTHER _____			
WELL SCREEN LENGTH:	☐ 5-FT	☑ 10-FT	☐ UNKNOWN	☐ OTHER _____				
WELL SCREEN SLOT SIZE:	☑ 0.01"	☐ 0.02"	☐ UNKNOWN	☐ OTHER _____				

DTW:	Not measured	T/ PVC
DTB:	Not measured	T/ PVC

DECOMMISSIONING PROCEDURE

NOTES:

Well casing filled with medium bentonite pellets then hydrated. Pro-cover and concrete pad removed. Well casing cut off at 2 feet below grade. Remaining hole backfilled and brought to grade with the surrounding surface sand.

GROUTING PROCEDURE:					
GROUT TYPE:	NA				
GROUT MIX:					
GROUT INTERVAL:		FT-BGS	TO		FT-BGS
BENTONITE SEAL:	MEDIUM CHIPS				
SEAL INTERVAL:	2	FT-BGS	TO	38	FT-BGS

NOTES:

ADDITIONAL COMMENTS:

Paula C Lancaster

SIGNED

Sarah B Holmstrom

CHECKED

REVISED 04/2019

Appendix B
November 2018 Assessment Monitoring Data Summary

1540 Eisenhower Place
Ann Arbor, MI 48108

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734.971.9022 FAX

www.trcsolutions.com

March 14, 2019

Bethany Swanberg
Environmental Services – Landfill Operations Compliance
Consumers Energy Company
1945 W. Parnall Road
Jackson, MI 49201

Subject: November 2018 Assessment Monitoring Data Summary and Statistical Evaluation, Consumers Energy, JH Campbell Site, Dry Ash Landfill CCR Unit

Dear Ms. Swanberg:

Consumers Energy Company (CEC) is continuing semiannual assessment monitoring in accordance with §257.95 of the CCR Rule[1] for the JH Campbell Power Plant (JHC) Dry Ash Landfill located in West Olive, Michigan. During the statistical evaluation of the initial assessment monitoring event, no Appendix IV constituents were present in downgradient monitoring wells at statistically significant levels exceeding the Groundwater Protection Standards (GWPSs). Therefore, CEC continued the assessment monitoring program at the Dry Ash Landfill. As discussed in the *2018 Annual Groundwater Monitoring Report* (2018 Annual Report) (TRC, January 2019), prepared by TRC on behalf of CEC, the second semiannual assessment monitoring event was conducted in November 2018, but laboratory analysis and the data quality review were ongoing as of the writing of the 2018 Annual Report. Therefore, the summary of the November 2018 groundwater data would be prepared under separate cover after laboratory analysis is complete and results have been reviewed for usability. This letter report has been prepared to provide the summary of the November 2018 assessment groundwater monitoring results, data quality review, and statistical data evaluation.

Assessment Monitoring Sampling Summary

TRC conducted the second semiannual assessment monitoring event for Appendix III and IV constituents at the Dry Ash Landfill (Landfill) CCR Unit in accordance with the *JH Campbell Monitoring Program Sample Analysis Plan* (SAP) (ARCADIS, 2016). The second semiannual assessment monitoring event was performed on November 12 through November 16, 2018. Downgradient

[1] USEPA final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) published April 17, 2015, as amended per Phase One, Part One of the CCR Rule (83 FR 36435).

monitoring wells JHC-MW-15017 through JHC-MW-15022, JHC-MW-15031 through JHC-MW-15037 and background monitoring wells JHC-MW-15023 through JHC-MW-15028 were sampled during this monitoring event. The locations of the monitoring wells are depicted on Figure 1.

During each event, TRC personnel collected static water level measurements. Static water elevation data are summarized in Table 1. Groundwater elevation data are shown on Figure 2. Monitoring wells were purged with peristaltic pumps or submersible pumps utilizing low-flow sampling methodology. Field parameters were stabilized at each monitoring well prior to collecting groundwater samples. Field parameters for each monitoring well are summarized in Table 2.

The groundwater samples were analyzed by Pace Analytical Services, LLC (Pace) for Appendix III and IV constituents in accordance with the SAP. The analytical results for the background wells are summarized in Table 3 and analytical results for the downgradient monitoring wells are summarized in Table 4.

Groundwater Flow Rate and Direction

Groundwater elevation data collected during the semiannual assessment monitoring event were generally similar to data collected previously in the background, detection monitoring events, and previous assessment monitoring events. The data showed that groundwater within the uppermost aquifer generally flows to the south-southeast across the Site, with a southwesterly groundwater flow component on the western edge of the Site. Groundwater elevations measured across the Site during the November 2018 sampling event are provided on Table 1 and were used to construct the groundwater contour map provided on Figure 2.

The figure shows that current groundwater flow is generally consistent with previous monitoring events since the background sampling events commenced in December 2015. The average hydraulic gradient throughout the Site during the November 2018 event is estimated at 0.0039 ft/ft. The gradient was calculated using the following well pairs: JHC-MW-15029/JHC-MW-15030, JHC-MW-15029/JHC-MW-15005, JHC-MW-15019/JHC-MW-15035 and JHC-MW-15023/JHC-MW-15037 (Figure 1). Using the mean hydraulic conductivity of 62 ft/day (ARCADIS, 2016) and an assumed effective porosity of 0.4, the estimated average seepage velocity is approximately 0.61 ft/day or 220 ft/year for the November 2018 event.

The general groundwater flow direction is similar to that identified in previous assessment monitoring rounds and continues to demonstrate that the downgradient wells are appropriately positioned to detect the presence of Appendix III/IV constituents that could potentially migrate from the Dry Ash Landfill CCR Unit.

Data Quality

Analytical data were found to be usable for assessment monitoring and were generally consistent with previous sampling events. The Data Quality Reviews are included as Attachment A.

Assessment Monitoring Statistical Evaluation

Following the second semiannual assessment monitoring sampling event, the compliance well groundwater concentrations for Appendix IV constituents were compared to the GWPSs to determine if a statistically significant exceedance had occurred in accordance with §257.95. Consistent with the *Unified Guidance*[2], the preferred method for comparisons to a fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS. GWPSs were established in accordance with §257.95(h), as detailed in the October 15, 2018 *Groundwater Protection Standards* technical memorandum, which was also included in 2018 Annual Report.

Confidence intervals were established per the statistical methods detailed in the *Statistical Evaluation of November 2018 Assessment Monitoring Sampling Event* technical memorandum provided in Attachment B. For each Appendix IV constituent, the concentrations for each well were first compared directly to the GWPS. Constituent-well combinations that included a direct exceedance of the GWPS were retained for further statistical analysis using confidence limits.

The statistical evaluation of the assessment monitoring data indicates that no constituents exceeded the GWPSs at the Landfill downgradient monitoring wells in November 2018. These results are consistent with the results of the initial assessment monitoring data statistical evaluation.

Return to Detection Monitoring

Per §257.95(e), CEC can return to detection monitoring at the Dry Ash Landfill CCR Unit if the concentrations of all of the Appendix III and IV constituents are at or below background values for two consecutive events, using the statistical procedures included in §257.93(g). As shown on Table 4, several Appendix III and Appendix IV constituents are above the background upper tolerance limits (UTLs). Therefore, CEC will continue semiannual assessment monitoring per §257.95(d) and will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

[2] USEPA. 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*. Office of Conservation and Recovery. EPA 530/R-09-007.

Sincerely,

TRC

Graham Crockford
Program Manager

Sarah B. Holmstrom
Hydrogeologist/Project Manager

Attachments

Table 1.	Summary of Groundwater Elevation Data
Table 2.	Summary of Field Parameter Results
Table 3.	Summary of Background Well Groundwater Sampling Results (Analytical)
Table 4.	Summary of Groundwater Sampling Results (Analytical)
Figure 1.	Monitoring Well Network and Site Plan
Figure 2.	Groundwater Contour Map – November 2018
Attachment A	Data Quality Reviews
Attachment B	Statistical Evaluation of November 2018 Assessment Monitoring Sampling Event

cc: Brad Runkel, Consumers Energy
Harold D. Register, Jr., Consumers Energy
Central Files

Tables

Table 1
Summary of Groundwater Elevation Data – November 2018
JH Campbell – RCRA CCR Monitoring Program
West Olive, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Elevation (ft)			November 12, 2018	
							Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background								
JHC-MW-15023	617.01	619.98	Sand	603.0	to	593.0	16.28	603.70
JHC-MW-15024	613.79	616.62	Sand	606.8	to	596.8	11.42	605.20
JHC-MW-15025	614.14	617.17	Sand	607.1	to	597.1	10.60	606.57
JHC-MW-15026	615.09	618.04	Sand	607.1	to	597.1	12.35	605.69
JHC-MW-15027	614.77	617.30	Sand	604.8	to	594.8	12.76	604.54
JHC-MW-15028	611.02	613.80	Sand	603.0	to	593.0	12.48	601.32
JHC-MW-15029	608.08	610.95	Sand	600.1	to	590.1	9.78	601.17
JHC-MW-15030	604.05	607.17	Sand	600.1	to	590.1	8.25(1)	598.92
Unit 1N, 1S, 2N, 2S								
JHC-MW-15001	607.02	609.53	Sand	603.5	to	598.5	10.90	598.63
JHC-MW-15002(2)	618.18	621.27	Sand	590.2	to	580.2	23.18	598.09
JHC-MW-15003(2)	623.16	627.20	Sand	595.2	to	585.2	31.78	595.42
JHC-MW-15005(2)	606.22	609.99	Sand	579.2	to	569.2	17.75	592.24
Unit 3N, 3S								
JHC-MW-15013	632.40	635.25	Sand	604.4	to	594.4	33.90	601.35
JHC-MW-15015	632.46	635.20	Sand	604.5	to	594.5	33.20	602.00
JHC-MW-15016	631.81	632.52	Sand	603.8	to	593.8	30.56(1)	601.96
Landfill								
JHC-MW-15017	613.69	616.61	Sand	603.7	to	593.7	13.85	602.76
JHC-MW-15018	614.26	617.02	Sand	604.3	to	594.3	14.61	602.41
JHC-MW-15019	609.81	612.86	Sand	603.8	to	593.8	11.04	601.82
JHC-MW-15022	620.92	623.79	Sand	597.9	to	587.9	27.89	595.90
JHC-MW-15031	632.94	635.87	Sand	599.9	to	589.9	42.32	593.55
JHC-MW-15032	611.32	614.29	Sand	598.3	to	588.3	16.06	598.23
JHC-MW-15033	618.08	620.99	Sand	602.1	to	592.1	20.79	600.20
JHC-MW-15034	612.90	615.97	Sand	601.9	to	591.9	14.57	601.40
JHC-MW-15035	632.53	634.28	Sand	599.5	to	589.5	39.60	594.68
JHC-MW-15036	617.94	618.34	Sand	597.9	to	587.9	25.92	592.42
JHC-MW-15037	614.28	616.06	Sand	591.3	to	586.3	24.45	591.61
Pond A								
JHC-MW-15006	624.74	627.58	Sand	599.7	to	589.7	33.36	594.22
JHC-MW-15007	624.82	627.70	Sand	602.8	to	592.8	33.75	593.95
JHC-MW-15008	632.43	635.30	Sand	604.4	to	594.4	40.37	594.93
JHC-MW-15009	632.33	635.32	Sand	602.3	to	592.3	41.55	593.77
JHC-MW-15010	632.55	635.57	Sand	602.6	to	592.6	41.00	594.57
JHC-MW-15011	627.71	630.83	Sand	600.7	to	590.7	37.70	593.13

Notes:

Survey conducted by Nederveld, November 2015, October 2018, and December 2018.

Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).

TOC: Top of well casing.

ft BTOC: Feet below top of well casing.

(1) - The static water levels for JHC-MW-15016 and JHC-MW-15030 were collected on November 15, 2018.

(2) - Surface elevation and TOC resurveyed December 2018 post construction activities.

Table 2
Summary of Field Parameter Results – November 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Background							
JHC-MW-15023	11/13/2018	0.86	30.3	6.1	75	9.8	6.9
JHC-MW-15024	11/13/2018	0.97	18.7	7.1	135	9.8	6.0
JHC-MW-15025	11/13/2018	2.60	30.7	7.9	145	9.7	5.9
JHC-MW-15026	11/13/2018	6.50	129.8	6.8	86	9.6	3.8
JHC-MW-15027	11/13/2018	5.90	148.8	6.4	79	9.2	12.4
JHC-MW-15028	11/13/2018	5.81	17.5	7.8	82	11.9	7.0
Landfill							
JHC-MW-15017	11/13/2018	3.70	-149.3	6.1	778	12.1	7.9
JHC-MW-15018	11/13/2018	1.75	38.5	6.3	183	11.9	2.4
JHC-MW-15019	11/14/2018	4.82	73.6	6.0	120	11.2	2.5
JHC-MW-15022	11/14/2018	5.48	53.6	7.0	383	10.9	3.2
JHC-MW-15031	11/14/2018	1.00	59.0	6.7	467	13.4	2.9
JHC-MW-15032	11/14/2018	1.97	36.7	6.2	48	10.3	2.8
JHC-MW-15033	11/14/2018	3.53	41.7	6.7	68	10.6	1.7
JHC-MW-15034	11/14/2018	5.30	52.5	5.9	29	10.9	0.8
JHC-MW-15035	11/14/2018	0.68	19.0	7.3	445	14.8	2.4
JHC-MW-15036	11/14/2018	2.8	78.0	7.4	381	11.2	3.1
JHC-MW-15037	11/14/2018	2.8	108.5	7.3	611	8.9	8.5

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

SU - Standard units.

umhos/cm - Micromhos per centimeter.

°C - Degrees Celsius

NTU - Nephelometric Turbidity Unit.

Table 3
Summary of Background Well Groundwater Sampling Results (Analytical): November 2018
JH Campbell Background – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15023	JHC-MW-15024	JHC-MW-15025	JHC-MW-15026	JHC-MW-15027	JHC-MW-15028
					Sample Date:	11/13/2018	11/13/2018	11/13/2018	11/13/2018	11/13/2018	11/13/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	Background					
Appendix III											
Boron	ug/L	NC	500	500	7,200	46.9	< 20.0	23.9	< 20.0	< 20.0	< 20.0
Calcium	mg/L	NC	NC	NC	500	15.6	28.0	16.7	9.2	9.6	11.4
Chloride	mg/L	250**	250	250	500	10.7	17.7	12.8	7.0	5.2	4.0
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250**	250	250	500	12.2	7.0	8.6	8.0	9.0	4.9
Total Dissolved Solids	mg/L	500**	500	500	500	80	180	94	< 50.0	54	50
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	**6.1**	7.1	7.9	6.8	**6.4**	7.8
Appendix IV											
Antimony	ug/L	6	6.0	6.0	130	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	10	10	10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	2,000	2,000	820	21.7	16.2	14.1	10.5	30.6	5.5
Beryllium	ug/L	4	4.0	4.0	18	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5.0	5.0	3.5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	39	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	73	210	3,200	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC	< 0.531	1.21	< 0.677	0.615	< 0.695	< 0.688
Radium-228	pCi/L	NC	NC	NC	NC	< 0.894	< 1.03	< 0.862	< 1.08	0.961	< 1.05
Radium-226/228	pCi/L	5	NC	NC	NC	< 1.43	1.76	< 1.54	< 1.25	1.61	< 1.74
Selenium	ug/L	50	50	50	5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	2.0	2.0	3.7	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 180 mg CaCO3/L as measured at surface water sample SW-01 collected on April 9, 2018 from the Pigeon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

Table 4
Summary of Groundwater Sampling Results (Analytical): November 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

							Sample Location:	JHC-MW-15017	JHC-MW-15018	JHC-MW-15019	JHC-MW-15022	JHC-MW-15031	JHC-MW-15032	JHC-MW-15033	JHC-MW-15034	JHC-MW-15035	JHC-MW-15036	JHC-MW-15037
							Sample Date:	11/13/2018	11/13/2018	11/14/2018	11/14/2018	11/14/2018	11/14/2018	11/14/2018	11/14/2018	11/14/2018	11/14/2018	11/14/2018
Constituent	Unit	UTL	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^		downgradient										
Appendix III																		
Boron	ug/L	51	NC	500	500	7,200		274	115	159	376	104	49.4	41.8	62.5	78.2	79.2	221
Calcium	mg/L	46	NC	NC	NC	500		60.9	37.6	30.4	109	63.3	8.1	10.0	6.0	66.6	51.6	103
Chloride	mg/L	43	250**	250	250	500		170	33.2	7.4	3.7	33.4	4.2	3.2	3.5	20.0	14.7	8.2
Fluoride	ug/L	1,000	4,000	NC	NC	NC		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	14	250**	250	250	500		72.0	51.1	19.8	40.6	34.7	11.9	9.2	14.4	18.8	20.0	50.1
Total Dissolved Solids	mg/L	258	500**	500	500	500		474	276	250	358	268	< 50.0	< 50.0	< 50.0	274	216	406
pH, Field	SU	4.8 - 9.2	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**		**6.1**	**6.3**	**6.0**	7.0	6.7	**6.2**	6.7	**5.9**	7.3	7.4	7.3
Appendix IV																		
Antimony	ug/L	2	6	6.0	6.0	130		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	1	10	10	10	10		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	35	2,000	2,000	2,000	820		85.5	79.6	53.5	21.3	21.4	7.7	6.1	6.0	12.3	8.2	14.3
Beryllium	ug/L	1	4	4.0	4.0	18		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	0.2	5	5.0	5.0	3.5		0.60	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	2	100	100	100	**11**		< 1.0	< 1.0	< 1.0	1.7	**24.6**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.6
Cobalt	ug/L	15	NC	40	100	100		< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	1000	4,000	NC	NC	NC		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	1	NC	4.0	4.0	39		< 1.0	< 1.0	< 1.0	< 1.0	1.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	10	NC	170	350	440		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	0.2	2	2.0	2.0	0.20#		< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	5	NC	73	210	3,200		28.5	6.7	10.4	6.5	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NA	NC	NC	NC	NC		< 1.05	< 0.760	< 0.838	< 0.692	0.849	< 0.748	< 0.766	< 0.688	< 0.850	0.812	< 0.578
Radium-228	pCi/L	NA	NC	NC	NC	NC		< 0.910	< 0.918	< 0.801	0.999	< 0.773	< 0.812	< 0.729	< 0.786	< 0.914	< 0.670	< 0.729
Radium-226/228	pCi/L	1.93	5	NC	NC	NC		< 1.96	< 1.68	< 1.64	< 1.35	< 1.50	< 1.56	< 1.50	< 1.47	< 1.76	0.874	< 1.31
Selenium	ug/L	5	50	50	50	**5**		**18.8**	**8.2**	**24.8**	**5.6**	2.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**21.1**
Thallium	ug/L	2	2	2.0	2.0	3.7		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
UTL - Upper Tolerance Limit of the background data set. Appendix III UTLs established in TRC's technical memorandum dated January 15, 2018. Appendix IV UTLs established in TRC's technical memorandum dated October 15, 2018.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NC - no criteria.
NA - not applicable.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 180 mg CaCO3/L as measured at surface water sample SW-01 collected on April 9, 2018 from the Pigeon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
Indicates that the concentration in one or more wells exceed the background level. If concentrations of all Appendix III and Appendix IV constituents are below the background level for two consecutive events, the unit may return to detection monitoring.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

Figures

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADIENT LANDFILL MONITORING WELL
- DOWNGRADIENT POND A MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- DECOMMISSIONED MONITORING WELL
- NEW DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2018)
- NEW DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL (2018)

NOTES

1. BASE MAP IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/20/2016.
2. WELL LOCATIONS SURVEYED BY NEDERVELD ON 11/25/2015.
3. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
4. MONITORING WELL DECOMMISSIONED JUNE 14, 2018.
5. MONITORING WELL DECOMMISSIONED OCTOBER 10, 2018.
6. JHC-MW-1800X MONITORING WELLS INSTALLED IN DECEMBER 2018.

0 600 1,200 Feet

1 " = 600 '

1:7,200

PROJECT:

CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:

SITE PLAN WITH CCR MONITORING WELL LOCATIONS

DRAWN BY:	J. PAPEZ	PROJ NO.:	290806-001
CHECKED BY:	S. HOLMSTROM		**FIGURE 1**
APPROVED BY:	G. CROCKFORD		
DATE:	MARCH 2019		

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 290806-001-015.mxd

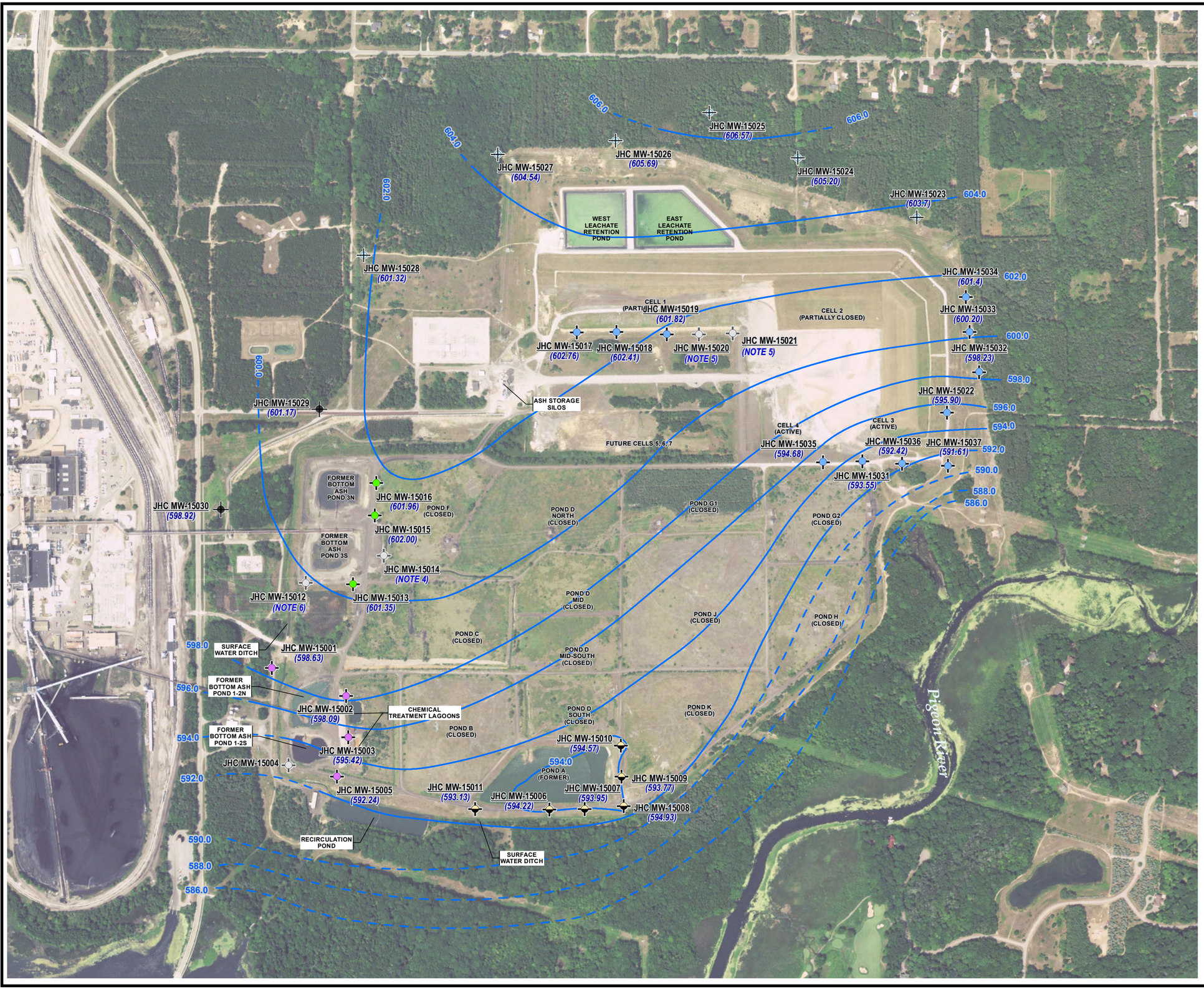
Plot Date: 3/12/2019, 11:06:55 AM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\290806-001-015.mxd
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

TRC - GIS

TRC - GIS

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

Plot Date: 3/1/2019, 12:48:18 PM by SMAJOR -- LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\290806-001-019.mxd



LEGEND

- BACKGROUND MONITORING WELL
- DECOMMISSIONED MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADIENT LANDFILL MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- POND A MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- *(600.97)* GROUNDWATER ELEVATION (FEET)

NOTES

1. BASE MAP IMAGERY FROM USDAL-NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/20/2016.
2. WELL LOCATIONS SURVEYED BY NEDERVELD ON 11/25/2015.
3. GROUNDWATER ELEVATIONS DISPLAYED IN FEET RELATIVE TO THE NORTH AMERICAN VERTICAL DATUM OF 1988.
4. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
5. MONITORING WELL DECOMMISSIONED JUNE 14, 2018.
6. MONITORING WELL DECOMMISSIONED OCTOBER 10, 2018.

N

0 700 1,400 Feet

1 " = 700 '
1:8,400

PROJECT:
CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:
GROUNDWATER CONTOUR MAP NOVEMBER 2018

DRAWN BY:	S. MAJOR	PROJ NO.:	322174-001
CHECKED BY:	K. LOWERY		
APPROVED BY:	S. HOLMSTROM		**FIGURE 2**
DATE:	MARCH 2019		

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FILE NO.: 290806-001-019.mxd

Attachment A
Data Quality Reviews

Laboratory Data Quality Review
Groundwater Monitoring Event November 2018
CEC JH Campbell Background

Groundwater samples were collected by TRC for the November 2018 sampling event. Samples were analyzed for anions, total dissolved solids, alkalinity, and total metals (except for antimony and selenium) by Pace Analytical Services, LLC (Pace) located in Grand Rapids, Michigan, for antimony and selenium by Pace located in Indianapolis, IN, and for radium by Pace located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory reports 4620343 and 4620344.

During the November 2018 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15023
- JHC-MW-15024
- JHC-MW-15025
- JHC-MW-15026
- JHC-MW-15027
- JHC-MW-15028

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	SW-846 300.0
Total Dissolved Solids	SM 2540C-11
Alkalinity (Total, Bicarbonate, Carbonate)	SM 2320B-11
Total Metals	SW-846 6010C/6020A/7470A
Radium (Radium-226, Radium-228, Total Radium)	EPA 903.1, EPA 904.0

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt, as noted in the cover page or case narrative;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;

- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures;
- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), where applicable. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Percent recoveries for tracer and carriers, where applicable, for radiochemistry only. Tracers and/or carriers are used to assess the chemical yield for the preparation and/or instrument efficiency;
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation are noted below.

- Appendix IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary

- The temperature for one of the six coolers upon receipt at the laboratory was >6°C (10.3°C). The samples were collected on 11/13/18, but the sample coolers were not received by the laboratory until 11/14/18. The results for fluoride, chloride, sulfate, alkalinity, and TDS in samples JHC-MW-15023_20181113, JHC-MW-15024_20181113; JHC-MW-15025_20181113; JHC-MW-15026_20181113; JHC-MW-15027_20181113, JHC-MW-15028_20181113, Dup#05_20181113, EB#05_20181113, and FB#05_20181113 may be biased low. The data were within or above the range of historical results with the exception of bicarbonate and total alkalinity in JHC-MW-15024 and JHC-MW-15025, which were below the range of historical concentrations.
- No target analytes were detected in the method blank.
- One field blank (FB#05_20181113) and one equipment blank (EB#05_20181113) were collected; no analytes were detected in these blank samples.
- LCS recoveries were within laboratory control limits.
- MS/MSDs were performed on sample JHC-MW-15025_20181113 for radium, metals, and anions, and MS analysis was performed on sample JHC-MW-15025_20181113 for alkalinity. All percent recoveries (%R) and relative percent differences (RPDs) were with the QC limits.
- Laboratory duplicate analyses were performed on sample JHC-MW-15025_20181113 for anions, alkalinity, and TDS; the RPDs between the parent and duplicate sample were within the QC limits.
- The field duplicate pair samples were Dup#05_20181113 and JHC-MW-15028_20181113; the RPDs for total alkalinity (98%) and bicarbonate alkalinity (98%) did not meet criteria. Potential variability exists for total alkalinity and bicarbonate alkalinity results for samples JHC-MW-15023_20181113, JHC-MW-15024_20181113; JHC-MW-15025_20181113; JHC-MW-15026_20181113; JHC-MW-15027_20181113, JHC-MW-15028_20181113, and Dup#05_20181113 due to field duplicate variability (see attached table).
- The RLs for chloride (2 mg/L) and TDS (50 mg/L) in the equipment blank (EB#05_20181113) and field blank (FB#05_20181113), and for TDS (50 mg/L) in sample JHC-MW-15026_20181113 exceeded the project-required RL of 1 mg/L.
  - The nondetect result for TDS in sample JHC-MW-15026_20181113 may not meet project objectives since the RL is above the project-required RL of 1 mg/L.
  - The exceeded RLs for the nondetect results for chloride and TDS in the equipment blank (EB#05_20181113) and field blank (FB#05_20181113) do not affect data usability.
- Carrier and tracer recoveries, where applicable, were within 30-110%.

Attachment A
Summary of Data Non-Conformances
JH Campbell Background – RCRA CCR Monitoring Program
West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15023_20181113	11/13/2018	Fluoride, Chloride, Sulfate, Total Alkalinity, Bicarbonate Alkalinity, Carbonate Alkalinity, TDS	Cooler(s) was received with temperature >6°C. Sample results may be biased low.
JHC-MW-15024_20181113	11/13/2018		
JHC-MW-15025_20181113	11/13/2018		
JHC-MW-15026_20181113	11/13/2018		
JHC-MW-15027_20181113	11/13/2018		
JHC-MW-15028_20181113	11/13/2018		
EB#05_20181113	11/13/2018		
FB#05_20181113	11/13/2018		
DUP#05_20181113	11/13/2018		
JHC-MW-15023_20181113	11/13/2018	Total alkalinity, Bicarbonate alkalinity	RPD for the field duplicate pair exceeded 30%. Potential uncertainty exists due to the field duplicate variability.
JHC_MW-15024_20181113	11/13/2018		
JHC-MW-15025_20181113	11/13/2018		
JHC-MW-15026_20181113	11/13/2018		
JHC-MW-15027_20181113	11/13/2018		
JHC-MW-15028_20181113	11/13/2018		
DUP#05_20181113	11/13/2018		

Notes:

RPD: Relative Percent Difference = |sample result - duplicate result|/(sample result + duplicate result/2)

Laboratory Data Quality Review
Groundwater Monitoring Event November 2018
CEC JH Campbell Landfill

Groundwater samples were collected by TRC for the November 2018 sampling event. Samples were analyzed for anions, total dissolved solids, alkalinity, and total metals (except for antimony and selenium) by Pace Analytical Services, LLC (Pace) located in Grand Rapids, Michigan, for antimony and selenium by Pace located in Indianapolis, IN, and for radium by Pace located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory reports 4620345 and 4620346.

During the November 2018 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15017
- JHC-MW-15018
- JHC-MW-15019
- JHC-MW-15022
- JHC-MW-15031
- JHC-MW-15032
- JHC-MW-15033
- JHC-MW-15034
- JHC-MW-15035
- JHC-MW-15036
- JHC-MW-15037

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	SW-846 300.0
Total Dissolved Solids	SM 2540C-11
Alkalinity (Total, Bicarbonate, Carbonate)	SM 2320B-11
Total Metals	SW-846 6010C/6020A/7470A
Radium (Radium-226, Radium-228, Total Radium)	EPA 903.1, EPA 904.0

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt, as noted in the cover page or case narrative;
- Technical holding times for analyses;

- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures;
- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), where applicable. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Percent recoveries for tracer and carriers, where applicable, for radiochemistry only. Tracers and/or carriers are used to assess the chemical yield for the preparation and/or instrument efficiency;
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation are noted below.

- Appendix III and Appendix IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary

- The temperature for one of the six coolers upon receipt at the laboratory was >6°C (10.3°C). The results for fluoride, chloride, sulfate, alkalinity, and TDS in samples JHC-MW-15017_20181113 and JHC-MW-15018_20181113 collected on 11/13/18 and received on 11/14/18 may be biased low (see attached table). All other samples were collected on 11/14/18, received on the same day as sample collection, and contained ice upon receipt; thus, there was no adverse impact to data usability. Concentrations were within or above the range of historical results with the exception of sulfate at JHC-MW-15018 bicarbonate alkalinity and total alkalinity at JHC-MW-15017 and JHC-MW-15018, which were below the range of historical concentrations.
- There were no analytes detected in the method blanks.
- One field blank (FB#02_20181114) was collected; no analytes were detected in this blank sample.
- One equipment blank (EB#02_20181114) was collected and the following analyte was detected:
  - Chromium at 2.7 µg/L; the chromium results in samples JHC-MW-15022_20181114; DUP#02_20181114, and JHC-MW-15037_20181114 may be false positives since these results were less than 5x the blank result (see attached table). However, data were within the range of historical results.
- LCS recoveries were within laboratory control limits.
- MS/MSD analyses were performed on sample JHC-MW-15036_20181114 for radium, metals, and anions, and an MS analysis was performed on sample JHC-MW-15036_20181114 for alkalinity. The relative percent differences (RPDs) and percent recoveries (%Rs) were within the QC limits.
- Laboratory duplicate analyses were performed on sample JHC-MW-15036_20181114 for anions, alkalinity, and TDS; RPDs between the parent and duplicate sample were within the QC limits.
- The field duplicate pair samples were Dup#02_20181114 and JHC-MW-15022_20181114.; all criteria were met for anions, metals, TDS, and alkalinity.
  - Ra-228 results in the field duplicate pair did not meet the relative error ratio (RER) acceptance criteria (RER<1.96); thus, uncertainty exists for Ra-228 results in samples JHC-MW-15017_20181113; JHC-MW-15018_20181113; JHC-MW-15019_20181114; JHC-MW-15022_20181114; JHC-MW-15031_20181114, JHC-MW-15032_20181114, JHC-MW-15033_20181114, JHC-MW-15034_20181114, JHC-MW-15035_20181114, JHC-MW-15036_20181114, JHC-MW-15037_20181114, and Dup#02_20181114 (see attached table). Radium-228 results were within the range of historical concentrations.
- The RLs for chloride (2 mg/L) and TDS (50 mg/L) in equipment blank (EB#02_20181114) and field blank (FB#02_20181114), for TDS (50 mg/L) in samples JHC-MW-15032_20181114,

JHC-MW-15033_20181114, and JHC-MW-15034_20181114 exceeded the project-required RLs of 1 mg/L.

  - The nondetect results for TDS in samples JHC-MW-15032_20181114, JHC-MW-15033_20181114, and JHC-MW-15034_20181114 may not meet project objectives since the RLs were above the project-required RL of 1 mg/L.
  - The elevated RLs for the nondetect results for chloride and TDS in the equipment blank (EB#02_20181114) and field blank (FB#02_20181114) do not affect data usability since these are QC samples.

- Carrier and tracer recoveries, where applicable, were within 30-110%.

Attachment A
Summary of Data Non-Conformances
JH Campbell Landfill Downgradient – RCRA CCR Monitoring Program
West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15017_20181113	11/13/2018	Fluoride, Chloride, Sulfate, Total Alkalinity, Bicarbonate Alkalinity, Carbonate Alkalinity, TDS	Cooler(s) was received with temperature >6°C. Sample results may be biased low; however, data were within the range of historcal concentrations.
JHC-MW-15018_20181113	11/13/2018		
JHC-MW-15022_20181114	11/14/2018	Chromium	Detection in equipment blank (EB-02). Sample result ≤5X the blank concentration. Result may be a false positive; however, data were within the range of historical concentrations.
DUP#02_20181114	11/14/2018		
MW-15037_20181114	11/14/2018		
JHC-MW-15017_20181113	11/13/2018	Ra-228	RER for the field duplicate pair was >1.96. Potential uncertainty exists due to the field duplicate variability; however, data were within range of historical concentrations
JHC-MW-15018_20181113	11/13/2018		
JHC-MW-15019_20181114	11/14/2018		
JHC-MW-15022_20181114	11/14/2018		
JHC-MW-15031_20181114	11/14/2018		
JHC-MW-15032_20181114	11/14/2018		
JHC-MW-15033_20181114	11/14/2018		
JHC-MW-15034_20181114	11/14/2018		
JHC-MW-15035_20181114	11/14/2018		
JHC-MW-15036_20181114	11/14/2018		
JHC-MW-15037_20181114	11/14/2018		
DUP#02_20181114	11/15/2018		

Notes:

RER: Replicate Error Ratio = |sample result - duplicate result|/√(sample total uncertainty2 + duplicate total uncertainty2)

Attachment B
Statistical Evaluation of November 2018 Assessment Monitoring Sampling Event

Technical Memorandum

Date: March 14, 2019

To: Bethany Swanberg, CEC

cc: Brad Runkel, CEC
JR Register, CEC
Michelle Marion, CEC

From: Darby Litz, TRC
Sarah Holmstrom, TRC
Kristin Lowery, TRC

Project No.: 290806.0000.0000

Subject: Statistical Evaluation of November 2018 Assessment Monitoring Sampling Event
JH Campbell Dry Ash Landfill, Consumers Energy Company, West Olive, Michigan

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During the statistical evaluation of the initial assessment monitoring event, no Appendix IV constituents were present at statistically significant levels exceeding the Groundwater Protection Standards (GWPSs). Therefore, Consumers Energy Company (CEC) is continuing semiannual assessment monitoring in accordance with §257.95 of the CCR Rule[1] at the JH Campbell Power Plant (JHC) Dry Ash Landfill. The second semiannual assessment monitoring event for 2018 was conducted on November 12 through November 16, 2018. In accordance with §257.95, the assessment monitoring data must be compared to GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs. GWPSs were established in accordance with §257.95(h), as described in the October 15, 2018 *Groundwater Protection Standards* technical memorandum, which was also included in the *2018 Annual Groundwater Monitoring Report* (TRC, January 2019). The following narrative describes the methods employed and the results obtained and the Sanitas™ output files are included as an attachment.

The statistical evaluation of the second semiannual assessment monitoring event data indicate no constituents exceeded the GWPSs at the Dry Ash Landfill monitoring wells. These results are consistent with the results of the initial assessment monitoring data statistical evaluation and concentrations remain above background levels. CEC will continue semiannual assessment

[1] USEPA final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) published April 17, 2015, as amended per Phase One, Part One of the CCR Rule (83 FR 36435).

monitoring per §257.95 and execute the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Assessment Monitoring Statistical Evaluation

The compliance well network at the JHC Dry Ash Landfill CCR Unit consists of eleven monitoring wells (JHC-MW-15017 through JHC-MW-15019, JHC-MW-15022, and JHC-MW-15031 through JHC-MW-15037) located on the south and east perimeters of the landfill Cells 1 through 4.

Following the second semiannual assessment monitoring sampling event, compliance well data for the JHC Dry Ash Landfill were evaluated in accordance with the *Groundwater Statistical Evaluation Plan* (Stats Plan) (TRC, October 2017). An assessment monitoring program was developed to evaluate concentrations of CCR constituents present in the uppermost aquifer relative to acceptable levels (i.e., GWPSs). In order to decide as to whether or not the GWPSs have been exceeded, the change in concentration observed at the downgradient wells during a given assessment monitoring event must be large enough, after accounting for variability in the sample data, that the result is unlikely to have occurred merely by chance. Consistent with the Unified Guidance[2], the preferred method for comparisons to a fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS. Based on the number of historical observations in the representative sample population, the population mean, the population standard deviation, and a selected confidence level (i.e., 99 percent), an upper and lower confidence limit is calculated. The true concentration, with 99 percent confidence, will fall between the lower and upper confidence limits.

The concentrations observed in the downgradient wells are deemed to be a statistically significant exceedance when the 99 percent lower confidence limit of the downgradient data exceeds the GWPS. If the confidence interval straddles the GWPS (i.e. the lower confidence level is below the GWPS but the upper confidence level is above), the statistical test results are inconclusive and there is not compelling evidence that the measured concentration is a result of a release from the CCR unit versus the inherent variability of the sample data. This statistical approach is consistent with the statistical methods for assessment monitoring presented in §257.93(f) and (g). Statistical evaluation methodologies built into the CCR Rule, and numerous other federal rules, are key in determining whether or not individually measured data points represent a concentration increase over the baseline or a fixed standard (such as a GWPS in an assessment monitoring program).

For each detected Appendix IV constituent, the concentrations from each well were first compared directly to the GWPS, as shown on Table A1. Data from each round were evaluated for completeness, overall quality, and usability and were deemed appropriate for the purposes of the CCR assessment

[2] USEPA. 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*. Office of Conservation and Recovery. EPA 530/R-09-007.

monitoring program. The direct comparison of the data to the GWPSs shows that all concentrations are below their associated GWPSs during the November 2018 assessment monitoring event, in addition to previous assessment monitoring events and the background monitoring events. Therefore, no confidence limits were calculated for the Dry Ash Landfill. The Sanitas™ data summary report is included in Attachment 1.

The statistical evaluation of the second assessment monitoring event data indicates that no constituents are present at concentrations above the GWPSs. These results are consistent with the results of the initial assessment monitoring data statistical evaluation and concentrations remain above background levels. CEC will continue semiannual assessment monitoring per §257.95 and execute the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Attachments

Table A1	Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
Attachment 1	Sanitas™ Output Files

Table

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15017										
						Sample Date:	12/3/2015	3/9/2016	6/22/2016	8/30/2016	11/15/2016	4/18/2017	6/22/2017	8/16/2017	9/27/2017	4/26/2018	6/20/2018	11/13/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient											
Appendix III																		
Boron	ug/L	NC	NA	51	NA		386	343	444	321	592	618	407	347	405	--	245	274
Calcium	mg/L	NC	NA	46	NA		64.9	70.8	68.3	62.5	58.5	52.2	56.0	56.3	44.8	--	44.0	60.9
Chloride	mg/L	250*	NA	43	NA		66.9	32.3	35.2	56.4	45.1	22.8	70.8	112	119	--	97.0	170
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		51.0	43.4	49.2	46.1	54.2	75.0	70.3	84.2	101	--	60.6	72.0
Total Dissolved Solids	mg/L	500*	NA	258	NA		350	280	300	370	320	300	366	476	490	--	348	474
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.77	6.6	6.3	6.3	6.1	5.8	6.1	6.1	5.2	6.0(1)	6.0	6.1
Appendix IV																		
Antimony	ug/L	6	NA	2	6		< 1	< 1	1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		50	57	75	73	127	116	76.4	103	--	79.7	80.0	85.5
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	0.2	0.3	0.22	0.42	--	0.47	0.54	0.60
Chromium	ug/L	100	NA	2	100		< 1	< 1	1	< 1	< 1	2	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	6	7	8	11	12	< 5.0	10.6	--	8.3	6.2	28.5
Radium-226	pCi/L	NC	NA	NA	NA		0.231	< 0.182	0.333	< 0.716	0.283	0.456	< 0.388	< 0.917	--	1.17	< 0.785	< 1.05
Radium-228	pCi/L	NC	NA	NA	NA		< 0.800	< 0.659	1.42	1.60	1.73	1.61	1.27	1.51	--	0.773	2.74	< 0.910
Radium-226/228	pCi/L	5	NA	1.93	5		< 0.8	< 0.659	1.75	1.81	2.01	2.07	1.64	2.30	--	1.94	3.02	< 1.96
Selenium	ug/L	50	NA	5	50		31	19	30	20	34	37	23.5	27.4	--	18.2	18.5	18.8
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15018													
						Sample Date:	12/3/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/18/2017	6/22/2017	6/22/2017	8/16/2017	8/16/2017	9/27/2017	9/27/2017	4/26/2018	6/20/2018	11/13/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient													
Appendix III														Field Dup		Field Dup		Field Dup			
Boron	ug/L	NC	NA	51	NA		110	128	164	137	133	146	159	165	133	139	127	130	--	117	115
Calcium	mg/L	NC	NA	46	NA		81.3	93.5	78.3	85.0	83.2	65.3	74.5	73.6	62.7	61.0	55.3	57.0	--	44.8	37.6
Chloride	mg/L	250*	NA	43	NA		46.1	18.2	30.7	41.1	34.5	31.8	43.8	44.4	43.7	43.6	41.5	41.6	--	31.9	33.2
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		70.8	64.7	75.5	80.2	77.3	73.6	79.8	78.9	88.4	86.2	80.8	81.1	--	62.3	51.1
Total Dissolved Solids	mg/L	500*	NA	258	NA		360	330	340	400	340	330	336	458	390	350	310	468	--	194	276
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.6	6.5	6.3	6.1	6.3	6.2	6.4	--	6.3	--	6.3	--	6.2(1)	6.1	6.3
Appendix IV																					
Antimony	ug/L	6	NA	2	6		< 1	1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		67	63	69	93	95	83	69.1	65.1	89.7	97.5	--	--	89.0	76.5	79.6
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	< 1	2	< 1	< 1	1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	< 15.0	< 15.0	--	--	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	6.8	6.8	--	--	17.2	19.7	6.7
Radium-226	pCi/L	NC	NA	NA	NA		< 0.203	0.228	< 0.285	< 0.318	< 0.257	< 0.306	0.420	0.596	0.667	1.15	--	--	< 0.656	< 0.692	< 0.760
Radium-228	pCi/L	NC	NA	NA	NA		0.951	1.03	1.03	1.33	< 0.408	1.04	< 0.556	< 0.623	1.24	0.935	--	--	< 0.572	< 1.14	< 0.918
Radium-226/228	pCi/L	5	NA	1.93	5		1.05	1.26	1.03	1.33	< 0.408	1.22	0.910	1.15	1.91	2.09	--	--	< 1.23	< 1.83	< 1.68
Selenium	ug/L	50	NA	5	50		13	7	11	14	12	18	15.6	15.7	13.9	13.9	--	--	12.7	9.9	8.2
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15019										
						Sample Date:	12/3/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/19/2017	6/22/2017	8/16/2017	9/27/2017	4/26/2018	6/20/2018	11/14/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient											
Appendix III																		
Boron	ug/L	NC	NA	51	NA		224	197	237	197	256	194	166	180	191	--	195	159
Calcium	mg/L	NC	NA	46	NA		137	121	125	86.5	106	63.2	85.9	53.1	58.3	--	64.1	30.4
Chloride	mg/L	250*	NA	43	NA		68.0	44.2	56.0	34.5	28.9	1.25	48.6	27.0	36.7	--	26.2	7.4
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		99.1	56.5	85.1	41.9	50.9	12.7	53.8	42.6	48.8	--	40.8	19.8
Total Dissolved Solids	mg/L	500*	NA	258	NA		580	440	520	370	420	250	378	268	306	--	286	250
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.9	6.6	6.6	6.2	6.6	6.3	6.8	6.4	6.4	6.7(1)	6.6	6.0
Appendix IV																		
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		53	44	50	38	47	69	41.1	40.0	--	63.6	44.6	53.5
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	< 1	2	1	1	3	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	8	< 5	7	21	33	7.0	< 5.0	--	11.2	7.7	10.4
Radium-226	pCi/L	NC	NA	NA	NA		< 0.246	0.436	< 0.184	< 0.297	< 0.253	< 0.316	< 0.601	< 0.856	--	0.402	< 0.717	< 0.838
Radium-228	pCi/L	NC	NA	NA	NA		0.839	1.08	1.58	0.874	< 0.715	0.775	0.685	0.947	--	< 0.638	< 0.951	< 0.801
Radium-226/228	pCi/L	5	NA	1.93	5		0.959	1.52	1.72	1.05	< 0.715	0.976	< 1.12	< 1.75	--	0.911	< 1.67	< 1.64
Selenium	ug/L	50	NA	5	50		6	12	9	14	13	18	18.0	15.8	--	22.2	18.4	24.8
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15020[2]										
						Sample Date:	12/3/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/19/2017	6/22/2017	8/16/2017	9/27/2017	4/26/2018	6/11/2018	6/11/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient											
Appendix III																		Field Dup
Boron	ug/L	NC	NA	51	NA		262	180	218	192	186	158	170	155	153	--	129	146
Calcium	mg/L	NC	NA	46	NA		75.1	59.7	57.7	58.3	62.3	45.9	50.0	49.1	49.5	--	39.2	42.7
Chloride	mg/L	250*	NA	43	NA		55.2	28.4	45.5	40.5	39.0	26.2	49.4	50.3	54.7	--	35.5	35.3
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		44.6	28.3	30.0	25.9	25.5	19.5	30.4	29.9	29.4	--	24.3	24.4
Total Dissolved Solids	mg/L	500*	NA	258	NA		340	230	280	280	290	220	306	272	278	--	222	254
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.6	6.3	6.2	6.0	6.4	6.2	6.4	6.5	6.5	6.4[1]	6.3	--
Appendix IV																		
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		57	27	40	40	31	32	41.9	38.7	--	31.6	39.2	38.8
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	1	2	< 1	2	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.224	< 0.181	< 0.186	< 0.334	< 0.280	< 0.289	< 0.567	< 0.444	--	< 0.704	< 0.588	< 0.755
Radium-228	pCi/L	NC	NA	NA	NA		< 0.568	0.886	1.83	1.64	0.606	< 0.581	< 0.700	1.92	--	< 1.13	1.48	1.03
Radium-226/228	pCi/L	5	NA	1.93	5		< 0.568	0.943	1.83	1.70	0.624	< 0.581	< 1.27	2.28	--	< 1.83	1.92	< 1.40
Selenium	ug/L	50	NA	5	50		7	4	< 1	7	7	5	5.2	4.5	--	2.9	4.0	4.2
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15021[2]									
						Sample Date:	12/3/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/19/2017	6/22/2017	8/16/2017	9/27/2017	4/26/2018	6/11/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient										
Appendix III																	
Boron	ug/L	NC	NA	51	NA		393	386	287	300	337	231	232	233	182	--	214
Calcium	mg/L	NC	NA	46	NA		61.1	74.2	42.7	50.2	56.9	30.1	32.8	35.7	37.0	--	26.6
Chloride	mg/L	250*	NA	43	NA		62.7	63.0	36.1	40.7	46.8	24.3	33.9	35.2	40.9	--	21.3
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		40.4	43.0	28.7	27.7	33.4	24.7	24.7	30.2	25.9	--	22.1
Total Dissolved Solids	mg/L	500*	NA	258	NA		340	340	250	260	300	190	204	238	280	--	174
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.3	6.1	6.0	6.1	6.3	6.0	6.2	6.3	6.5	6.3[1]	6.0
Appendix IV																	
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		71	70	56	46	54	55	63.3	47.6	--	64.2	57.6
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	< 1	2	< 1	< 1	1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.268	< 0.200	< 0.171	< 0.324	< 0.270	< 0.221	0.354	0.238	--	< 0.562	< 0.466
Radium-228	pCi/L	NC	NA	NA	NA		0.879	2.03	1.18	1.52	0.571	< 0.536	< 0.729	1.29	--	< 0.888	< 0.818
Radium-226/228	pCi/L	5	NA	1.93	5		1.05	2.11	1.23	1.52	0.592	< 0.536	< 0.866	1.53	--	< 1.45	< 1.28
Selenium	ug/L	50	NA	5	50		3	1	2	3	2	3	2.0	3.3	--	2.7	3.0
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15022											
						Sample Date:	12/5/2015	3/9/2016	6/23/2016	8/31/2016	11/17/2016	4/19/2017	6/22/2017	8/15/2017	9/27/2017	4/27/2018	6/20/2018	11/14/2018	11/14/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient												
Appendix III																			Field Dup
Boron	ug/L	NC	NA	51	NA		433	393	329	371	413	444	397	376	340	--	315	376	374
Calcium	mg/L	NC	NA	46	NA		109	93.6	102	121	118	115	101	122	103	--	109	109	106
Chloride	mg/L	250*	NA	43	NA		11.2	8.68	1.28	3.94	4.67	2.07	1.1	1.6	2.4	--	3.5	3.7	3.8
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		75.3	47.6	24.4	42.1	81.5	26.9	19.2	35.0	43.7	--	26.0	40.6	40.7
Total Dissolved Solids	mg/L	500*	NA	258	NA		480	440	380	480	500	440	502	466	406	--	414	358	400
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.0	6.9	6.8	6.8	6.8	7.0	7.0	7.0	7.0	7.6(1)	6.9	7.0	--
Appendix IV																			
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		51	27	21	26	28	26	22.6	26.8	--	20.3	21.2	21.3	22.6
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		2	1	2	1	2	3	< 1.0	< 1.0	--	1.3	< 1.0	1.7	1.5
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		6	5	5	6	< 5	5	< 5.0	5.3	--	5.2	< 5.0	6.5	6.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.159	< 0.186	1.12	< 0.219	< 0.224	< 0.26	< 0.426	< 0.861	--	< 0.431	< 0.673	< 0.692	<0.924
Radium-228	pCi/L	NC	NA	NA	NA		2.22	< 0.636	1.08	1.26	1.62	1.60	< 0.511	< 1.03	--	< 0.583	< 0.697	0.999	< 0.849
Radium-226/228	pCi/L	5	NA	1.93	5		2.29	< 0.636	2.2	1.32	1.75	1.84	< 0.937	< 1.89	--	< 1.01	< 1.37	< 1.35	< 1.77
Selenium	ug/L	50	NA	5	50		8	10	< 1	6	9	4	1.3	4.1	--	4.1	2.8	5.6	5.2
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15031													
						Sample Date:	12/4/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/22/2017	6/22/2017	8/16/2017	8/16/2017	9/27/2017	9/27/2017	4/27/2018	6/20/2018	11/14/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient													
Appendix III														Field Dup		Field Dup		Field Dup		
Boron	ug/L	NC	NA	51	NA		89	117	106	111	102	112	96.5	98.9	97.0	< 100	95.6	99.5	--	108	104
Calcium	mg/L	NC	NA	46	NA		77.1	94.2	80.3	84.8	70.3	76.3	63.9	66.8	62.5	67.5	68.5	67.2	--	66.9	63.3
Chloride	mg/L	250*	NA	43	NA		38.6	45.6	40	42.1	37.8	38.3	41.7	41.7	48.1	48.5	47.5	47.1	--	38.9	33.4
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		36.6	45.8	41.1	40.1	29.8	34.1	35.2	35.1	40.9	41.2	38.9	38.7	--	40.0	34.7
Total Dissolved Solids	mg/L	500*	NA	258	NA		340	390	380	370	310	340	348	412	454	454	386	452	--	352	268
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.0	6.7	6.7	6.8	6.8	6.9	6.9	--	6.8	--	6.8	--	7.6(1)	6.8	6.7
Appendix IV																				
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		21	23	21	20	18	20	16.6	17.0	19.2	18.9	--	--	15.4	18.9	21.4
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		11	1	2	1	2	3	12.3	8.2	1.7	1.1	--	--	< 1.0	< 1.0	24.6
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	< 15.0	< 15.0	--	--	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	1.3
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	< 5.0	< 5.0	--	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.230	< 0.272	< 0.309	< 0.379	< 0.279	0.419	< 1.03	0.393	< 0.423	0.675	--	--	< 0.479	< 0.638	0.849
Radium-228	pCi/L	NC	NA	NA	NA		0.922	< 0.424	0.872	1.53	0.759	1.25	< 0.636	< 0.662	< 1.05	< 0.894	--	--	< 0.708	< 1.02	< 0.773
Radium-226/228	pCi/L	5	NA	1.93	5		1.06	< 0.424	1.01	1.79	0.922	1.67	< 1.67	0.835	< 1.47	1.33	--	--	< 1.19	< 1.66	< 1.50
Selenium	ug/L	50	NA	5	50		3	2	1	1	2	2	1.3	1.3	< 1.0	1.9	--	--	4.0	3.0	2.4
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15032											
						Sample Date:	12/4/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/23/2017	8/15/2017	9/26/2017	4/26/2018	6/19/2018	6/19/2018	11/14/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient											Field Dup	
Appendix III																			
Boron	ug/L	NC	NA	51	NA		73	74	61	72	78	71	56.4	62.4	57.8	--	45.7	44.6	49.4
Calcium	mg/L	NC	NA	46	NA		11.6	10.2	9.91	11.6	8.85	8.87	7.2	7.0	6.8	--	8.8	8.4	8.1
Chloride	mg/L	250*	NA	43	NA		1.99	2.14	2.43	2.84	2.55	3.49	2.7	3.0	3.2	--	3.4	3.4	4.2
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		18.4	18.0	19.4	19.7	16.0	16.1	13.9	16.3	< 2.0	--	11.8	11.6	11.9
Total Dissolved Solids	mg/L	500*	NA	258	NA		64	64	79	67	57	66	54	< 50.0	84	--	64	< 50.0	< 50.0
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.4	6.2	6.0	5.6	6.2	6.1	6.0	6.1	6.0	5.9(1)	6.3	--	6.2
Appendix IV																			
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		10	9	9	10	9	9	7.3	9.1	--	7.8	8.8	8.7	7.7
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	1	< 1	1	1	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.197	< 0.178	< 0.234	< 0.195	< 0.245	< 0.278	< 0.457	< 0.973	--	< 0.514	< 0.464	< 0.722	< 0.748
Radium-228	pCi/L	NC	NA	NA	NA		< 0.566	< 0.466	< 0.509	< 0.498	< 0.654	< 0.441	< 0.893	< 0.923	--	< 0.784	< 0.721	< 1.17	< 0.812
Radium-226/228	pCi/L	5	NA	1.93	5		< 0.566	< 0.466	< 0.509	< 0.498	< 0.654	< 0.441	< 1.35	< 1.90	--	< 1.30	< 1.19	< 1.89	< 1.56
Selenium	ug/L	50	NA	5	50		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15033											
						Sample Date:	12/4/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/20/2017	6/23/2017	8/15/2017	9/26/2017	4/26/2018	4/26/2018	6/19/2018	11/14/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient										Field Dup		
Appendix III																			
Boron	ug/L	NC	NA	51	NA		27	32	35	31	34	33	33.0	30.8	34.1	--	--	33.0	41.8
Calcium	mg/L	NC	NA	46	NA		16.2	13.1	13.4	13.1	11.5	15.4	12.6	9.6	10.1	--	--	9.0	10.0
Chloride	mg/L	250*	NA	43	NA		< 1	1.03	1.98	1.56	1.25	1.82	1.7	1.1	1.4	--	--	3.4	3.2
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		10.4	8.83	10.3	8.86	9.02	10.1	9.0	9.7	< 2.0	--	--	8.1	9.2
Total Dissolved Solids	mg/L	500*	NA	258	NA		64	66	69	74	54	79	124	126	< 50.0	--	--	68	< 50.0
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.0	6.7	6.5	6.1	6.7	6.8	6.8	6.8	6.7	6.8(1)	--	6.7	6.7
Appendix IV																			
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		< 5	5	6	5	6	6	5.2	4.6	--	4.8	4.3	5.2	6.1
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	< 1	< 1	1	1	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.148	< 0.296	< 0.332	< 0.300	< 0.215	< 0.415	0.521	< 0.617	--	< 0.460	< 0.151	< 0.570	< 0.766
Radium-228	pCi/L	NC	NA	NA	NA		< 0.522	< 0.534	< 0.511	0.537	< 0.356	0.887	< 0.824	< 1.05	--	< 0.732	< 0.792	< 0.845	< 0.729
Radium-226/228	pCi/L	5	NA	1.93	5		< 0.522	< 0.534	< 0.511	0.622	< 0.356	0.887	< 1.30	< 1.67	--	< 1.19	< 0.943	< 1.42	< 1.50
Selenium	ug/L	50	NA	5	50		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15034										
						Sample Date:	12/4/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/20/2017	6/23/2017	8/15/2017	9/26/2017	4/25/2018	6/19/2018	11/14/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient											
Appendix III																		
Boron	ug/L	NC	NA	51	NA		54	69	48	66	70	67	68.1	62.1	51.4	--	62.6	62.5
Calcium	mg/L	NC	NA	46	NA		10.3	8.6	6.91	11	8.33	5.83	5.5	5.9	6.0	--	5.8	6.0
Chloride	mg/L	250*	NA	43	NA		2.48	1.91	4.31	1.56	1.88	1.43	1.5	2.0	2.2	--	3.1	3.5
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		23.9	18.5	13.2	16.6	16.9	15.1	12.6	16.5	< 2.0	--	12.5	14.4
Total Dissolved Solids	mg/L	500*	NA	258	NA		50	62	53	61	48	49	104	60	< 50.0	--	50	< 50.0
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.2	6.2	5.8	5.7	6.0	6.0	6.1	6.1	6.0	6.0(1)	6.0	5.9
Appendix IV																		
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	1.7	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		8	7	5	6	6	6	5.4	5.5	--	5.3	5.5	6.0
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	< 1	< 1	< 1	< 1	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.256	< 0.193	< 0.244	< 0.267	< 0.283	< 0.307	< 0.607	< 0.763	--	< 0.775	< 0.514	< 0.688
Radium-228	pCi/L	NC	NA	NA	NA		0.880	< 0.418	0.853	0.819	0.451	0.877	0.905	< 0.760	--	< 0.804	< 1.04	< 0.786
Radium-226/228	pCi/L	5	NA	1.93	5		0.963	< 0.418	1.03	0.858	0.603	0.998	1.49	< 1.52	--	< 1.58	< 1.55	< 1.47
Selenium	ug/L	50	NA	5	50		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15035										
						Sample Date:	12/4/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/23/2017	8/16/2017	9/26/2017	4/27/2018	6/20/2018	11/14/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient											
Appendix III																		
Boron	ug/L	NC	NA	51	NA		146	130	81	86	103	123	121	116	126	--	111	78.2
Calcium	mg/L	NC	NA	46	NA		118	111	78.7	72.5	83.3	88.5	82.1	91.3	107	--	90.5	66.6
Chloride	mg/L	250*	NA	43	NA		34.2	31.3	16.7	19	25.4	21.2	28.3	33.9	35.9	--	27.1	20.00
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		39.2	32.4	20.8	21.8	24.9	24.7	28.2	35.4	35.6	--	26.7	18.8
Total Dissolved Solids	mg/L	500*	NA	258	NA		450	400	300	320	320	320	314	578	512	--	342	274
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.0	6.9	7.2	7.3	7.1	7.2	7.2	7.0	7.0	8.0(1)	7.0	7.3
Appendix IV																		
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		27	21	14	13	16	17	15.8	19.4	--	17.4	18.1	12.3
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		15	< 1	1	< 1	2	3	1.1	< 1.0	--	4.8	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.151	< 0.156	0.355	< 0.345	< 0.239	< 0.429	< 0.452	< 1.08	--	< 0.733	< 0.548	< 0.850
Radium-228	pCi/L	NC	NA	NA	NA		0.902	< 0.622	1.04	1.23	1.40	0.764	0.899	0.952	--	0.937	1.27	< 0.914
Radium-226/228	pCi/L	5	NA	1.93	5		0.929	< 0.622	1.40	1.28	1.47	0.801	< 1.35	< 1.98	--	< 1.41	1.63	< 1.76
Selenium	ug/L	50	NA	5	50		3	2	< 1	< 1	1	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15036										
						Sample Date:	12/5/2015	3/10/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/23/2017	8/15/2017	9/26/2017	4/27/2018	6/20/2018	11/14/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient											
Appendix III																		
Boron	ug/L	NC	NA	51	NA		54	79	74	70	51	99	87.3	51.7	41.3	--	88.3	79.2
Calcium	mg/L	NC	NA	46	NA		46.2	53.9	70.9	61.7	36.1	82.9	69.4	39.6	34.5	--	64.8	51.6
Chloride	mg/L	250*	NA	43	NA		19.1	13.9	25.2	20.7	11.9	27.3	27.2	23.4	13.5	--	24.3	14.7
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		18.5	16.6	23.6	19.4	12.1	29.2	29.4	20.3	14.9	--	26.1	20.0
Total Dissolved Solids	mg/L	500*	NA	258	NA		180	230	300	290	160	340	404	246	300	--	278	216
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.6	7.4	7.0	6.8	7.4	7.2	7.3	7.5	7.5	8.1(1)	7.1	7.4
Appendix IV																		
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		8	8	10	10	6	13	10.9	7.2	--	8.9	11.5	8.2
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	1.1	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	1	1	< 1	1	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.174	0.194	< 0.229	< 0.260	< 0.202	< 0.303	< 0.692	< 0.671	--	< 0.618	< 0.555	0.812
Radium-228	pCi/L	NC	NA	NA	NA		2.10	< 0.470	0.513	0.367	0.700	< 0.874	< 0.783	< 1.21	--	< 0.626	< 0.743	< 0.670
Radium-226/228	pCi/L	5	NA	1.93	5		2.20	< 0.47	0.623	0.486	0.745	< 0.874	< 1.48	< 1.88	--	< 1.24	< 1.30	0.874
Selenium	ug/L	50	NA	5	50		< 1	< 1	< 1	< 1	< 1	2	< 1.0	< 1.0	--	1.6	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15037										
						Sample Date:	12/4/2015	3/10/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/23/2017	8/15/2017	9/26/2017	4/27/2018	6/20/2018	11/14/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient											
Appendix III																		
Boron	ug/L	NC	NA	51	NA		107	122	164	153	210	273	263	171	114	--	153	221
Calcium	mg/L	NC	NA	46	NA		71.9	64.6	73.4	78.8	89.7	91.2	94.6	83.8	76.0	--	72.6	103
Chloride	mg/L	250*	NA	43	NA		23.6	32.8	38.6	29.6	30.4	15.3	14.7	25.0	30.3	--	7.9	8.2
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		38.3	27.9	27.2	35.1	54.6	35.1	41.3	52.3	45.3	--	36.3	50.1
Total Dissolved Solids	mg/L	500*	NA	258	NA		290	260	380	360	400	380	404	408	376	--	360	406
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.3	7.1	7.0	6.8	7.3	7.0	7.2	7.2	7.3	7.9(1)	7.1	7.3
Appendix IV																		
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		13	14	17	16	16	15	15.1	13.4	--	11.5	11.7	14.3
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	< 1	3	< 1	1	2	< 1.0	< 1.0	--	< 1.0	< 1.0	1.6
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.185	< 0.212	< 0.280	< 0.271	< 0.217	< 0.363	< 0.733	< 0.685	--	< 0.549	< 0.648	< 0.578
Radium-228	pCi/L	NC	NA	NA	NA		0.801	< 0.750	0.814	1.05	0.512	2.17	0.941	< 1.22	--	< 0.699	< 0.804	< 0.729
Radium-226/228	pCi/L	5	NA	1.93	5		0.868	< 0.75	0.973	1.14	0.667	2.27	< 1.40	< 1.91	--	< 1.25	< 1.45	< 1.31
Selenium	ug/L	50	NA	5	50		25	6	< 1	13	25	11	11.9	14.1	--	1.1	9.9	21.1
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Technical Memorandum

Sanitas™ Output Files

Summary Report

Constituent: Antimony, Total Analysis Run 2/20/2019 4:39 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/3/2015 and 11/14/2018, a summary of the selected data set:

Observations = 121
ND/Trace = 118
Wells = 11
Minimum Value = 1
Maximum Value = 1.7
Mean Value = 1.006
Median Value = 1
Standard Deviation = 0.06364
Coefficient of Variation = 0.06327
Skewness = 10.86

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	11	10	1	1	1	1	0	0	NaN
JHC-MW-15018	11	10	1	1	1	1	0	0	NaN
JHC-MW-15019	11	11	1	1	1	1	0	0	NaN
JHC-MW-15022	11	11	1	1	1	1	0	0	NaN
JHC-MW-15031	11	11	1	1	1	1	0	0	NaN
JHC-MW-15032	11	11	1	1	1	1	0	0	NaN
JHC-MW-15033	11	11	1	1	1	1	0	0	NaN
JHC-MW-15034	11	10	1	1.7	1.064	1	0.2111	0.1984	2.846
JHC-MW-15035	11	11	1	1	1	1	0	0	NaN
JHC-MW-15036	11	11	1	1	1	1	0	0	NaN
JHC-MW-15037	11	11	1	1	1	1	0	0	NaN

Summary Report

Constituent: Arsenic, Total Analysis Run 2/20/2019 4:39 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/3/2015 and 11/14/2018, a summary of the selected data set:

Observations = 121
ND/Trace = 121
Wells = 11
Minimum Value = 1
Maximum Value = 1
Mean Value = 1
Median Value = 1
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	11	11	1	1	1	1	0	0	NaN
JHC-MW-15018	11	11	1	1	1	1	0	0	NaN
JHC-MW-15019	11	11	1	1	1	1	0	0	NaN
JHC-MW-15022	11	11	1	1	1	1	0	0	NaN
JHC-MW-15031	11	11	1	1	1	1	0	0	NaN
JHC-MW-15032	11	11	1	1	1	1	0	0	NaN
JHC-MW-15033	11	11	1	1	1	1	0	0	NaN
JHC-MW-15034	11	11	1	1	1	1	0	0	NaN
JHC-MW-15035	11	11	1	1	1	1	0	0	NaN
JHC-MW-15036	11	11	1	1	1	1	0	0	NaN
JHC-MW-15037	11	11	1	1	1	1	0	0	NaN

Summary Report

Constituent: Barium, Total Analysis Run 2/20/2019 4:39 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/3/2015 and 11/14/2018, a summary of the selected data set:

Observations = 121
ND/Trace = 1
Wells = 11
Minimum Value = 4.55
Maximum Value = 127
Mean Value = 29.09
Median Value = 16.8
Standard Deviation = 28.93
Coefficient of Variation = 0.9948
Skewness = 1.39

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	11	0	50	127	83.87	79.7	23.27	0.2775	0.4958
JHC-MW-15018	11	0	63	95	79.62	79.6	11.94	0.1499	-0.009498
JHC-MW-15019	11	0	38	69	49.44	47	9.803	0.1983	0.8057
JHC-MW-15022	11	0	20.3	51	26.53	26	8.579	0.3234	2.314
JHC-MW-15031	11	0	15.4	23	19.5	20	2.186	0.1121	-0.3637
JHC-MW-15032	11	0	7.3	10	8.786	9	0.8712	0.09916	-0.2983
JHC-MW-15033	11	1	4.55	6.1	5.332	5.2	0.5866	0.11	0.1892
JHC-MW-15034	11	0	5	8	5.973	6	0.8568	0.1435	1.299
JHC-MW-15035	11	0	12.3	27	17.36	17	4.138	0.2383	1.028
JHC-MW-15036	11	0	6	13	9.245	8.9	2.052	0.2219	0.267
JHC-MW-15037	11	0	11.5	17	14.27	14.3	1.771	0.1241	-0.1802

Summary Report

Constituent: Beryllium, Total Analysis Run 2/20/2019 4:39 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/3/2015 and 11/14/2018, a summary of the selected data set:

Observations = 121
ND/Trace = 121
Wells = 11
Minimum Value = 1
Maximum Value = 1
Mean Value = 1
Median Value = 1
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	11	11	1	1	1	1	0	0	NaN
JHC-MW-15018	11	11	1	1	1	1	0	0	NaN
JHC-MW-15019	11	11	1	1	1	1	0	0	NaN
JHC-MW-15022	11	11	1	1	1	1	0	0	NaN
JHC-MW-15031	11	11	1	1	1	1	0	0	NaN
JHC-MW-15032	11	11	1	1	1	1	0	0	NaN
JHC-MW-15033	11	11	1	1	1	1	0	0	NaN
JHC-MW-15034	11	11	1	1	1	1	0	0	NaN
JHC-MW-15035	11	11	1	1	1	1	0	0	NaN
JHC-MW-15036	11	11	1	1	1	1	0	0	NaN
JHC-MW-15037	11	11	1	1	1	1	0	0	NaN

Summary Report

Constituent: Cadmium, Total Analysis Run 2/20/2019 4:39 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/3/2015 and 11/14/2018, a summary of the selected data set:

Observations = 121
ND/Trace = 113
Wells = 11
Minimum Value = 0.2
Maximum Value = 1.1
Mean Value = 0.2186
Median Value = 0.2
Standard Deviation = 0.09897
Coefficient of Variation = 0.4528
Skewness = 6.882

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	11	4	0.2	0.6	0.3227	0.22	0.1554	0.4816	0.7079
JHC-MW-15018	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15019	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15022	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15031	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15032	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15033	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15034	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15035	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15036	11	10	0.2	1.1	0.2818	0.2	0.2714	0.9629	2.846
JHC-MW-15037	11	11	0.2	0.2	0.2	0.2	0	0	NaN

Summary Report

Constituent: Chromium, Total Analysis Run 2/20/2019 4:39 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/3/2015 and 11/14/2018, a summary of the selected data set:

Observations = 121
ND/Trace = 74
Wells = 11
Minimum Value = 1
Maximum Value = 24.6
Mean Value = 1.683
Median Value = 1
Standard Deviation = 2.78
Coefficient of Variation = 1.652
Skewness = 6.171

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	11	9	1	2	1.091	1	0.3015	0.2764	2.846
JHC-MW-15018	11	9	1	2	1.091	1	0.3015	0.2764	2.846
JHC-MW-15019	11	7	1	3	1.273	1	0.6467	0.5081	2.077
JHC-MW-15022	11	3	1	3	1.536	1.3	0.6546	0.4261	0.9907
JHC-MW-15031	11	2	1	24.6	5.295	2	7.387	1.395	1.832
JHC-MW-15032	11	7	1	1	1	1	0	0	NaN
JHC-MW-15033	11	8	1	1	1	1	0	0	NaN
JHC-MW-15034	11	10	1	1	1	1	0	0	NaN
JHC-MW-15035	11	5	1	15	2.9	1	4.192	1.446	2.464
JHC-MW-15036	11	7	1	1	1	1	0	0	NaN
JHC-MW-15037	11	7	1	3	1.327	1	0.6467	0.4872	1.832

Summary Report

Constituent: Cobalt, Total Analysis Run 2/20/2019 4:39 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/3/2015 and 11/14/2018, a summary of the selected data set:

Observations = 121
ND/Trace = 121
Wells = 11
Minimum Value = 6
Maximum Value = 15
Mean Value = 14.18
Median Value = 15
Standard Deviation = 2.598
Coefficient of Variation = 0.1832
Skewness = -2.846

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	11	11	6	15	14.18	15	2.714	0.1913	-2.846
JHC-MW-15018	11	11	6	15	14.18	15	2.714	0.1913	-2.846
JHC-MW-15019	11	11	6	15	14.18	15	2.714	0.1913	-2.846
JHC-MW-15022	11	11	6	15	14.18	15	2.714	0.1913	-2.846
JHC-MW-15031	11	11	6	15	14.18	15	2.714	0.1913	-2.846
JHC-MW-15032	11	11	6	15	14.18	15	2.714	0.1913	-2.846
JHC-MW-15033	11	11	6	15	14.18	15	2.714	0.1913	-2.846
JHC-MW-15034	11	11	6	15	14.18	15	2.714	0.1913	-2.846
JHC-MW-15035	11	11	6	15	14.18	15	2.714	0.1913	-2.846
JHC-MW-15036	11	11	6	15	14.18	15	2.714	0.1913	-2.846
JHC-MW-15037	11	11	6	15	14.18	15	2.714	0.1913	-2.846

Summary Report

Constituent: Fluoride Analysis Run 2/20/2019 4:39 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/3/2015 and 11/14/2018, a summary of the selected data set:

Observations = 132
ND/Trace = 132
Wells = 11
Minimum Value = 1000
Maximum Value = 1000
Mean Value = 1000
Median Value = 1000
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	12	12	1000	1000	1000	1000	0	0	NaN
JHC-MW-15018	12	12	1000	1000	1000	1000	0	0	NaN
JHC-MW-15019	12	12	1000	1000	1000	1000	0	0	NaN
JHC-MW-15022	12	12	1000	1000	1000	1000	0	0	NaN
JHC-MW-15031	12	12	1000	1000	1000	1000	0	0	NaN
JHC-MW-15032	12	12	1000	1000	1000	1000	0	0	NaN
JHC-MW-15033	12	12	1000	1000	1000	1000	0	0	NaN
JHC-MW-15034	12	12	1000	1000	1000	1000	0	0	NaN
JHC-MW-15035	12	12	1000	1000	1000	1000	0	0	NaN
JHC-MW-15036	12	12	1000	1000	1000	1000	0	0	NaN
JHC-MW-15037	12	12	1000	1000	1000	1000	0	0	NaN

Summary Report

Constituent: Lead, Total Analysis Run 2/20/2019 4:39 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/3/2015 and 11/14/2018, a summary of the selected data set:

Observations = 121
ND/Trace = 120
Wells = 11
Minimum Value = 1
Maximum Value = 1.3
Mean Value = 1.002
Median Value = 1
Standard Deviation = 0.02727
Coefficient of Variation = 0.02721
Skewness = 10.86

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	11	11	1	1	1	1	0	0	NaN
JHC-MW-15018	11	11	1	1	1	1	0	0	NaN
JHC-MW-15019	11	11	1	1	1	1	0	0	NaN
JHC-MW-15022	11	11	1	1	1	1	0	0	NaN
JHC-MW-15031	11	10	1	1.3	1.027	1	0.09045	0.08805	2.846
JHC-MW-15032	11	11	1	1	1	1	0	0	NaN
JHC-MW-15033	11	11	1	1	1	1	0	0	NaN
JHC-MW-15034	11	11	1	1	1	1	0	0	NaN
JHC-MW-15035	11	11	1	1	1	1	0	0	NaN
JHC-MW-15036	11	11	1	1	1	1	0	0	NaN
JHC-MW-15037	11	11	1	1	1	1	0	0	NaN

Summary Report

Constituent: Lithium, Total Analysis Run 2/20/2019 4:39 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/3/2015 and 11/14/2018, a summary of the selected data set:

Observations = 121
ND/Trace = 121
Wells = 11
Minimum Value = 10
Maximum Value = 10
Mean Value = 10
Median Value = 10
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	11	11	10	10	10	10	0	0	NaN
JHC-MW-15018	11	11	10	10	10	10	0	0	NaN
JHC-MW-15019	11	11	10	10	10	10	0	0	NaN
JHC-MW-15022	11	11	10	10	10	10	0	0	NaN
JHC-MW-15031	11	11	10	10	10	10	0	0	NaN
JHC-MW-15032	11	11	10	10	10	10	0	0	NaN
JHC-MW-15033	11	11	10	10	10	10	0	0	NaN
JHC-MW-15034	11	11	10	10	10	10	0	0	NaN
JHC-MW-15035	11	11	10	10	10	10	0	0	NaN
JHC-MW-15036	11	11	10	10	10	10	0	0	NaN
JHC-MW-15037	11	11	10	10	10	10	0	0	NaN

Summary Report

Constituent: Mercury, Total Analysis Run 2/20/2019 4:39 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/3/2015 and 11/14/2018, a summary of the selected data set:

Observations = 121
ND/Trace = 121
Wells = 11
Minimum Value = 0.2
Maximum Value = 0.2
Mean Value = 0.2
Median Value = 0.2
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15018	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15019	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15022	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15031	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15032	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15033	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15034	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15035	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15036	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15037	11	11	0.2	0.2	0.2	0.2	0	0	NaN

Summary Report

Constituent: Molybdenum, Total Analysis Run 2/20/2019 4:39 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/3/2015 and 11/14/2018, a summary of the selected data set:

Observations = 121
ND/Trace = 92
Wells = 11
Minimum Value = 5
Maximum Value = 33
Mean Value = 6.257
Median Value = 5
Standard Deviation = 4.093
Coefficient of Variation = 0.6542
Skewness = 4.573

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	11	2	5	28.5	9.782	8	6.659	0.6807	2.21
JHC-MW-15018	11	7	5	19.7	7.764	5	5.358	0.6901	1.631
JHC-MW-15019	11	3	5	33	10.94	7.7	8.627	0.7888	1.789
JHC-MW-15022	11	3	5	6.25	5.341	5	0.4913	0.09199	0.9579
JHC-MW-15031	11	11	5	5	5	5	0	0	NaN
JHC-MW-15032	11	11	5	5	5	5	0	0	NaN
JHC-MW-15033	11	11	5	5	5	5	0	0	NaN
JHC-MW-15034	11	11	5	5	5	5	0	0	NaN
JHC-MW-15035	11	11	5	5	5	5	0	0	NaN
JHC-MW-15036	11	11	5	5	5	5	0	0	NaN
JHC-MW-15037	11	11	5	5	5	5	0	0	NaN

Summary Report

Constituent: Radium-226 Analysis Run 2/20/2019 4:39 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/3/2015 and 11/14/2018, a summary of the selected data set:

Observations = 121
ND/Trace = 102
Wells = 11
Minimum Value = 0.148
Maximum Value = 1.17
Mean Value = 0.4663
Median Value = 0.402
Standard Deviation = 0.2549
Coefficient of Variation = 0.5466
Skewness = 0.7216

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	11	6	0.182	1.17	0.5919	0.456	0.3497	0.5909	0.39
JHC-MW-15018	11	8	0.203	0.9085	0.4656	0.318	0.2492	0.5352	0.5235
JHC-MW-15019	11	9	0.184	0.856	0.4678	0.402	0.2452	0.524	0.5308
JHC-MW-15022	11	10	0.159	1.12	0.4985	0.426	0.3409	0.684	0.6453
JHC-MW-15031	11	7	0.23	0.849	0.465	0.419	0.2016	0.4335	0.5929
JHC-MW-15032	11	11	0.178	0.973	0.431	0.278	0.2753	0.6387	0.7868
JHC-MW-15033	11	10	0.148	0.766	0.4218	0.415	0.1861	0.4412	0.3025
JHC-MW-15034	11	11	0.193	0.775	0.4452	0.307	0.2273	0.5106	0.3871
JHC-MW-15035	11	10	0.151	1.08	0.4853	0.429	0.2956	0.6091	0.7356
JHC-MW-15036	11	9	0.174	0.812	0.4282	0.303	0.2413	0.5635	0.3184
JHC-MW-15037	11	11	0.185	0.733	0.4292	0.363	0.2111	0.4919	0.2047

Summary Report

Constituent: Radium-226/228 Analysis Run 2/20/2019 4:39 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/3/2015 and 11/14/2018, a summary of the selected data set:

Observations = 121
ND/Trace = 64
Wells = 11
Minimum Value = 0.356
Maximum Value = 3.02
Mean Value = 1.272
Median Value = 1.3
Standard Deviation = 0.5267
Coefficient of Variation = 0.4142
Skewness = 0.2748

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	11	3	0.659	3.02	1.814	1.94	0.6503	0.3584	-0.2656
JHC-MW-15018	11	4	0.408	2	1.279	1.23	0.4391	0.3433	-0.1199
JHC-MW-15019	11	5	0.715	1.75	1.276	1.12	0.3851	0.3019	0.03781
JHC-MW-15022	11	6	0.636	2.29	1.547	1.75	0.5335	0.3449	-0.2614
JHC-MW-15031	11	4	0.424	1.79	1.262	1.252	0.4008	0.3177	-0.5807
JHC-MW-15032	11	11	0.441	1.9	1.012	0.654	0.5937	0.5866	0.4287
JHC-MW-15033	11	9	0.356	1.67	0.9556	0.887	0.4727	0.4947	0.1809
JHC-MW-15034	11	5	0.418	1.58	1.135	1.03	0.4111	0.3623	-0.3743
JHC-MW-15035	11	5	0.622	1.98	1.33	1.4	0.409	0.3075	-0.2815
JHC-MW-15036	11	6	0.47	2.2	1.107	0.874	0.5702	0.5153	0.6502
JHC-MW-15037	11	6	0.667	2.27	1.272	1.25	0.486	0.3822	0.736

Summary Report

Constituent: Radium-228 Analysis Run 2/20/2019 4:39 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/3/2015 and 11/14/2018, a summary of the selected data set:

Observations = 121
ND/Trace = 62
Wells = 11
Minimum Value = 0.356
Maximum Value = 2.74
Mean Value = 0.9218
Median Value = 0.845
Standard Deviation = 0.3971
Coefficient of Variation = 0.4307
Skewness = 1.698

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	11	3	0.659	2.74	1.366	1.42	0.5956	0.4361	0.9122
JHC-MW-15018	11	5	0.408	1.33	0.9209	1.03	0.2749	0.2985	-0.5849
JHC-MW-15019	11	4	0.638	1.58	0.8986	0.839	0.2605	0.2899	1.696
JHC-MW-15022	11	5	0.511	2.22	1.106	1.03	0.5318	0.481	0.7767
JHC-MW-15031	11	6	0.424	1.53	0.9064	0.872	0.3022	0.3334	0.5599
JHC-MW-15032	11	11	0.441	1.17	0.7015	0.654	0.2338	0.3333	0.6057
JHC-MW-15033	11	9	0.356	1.05	0.6897	0.729	0.2102	0.3048	0.07677
JHC-MW-15034	11	5	0.418	1.04	0.7812	0.819	0.187	0.2394	-1
JHC-MW-15035	11	2	0.622	1.4	0.9936	0.937	0.2278	0.2293	0.3167
JHC-MW-15036	11	7	0.367	2.1	0.8233	0.7	0.4793	0.5822	1.864
JHC-MW-15037	11	5	0.512	2.17	0.9536	0.804	0.4446	0.4662	2.013

Summary Report

Constituent: Selenium, Total Analysis Run 2/20/2019 4:39 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/3/2015 and 11/14/2018, a summary of the selected data set:

Observations = 121
ND/Trace = 51
Wells = 11
Minimum Value = 1
Maximum Value = 37
Mean Value = 7.12
Median Value = 2
Standard Deviation = 8.68
Coefficient of Variation = 1.219
Skewness = 1.41

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	11	0	18.2	37	25.22	23.5	6.938	0.2751	0.416
JHC-MW-15018	11	0	7	18	12.3	12.7	3.198	0.2599	-0.009738
JHC-MW-15019	11	0	6	24.8	15.56	15.8	5.528	0.3552	-0.05677
JHC-MW-15022	11	1	1	10	5.064	4.1	2.971	0.5867	0.2898
JHC-MW-15031	11	0	1	4	2.105	2	0.9398	0.4466	0.603
JHC-MW-15032	11	11	1	1	1	1	0	0	NaN
JHC-MW-15033	11	11	1	1	1	1	0	0	NaN
JHC-MW-15034	11	11	1	1	1	1	0	0	NaN
JHC-MW-15035	11	7	1	3	1.273	1	0.6467	0.5081	2.077
JHC-MW-15036	11	9	1	2	1.145	1	0.3357	0.2931	1.913
JHC-MW-15037	11	1	1	25	12.65	11.9	8.384	0.663	0.1676

Summary Report

Constituent: Thallium, Total Analysis Run 2/20/2019 4:39 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/3/2015 and 11/14/2018, a summary of the selected data set:

Observations = 121
ND/Trace = 121
Wells = 11
Minimum Value = 2
Maximum Value = 2
Mean Value = 2
Median Value = 2
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	11	11	2	2	2	2	0	0	NaN
JHC-MW-15018	11	11	2	2	2	2	0	0	NaN
JHC-MW-15019	11	11	2	2	2	2	0	0	NaN
JHC-MW-15022	11	11	2	2	2	2	0	0	NaN
JHC-MW-15031	11	11	2	2	2	2	0	0	NaN
JHC-MW-15032	11	11	2	2	2	2	0	0	NaN
JHC-MW-15033	11	11	2	2	2	2	0	0	NaN
JHC-MW-15034	11	11	2	2	2	2	0	0	NaN
JHC-MW-15035	11	11	2	2	2	2	0	0	NaN
JHC-MW-15036	11	11	2	2	2	2	0	0	NaN
JHC-MW-15037	11	11	2	2	2	2	0	0	NaN

Appendix C
Data Quality Review

Laboratory Data Quality Review
Groundwater Monitoring Event April 2019
CEC JH Campbell Background

Groundwater samples were collected by TRC for the April 2019 sampling event. Samples were analyzed for anions, total dissolved solids, and total metals by Eurofins TestAmerica, located in Irvine, California (Eurofins TA - Irvine). The lithium analyses by method SW-846 6020 were subcontracted to Eurofins TA in North Canton, Ohio (Eurofins TA – Canton) and the radium analyses were subcontracted to Eurofins TA in St. Louis, Missouri (Eurofins TA – St. Louis). The laboratory analytical results were reported in laboratory sample delivery groups (SDGs) 440-239742-1 and 440-239737-1.

During the April 2019 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15023
- JHC-MW-15024
- JHC-MW-15025
- JHC-MW-15026
- JHC-MW-15027
- JHC-MW-15028

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	SW-846 300.0
Total Dissolved Solids	SM 2540C-11
Total Metals	SW-846 6010B/6020A/7470A
Radium (Radium-226, Radium-228, Total Radium)	EPA 903.0, EPA 904.0

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt, as noted in the cover page or case narrative;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or

analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures;

- Data for laboratory control samples (LCSs) and/or LCS duplicates (LCSDs). The LCSs and/or LCSDs are used to assess the accuracy and/or precision of the analytical method for each analyte spiked using a clean matrix;
- Data for matrix spikes (MSs) and/or matrix spike duplicates (MSDs), when performed on project samples. The MS/MSDs are used to assess the accuracy and/or precision of the analytical method for each analyte spiked and used to assess bias due to sample matrix effects;
- Percent recoveries for carriers, where applicable, for radiochemistry only. Carriers are used to assess the chemical yield for the preparation and/or instrument efficiency;
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation are noted below.

- Appendix III and Appendix IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary

- The holding time and preservation criteria were met with one exception; the TDS holding time for samples JHC-MW-15024 and JHC-MW-15025 exceeded the 7-day holding time criteria by one hour and two hours, respectively. These results may be estimated, biased low, as summarized in the attached table.

- No target analytes were detected in the method blanks.
- One field blank (FB-05) and one equipment blank (EB-05) were collected; no analytes were detected in these blank samples.
- LCS and/or LCSD recoveries and relative percent differences (RPDs), where applicable, were within laboratory control limits. The following issue was noted:
- Note that the LCS/LCSD in analytical batch 437243 had an RER (replicate error ratio) result outside of the acceptance criteria of <1 (1.33) for Radium-226. However, duplicate precision was demonstrated by an acceptable RPD (27%), which was within the laboratory control limit of 40%. Thus, there was no impact on the data usability.
- MS/MSDs were not performed on samples in this data set.
- Laboratory duplicate analyses were not performed on samples in this data set.
- The field duplicate pair samples were DUP-05 and JHC-MW-15028; all criteria were met.
- Carrier recoveries for radium analyses were within laboratory control criteria.

Attachment A
Summary of Data Non-Conformances
JH Campbell Background – RCRA CCR Monitoring Program
West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15024	4/23/2019	TDS	Anlaysis performed past holding time; sample results may be biased low.
JHC-MW-15025	4/23/2019		

Laboratory Data Quality Review
Groundwater Monitoring Event April 2019
CEC JH Campbell Landfill

Groundwater samples were collected by TRC for the April 2019 sampling event. Samples were analyzed for anions, alkalinity, total dissolved solids, and/or total metals by Eurofins TestAmerica, located in Irvine, California (Eurofins TA - Irvine). The lithium analyses by method SW-846 6020 were subcontracted to Eurofins TA in North Canton, Ohio (Eurofins TA – Canton). The laboratory analytical results were reported in laboratory sample delivery groups (SDGs) 440-239742-3 and 440-239817-1.

During the April 2019 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15017
- JHC-MW-15018
- JHC-MW-15019
- JHC-MW-15022
- JHC-MW-15031
- JHC-MW-15032
- JHC-MW-15033
- JHC-MW-15034
- JHC-MW-15035
- JHC-MW-15036
- JHC-MW-15037

Each sample was analyzed for one or more of the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	SW-846 300.0
Total Dissolved Solids	SM 2540C
Alkalinity (Total, Bicarbonate, Carbonate)	SM 2320B
Total Metals	SW-846 6010B/6020/7470A
Radium (Radium-226, Radium-228, Total Radium)	EPA 903.1, EPA 904.0

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt, as noted in the cover page or case narrative;
- Technical holding times for analyses;

- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks, equipment blanks, and field blanks, if applicable. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures;
- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), where applicable. The MS/MSDs are used to assess the accuracy and precision of the analytical method for each analyte spiked and used to assess bias due to sample matrix effects;
- Percent recoveries for tracer and carriers, where applicable, for radiochemistry only. Tracers and/or carriers are used to assess the chemical yield for the preparation and/or instrument efficiency;
- Data for laboratory duplicates, when performed on project samples. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation are noted below.

- Appendix III and Appendix IV constituents will be utilized for the purposes of an assessment monitoring program.
- Radium data is pending laboratory analysis.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary

- There were two sets of 6020 metals results reported in SDG 440-239817-1 for samples JHC-MW-15035, DUP-02, and JHC-MW-15022 due to suspect chromium results in the original analyses of these three samples. In general, the re-analyses confirmed the original results, with the exception of the chromium RPDs being above the acceptance criteria for the re-analysis discussed below. Only the original results for 6020 metals for these three samples will be used for project objectives; however, re-analysis data are considered for purposes of the data usability review.
- There were two sets of anion results reported for sample JHC-MW-15036 (1-fold and 5-fold dilutions) in SDG 440-239817-1. The results for chloride and sulfate in the undiluted analysis are comparable to the 5-fold dilution but slightly higher, and the nondetect RL for fluoride meets the project-specified RL in the undiluted analysis. Thus, only the undiluted results for anions for this sample will be used for project objectives.
- Holding time criteria were met except the TDS holding time for samples JHC-MW-15032 and JHC-MW-15031 exceeded the 7-day holding time criteria by 12 min and 1 hour 27 minutes, respectively. These results may be estimated, biased low, as summarized in the attached table. However, the data was within range of previous sampling events.
- There were no analytes detected in the method blanks.
- One field blank (FB-02) and one equipment blank (EB-02) were collected; no analytes were detected in these blank samples.
- LCS recoveries were within laboratory control limits.
- MS/MSD analyses were performed on samples JHC-MW-15036 for anions and metals, and JHC-MW-15035 for select metals. The relative percent differences (RPDs) and percent recoveries (%Rs) were within the QC limits with the following exceptions. The recoveries of calcium in the MS/MSD performed on sample JHC-MW-15036 and chromium in the MS/MSD performed on sample JHC-MW-15035 were outside of the acceptance criteria. However, the calcium and/or chromium concentrations in the parent samples were >4x the spike concentrations; therefore, the laboratory control limits were not applicable. Data usability was not affected.
- Laboratory duplicate analysis was performed on sample JHC-MW-15036 for TDS; RPD between the parent and duplicate sample was within the QC limit.
- The field duplicate pair samples were DUP-02 and JHC-MW-15022; all criteria were met with the following exception. All RPDs were within the acceptance criteria in the original 6020 metals analyses. The RPD for chromium (76%) in the field duplicate pair was above the acceptance criteria in the re-analyses of these samples. Further, the results of the original and re-analyses in the field duplicate pair were evaluated using field duplicate criteria. The RPDs for chromium were above the acceptance criteria in the comparison of the original and re-analysis for samples JHC-MW-15035 (36%) and DUP-02 (71%) (collected at monitoring well JHC-MW-15022). Due to the anomalously high chromium results and

the elevated RPDs for chromium in the re-analysis, there is uncertainty that project data quality objectives were met for all samples. The results for chromium may be estimated, as summarized in the attached table. Therefore, groundwater samples were re-collected in June 2019 and analyzed for chromium from the two locations where April 2019 chromium concentrations were observed one to two orders of magnitude higher than historical chromium concentrations at each well (JHC-MW-15022 and JHC-MW-15035).

- Carrier and tracer recoveries, where applicable, were within 30-110%.

Attachment A
Summary of Data Non-Conformances
JH Campbell Landfill Downgradient – RCRA CCR Monitoring Program
West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15031	4/24/2019	TDS	Analysis performed past holding time; sample results may be biased low.
JHC-MW-15032	4/24/2019		
JHC-MW-15018	4/24/2019	Chromium	RPD acceptance criteria not met between the original and re-analysis duplicate result and re-analysis sample/field duplicate pair; sample results considered estimated.
JHC-MW-15019	4/24/2019		
JHC-MW-15022	4/24/2019		
JHC-MW-15031	4/24/2019		
JHC-MW-15032	4/24/2019		
JHC-MW-15033	4/24/2019		
JHC-MW-15034	4/24/2019		
JHC-MW-15035	4/24/2019		
JHC-MW-15036	4/24/2019		
JHC-MW-15037	4/24/2019		
FB-02	4/24/2019		
EB-02	4/24/2019		
DUP-02	4/24/2019		

Laboratory Data Quality Review
Groundwater Monitoring Event June 2019
CEC JH Campbell Landfill

Groundwater samples were collected by TRC for the June 2019 re-sampling event. Samples were analyzed for total and dissolved chromium by Eurofins TestAmerica, located in Irvine, California (Eurofins TA - Irvine). The laboratory analytical results were reported in laboratory sample delivery group (SDG) 440-244485-1.

During the June 2019 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15022
- JHC-MW-15035

Each sample was analyzed for the following constituent:

Analyte Group	Method
Total and Dissolved Chromium	SW-846 6020

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017). The following items were included in the evaluation of the data:

- Sample receipt, as noted in the cover page or case narrative;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks, equipment blanks, and field blanks, if applicable. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures;
- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), where applicable. The MS/MSDs are used to assess the accuracy and precision of the analytical method for each analyte spiked and used to assess bias due to sample matrix effects;

- Data for laboratory duplicates, when performed on project samples. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation are noted below.

- The Appendix IV constituent will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary

- Holding time and sample receipt criteria were met.
- There were no analytes detected in the method blanks.
- One field blank (FB-01) and one equipment blank (EB-01) were collected; total chromium was not detected in these blank samples.
- LCS recoveries were within laboratory control limits.
- MS/MSD analyses were performed on sample JHC-MW-15035 for total and dissolved chromium. The relative percent differences (RPDs) and percent recoveries (%Rs) were within the QC limits.
- Laboratory duplicate analyses were not performed on a sample in this data set.
- The field duplicate pair samples were Dup-01 and JHC-MW-15035; all criteria were met.

Laboratory Data Quality Review
Groundwater Monitoring Event October 2019
Consumers Energy JH Campbell Background

Groundwater samples were collected by TRC for the October 2019 sampling event. Samples were analyzed for lithium, anions, and total dissolved solids by Eurofins TA in North Canton, Ohio (Eurofins TA – Canton). The remaining analyses were subcontracted to Eurofins TA in Irvine, California (Eurofins TA – Irvine). The radium analyses were subcontracted to Eurofins TA in St. Louis (Eurofins TA – St. Louis). The laboratory analytical results were reported in laboratory sample delivery groups (SDGs) 240-120197-1, 240-120197-2, and 240-120197-3.

During the October 2019 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15023
- JHC-MW-15024
- JHC-MW-15025
- JHC-MW-15026
- JHC-MW-15027
- JHC-MW-15028

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Total Dissolved Solids	SM 2540C-11
Total Metals	SW-846 6010B/6020/7470A
Radium (Radium-226, Radium-228, Combined Radium)	EPA 903.0, EPA 904.0

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt, as noted in the cover page or case narrative;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or

analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures;

- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix. The LCSs and/or LCSDs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), where applicable. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Percent recoveries for tracer and carriers, where applicable, for radiochemistry only. Tracers and/or carriers are used to assess the chemical yield for the preparation and/or instrument efficiency;
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation are noted below.

- Appendix III and IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary

- Holding time criteria were met with the following exceptions. The holding time for mercury was exceeded by 10 days in samples JHC-MW-15023, JHC-MW-15024, JHC-MW-15025, EB-1, and FB-1 and 11 days in samples JHC-MW-15026, JHC-MW-15027, and JHC-MW-15028 . These results may be estimated, biased low, as summarized in the attached table, Attachment A.
- A method blank was analyzed with each analytical batch. Target analytes were not detected in the method blank samples with the following exception. Normalized absolute difference comparisons between blank and sample that are between 1.96 and 2.58 may indicate biased high results and normalized absolute differences <1.96 may indicate a false positive sample result.
  - Radium-228 was detected in method blank 160-446063/20-A at a concentration of 0.5137 ± 0.259 pCi/L. The detected radium-228 results for the samples associated with this method blank were potentially impacted, as summarized in the attached table, Attachment A.
- One equipment blank (EB-1) and one field blank (FB-1) were collected. Target analytes were not detected in these blank samples with the following exceptions:
  - Combined radium was detected in EB-1 at 0.383 +/- 0.232 pCi/L. The detected combined results for the samples associated with this equipment blank were potentially impacted, as summarized in the attached table, Attachment A.
- The LCS and/or LCSD recoveries and relative percent differences (RPDs), where applicable, for all analytes were within QC limits.
- MS and MSD analyses were performed on were performed sample JHC-MW-15025 for metals and anions. All recoveries and RPDs were within the QC limits with the following exceptions.
  - The recoveries of calcium were outside of the acceptance criteria in the MS/MSD analyses. The calcium concentration in this sample was >4x the spike concentrations; therefore, the MS/MSD results for calcium were not evaluated. Data usability was not affected.
- Laboratory duplicate analysis was performed on sample JCW-MW-15025 for TDS; the RPD was within QC limits.
- The field duplicate pair samples were DUP-1 and JHC-MW-12028. The absolute difference for chromium (absolute difference >RL) exceeded the acceptance limits. Potential uncertainty exists for positive results for chromium in all groundwater samples in this data set as noted in the attached table, Attachment A.
- Samples did not undergo a 21-day wait period prior to radium analysis; however, combined radium results were all < 5 pCi/L so there is no impact on data usability.
- Carrier recoveries, where applicable, were within 40-110%.

Attachment A

Summary of Data Non-Conformances

JH Campbell Background – RCRA CCR Monitoring Program

West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15024	10/8/2019	Radium-228	Detection in method blank. Normalized absolute difference between blank and sample <1.96; indicates possible false positive result.
JHC-MW-15024	10/8/2019	Combined Radium	Detection in equipment blank (EB-1). Normalized absolute difference between blank and samples <1.96; indicates possible false positive results.
JHC-MW-15025	10/8/2019		
JHC-MW-15027	10/7/2019		
JHC-MW-15023	10/8/2019	Mercury	Holding time for mercury exceeded; indicates potential low bias in mercury results.
JHC-MW-15024	10/8/2019		
JHC-MW-15025	10/8/2019		
JHC-MW-15026	10/7/2019		
JHC-MW-15027	10/7/2019		
JHC-MW-15028	10/7/2019		
DUP-01	10/7/2019		
EB-1	10/8/2019		
FB-1	10/8/2019		
JHC-MW-15023	10/8/2019	Chromium	Field duplicate analysis exceeds acceptance criteria (absolute difference >RL); indicates potential uncertainty in chromium results.
JHC-MW-15024	10/8/2019		
JHC-MW-15025	10/8/2019		
JHC-MW-15026	10/7/2019		
JHC-MW-15027	10/7/2019		
JHC-MW-15028	10/7/2019		
DUP-01	10/7/2019		

Laboratory Data Quality Review
Groundwater Monitoring Event October 2019
Consumers Energy JH Campbell Landfill

Groundwater samples were collected by TRC for the October 2019 sampling event. Samples were analyzed for lithium, anions, and total dissolved solids (TDS) by Eurofins TA in North Canton, Ohio (Eurofins TA – Canton). The remaining metals analyses were subcontracted to Eurofins TA in Irvine, California (Eurofins TA - Irvine). The radium analyses were subcontracted to Eurofins TA in St. Louis, Missouri (Eurofins TA – St. Louis). The laboratory analytical results were reported in laboratory sample delivery groups (SDGs) 240-120213-1, 240-120213-2, 240-120313-1, and 240-120313-2.

During the October 2019 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15017
- JHC-MW-15018
- JHC-MW-15019
- JHC-MW-15022
- JHC-MW-15031
- JHC-MW-15032
- JHC-MW-15033
- JHC-MW-15034
- JHC-MW-15035
- JHC-MW-15036
- JHC-MW-15037

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	SW-846 300.0
Total Dissolved Solids	SM 2540C-11
Total Metals	SW-846 6010B/6020/7470A
Radium (Radium-226, Radium-228, Combined Radium)	EPA 903.0, EPA 904.0

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt, as noted in the cover page or case narrative;

- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures;
- Data for laboratory control samples (LCSs) and laboratory control sample duplicates (LCSDs), when performed. The LCSs and/or LCSDs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when performed on project samples. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Percent recoveries for carriers, where applicable, for radiochemistry only. Carriers are used to assess the chemical yield for the preparation and/or instrument efficiency;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation are noted below.

- Appendix III and Appendix IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary

- The temperature of the cooler received by Eurofins TA - Irvine in SDG 240-120213-1 was above the acceptance criteria (>6°C); samples were received on melted ice. However, there is no impact on data usability since only metals analyses were performed at the Irvine, CA location and metals samples do not require thermal preservation.
- The TDS analysis of sample JHC-MW-15034 was performed approximately 10 minutes past the 7-day holding time. No impact on data usability since the analysis was on the 7th day of collection.
- A method blank was analyzed with each analytical batch. Target analytes were not detected in the method blank samples with the following exception. Normalized absolute difference comparisons between blank and sample that are between 1.96 and 2.58 may indicate biased high results and normalized absolute differences <1.96 may indicate a false positive sample result.
  - Radium-228 was detected in method blank 160-446063/20-A at 0.5137 +/- 0.259 pCi/L. The detected radium-228 results for the samples associated with this method blank were potentially impacted, as summarized in the attached table, Attachment A.
  - Radium-226 was detected in method blank 160-446490/22-A at 0.2261 +/- 0.102 pCi/L. The detected radium-226 results for the samples associated with this method blank were potentially impacted, as summarized in the attached table, Attachment A.
- One field blank (FB-1) and one equipment blank (EB-1) were collected; no analytes were detected in these blank samples.
- The LCS and/or LCSD recoveries and relative percent differences (RPDs), where applicable, for all analytes were within QC limits.
- MS/MSD analyses were performed on sample JHC-MW-15036 for metals and anions. All recoveries and relative percent differences (RPDs) were within the QC limits.
- The field duplicate pair samples were Dup-2 and JHC-MW-15034; RPDs between the parent and duplicate sample were within the QC limits.
- Laboratory duplicate analysis was performed on sample JHC-MW-15036 TDS; the RPD was within QC limits.
- Samples did not undergo a 21-day wait period prior to radium-226 analysis; however, combined radium results were < 5 pCi/L so there is no impact on data usability.
- Carrier recoveries, where applicable, were within 40-110%.

Attachment A

Summary of Data Non-Conformances

JH Campbell Landfill – RCRA CCR Monitoring Program

West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15017	10/8/2019	Radium-228	Detection in method blank. Normalized absolute difference between blank and samples <1.96; indicates possible false positive results.
JHC-MW-15018	10/8/2019		
JHC-MW-15022	10/9/2019	Radium-226	Detection in method blank. Normalized absolute difference between blank and samples <1.96; indicates possible false positive results.
JHC-MW-15031	10/9/2019		
JHC-MW-15035	10/9/2019		
JHC-MW-15037	10/8/2019		
JHC-MW-15036	10/8/2019		

Appendix D
June 2018 Assessment Monitoring Statistical Evaluation

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January 14, 2019

Bethany Swanberg
Environmental Services
Consumers Energy Company
1945 W. Parnall Road
Jackson, MI 49201

Subject: Statistical Evaluation of Initial Assessment Monitoring Sampling Event,
JH Campbell Dry Ash Landfill, Consumers Energy Company, West Olive, Michigan

Dear Ms. Swanberg:

Consumers Energy Company (CEC) reported in the January 31, 2018 *Annual Groundwater Monitoring Report for the JH Campbell Power Plant Dry Ash Landfill CCR Unit* for the JH Campbell (JHC) site in West Olive, Michigan, that boron, calcium, chloride, sulfate and total dissolved solids were observed within groundwater at one or more downgradient monitoring well(s) with potential statistically significant increases (SSIs) above background concentration levels. TRC completed an Alternate Source Demonstration for the parameters listed above and did not find strong enough evidence within 90 days to determine the observation of constituents above background was attributable to an error or source other than the coal combustion residual (CCR) unit.

Therefore, CEC initiated an Assessment Monitoring Program for the JHC Dry Ash Landfill CCR Unit pursuant to §257.95 of the CCR Rule[1] that included sampling and analyzing groundwater within the groundwater monitoring system for all constituents listed in Appendix IV. The results from the initial assessment monitoring sampling event were used to establish groundwater protection standards (GWPSs) for the Appendix IV constituents in accordance with §257.95(h), as presented in the October 15, 2018 *Assessment Monitoring Data Summary and Establishment of Groundwater Protection Standards.* The GWPS is established as the higher of the EPA Maximum Contaminant Level (MCL) or statistically derived background level for constituents with MCLs and the higher of the EPA Regional Screening Levels (RSLs) or background level for Appendix IV constituents with RSLs. The Dry Ash Landfill monitoring system was subsequently sampled for the Appendix III and Appendix IV

[1] USEPA final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) published April 17, 2015, as amended per Phase One, Part One of the CCR Rule (83 FR 36435).

constituents within 90 days from the initial Appendix IV sampling event (June 2018). In accordance with §257.95, the assessment monitoring data must be compared to GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs.

This letter report presents a summary of the collected assessment monitoring data and the comparison of the assessment monitoring data to the GWPSs. The results of the assessment monitoring evaluation indicate that no constituents exceeded the GWPSs at the Dry Ash Landfill monitoring wells.

Background

The JH Campbell Plant is a coal fired power generation facility located in West Olive, Michigan, on the eastern shore of Lake Michigan. It is bordered by the Pigeon River on the south, 156th Avenue on the east, and Croswell Street to the north with Lakeshore Drive bisecting the site from north to south. The power generating plant consists of three coal fired electric generating units located on the western side of the site and the CCR disposal area is on the east side of the site, east of Lakeshore Drive. Figure 1 is a site location map showing the facility and the surrounding area.

The Dry Ash Landfill is a geomembrane lined landfill that is permitted for an area of about 108 acres and includes two leachate and contact water retention ponds. Site features are shown on Figure 2. Dry, moisture-conditioned CCR from the three coal fired electric generating units continues to be managed in the licensed solid waste landfill which is regulated under Part 115 of the Natural Resources and Environmental Protection Act (NREPA), PA 451 of 1994, as amended, and monitored in adherence to the facility's Michigan Department of Environmental Quality (MDEQ)-approved Hydrogeological Monitoring Plan (HMP)[2].

The purpose of the dry ash disposal facility is to contain dry bottom and fly ash produced as a result of burning coal for power production. The facility consists of the existing CCR landfill Cells 1 through 4. The state permit also identifies Cells 5 through 7 for future construction and operation. Dry ash from all of the generating units is stored in silos until it is placed into the facility or is sold for beneficial reuse and shipped off site. At this time, the north faces of Cells 1 and 2 and the eastern face of Cell 2 have been closed along with Cell 3. Cell 4 is currently being filled with ash. Construction of Cell 5 began in July 2018 under the state program. Cells 6 through 7 have not yet been constructed.

Groundwater Monitoring System

In accordance with 40 CFR 257.91, CEC established a groundwater monitoring system for the JHC Dry Ash Landfill unit, which consists of 19 monitoring wells (six background monitoring wells and 13 downgradient monitoring wells) that are screened in the uppermost aquifer. Two of the downgradient monitoring wells, JHC-MW-15020 and JHC-MW-15021, located downgradient from the

[2] Consumers Energy Company. 1996. *Hydrogeological Monitoring Plan (HMP) for JH Campbell Ash Storage Facility, Consumers Power Company, Solid Waste Disposal Area, Coal Ash, Type III.* September.

Dry Ash Landfill Cell 1, were decommissioned on June 14, 2018 (subsequent to the completion of the April and June 2018 assessment monitoring events) to accommodate Cell 5 construction. Since these wells are in the footprint of Cell 5, they are unable to be replaced. The remaining downgradient monitoring wells will continue to be used for monitoring groundwater quality downgradient from the Dry Ash Landfill. The monitoring well locations are shown on Figure 2. Six monitoring wells located north-northwest of the JHC Landfill provide data on background groundwater quality that has not been affected by the CCR unit (JHC-MW-15023 through JHC-MW-15028). Background groundwater quality data from these six background wells are additionally used for the CCR groundwater monitoring program at three other CCR units on the JHC site.

Groundwater within the uppermost aquifer generally flows to the south-southeast across the Site, with a southwesterly groundwater flow component on the western edge of the Site. Groundwater contour maps were constructed using the static water elevation data from the April 2018 and June 2018 assessment monitoring sampling events are provided as Figures 3 and 4, respectively. The general groundwater flow direction is similar to that identified in previous monitoring rounds and continues to demonstrate that the downgradient wells (JHC-MW-15017 through JHC-MW-15022 and JHC-MW-15031 through JHC-MW-15037) are appropriately positioned to detect the presence of Appendix IV parameters that could potentially migrate from the Dry Ash Landfill CCR Unit.

Data Quality

Data from each sampling round were evaluated for completeness, overall quality and usability, method-specified sample holding times, precision and accuracy, and potential sample contamination. The review was completed using the following quality control (QC) information which at a minimum included chain-of-custody forms, investigative sample results including blind field duplicates, and, as provided by the laboratory, method blanks, laboratory control spikes, laboratory duplicates. The data were found to be complete and usable for the purposes of the CCR monitoring program.

Assessment Monitoring Statistical Evaluation

Following the initial and resample assessment monitoring sampling event, compliance well data for the JHC Dry Ash Landfill were evaluated in accordance with the *Groundwater Statistical Evaluation Plan* (Stats Plan) (TRC, October 2017). Consistent with the Unified Guidance[3], the preferred method for comparisons to a fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS.

For each detected Appendix IV constituent, the concentrations from each well were first compared directly to the GWPS, as shown on Table 1. The direct comparison of the data to the GWPSs shows

[3] USEPA. 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*. Office of Conservation and Recovery. EPA 530/R-09-007.

that all concentrations are below their associated GWPSs during both the April and June 2018 assessment monitoring events, in addition to all of the background monitoring events. Therefore, no statistical evaluations were conducted for the Dry Ash Landfill.

The evaluation of the Appendix IV data shows there are no GWPS exceedances in groundwater at the Dry Ash Landfill. Per §257.95(f), since all of the Appendix IV constituent concentrations are below the GWPSs, the facility continues assessment monitoring for the CCR unit in accordance with §257.95.

Next Steps

In accordance with the CCR Rule, CEC will continue assessment monitoring for the JHC Dry Ash Landfill unit. The next semiannual assessment monitoring event is scheduled to occur within the second calendar quarter of 2019.

Sincerely,

TRC

Graham Crockford
Program Manager

Sarah B. Holmstrom
Project Hydrogeologist

Attachments

Table 1.	Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to June 2018
Figure 1.	Site Location Map
Figure 2.	Site Plan
Figure 3.	Shallow Groundwater Contour Map – April 2018
Figure 4.	Shallow Groundwater Contour Map – June 2018
Attachment A	Sanitas™ Output

cc: Brad Runkel, Consumers Energy
JR Register, Consumers Energy
Michelle Marion, Consumers Energy
Central Files

Table

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to June 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15017									
						Sample Date:	12/3/2015	3/9/2016	6/22/2016	8/30/2016	11/15/2016	4/18/2017	6/22/2017	8/16/2017	9/27/2017	4/26/2018	6/20/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient										
Appendix III																	
Boron	ug/L	NC	NA	51	NA		386	343	444	321	592	618	407	347	405	--	245
Calcium	mg/L	NC	NA	46	NA		64.9	70.8	68.3	62.5	58.5	52.2	56.0	56.3	44.8	--	44.0
Chloride	mg/L	250*	NA	43	NA		66.9	32.3	35.2	56.4	45.1	22.8	70.8	112	119	--	97.0
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.8	6.6	6.3	6.3	6.1	5.8	6.1	6.1	5.2	6.0(1)	6.0
Sulfate	mg/L	250*	NA	14	NA		51	43.4	49.2	46.1	54.2	75	70.3	84.2	101	--	60.6
Total Dissolved Solids	mg/L	500*	NA	258	NA		350	280	300	370	320	300	366	476	490	--	348
Appendix IV																	
Antimony	ug/L	6	NA	2	6		< 1	< 1	1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		50	57	75	73	127	116	76.4	103	--	79.7	80.0
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	0.2	0.3	0.22	0.42	--	0.47	0.54
Chromium	ug/L	100	NA	2	100		< 1	< 1	1	< 1	< 1	2	< 1.0	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	6	7	8	11	12	< 5.0	10.6	--	8.3	6.2
Radium-226	pCi/L	5	NA	NA	NA		0.231	< 0.182	0.333	< 0.716	0.283	0.456	< 0.388	< 0.917	--	1.17	< 0.785
Radium-226/228	pCi/L	5	NA	1.93	5		< 0.8	< 0.659	1.75	1.81	2.01	2.07	1.64	2.30	--	1.94	3.02
Radium-228	pCi/L	5	NA	NA	NA		< 0.8	< 0.659	1.42	1.6	1.73	1.61	1.27	1.51	--	0.773	2.74
Selenium	ug/L	50	NA	5	50		31	19	30	20	34	37	23.5	27.4	--	18.2	18.5
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

NC - no criteria.

-- - not analyzed.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

RSL - Regional Screening Level from 83 FR 36435.

UTL - Upper Tolerance Limit (95%) of the background data set.

GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.

* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.

All metals were analyzed as total unless otherwise specified.

(1) pH value potentially biased high due to groundwater quality meter malfunction.

(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to June 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15018												
						Sample Date:	12/3/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/18/2017	6/22/2017	6/22/2017	8/16/2017	8/16/2017	9/27/2017	9/27/2017	4/26/2018	6/20/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient													
Appendix III														Field Dup		Field Dup		Field Dup		
Boron	ug/L	NC	NA	51	NA		110	128	164	137	133	146	159	165	133	139	127	130	--	117
Calcium	mg/L	NC	NA	46	NA		81.3	93.5	78.3	85	83.2	65.3	74.5	73.6	62.7	61.0	55.3	57.0	--	44.8
Chloride	mg/L	250*	NA	43	NA		46.1	18.2	30.7	41.1	34.5	31.8	43.8	44.4	43.7	43.6	41.5	41.6	--	31.9
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.6	6.5	6.3	6.1	6.3	6.2	6.4	--	6.3	--	6.3	--	6.2[(1)]	6.1
Sulfate	mg/L	250*	NA	14	NA		70.8	64.7	75.5	80.2	77.3	73.6	79.8	78.9	88.4	86.2	80.8	81.1	--	62.3
Total Dissolved Solids	mg/L	500*	NA	258	NA		360	330	340	400	340	330	336	458	390	350	310	468	--	194
Appendix IV																				
Antimony	ug/L	6	NA	2	6		< 1	1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		67	63	69	93	95	83	69.1	65.1	89.7	97.5	--	--	89.0	76.5
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	< 1	2	< 1	< 1	1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	< 15.0	< 15.0	--	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	6.8	6.8	--	--	17.2	19.7
Radium-226	pCi/L	5	NA	NA	NA		< 0.203	0.228	< 0.285	< 0.318	< 0.257	< 0.306	0.420	0.596	0.667	1.15	--	--	< 0.656	< 0.692
Radium-226/228	pCi/L	5	NA	1.93	5		1.05	1.26	1.03	1.33	< 0.408	1.22	0.910	1.15	1.91	2.09	--	--	< 1.23	< 1.83
Radium-228	pCi/L	5	NA	NA	NA		0.951	1.03	1.03	1.33	< 0.408	1.04	< 0.556	< 0.623	1.24	0.935	--	--	< 0.572	< 1.14
Selenium	ug/L	50	NA	5	50		13	7	11	14	12	18	15.6	15.7	13.9	13.9	--	--	12.7	9.9
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	< 2.0	< 2.0	--	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to June 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15019									
						Sample Date:	12/3/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/19/2017	6/22/2017	8/16/2017	9/27/2017	4/26/2018	6/20/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient										
Appendix III																	
Boron	ug/L	NC	NA	51	NA		224	197	237	197	256	194	166	180	191	--	195
Calcium	mg/L	NC	NA	46	NA		137	121	125	86.5	106	63.2	85.9	53.1	58.3	--	64.1
Chloride	mg/L	250*	NA	43	NA		68	44.2	56	34.5	28.9	1.25	48.6	27.0	36.7	--	26.2
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.9	6.6	6.6	6.2	6.6	6.3	6.8	6.4	6.4	6.7(1)	6.6
Sulfate	mg/L	250*	NA	14	NA		99.1	56.5	85.1	41.9	50.9	12.7	53.8	42.6	48.8	--	40.8
Total Dissolved Solids	mg/L	500*	NA	258	NA		580	440	520	370	420	250	378	268	306	--	286
Appendix IV																	
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		53	44	50	38	47	69	41.1	40.0	--	63.6	44.6
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	< 1	2	1	1	3	< 1.0	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	8	< 5	7	21	33	7.0	< 5.0	--	11.2	7.7
Radium-226	pCi/L	5	NA	NA	NA		< 0.246	0.436	< 0.184	< 0.297	< 0.253	< 0.316	< 0.601	< 0.856	--	0.402	< 0.717
Radium-226/228	pCi/L	5	NA	1.93	5		0.959	1.52	1.72	1.05	< 0.715	0.976	< 1.12	< 1.75	--	0.911	< 1.67
Radium-228	pCi/L	5	NA	NA	NA		0.839	1.08	1.58	0.874	< 0.715	0.775	0.685	0.947	--	< 0.638	< 0.951
Selenium	ug/L	50	NA	5	50		6	12	9	14	13	18	18.0	15.8	--	22.2	18.4
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

NC - no criteria.

-- - not analyzed.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

RSL - Regional Screening Level from 83 FR 36435.

UTL - Upper Tolerance Limit (95%) of the background data set.

GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.

* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.

All metals were analyzed as total unless otherwise specified.

(1) pH value potentially biased high due to groundwater quality meter malfunction.

(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to June 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15020[2]										
						Sample Date:	12/3/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/19/2017	6/22/2017	8/16/2017	9/27/2017	4/26/2018	6/11/2018	6/11/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient											
Appendix III																		Field Dup
Boron	ug/L	NC	NA	51	NA		262	180	218	192	186	158	170	155	153	--	129	146
Calcium	mg/L	NC	NA	46	NA		75.1	59.7	57.7	58.3	62.3	45.9	50.0	49.1	49.5	--	39.2	42.7
Chloride	mg/L	250*	NA	43	NA		55.2	28.4	45.5	40.5	39	26.2	49.4	50.3	54.7	--	35.5	35.3
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.6	6.3	6.2	6.0	6.4	6.2	6.4	6.5	6.5	6.4[1]	6.3	--
Sulfate	mg/L	250*	NA	14	NA		44.6	28.3	30	25.9	25.5	19.5	30.4	29.9	29.4	--	24.3	24.4
Total Dissolved Solids	mg/L	500*	NA	258	NA		340	230	280	280	290	220	306	272	278	--	222	254
Appendix IV																		
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		57	27	40	40	31	32	41.9	38.7	--	31.6	39.2	38.8
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	1	2	< 1	2	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA		< 0.224	< 0.181	< 0.186	< 0.334	< 0.28	< 0.289	< 0.567	< 0.444	--	< 0.704	< 0.588	< 0.755
Radium-226/228	pCi/L	5	NA	1.93	5		< 0.568	0.943	1.83	1.70	0.624	< 0.581	< 1.27	2.28	--	< 1.83	1.92	< 1.40
Radium-228	pCi/L	5	NA	NA	NA		< 0.568	0.886	1.83	1.64	0.606	< 0.581	< 0.700	1.92	--	< 1.13	1.48	1.03
Selenium	ug/L	50	NA	5	50		7	4	< 1	7	7	5	5.2	4.5	--	2.9	4.0	4.2
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to June 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15021[2]									
						Sample Date:	12/3/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/19/2017	6/22/2017	8/16/2017	9/27/2017	4/26/2018	6/11/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient										
Appendix III																	
Boron	ug/L	NC	NA	51	NA		393	386	287	300	337	231	232	233	182	--	214
Calcium	mg/L	NC	NA	46	NA		61.1	74.2	42.7	50.2	56.9	30.1	32.8	35.7	37.0	--	26.6
Chloride	mg/L	250*	NA	43	NA		62.7	63	36.1	40.7	46.8	24.3	33.9	35.2	40.9	--	21.3
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.3	6.1	6.0	6.1	6.3	6.0	6.2	6.3	6.5	6.3[1]	6.0
Sulfate	mg/L	250*	NA	14	NA		40.4	43	28.7	27.7	33.4	24.7	24.7	30.2	25.9	--	22.1
Total Dissolved Solids	mg/L	500*	NA	258	NA		340	340	250	260	300	190	204	238	280	--	174
Appendix IV																	
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		71	70	56	46	54	55	63.3	47.6	--	64.2	57.6
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	< 1	2	< 1	< 1	1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA		< 0.268	< 0.2	< 0.171	< 0.324	< 0.27	< 0.221	0.354	0.238	--	< 0.562	< 0.466
Radium-226/228	pCi/L	5	NA	1.93	5		1.05	2.11	1.23	1.52	0.592	< 0.536	< 0.866	1.53	--	< 1.45	< 1.28
Radium-228	pCi/L	5	NA	NA	NA		0.879	2.03	1.18	1.52	0.571	< 0.536	< 0.729	1.29	--	< 0.888	< 0.818
Selenium	ug/L	50	NA	5	50		3	1	2	3	2	3	2.0	3.3	--	2.7	3.0
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

NC - no criteria.

-- - not analyzed.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

RSL - Regional Screening Level from 83 FR 36435.

UTL - Upper Tolerance Limit (95%) of the background data set.

GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.

* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.

All metals were analyzed as total unless otherwise specified.

(1) pH value potentially biased high due to groundwater quality meter malfunction.

(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to June 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15022									
						Sample Date:	12/5/2015	3/9/2016	6/23/2016	8/31/2016	11/17/2016	4/19/2017	6/22/2017	8/15/2017	9/27/2017	4/27/2018	6/20/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient										
Appendix III																	
Boron	ug/L	NC	NA	51	NA		433	393	329	371	413	444	397	376	340	--	315
Calcium	mg/L	NC	NA	46	NA		109	93.6	102	121	118	115	101	122	103	--	109
Chloride	mg/L	250*	NA	43	NA		11.2	8.68	1.28	3.94	4.67	2.07	1.1	1.6	2.4	--	3.5
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.0	6.9	6.8	6.8	6.8	7.0	7.0	7.0	7.0	7.6(1)	6.9
Sulfate	mg/L	250*	NA	14	NA		75.3	47.6	24.4	42.1	81.5	26.9	19.2	35.0	43.7	--	26.0
Total Dissolved Solids	mg/L	500*	NA	258	NA		480	440	380	480	500	440	502	466	406	--	414
Appendix IV																	
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 10	< 1.0	< 1.0	--	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		51	27	21	26	28	26	22.6	26.8	--	20.3	21.2
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		2	1	2	1	2	3	< 1.0	< 1.0	--	1.3	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		6	5	5	6	< 5	5	< 5.0	5.3	--	5.2	< 5.0
Radium-226	pCi/L	5	NA	NA	NA		< 0.159	< 0.186	1.12	< 0.219	< 0.224	< 0.26	< 0.426	< 0.861	--	< 0.431	< 0.673
Radium-226/228	pCi/L	5	NA	1.93	5		2.29	< 0.636	2.20	1.32	1.75	1.84	< 0.937	< 1.89	--	< 1.01	< 1.37
Radium-228	pCi/L	5	NA	NA	NA		2.22	< 0.636	1.08	1.26	1.62	1.6	< 0.511	< 1.03	--	< 0.583	< 0.697
Selenium	ug/L	50	NA	5	50		8	10	< 1	6	9	4	1.3	4.1	--	4.1	2.8
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

NC - no criteria.

-- - not analyzed.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

RSL - Regional Screening Level from 83 FR 36435.

UTL - Upper Tolerance Limit (95%) of the background data set.

GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.

* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.

All metals were analyzed as total unless otherwise specified.

(1) pH value potentially biased high due to groundwater quality meter malfunction.

(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to June 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15031												
						Sample Date:	12/4/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/22/2017	6/22/2017	8/16/2017	8/16/2017	9/27/2017	9/27/2017	4/27/2018	6/20/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient													
Appendix III														Field Dup		Field Dup		Field Dup		
Boron	ug/L	NC	NA	51	NA		89	117	106	111	102	112	96.5	98.9	97.0	< 100	95.6	99.5	--	108
Calcium	mg/L	NC	NA	46	NA		77.1	94.2	80.3	84.8	70.3	76.3	63.9	66.8	62.5	67.5	68.5	67.2	--	66.9
Chloride	mg/L	250*	NA	43	NA		38.6	45.6	40	42.1	37.8	38.3	41.7	41.7	48.1	48.5	47.5	47.1	--	38.9
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.0	6.7	6.7	6.8	6.8	6.9	6.9	--	6.8	--	6.8	--	*7.6* (1)	6.8
Sulfate	mg/L	250*	NA	14	NA		36.6	45.8	41.1	40.1	29.8	34.1	35.2	35.1	40.9	41.2	38.9	38.7	--	40.0
Total Dissolved Solids	mg/L	500*	NA	258	NA		340	390	380	370	310	340	348	412	454	454	386	452	--	352
Appendix IV																				
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 10	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		21	23	21	20	18	20	16.6	17.0	19.2	18.9	--	--	15.4	18.9
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		11	1	2	1	2	3	12.3	8.2	1.7	1.1	--	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	< 15.0	< 15.0	--	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	< 5.0	< 5.0	--	--	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA		< 0.23	< 0.272	< 0.309	< 0.379	< 0.279	0.419	< 1.03	0.393	< 0.423	0.675	--	--	< 0.479	< 0.638
Radium-226/228	pCi/L	5	NA	1.93	5		1.06	< 0.424	1.01	1.79	0.922	1.67	< 1.67	0.835	< 1.47	1.33	--	--	< 1.19	< 1.66
Radium-228	pCi/L	5	NA	NA	NA		0.922	< 0.424	0.872	1.53	0.759	1.25	< 0.636	< 0.662	< 1.05	< 0.894	--	--	< 0.708	< 1.02
Selenium	ug/L	50	NA	5	50		3	2	1	1	2	2	1.3	1.3	< 1.0	1.9	--	--	4.0	3.0
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	< 2.0	< 2.0	--	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

NC - no criteria.

-- - not analyzed.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

RSL - Regional Screening Level from 83 FR 36435.

UTL - Upper Tolerance Limit (95%) of the background data set.

GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.

* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.

All metals were analyzed as total unless otherwise specified.

(1) pH value potentially biased high due to groundwater quality meter malfunction.

(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to June 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15032										
						Sample Date:	12/4/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/23/2017	8/15/2017	9/26/2017	4/26/2018	6/19/2018	6/19/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient											
Appendix III																		Field Dup
Boron	ug/L	NC	NA	51	NA		73	74	61	72	78	71	56.4	62.4	57.8	--	45.7	44.6
Calcium	mg/L	NC	NA	46	NA		11.6	10.2	9.91	11.6	8.85	8.87	7.2	7.0	6.8	--	8.8	8.4
Chloride	mg/L	250*	NA	43	NA		1.99	2.14	2.43	2.84	2.55	3.49	2.7	3.0	3.2	--	3.4	3.4
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.4	6.2	6.0	5.6	6.2	6.1	6.0	6.1	6.0	5.9(1)	6.3	--
Sulfate	mg/L	250*	NA	14	NA		18.4	18	19.4	19.7	16	16.1	13.9	16.3	< 2.0	--	11.8	11.6
Total Dissolved Solids	mg/L	500*	NA	258	NA		64	64	79	67	57	66	54	< 50.0	84	--	64	< 50.0
Appendix IV																		
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 10	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		10	9	9	10	9	9	7.3	9.1	--	7.8	8.8	8.7
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	1	< 1	1	1	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA		< 0.197	< 0.178	< 0.234	< 0.195	< 0.245	< 0.278	< 0.457	< 0.973	--	< 0.514	< 0.464	< 0.722
Radium-226/228	pCi/L	5	NA	1.93	5		< 0.566	< 0.466	< 0.509	< 0.498	< 0.654	< 0.441	< 1.35	< 1.90	--	< 1.30	< 1.19	< 1.89
Radium-228	pCi/L	5	NA	NA	NA		< 0.566	< 0.466	< 0.509	< 0.498	< 0.654	< 0.441	< 0.893	< 0.923	--	< 0.784	< 0.721	< 1.17
Selenium	ug/L	50	NA	5	50		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to June 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15033										
						Sample Date:	12/4/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/20/2017	6/23/2017	8/15/2017	9/26/2017	4/26/2018	4/26/2018	6/19/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient											
Appendix III																	Field Dup	
Boron	ug/L	NC	NA	51	NA		27	32	35	31	34	33	33.0	30.8	34.1	--	--	33.0
Calcium	mg/L	NC	NA	46	NA		16.2	13.1	13.4	13.1	11.5	15.4	12.6	9.6	10.1	--	--	9.0
Chloride	mg/L	250*	NA	43	NA		< 1	1.03	1.98	1.56	1.25	1.82	1.7	1.1	1.4	--	--	3.4
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.0	6.7	6.5	6.1	6.7	6.8	6.8	6.8	6.7	6.8(1)	--	6.7
Sulfate	mg/L	250*	NA	14	NA		10.4	8.83	10.3	8.86	9.02	10.1	9.0	9.7	< 2.0	--	--	8.1
Total Dissolved Solids	mg/L	500*	NA	258	NA		64	66	69	74	54	79	124	126	< 50.0	--	--	68
Appendix IV																		
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 10	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		< 5	5	6	5	6	6	5.2	4.6	--	4.8	4.3	5.2
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	< 1	< 1	1	1	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA		< 0.148	< 0.296	< 0.332	< 0.3	< 0.215	< 0.415	0.521	< 0.617	--	< 0.460	< 0.151	< 0.570
Radium-226/228	pCi/L	5	NA	1.93	5		< 0.522	< 0.534	< 0.511	0.622	< 0.356	0.887	< 1.30	< 1.67	--	< 1.19	< 0.943	< 1.42
Radium-228	pCi/L	5	NA	NA	NA		< 0.522	< 0.534	< 0.511	0.537	< 0.356	0.887	< 0.824	< 1.05	--	< 0.732	< 0.792	< 0.845
Selenium	ug/L	50	NA	5	50		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to June 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15034									
						Sample Date:	12/4/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/20/2017	6/23/2017	8/15/2017	9/26/2017	4/25/2018	6/19/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient										
Appendix III																	
Boron	ug/L	NC	NA	51	NA		54	69	48	66	70	67	68.1	62.1	51.4	--	62.6
Calcium	mg/L	NC	NA	46	NA		10.3	8.6	6.91	11	8.33	5.83	5.5	5.9	6.0	--	5.8
Chloride	mg/L	250*	NA	43	NA		2.48	1.91	4.31	1.56	1.88	1.43	1.5	2.0	2.2	--	3.1
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.2	6.2	5.8	5.7	6.0	6.0	6.1	6.1	6.0	6.0(1)	6.0
Sulfate	mg/L	250*	NA	14	NA		23.9	18.5	13.2	16.6	16.9	15.1	12.6	16.5	< 2.0	--	12.5
Total Dissolved Solids	mg/L	500*	NA	258	NA		50	62	53	61	48	49	104	60	< 50.0	--	50
Appendix IV																	
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	1.7	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 10	< 1.0	< 1.0	--	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		8	7	5	6	6	6	5.4	5.5	--	5.3	5.5
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	< 1	< 1	< 1	< 1	1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA		< 0.256	< 0.193	< 0.244	< 0.267	< 0.283	< 0.307	< 0.607	< 0.763	--	< 0.775	< 0.514
Radium-226/228	pCi/L	5	NA	1.93	5		0.963	< 0.418	1.03	0.858	0.603	0.998	1.49	< 1.52	--	< 1.58	< 1.55
Radium-228	pCi/L	5	NA	NA	NA		0.88	< 0.418	0.853	0.819	0.451	0.877	0.905	< 0.760	--	< 0.804	< 1.04
Selenium	ug/L	50	NA	5	50		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

NC - no criteria.

-- - not analyzed.

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RSL - Regional Screening Level from 83 FR 36435.

UTL - Upper Tolerance Limit (95%) of the background data set.

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(1) pH value potentially biased high due to groundwater quality meter malfunction.

(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to June 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15035									
						Sample Date:	12/4/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/23/2017	8/16/2017	9/26/2017	4/27/2018	6/20/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient										
Appendix III																	
Boron	ug/L	NC	NA	51	NA		146	130	81	86	103	123	121	116	126	--	111
Calcium	mg/L	NC	NA	46	NA		118	111	78.7	72.5	83.3	88.5	82.1	91.3	107	--	90.5
Chloride	mg/L	250*	NA	43	NA		34.2	31.3	16.7	19	25.4	21.2	28.3	33.9	35.9	--	27.1
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.0	6.9	7.2	7.3	7.1	7.2	7.2	7.0	7.0	8.0(1)	7.0
Sulfate	mg/L	250*	NA	14	NA		39.2	32.4	20.8	21.8	24.9	24.7	28.2	35.4	35.6	--	26.7
Total Dissolved Solids	mg/L	500*	NA	258	NA		450	400	300	320	320	320	314	578	512	--	342
Appendix IV																	
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 10	< 1.0	< 1.0	--	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		27	21	14	13	16	17	15.8	19.4	--	17.4	18.1
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		15	< 1	1	< 1	2	3	1.1	< 1.0	--	4.8	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA		< 0.151	< 0.156	0.355	< 0.345	< 0.239	< 0.429	< 0.452	< 1.08	--	< 0.733	< 0.548
Radium-226/228	pCi/L	5	NA	1.93	5		0.929	< 0.622	1.40	1.28	1.47	0.801	< 1.35	< 1.98	--	< 1.41	1.63
Radium-228	pCi/L	5	NA	NA	NA		0.902	< 0.622	1.04	1.23	1.4	0.764	0.899	0.952	--	0.937	1.27
Selenium	ug/L	50	NA	5	50		3	2	< 1	< 1	1	1	< 1.0	< 1.0	--	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

NC - no criteria.

-- - not analyzed.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

RSL - Regional Screening Level from 83 FR 36435.

UTL - Upper Tolerance Limit (95%) of the background data set.

GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.

* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.

All metals were analyzed as total unless otherwise specified.

(1) pH value potentially biased high due to groundwater quality meter malfunction.

(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to June 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15036									
						Sample Date:	12/5/2015	3/10/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/23/2017	8/15/2017	9/26/2017	4/27/2018	6/20/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient										
Appendix III																	
Boron	ug/L	NC	NA	51	NA		54	79	74	70	51	99	87.3	51.7	41.3	--	88.3
Calcium	mg/L	NC	NA	46	NA		46.2	53.9	70.9	61.7	36.1	82.9	69.4	39.6	34.5	--	64.8
Chloride	mg/L	250*	NA	43	NA		19.1	13.9	25.2	20.7	11.9	27.3	27.2	23.4	13.5	--	24.3
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.6	7.4	7.0	6.8	7.4	7.2	7.3	7.5	7.5	8.1(1)	7.1
Sulfate	mg/L	250*	NA	14	NA		18.5	16.6	23.6	19.4	12.1	29.2	29.4	20.3	14.9	--	26.1
Total Dissolved Solids	mg/L	500*	NA	258	NA		180	230	300	290	160	340	404	246	300	--	278
Appendix IV																	
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 10	< 1.0	< 1.0	--	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		8	8	10	10	6	13	10.9	7.2	--	8.9	11.5
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	1.1	< 0.20	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	1	1	< 1	1	1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA		< 0.174	0.194	< 0.229	< 0.26	< 0.202	< 0.303	< 0.692	< 0.671	--	< 0.618	< 0.555
Radium-226/228	pCi/L	5	NA	1.93	5		2.20	< 0.47	0.623	0.486	0.745	< 0.874	< 1.48	< 1.88	--	< 1.24	< 1.30
Radium-228	pCi/L	5	NA	NA	NA		2.1	< 0.47	0.513	0.367	0.7	< 0.874	< 0.783	< 1.21	--	< 0.626	< 0.743
Selenium	ug/L	50	NA	5	50		< 1	< 1	< 1	< 1	< 1	2	< 1.0	< 1.0	--	1.6	< 1.0
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

NC - no criteria.

-- - not analyzed.

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All metals were analyzed as total unless otherwise specified.

(1) pH value potentially biased high due to groundwater quality meter malfunction.

(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to June 2018
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15037									
						Sample Date:	12/4/2015	3/10/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/23/2017	8/15/2017	9/26/2017	4/27/2018	6/20/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient										
Appendix III																	
Boron	ug/L	NC	NA	51	NA		107	122	164	153	210	273	263	171	114	--	153
Calcium	mg/L	NC	NA	46	NA		71.9	64.6	73.4	78.8	89.7	91.2	94.6	83.8	76.0	--	72.6
Chloride	mg/L	250*	NA	43	NA		23.6	32.8	38.6	29.6	30.4	15.3	14.7	25.0	30.3	--	7.9
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.3	7.1	7.0	6.8	7.3	7.0	7.2	7.2	7.3	7.9(1)	7.1
Sulfate	mg/L	250*	NA	14	NA		38.3	27.9	27.2	35.1	54.6	35.1	41.3	52.3	45.3	--	36.3
Total Dissolved Solids	mg/L	500*	NA	258	NA		290	260	380	360	400	380	404	408	376	--	360
Appendix IV																	
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 10	< 1.0	< 1.0	--	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		13	14	17	16	16	15	15.1	13.4	--	11.5	11.7
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	< 1	3	< 1	1	2	< 1.0	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA		< 0.185	< 0.212	< 0.28	< 0.271	< 0.217	< 0.363	< 0.733	< 0.685	--	< 0.549	< 0.648
Radium-226/228	pCi/L	5	NA	1.93	5		0.868	< 0.75	0.973	1.14	0.667	2.27	< 1.40	< 1.91	--	< 1.25	< 1.45
Radium-228	pCi/L	5	NA	NA	NA		0.801	< 0.75	0.814	1.05	0.512	2.17	0.941	< 1.22	--	< 0.699	< 0.804
Selenium	ug/L	50	NA	5	50		25	6	< 1	13	25	11	11.9	14.1	--	1.1	9.9
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0

Notes:

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NA - not applicable.

NC - no criteria.

-- - not analyzed.

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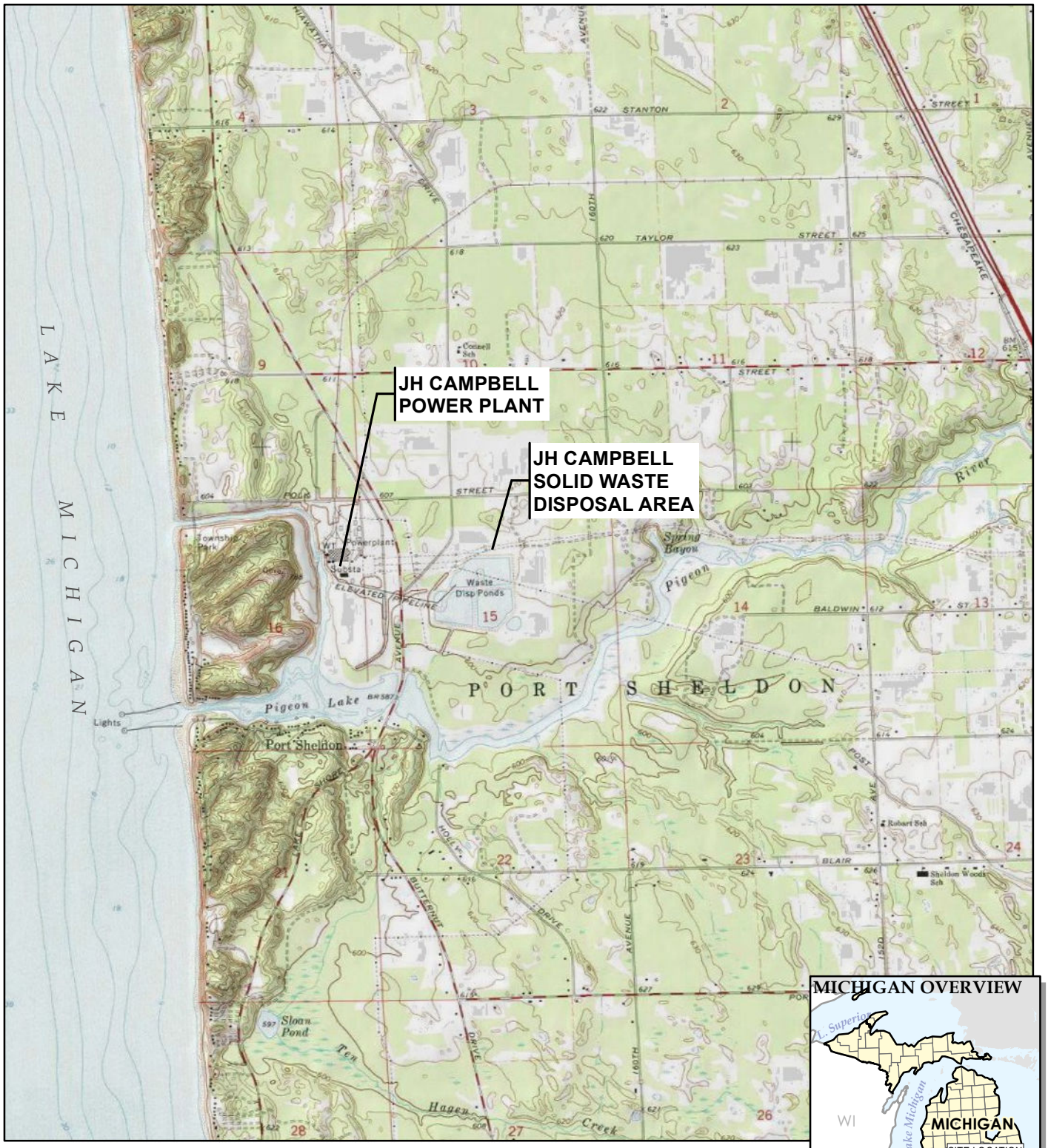
(1) pH value potentially biased high due to groundwater quality meter malfunction.

(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.

Figures



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

1 " = 3,000 '
1:36,000

0 3,000 6,000
FEET

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080

TRC - GIS

PROJECT:

CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:

SITE LOCATION MAP

DRAWN BY:	J. PAPEZ
CHECKED BY:	S. HOLMSTROM
APPROVED BY:	G. CROCKFORD
DATE:	NOVEMBER 2018
PROJ. NO.:	269767-005
FILE:	269767-005-009SLM.mxd

FIGURE 1

E:\ConsumersEnergy\CCR_GW\2017_269767\269767-005-009SLM.mxd -- Saved By: SMAJOR on 11/29/2018, 12:55:00 PM

TRC - GIS

JHC MW-15025
JHC MW-15026
JHC MW-15027
JHC MW-15024
WEST LEACHATE RETENTION POND
EAST LEACHATE RETENTION POND
JHC MW-15023
JHC MW-15028
CELL 1 (PARTIALLY CLOSED)
CELL 2 (PARTIALLY CLOSED)
JHC MW-15034
JHC MW-15017
JHC MW-15018
JHC MW-15019
JHC MW-15021 (NOTE 4)
JHC MW-15020 (NOTE 4)
JHC MW-15033
JHC MW-15032
ASH STORAGE SILOS
JHC MW-15029
SURFACE WATER DITCH
CELL 4 (ACTIVE)
CELL 3 (ACTIVE)
JHC MW-15022
FUTURE CELLS 5, 6, 7
JHC MW-15036
JHC MW-15031
JHC MW-15037
JHC MW-15035
JHC MW-15016
FORMER BOTTOM ASH POND 3N
POND F (CLOSED)
POND D NORTH (CLOSED)
POND G1 (CLOSED)
POND G2 (CLOSED)
JHC MW-15030
JHC MW-18001
JHC MW-15015
JHC MW-15014 (NOTE 3)
UNIT 3 DRAINAGE DITCH
BOTTOM ASH POND 3S
JHC MW-18002
JHC MW-18003
JHC MW-15012 (NOTE 5)
JHC MW-15013
POND D MID (CLOSED)
POND J (CLOSED)
POND H (CLOSED)
POND C (CLOSED)
SURFACE WATER DITCH
POND D MID-SOUTH (CLOSED)
UNIT 1-2 DRAINAGE DITCH
JHC MW-15001
BOTTOM ASH POND 1-2N
JHC MW-15002
CHEMICAL TREATMENT LAGOONS
POND D SOUTH (CLOSED)
POND K (CLOSED)
JHC MW-15003
JHC MW-18004
POND B (CLOSED)
BOTTOM ASH POND 1-2S
JHC MW-15010
JHC MW-15004 (NOTE 4)
JHC MW-18005
JHC MW-15009
POND A (ACTIVE)
JHC MW-15005
JHC MW-15008
JHC MW-15011
JHC MW-15006
JHC MW-15007
RECIRCULATION POND
SURFACE WATER DITCH
Lakeshore Dr
Pigeon River

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADIENT LANDFILL MONITORING WELL
- DOWNGRADIENT POND A MONITORING WELL
- MONITORING WELL (2018)
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- DECOMMISSIONED MONITORING WELL

NOTES

1. BASE MAP IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/20/2016.
2. WELL LOCATIONS SURVEYED BY NEDERVELD ON 11/25/2015.
3. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
4. MONITORING WELL DECOMMISSIONED JUNE 14, 2018.
5. MONITORING WELL DECOMMISSIONED OCTOBER 10, 2018.
6. JHC-MW-1800X MONITORING WELLS INSTALLED IN LATE 2018.

0 600 1,200 Feet

1 " = 600 '
1:7,200

PROJECT:
CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:
SITE PLAN WITH CCR MONITORING WELL LOCATIONS

DRAWN BY:	J. PAPEZ	PROJ NO.:	290806-001
CHECKED BY:	S. HOLMSTROM		
APPROVED BY:	G. CROCKFORD		**FIGURE 2**
DATE:	JANUARY 2019		

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 290806-001-013.mxd

Plot Date: 1/9/2019, 10:46:35 AM by SMAJOR -- LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\290806-001-013.mxd
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

TRC - GIS

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

Plot Date: 11/28/2018, 13:36:00 PM by SMAJOR -- LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\290806-001-007.mxd

LEGEND

- BACKGROUND MONITORING WELL
- DECOMMISSIONED MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADIENT LANDFILL MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- POND A MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- *(600.97)* GROUNDWATER ELEVATION (FEET)

NOTES

1. BASE MAP IMAGERY FROM USDAL-NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/20/2016.
2. WELL LOCATIONS SURVEYED BY NEDERVELD ON 11/25/2015.
3. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
4. GROUNDWATER ELEVATIONS DISPLAYED IN FEET RELATIVE TO THE NORTH AMERICAN VERTICAL DATUM OF 1988.
5. ASH SLUICING OPERATIONS AT UNIT 3 WERE TEMPORARILY CEASED FROM MARCH 14 TO APRIL 26, 2018.

0 600 1,200 Feet

1 " = 600 '
1:7,200

PROJECT:
CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:
GROUNDWATER CONTOUR MAP APRIL 24, 2018

DRAWN BY:	S. MAJOR	PROJ NO.:	290806-001
CHECKED BY:	C. SCIESZKA		
APPROVED BY:	S. HOLMSTROM		**FIGURE 3**
DATE:	NOVEMBER 2018		

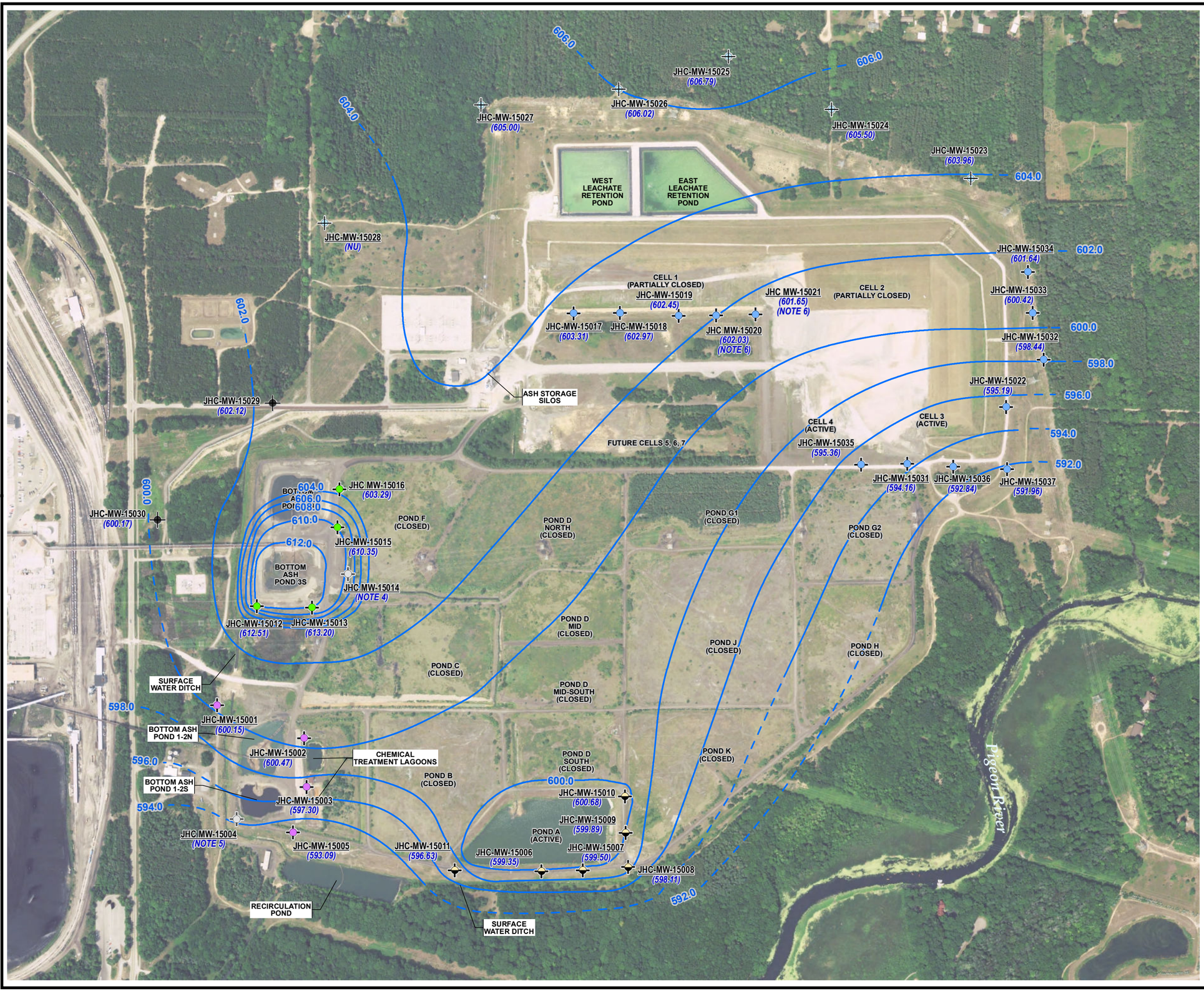
TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 290806-001-007.mxd

TRC - GIS

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

Plot Date: 11/30/2018, 09:15:20 AM by SMAJOR -- LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\290806-001-010.mxd



LEGEND

- BACKGROUND MONITORING WELL
- DECOMMISSIONED MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADIENT LANDFILL MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- POND A MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- *(600.97)* GROUNDWATER ELEVATION (FEET)
- *(NU)* ANOMALOUS DATA NOT USED TO CONSTRUCT CONTOUR MAP

NOTES

1. BASE MAP IMAGERY FROM USDAL-NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/20/2016.
2. WELL LOCATIONS SURVEYED BY NEDERVELD ON 11/25/2015.
3. GROUNDWATER ELEVATIONS DISPLAYED IN FEET RELATIVE TO THE NORTH AMERICAN VERTICAL DATUM OF 1988.
4. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
5. MONITORING WELL DECOMMISSIONED JUNE 14, 2018.
6. GROUNDWATER ELEVATION DATA COLLECTED ON JUNE 11, 2018, MONITORING WELL DECOMMISSIONED ON JUNE 14, 2018.

N

0 600 1,200 Feet

1 " = 600 '
1:7,200

PROJECT:
CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:
GROUNDWATER CONTOUR MAP JUNE 18, 2018

DRAWN BY:	S. MAJOR	PROJ NO.:	290806-001
CHECKED BY:	C. SCIESZKA		
APPROVED BY:	S. HOLMSTROM		**FIGURE 4**
DATE:	NOVEMBER 2018		

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 290806-001-010.mxd

Attachment A
Sanitas™ Output

Summary Report

Constituent: Antimony, Total Analysis Run 11/15/2018 9:59 AM
Client: Consumers Energy Data: JHC_Landfill_Sanitas

For observations made between 12/3/2015 and 6/21/2018, a summary of the selected data set:

Observations = 130
ND/Trace = 127
Wells = 13
Minimum Value = 1
Maximum Value = 1.7
Mean Value = 1.005
Median Value = 1
Standard Deviation = 0.06139
Coefficient of Variation = 0.06107
Skewness = 11.27

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	10	9	1	1	1	1	0	0	NaN
JHC-MW-15018	10	9	1	1	1	1	0	0	NaN
JHC-MW-15019	10	10	1	1	1	1	0	0	NaN
JHC-MW-15020	10	10	1	1	1	1	0	0	NaN
JHC-MW-15021	10	10	1	1	1	1	0	0	NaN
JHC-MW-15022	10	10	1	1	1	1	0	0	NaN
JHC-MW-15031	10	10	1	1	1	1	0	0	NaN
JHC-MW-15032	10	10	1	1	1	1	0	0	NaN
JHC-MW-15033	10	10	1	1	1	1	0	0	NaN
JHC-MW-15034	10	9	1	1.7	1.07	1	0.2214	0.2069	2.667
JHC-MW-15035	10	10	1	1	1	1	0	0	NaN
JHC-MW-15036	10	10	1	1	1	1	0	0	NaN
JHC-MW-15037	10	10	1	1	1	1	0	0	NaN

Summary Report

Constituent: Arsenic, Total Analysis Run 11/15/2018 9:59 AM
Client: Consumers Energy Data: JHC_Landfill_Sanitas

For observations made between 12/3/2015 and 6/21/2018, a summary of the selected data set:

Observations = 130
ND/Trace = 130
Wells = 13
Minimum Value = 1
Maximum Value = 10
Mean Value = 1.554
Median Value = 1
Standard Deviation = 2.171
Coefficient of Variation = 1.397
Skewness = 3.649

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	10	10	1	1	1	1	0	0	NaN
JHC-MW-15018	10	10	1	1	1	1	0	0	NaN
JHC-MW-15019	10	10	1	1	1	1	0	0	NaN
JHC-MW-15020	10	10	1	1	1	1	0	0	NaN
JHC-MW-15021	10	10	1	1	1	1	0	0	NaN
JHC-MW-15022	10	10	1	10	1.9	1	2.846	1.498	2.667
JHC-MW-15031	10	10	1	10	1.9	1	2.846	1.498	2.667
JHC-MW-15032	10	10	1	10	1.9	1	2.846	1.498	2.667
JHC-MW-15033	10	10	1	10	1.9	1	2.846	1.498	2.667
JHC-MW-15034	10	10	1	10	1.9	1	2.846	1.498	2.667
JHC-MW-15035	10	10	1	10	1.9	1	2.846	1.498	2.667
JHC-MW-15036	10	10	1	10	1.9	1	2.846	1.498	2.667
JHC-MW-15037	10	10	1	10	1.9	1	2.846	1.498	2.667

Summary Report

Constituent: Barium, Total Analysis Run 11/15/2018 9:59 AM
Client: Consumers Energy Data: JHC_Landfill_Sanitas

For observations made between 12/3/2015 and 6/21/2018, a summary of the selected data set:

Observations = 130
ND/Trace = 1
Wells = 13
Minimum Value = 4.55
Maximum Value = 127
Mean Value = 32.04
Median Value = 20.15
Standard Deviation = 28
Coefficient of Variation = 0.8737
Skewness = 1.132

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	10	0	50	127	83.71	78.05	24.52	0.293	0.4941
JHC-MW-15018	10	0	63	95	79.62	79.75	12.58	0.158	-0.009513
JHC-MW-15019	10	0	38	69	49.03	45.8	10.24	0.2088	0.9088
JHC-MW-15020	10	0	27	57	37.82	38.85	8.382	0.2216	1.019
JHC-MW-15021	10	0	46	71	58.47	56.8	8.555	0.1463	0.08055
JHC-MW-15022	10	0	20.3	51	26.99	26	8.9	0.3298	2.167
JHC-MW-15031	10	0	15.4	23	19.32	19.53	2.207	0.1142	-0.1965
JHC-MW-15032	10	0	7.3	10	8.895	9	0.8361	0.094	-0.5333
JHC-MW-15033	10	1	4.55	6	5.255	5.1	0.557	0.106	0.3789
JHC-MW-15034	10	0	5	8	5.97	5.75	0.9031	0.1513	1.248
JHC-MW-15035	10	0	13	27	17.87	17.2	3.986	0.2231	1.12
JHC-MW-15036	10	0	6	13	9.35	9.45	2.131	0.228	0.1245
JHC-MW-15037	10	0	11.5	17	14.27	14.5	1.867	0.1309	-0.1672

Summary Report

Constituent: Beryllium, Total Analysis Run 11/15/2018 9:59 AM
Client: Consumers Energy Data: JHC_Landfill_Sanitas

For observations made between 12/3/2015 and 6/21/2018, a summary of the selected data set:

Observations = 130
ND/Trace = 130
Wells = 13
Minimum Value = 1
Maximum Value = 1
Mean Value = 1
Median Value = 1
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	10	10	1	1	1	1	0	0	NaN
JHC-MW-15018	10	10	1	1	1	1	0	0	NaN
JHC-MW-15019	10	10	1	1	1	1	0	0	NaN
JHC-MW-15020	10	10	1	1	1	1	0	0	NaN
JHC-MW-15021	10	10	1	1	1	1	0	0	NaN
JHC-MW-15022	10	10	1	1	1	1	0	0	NaN
JHC-MW-15031	10	10	1	1	1	1	0	0	NaN
JHC-MW-15032	10	10	1	1	1	1	0	0	NaN
JHC-MW-15033	10	10	1	1	1	1	0	0	NaN
JHC-MW-15034	10	10	1	1	1	1	0	0	NaN
JHC-MW-15035	10	10	1	1	1	1	0	0	NaN
JHC-MW-15036	10	10	1	1	1	1	0	0	NaN
JHC-MW-15037	10	10	1	1	1	1	0	0	NaN

Summary Report

Constituent: Cadmium, Total Analysis Run 11/15/2018 9:59 AM
Client: Consumers Energy Data: JHC_Landfill_Sanitas

For observations made between 12/3/2015 and 6/21/2018, a summary of the selected data set:

Observations = 130
ND/Trace = 123
Wells = 13
Minimum Value = 0.2
Maximum Value = 1.1
Mean Value = 0.2142
Median Value = 0.2
Standard Deviation = 0.0894
Coefficient of Variation = 0.4173
Skewness = 8.226

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	10	4	0.2	0.54	0.295	0.21	0.1321	0.4478	0.8795
JHC-MW-15018	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15019	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15020	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15021	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15022	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15031	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15032	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15033	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15034	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15035	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15036	10	9	0.2	1.1	0.29	0.2	0.2846	0.9814	2.667
JHC-MW-15037	10	10	0.2	0.2	0.2	0.2	0	0	NaN

Summary Report

Constituent: Chromium, Total Analysis Run 11/15/2018 9:59 AM
Client: Consumers Energy Data: JHC_Landfill_Sanitas

For observations made between 12/3/2015 and 6/21/2018, a summary of the selected data set:

Observations = 130
ND/Trace = 80
Wells = 13
Minimum Value = 1
Maximum Value = 15
Mean Value = 1.468
Median Value = 1
Standard Deviation = 1.763
Coefficient of Variation = 1.201
Skewness = 5.78

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	10	8	1	2	1.1	1	0.3162	0.2875	2.667
JHC-MW-15018	10	8	1	2	1.1	1	0.3162	0.2875	2.667
JHC-MW-15019	10	6	1	3	1.3	1	0.6749	0.5192	1.92
JHC-MW-15020	10	6	1	2	1.2	1	0.4216	0.3514	1.5
JHC-MW-15021	10	8	1	2	1.1	1	0.3162	0.2875	2.667
JHC-MW-15022	10	3	1	3	1.53	1.15	0.6897	0.4508	0.9752
JHC-MW-15031	10	2	1	11	3.365	1.7	3.884	1.154	1.411
JHC-MW-15032	10	6	1	1	1	1	0	0	NaN
JHC-MW-15033	10	7	1	1	1	1	0	0	NaN
JHC-MW-15034	10	9	1	1	1	1	0	0	NaN
JHC-MW-15035	10	4	1	15	3.09	1.05	4.369	1.414	2.303
JHC-MW-15036	10	6	1	1	1	1	0	0	NaN
JHC-MW-15037	10	7	1	3	1.3	1	0.6749	0.5192	1.92

Summary Report

Constituent: Cobalt, Total Analysis Run 11/15/2018 9:59 AM
Client: Consumers Energy Data: JHC_Landfill_Sanitas

For observations made between 12/3/2015 and 6/21/2018, a summary of the selected data set:

Observations = 130
ND/Trace = 130
Wells = 13
Minimum Value = 15
Maximum Value = 15
Mean Value = 15
Median Value = 15
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	10	10	15	15	15	15	0	0	NaN
JHC-MW-15018	10	10	15	15	15	15	0	0	NaN
JHC-MW-15019	10	10	15	15	15	15	0	0	NaN
JHC-MW-15020	10	10	15	15	15	15	0	0	NaN
JHC-MW-15021	10	10	15	15	15	15	0	0	NaN
JHC-MW-15022	10	10	15	15	15	15	0	0	NaN
JHC-MW-15031	10	10	15	15	15	15	0	0	NaN
JHC-MW-15032	10	10	15	15	15	15	0	0	NaN
JHC-MW-15033	10	10	15	15	15	15	0	0	NaN
JHC-MW-15034	10	10	15	15	15	15	0	0	NaN
JHC-MW-15035	10	10	15	15	15	15	0	0	NaN
JHC-MW-15036	10	10	15	15	15	15	0	0	NaN
JHC-MW-15037	10	10	15	15	15	15	0	0	NaN

Summary Report

Constituent: Fluoride Analysis Run 11/15/2018 9:59 AM
Client: Consumers Energy Data: JHC_Landfill_Sanitas

For observations made between 12/3/2015 and 6/21/2018, a summary of the selected data set:

Observations = 143
ND/Trace = 143
Wells = 13
Minimum Value = 1000
Maximum Value = 1000
Mean Value = 1000
Median Value = 1000
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	11	11	1000	1000	1000	1000	0	0	NaN
JHC-MW-15018	11	11	1000	1000	1000	1000	0	0	NaN
JHC-MW-15019	11	11	1000	1000	1000	1000	0	0	NaN
JHC-MW-15020	11	11	1000	1000	1000	1000	0	0	NaN
JHC-MW-15021	11	11	1000	1000	1000	1000	0	0	NaN
JHC-MW-15022	11	11	1000	1000	1000	1000	0	0	NaN
JHC-MW-15031	11	11	1000	1000	1000	1000	0	0	NaN
JHC-MW-15032	11	11	1000	1000	1000	1000	0	0	NaN
JHC-MW-15033	11	11	1000	1000	1000	1000	0	0	NaN
JHC-MW-15034	11	11	1000	1000	1000	1000	0	0	NaN
JHC-MW-15035	11	11	1000	1000	1000	1000	0	0	NaN
JHC-MW-15036	11	11	1000	1000	1000	1000	0	0	NaN
JHC-MW-15037	11	11	1000	1000	1000	1000	0	0	NaN

Summary Report

Constituent: Lead, Total Analysis Run 11/15/2018 9:59 AM
Client: Consumers Energy Data: JHC_Landfill_Sanitas

For observations made between 12/3/2015 and 6/21/2018, a summary of the selected data set:

Observations = 130
ND/Trace = 130
Wells = 13
Minimum Value = 1
Maximum Value = 1
Mean Value = 1
Median Value = 1
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	10	10	1	1	1	1	0	0	NaN
JHC-MW-15018	10	10	1	1	1	1	0	0	NaN
JHC-MW-15019	10	10	1	1	1	1	0	0	NaN
JHC-MW-15020	10	10	1	1	1	1	0	0	NaN
JHC-MW-15021	10	10	1	1	1	1	0	0	NaN
JHC-MW-15022	10	10	1	1	1	1	0	0	NaN
JHC-MW-15031	10	10	1	1	1	1	0	0	NaN
JHC-MW-15032	10	10	1	1	1	1	0	0	NaN
JHC-MW-15033	10	10	1	1	1	1	0	0	NaN
JHC-MW-15034	10	10	1	1	1	1	0	0	NaN
JHC-MW-15035	10	10	1	1	1	1	0	0	NaN
JHC-MW-15036	10	10	1	1	1	1	0	0	NaN
JHC-MW-15037	10	10	1	1	1	1	0	0	NaN

Summary Report

Constituent: Lithium, Total Analysis Run 11/15/2018 9:59 AM
Client: Consumers Energy Data: JHC_Landfill_Sanitas

For observations made between 12/3/2015 and 6/21/2018, a summary of the selected data set:

Observations = 130
ND/Trace = 130
Wells = 13
Minimum Value = 10
Maximum Value = 10
Mean Value = 10
Median Value = 10
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	10	10	10	10	10	10	0	0	NaN
JHC-MW-15018	10	10	10	10	10	10	0	0	NaN
JHC-MW-15019	10	10	10	10	10	10	0	0	NaN
JHC-MW-15020	10	10	10	10	10	10	0	0	NaN
JHC-MW-15021	10	10	10	10	10	10	0	0	NaN
JHC-MW-15022	10	10	10	10	10	10	0	0	NaN
JHC-MW-15031	10	10	10	10	10	10	0	0	NaN
JHC-MW-15032	10	10	10	10	10	10	0	0	NaN
JHC-MW-15033	10	10	10	10	10	10	0	0	NaN
JHC-MW-15034	10	10	10	10	10	10	0	0	NaN
JHC-MW-15035	10	10	10	10	10	10	0	0	NaN
JHC-MW-15036	10	10	10	10	10	10	0	0	NaN
JHC-MW-15037	10	10	10	10	10	10	0	0	NaN

Summary Report

Constituent: Mercury, Total Analysis Run 11/15/2018 9:59 AM
Client: Consumers Energy Data: JHC_Landfill_Sanitas

For observations made between 12/3/2015 and 6/21/2018, a summary of the selected data set:

Observations = 130
ND/Trace = 130
Wells = 13
Minimum Value = 0.2
Maximum Value = 0.2
Mean Value = 0.2
Median Value = 0.2
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15018	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15019	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15020	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15021	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15022	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15031	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15032	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15033	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15034	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15035	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15036	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15037	10	10	0.2	0.2	0.2	0.2	0	0	NaN

Summary Report

Constituent: Molybdenum, Total Analysis Run 11/15/2018 9:59 AM
Client: Consumers Energy Data: JHC_Landfill_Sanitas

For observations made between 12/3/2015 and 6/21/2018, a summary of the selected data set:

Observations = 130
ND/Trace = 105
Wells = 13
Minimum Value = 5
Maximum Value = 33
Mean Value = 5.925
Median Value = 5
Standard Deviation = 3.415
Coefficient of Variation = 0.5764
Skewness = 5.447

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	10	2	5	12	7.91	7.5	2.539	0.321	0.3968
JHC-MW-15018	10	7	5	19.7	7.87	5	5.635	0.716	1.506
JHC-MW-15019	10	3	5	33	10.99	7.35	9.092	0.8273	1.688
JHC-MW-15020	10	10	5	5	5	5	0	0	NaN
JHC-MW-15021	10	10	5	5	5	5	0	0	NaN
JHC-MW-15022	10	3	5	6	5.25	5	0.4089	0.07789	1.285
JHC-MW-15031	10	10	5	5	5	5	0	0	NaN
JHC-MW-15032	10	10	5	5	5	5	0	0	NaN
JHC-MW-15033	10	10	5	5	5	5	0	0	NaN
JHC-MW-15034	10	10	5	5	5	5	0	0	NaN
JHC-MW-15035	10	10	5	5	5	5	0	0	NaN
JHC-MW-15036	10	10	5	5	5	5	0	0	NaN
JHC-MW-15037	10	10	5	5	5	5	0	0	NaN

Summary Report

Constituent: Radium-226 Analysis Run 11/15/2018 9:59 AM
Client: Consumers Energy Data: JHC_Landfill_Sanitas

For observations made between 12/3/2015 and 6/21/2018, a summary of the selected data set:

Observations = 130
ND/Trace = 111
Wells = 13
Minimum Value = 0.148
Maximum Value = 1.17
Mean Value = 0.42
Median Value = 0.328
Standard Deviation = 0.232
Coefficient of Variation = 0.5524
Skewness = 1.056

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	10	5	0.182	1.17	0.5461	0.422	0.3321	0.6081	0.6407
JHC-MW-15018	10	7	0.203	0.9085	0.4361	0.312	0.2417	0.5541	0.8165
JHC-MW-15019	10	8	0.184	0.856	0.4308	0.359	0.2237	0.5192	0.7781
JHC-MW-15020	10	10	0.181	0.755	0.3964	0.3115	0.2119	0.5344	0.6504
JHC-MW-15021	10	8	0.171	0.562	0.3074	0.269	0.1237	0.4025	0.9724
JHC-MW-15022	10	9	0.159	1.12	0.4559	0.343	0.3271	0.7175	0.9718
JHC-MW-15031	10	7	0.23	0.7115	0.4266	0.399	0.1647	0.3861	0.481
JHC-MW-15032	10	10	0.178	0.973	0.3993	0.2615	0.2682	0.6716	1.133
JHC-MW-15033	10	9	0.148	0.617	0.3874	0.3735	0.1549	0.3999	0.01683
JHC-MW-15034	10	10	0.193	0.775	0.4209	0.295	0.2241	0.5323	0.6465
JHC-MW-15035	10	9	0.151	1.08	0.4488	0.392	0.2843	0.6335	1.084
JHC-MW-15036	10	9	0.174	0.692	0.3898	0.2815	0.2161	0.5543	0.4069
JHC-MW-15037	10	10	0.185	0.733	0.4143	0.3215	0.2163	0.5222	0.3921

Summary Report

Constituent: Radium-226/228 Analysis Run 11/15/2018 9:59 AM
Client: Consumers Energy Data: JHC_Landfill_Sanitas

For observations made between 12/3/2015 and 6/21/2018, a summary of the selected data set:

Observations = 130
ND/Trace = 62
Wells = 13
Minimum Value = 0.356
Maximum Value = 3.02
Mean Value = 1.248
Median Value = 1.251
Standard Deviation = 0.5364
Coefficient of Variation = 0.4297
Skewness = 0.3565

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	10	2	0.659	3.02	1.8	1.875	0.6835	0.3798	-0.1892
JHC-MW-15018	10	3	0.408	2	1.239	1.225	0.4411	0.3561	0.06833
JHC-MW-15019	10	4	0.715	1.75	1.239	1.085	0.3854	0.311	0.2431
JHC-MW-15020	10	4	0.568	2.28	1.329	1.465	0.6184	0.4654	-0.03184
JHC-MW-15021	10	4	0.536	2.11	1.216	1.255	0.4774	0.3925	0.1931
JHC-MW-15022	10	5	0.636	2.29	1.524	1.56	0.5569	0.3653	-0.1373
JHC-MW-15031	10	3	0.424	1.79	1.238	1.221	0.4142	0.3346	-0.4278
JHC-MW-15032	10	10	0.441	1.9	0.9574	0.61	0.5958	0.6224	0.6743
JHC-MW-15033	10	8	0.356	1.67	0.9012	0.7545	0.4605	0.511	0.4008
JHC-MW-15034	10	4	0.418	1.58	1.101	1.014	0.4172	0.3789	-0.206
JHC-MW-15035	10	4	0.622	1.98	1.287	1.375	0.4041	0.314	-0.1292
JHC-MW-15036	10	6	0.47	2.2	1.13	1.057	0.5955	0.5271	0.5208
JHC-MW-15037	10	5	0.667	2.27	1.268	1.195	0.5121	0.4039	0.7262

Summary Report

Constituent: Radium-228 Analysis Run 11/15/2018 9:59 AM
Client: Consumers Energy Data: JHC_Landfill_Sanitas

For observations made between 12/3/2015 and 6/21/2018, a summary of the selected data set:

Observations = 130
ND/Trace = 60
Wells = 13
Minimum Value = 0.356
Maximum Value = 2.74
Mean Value = 0.9548
Median Value = 0.874
Standard Deviation = 0.4274
Coefficient of Variation = 0.4476
Skewness = 1.392

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	10	2	0.659	2.74	1.411	1.465	0.6073	0.4303	0.7728
JHC-MW-15018	10	4	0.408	1.33	0.9212	1.03	0.2897	0.3145	-0.5608
JHC-MW-15019	10	3	0.638	1.58	0.9084	0.8565	0.2724	0.2999	1.548
JHC-MW-15020	10	4	0.568	1.92	1.112	1.008	0.5294	0.4763	0.4176
JHC-MW-15021	10	4	0.536	2.03	1.044	0.8835	0.4668	0.4471	0.9155
JHC-MW-15022	10	5	0.511	2.22	1.124	1.055	0.557	0.4957	0.656
JHC-MW-15031	10	5	0.424	1.53	0.9197	0.897	0.3151	0.3426	0.4264
JHC-MW-15032	10	10	0.441	1.17	0.6904	0.61	0.2434	0.3526	0.7323
JHC-MW-15033	10	8	0.356	1.05	0.6858	0.6645	0.2212	0.3225	0.1291
JHC-MW-15034	10	4	0.418	1.04	0.7807	0.836	0.1971	0.2525	-0.9462
JHC-MW-15035	10	1	0.622	1.4	1.002	0.9445	0.2385	0.2381	0.2069
JHC-MW-15036	10	6	0.367	2.1	0.8386	0.7215	0.5024	0.599	1.714
JHC-MW-15037	10	4	0.512	2.17	0.9761	0.809	0.4621	0.4734	1.863

Summary Report

Constituent: Selenium, Total Analysis Run 11/15/2018 9:59 AM
Client: Consumers Energy Data: JHC_Landfill_Sanitas

For observations made between 12/3/2015 and 6/21/2018, a summary of the selected data set:

Observations = 130
ND/Trace = 47
Wells = 13
Minimum Value = 1
Maximum Value = 37
Mean Value = 6.527
Median Value = 2.35
Standard Deviation = 8.091
Coefficient of Variation = 1.24
Skewness = 1.693

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	10	0	18.2	37	25.86	25.45	6.961	0.2692	0.2593
JHC-MW-15018	10	0	7	18	12.72	12.85	3.05	0.2399	-0.1555
JHC-MW-15019	10	0	6	22.2	14.64	14.9	4.85	0.3313	-0.2923
JHC-MW-15020	10	1	1	7	4.77	4.75	1.943	0.4074	-0.4396
JHC-MW-15021	10	0	1	3.3	2.5	2.85	0.7211	0.2884	-0.8527
JHC-MW-15022	10	1	1	10	5.03	4.1	3.129	0.6222	0.3107
JHC-MW-15031	10	0	1	4	2.075	2	0.9852	0.4748	0.6761
JHC-MW-15032	10	10	1	1	1	1	0	0	NaN
JHC-MW-15033	10	10	1	1	1	1	0	0	NaN
JHC-MW-15034	10	10	1	1	1	1	0	0	NaN
JHC-MW-15035	10	6	1	3	1.3	1	0.6749	0.5192	1.92
JHC-MW-15036	10	8	1	2	1.16	1	0.3502	0.3019	1.759
JHC-MW-15037	10	1	1	25	11.8	11.45	8.328	0.7058	0.3906

Summary Report

Constituent: Thallium, Total Analysis Run 11/15/2018 9:59 AM
Client: Consumers Energy Data: JHC_Landfill_Sanitas

For observations made between 12/3/2015 and 6/21/2018, a summary of the selected data set:

Observations = 130
ND/Trace = 130
Wells = 13
Minimum Value = 2
Maximum Value = 2
Mean Value = 2
Median Value = 2
Standard Deviation = 0
Coefficient of Variation = 0
Skewness = NaN

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15017	10	10	2	2	2	2	0	0	NaN
JHC-MW-15018	10	10	2	2	2	2	0	0	NaN
JHC-MW-15019	10	10	2	2	2	2	0	0	NaN
JHC-MW-15020	10	10	2	2	2	2	0	0	NaN
JHC-MW-15021	10	10	2	2	2	2	0	0	NaN
JHC-MW-15022	10	10	2	2	2	2	0	0	NaN
JHC-MW-15031	10	10	2	2	2	2	0	0	NaN
JHC-MW-15032	10	10	2	2	2	2	0	0	NaN
JHC-MW-15033	10	10	2	2	2	2	0	0	NaN
JHC-MW-15034	10	10	2	2	2	2	0	0	NaN
JHC-MW-15035	10	10	2	2	2	2	0	0	NaN
JHC-MW-15036	10	10	2	2	2	2	0	0	NaN
JHC-MW-15037	10	10	2	2	2	2	0	0	NaN

Appendix E
April 2019 Assessment Monitoring Statistical Evaluation

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Technical Memorandum

Date: August 1, 2019

To: Bethany Swanberg, Consumers Energy

cc: Brad Runkel, Consumers Energy
JR Register, Consumers Energy
Michelle Marion, Consumers Energy

From: Darby Litz, TRC
Sarah Holmstrom, TRC
Meredith Brehob, TRC

Project No.: 322174.0000.0000 Phase 1 Task 3

Subject: Statistical Evaluation of April 2019 Assessment Monitoring Sampling Event
JH Campbell Dry Ash Landfill, Consumers Energy Company, West Olive, Michigan

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During the statistical evaluation of the initial assessment monitoring event, no Appendix IV constituents were present at statistically significant levels exceeding the Groundwater Protection Standards (GWPSs). Therefore, Consumers Energy Company (Consumers Energy) is continuing semiannual assessment monitoring in accordance with §257.95 of the CCR Rule[1] at the JH Campbell Power Plant (JHC) Dry Ash Landfill. The first semiannual assessment monitoring event for 2019 was conducted on April 22 through April 29, 2019. In accordance with §257.95, the assessment monitoring data must be compared to GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs. GWPSs were established in accordance with §257.95(h), as described in the October 15, 2018 *Groundwater Protection Standards* technical memorandum, which was also included in the *2018 Annual Groundwater Monitoring Report* (TRC, January 2019). The following narrative describes the methods employed and the results obtained .

The statistical evaluation of the first semiannual assessment monitoring event data indicate no constituents are present at statistically significant levels that exceed the GWPSs at the Dry Ash Landfill monitoring wells. These results are consistent with the results of the initial assessment monitoring data statistical evaluation and concentrations remain above background levels.

[1] USEPA final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) published April 17, 2015, as amended per Phase One, Part One of the CCR Rule (83 FR 36435).

Consumers Energy will continue semiannual assessment monitoring per §257.95 and execute the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Assessment Monitoring Statistical Evaluation

The compliance well network at the JHC Dry Ash Landfill CCR Unit consists of eleven monitoring wells (JHC-MW-15017 through JHC-MW-15019, JHC-MW-15022, and JHC-MW-15031 through JHC-MW-15037) located on the south and east perimeters of the landfill Cells 1 through 4.

Following the first semiannual assessment monitoring sampling event, compliance well data for the JHC Dry Ash Landfill were evaluated in accordance with the *Groundwater Statistical Evaluation Plan* (Stats Plan) (TRC, October 2017). An assessment monitoring program was developed to evaluate concentrations of CCR constituents present in the uppermost aquifer relative to acceptable levels (i.e., GWPSs). To evaluate whether or not a GWPS exceedances is statistically significant, the difference in concentration observed at the downgradient wells during a given assessment monitoring event compared to the GWPS must be large enough, after accounting for variability in the sample data, that the result is unlikely to have occurred merely by chance. Consistent with the Unified Guidance [2], the preferred method for comparisons to a fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS. Based on the number of historical observations in the representative sample population, the population mean, the population standard deviation, and a selected confidence level (i.e., 99 percent), an upper and lower confidence limit is calculated. The true concentration, with 99 percent confidence, will fall between the lower and upper confidence limits.

The concentrations observed in the downgradient wells are deemed to be a statistically significant exceedance when the 99 percent lower confidence limit of the downgradient data exceeds the GWPS. If the confidence interval straddles the GWPS (i.e. the lower confidence level is below the GWPS but the upper confidence level is above), the statistical test result indicates that there is insufficient confidence that the measured concentrations are different from the GWPS and thus there is not compelling evidence that the measured concentration is a result of a release from the CCR unit versus the inherent variability of the sample data. This statistical approach is consistent with the statistical methods for assessment monitoring presented in §257.93(f) and (g). Statistical evaluation methodologies built into the CCR Rule, and numerous other federal rules, are key in determining whether or not individually measured data points represent a concentration increase over the baseline or a fixed standard (such as a GWPS in an assessment monitoring program).

For each detected Appendix IV constituent, the concentrations from each well were first compared directly to the GWPS, as shown on Table A1. No parameter-well combinations included a direct

[2] USEPA. 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*. Office of Conservation and Recovery. EPA 530/R-09-007.

exceedance of the GWPS within the past 8 events (June 2017 through April 2019) for data that met project data quality objectives[3].

Therefore, no confidence limits were calculated for the Dry Ash Landfill.

The direct comparison of the Appendix IV constituents shows no potential GWPS exceedances. These results are consistent with the results of the initial assessment monitoring data statistical evaluation and Consumers Energy will continue to initiate an assessment of corrective measures per §257.95(g). Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Attachments

Table A1 Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to June 2019

[3] Anomalously high chromium results were reported for JHC-MW-15022 and JHC-MW-15035 in April 2019. Reanalysis was conducted with similar results, but the relative percent differ4ence (RPD) was above the acceptance criteria. The two wells were resampled in in June 2019 with results consistent with earlier sampling events. The June 2019 chromium concentrations are used for statistical analysis in lieu of the April 2019 results.

Table

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15017													
					Sample Date:	12/3/2015	3/9/2016	6/22/2016	8/30/2016	11/15/2016	4/18/2017	6/22/2017	8/16/2017	9/27/2017	4/26/2018	6/20/2018	11/13/2018	4/23/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient													
Appendix III																			
Boron	ug/L	NC	NA	51	NA	386	343	444	321	592	618	407	347	405	--	245	274	340	
Calcium	mg/L	NC	NA	46	NA	64.9	70.8	68.3	62.5	58.5	52.2	56.0	56.3	44.8	--	44.0	60.9	81	
Chloride	mg/L	250*	NA	43	NA	66.9	32.3	35.2	56.4	45.1	22.8	70.8	112	119	--	97.0	170	120	
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	
Sulfate	mg/L	250*	NA	14	NA	51.0	43.4	49.2	46.1	54.2	75.0	70.3	84.2	101	--	60.6	72.0	100	
Total Dissolved Solids	mg/L	500*	NA	258	NA	350	280	300	370	320	300	366	476	490	--	348	474	520	
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	6.77	6.6	6.3	6.3	6.1	5.8	6.1	6.1	5.2	6.0(1)	6.0	6.1	6.1	
Appendix IV																			
Antimony	ug/L	6	NA	2	6	< 1	< 1	1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	
Arsenic	ug/L	10	NA	1	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	
Barium	ug/L	2,000	NA	35	2,000	50	57	75	73	127	116	76.4	103	--	79.7	80.0	85.5	70	
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	0.2	0.3	0.22	0.42	--	0.47	0.54	0.60	0.57	
Chromium	ug/L	100	NA	2	100	< 1	< 1	1	< 1	< 1	2	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	12	
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	
Lithium	ug/L	NC	40	10	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	
Molybdenum	ug/L	NC	100	5	100	< 5	6	7	8	11	12	< 5.0	10.6	--	8.3	6.2	28.5	11	
Radium-226	pCi/L	NC	NA	NA	NA	0.231	< 0.182	0.333	< 0.716	0.283	0.456	< 0.388	< 0.917	--	1.17	< 0.785	< 1.05	0.176	
Radium-228	pCi/L	NC	NA	NA	NA	< 0.800	< 0.659	1.42	1.60	1.73	1.61	1.27	1.51	--	0.773	2.74	< 0.910	0.827	
Radium-226/228	pCi/L	5	NA	1.93	5	< 0.800	< 0.659	1.75	1.81	2.01	2.07	1.64	2.30	--	1.94	3.02	< 1.96	1.00	
Selenium	ug/L	50	NA	5	50	31	19	30	20	34	37	23.5	27.4	--	18.2	18.5	18.8	16	
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15018													
					Sample Date:	12/3/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/18/2017	6/22/2017	6/22/2017	8/16/2017	8/16/2017	9/27/2017	9/27/2017	4/26/2018	6/20/2018	11/13/2018	4/23/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient															
Appendix III													Field Dup		Field Dup		Field Dup				
Boron	ug/L	NC	NA	51	NA	110	128	164	137	133	146	159	165	133	139	127	130	--	117	115	130
Calcium	mg/L	NC	NA	46	NA	81.3	93.5	78.3	85.0	83.2	65.3	74.5	73.6	62.7	61.0	55.3	57.0	--	44.8	37.6	58
Chloride	mg/L	250*	NA	43	NA	46.1	18.2	30.7	41.1	34.5	31.8	43.8	44.4	43.7	43.6	41.5	41.6	--	31.9	33.2	43
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	70.8	64.7	75.5	80.2	77.3	73.6	79.8	78.9	88.4	86.2	80.8	81.1	--	62.3	51.1	61
Total Dissolved Solids	mg/L	500*	NA	258	NA	360	330	340	400	340	330	336	458	390	350	310	468	--	194	276	320
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	6.6	6.5	6.3	6.1	6.3	6.2	6.4	--	6.3	--	6.3	--	6.2(1)	6.1	6.3	6.4
Appendix IV																					
Antimony	ug/L	6	NA	2	6	< 1	1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000	67	63	69	93	95	83	69.1	65.1	89.7	97.5	--	--	89.0	76.5	79.6	80
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100	< 1	< 1	2	< 1	< 1	1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	< 15.0	< 15.0	--	--	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	6.8	6.8	--	--	17.2	19.7	6.7	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.203	0.228	< 0.285	< 0.318	< 0.257	< 0.306	0.420	0.596	0.667	1.15	--	--	< 0.656	< 0.692	< 0.760	0.217
Radium-228	pCi/L	NC	NA	NA	NA	0.951	1.03	1.03	1.33	< 0.408	1.04	< 0.556	< 0.623	1.24	0.935	--	--	< 0.572	< 1.14	< 0.918	< 0.476
Radium-226/228	pCi/L	5	NA	1.93	5	1.05	1.26	1.03	1.33	< 0.408	1.22	0.910	1.15	1.91	2.09	--	--	< 1.23	< 1.83	< 1.68	< 0.476
Selenium	ug/L	50	NA	5	50	13	7	11	14	12	18	15.6	15.7	13.9	13.9	--	--	12.7	9.9	8.2	12
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15019												
					Sample Date:	12/3/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/19/2017	6/22/2017	8/16/2017	9/27/2017	4/26/2018	6/20/2018	11/14/2018	4/23/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												
Appendix III																		
Boron	ug/L	NC	NA	51	NA	224	197	237	197	256	194	166	180	191	--	195	159	150
Calcium	mg/L	NC	NA	46	NA	137	121	125	86.5	106	63.2	85.9	53.1	58.3	--	64.1	30.4	45
Chloride	mg/L	250*	NA	43	NA	68.0	44.2	56.0	34.5	28.9	1.25	48.6	27.0	36.7	--	26.2	7.4	14
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	99.1	56.5	85.1	41.9	50.9	12.7	53.8	42.6	48.8	--	40.8	19.8	25
Total Dissolved Solids	mg/L	500*	NA	258	NA	580	440	520	370	420	250	378	268	306	--	286	250	200
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	6.9	6.6	6.6	6.2	6.6	6.3	6.8	6.4	6.4	6.7(1)	6.6	6.0	6.5
Appendix IV																		
Antimony	ug/L	6	NA	2	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000	53	44	50	38	47	69	41.1	40.0	--	63.6	44.6	53.5	46
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100	< 1	< 1	2	1	1	3	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100	< 5	8	< 5	7	21	33	7.0	< 5.0	--	11.2	7.7	10.4	12
Radium-226	pCi/L	NC	NA	NA	NA	< 0.246	0.436	< 0.184	< 0.297	< 0.253	< 0.316	< 0.601	< 0.856	--	0.402	< 0.717	< 0.838	0.124
Radium-228	pCi/L	NC	NA	NA	NA	0.839	1.08	1.58	0.874	< 0.715	0.775	0.685	0.947	--	< 0.638	< 0.951	< 0.801	< 0.465
Radium-226/228	pCi/L	5	NA	1.93	5	0.959	1.52	1.72	1.05	< 0.715	0.976	< 1.12	< 1.75	--	0.911	< 1.67	< 1.64	< 0.465
Selenium	ug/L	50	NA	5	50	6	12	9	14	13	18	18.0	15.8	--	22.2	18.4	24.8	11
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15020[2]										
						Sample Date:	12/3/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/19/2017	6/22/2017	8/16/2017	9/27/2017	4/26/2018	6/11/2018	6/11/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient											
Appendix III																		Field Dup
Boron	ug/L	NC	NA	51	NA		262	180	218	192	186	158	170	155	153	--	129	146
Calcium	mg/L	NC	NA	46	NA		75.1	59.7	57.7	58.3	62.3	45.9	50.0	49.1	49.5	--	39.2	42.7
Chloride	mg/L	250*	NA	43	NA		55.2	28.4	45.5	40.5	39.0	26.2	49.4	50.3	54.7	--	35.5	35.3
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		44.6	28.3	30.0	25.9	25.5	19.5	30.4	29.9	29.4	--	24.3	24.4
Total Dissolved Solids	mg/L	500*	NA	258	NA		340	230	280	280	290	220	306	272	278	--	222	254
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.6	6.3	6.2	6.0	6.4	6.2	6.4	6.5	6.5	6.4[1]	6.3	--
Appendix IV																		
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		57	27	40	40	31	32	41.9	38.7	--	31.6	39.2	38.8
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	1	2	< 1	2	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.224	< 0.181	< 0.186	< 0.334	< 0.280	< 0.289	< 0.567	< 0.444	--	< 0.704	< 0.588	< 0.755
Radium-228	pCi/L	NC	NA	NA	NA		< 0.568	0.886	1.83	1.64	0.606	< 0.581	< 0.700	1.92	--	< 1.13	1.48	1.03
Radium-226/228	pCi/L	5	NA	1.93	5		< 0.568	0.943	1.83	1.70	0.624	< 0.581	< 1.27	2.28	--	< 1.83	1.92	< 1.40
Selenium	ug/L	50	NA	5	50		7	4	< 1	7	7	5	5.2	4.5	--	2.9	4.0	4.2
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15021[2]									
						Sample Date:	12/3/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/19/2017	6/22/2017	8/16/2017	9/27/2017	4/26/2018	6/11/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient										
Appendix III																	
Boron	ug/L	NC	NA	51	NA		393	386	287	300	337	231	232	233	182	--	214
Calcium	mg/L	NC	NA	46	NA		61.1	74.2	42.7	50.2	56.9	30.1	32.8	35.7	37.0	--	26.6
Chloride	mg/L	250*	NA	43	NA		62.7	63.0	36.1	40.7	46.8	24.3	33.9	35.2	40.9	--	21.3
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		40.4	43.0	28.7	27.7	33.4	24.7	24.7	30.2	25.9	--	22.1
Total Dissolved Solids	mg/L	500*	NA	258	NA		340	340	250	260	300	190	204	238	280	--	174
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.3	6.1	6.0	6.1	6.3	6.0	6.2	6.3	6.5	6.3[1]	6.0
Appendix IV																	
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		71	70	56	46	54	55	63.3	47.6	--	64.2	57.6
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	< 1	2	< 1	< 1	1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.268	< 0.200	< 0.171	< 0.324	< 0.270	< 0.221	0.354	0.238	--	< 0.562	< 0.466
Radium-228	pCi/L	NC	NA	NA	NA		0.879	2.03	1.18	1.52	0.571	< 0.536	< 0.729	1.29	--	< 0.888	< 0.818
Radium-226/228	pCi/L	5	NA	1.93	5		1.05	2.11	1.23	1.52	0.592	< 0.536	< 0.866	1.53	--	< 1.45	< 1.28
Selenium	ug/L	50	NA	5	50		3	1	2	3	2	3	2.0	3.3	--	2.7	3.0
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15022													
					Sample Date:	12/5/2015	3/9/2016	6/23/2016	8/31/2016	11/17/2016	4/19/2017	6/22/2017	8/15/2017	9/27/2017	4/27/2018	6/20/2018	11/14/2018	11/14/2018	4/24/2019	4/24/2019	6/21/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												Field Dup		Field Dup	
Appendix III																					
Boron	ug/L	NC	NA	51	NA	433	393	329	371	413	444	397	376	340	--	315	376	374	360	360	--
Calcium	mg/L	NC	NA	46	NA	109	93.6	102	121	118	115	101	122	103	--	109	109	106	110	110	--
Chloride	mg/L	250*	NA	43	NA	11.2	8.68	1.28	3.94	4.67	2.07	1.1	1.6	2.4	--	3.5	3.7	3.8	2.7	2.7	--
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	<1,000	--
Sulfate	mg/L	250*	NA	14	NA	75.3	47.6	24.4	42.1	81.5	26.9	19.2	35.0	43.7	--	26.0	40.6	40.7	37	37	--
Total Dissolved Solids	mg/L	500*	NA	258	NA	480	440	380	480	500	440	502	466	406	--	414	358	400	410	400	--
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.0	6.9	6.8	6.8	6.8	7.0	7.0	7.0	7.0	7.6 (1)	6.9	7.0	--	7.0	--	7.1
Appendix IV																					
Antimony	ug/L	6	NA	2	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Arsenic	ug/L	10	NA	1	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Barium	ug/L	2,000	NA	35	2,000	51	27	21	26	28	26	22.6	26.8	--	20.3	21.2	21.3	22.6	23	22	--
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--
Chromium	ug/L	100	NA	2	100	2	1	2	1	2	3	< 1.0	< 1.0	--	1.3	< 1.0	1.7	1.5	82 (3)(4)	63 (4)	2.2 (4)
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	< 6.0	--
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--
Lithium	ug/L	NC	40	10	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	< 10	< 10	--
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--
Molybdenum	ug/L	NC	100	5	100	6	5	5	6	< 5	5	< 5.0	5.3	--	5.2	< 5.0	6.5	6.0	7.2	6.4	--
Radium-226	pCi/L	NC	NA	NA	NA	< 0.159	< 0.186	1.12	< 0.219	< 0.224	< 0.26	< 0.426	< 0.861	--	< 0.431	< 0.673	< 0.692	<0.924	< 0.0968	< 0.0955	--
Radium-228	pCi/L	NC	NA	NA	NA	2.22	< 0.636	1.08	1.26	1.62	1.60	< 0.511	< 1.03	--	< 0.583	< 0.697	0.999	< 0.849	< 0.505	< 0.470	--
Radium-226/228	pCi/L	5	NA	1.93	5	2.29	< 0.636	2.2	1.32	1.75	1.84	< 0.937	< 1.89	--	< 1.01	< 1.37	< 1.35	< 1.77	< 0.505	< 0.470	--
Selenium	ug/L	50	NA	5	50	8	10	< 1	6	9	4	1.3	4.1	--	4.1	2.8	5.6	5.2	7.2	7.4	--
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15031													
					Sample Date:	12/4/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/22/2017	6/22/2017	8/16/2017	8/16/2017	9/27/2017	9/27/2017	4/27/2018	6/20/2018	11/14/2018	4/24/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient															
Appendix III													Field Dup		Field Dup		Field Dup				
Boron	ug/L	NC	NA	51	NA	89	117	106	111	102	112	96.5	98.9	97.0	< 100	95.6	99.5	--	108	104	79
Calcium	mg/L	NC	NA	46	NA	77.1	94.2	80.3	84.8	70.3	76.3	63.9	66.8	62.5	67.5	68.5	67.2	--	66.9	63.3	59
Chloride	mg/L	250*	NA	43	NA	38.6	45.6	40	42.1	37.8	38.3	41.7	41.7	48.1	48.5	47.5	47.1	--	38.9	33.4	24
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	36.6	45.8	41.1	40.1	29.8	34.1	35.2	35.1	40.9	41.2	38.9	38.7	--	40.0	34.7	25
Total Dissolved Solids	mg/L	500*	NA	258	NA	340	390	380	370	310	340	348	412	454	454	386	452	--	352	268	280
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.0	6.7	6.7	6.8	6.8	6.9	6.9	--	6.8	--	6.8	--	7.6(1)	6.8	6.7	6.9
Appendix IV																					
Antimony	ug/L	6	NA	2	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000	21	23	21	20	18	20	16.6	17.0	19.2	18.9	--	--	15.4	18.9	21.4	14
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100	11	1	2	1	2	3	12.3	8.2	1.7	1.1	--	--	< 1.0	< 1.0	24.6	5.4
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	< 15.0	< 15.0	--	--	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	1.3	< 1.0
Lithium	ug/L	NC	40	10	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	< 5.0	< 5.0	--	--	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.230	< 0.272	< 0.309	< 0.379	< 0.279	0.419	< 1.03	0.393	< 0.423	0.675	--	--	< 0.479	< 0.638	0.849	0.102
Radium-228	pCi/L	NC	NA	NA	NA	0.922	< 0.424	0.872	1.53	0.759	1.25	< 0.636	< 0.662	< 1.05	< 0.894	--	--	< 0.708	< 1.02	< 0.773	< 0.427
Radium-226/228	pCi/L	5	NA	1.93	5	1.06	< 0.424	1.01	1.79	0.922	1.67	< 1.67	0.835	< 1.47	1.33	--	--	< 1.19	< 1.66	< 1.50	0.466
Selenium	ug/L	50	NA	5	50	3	2	1	1	2	2	1.3	1.3	< 1.0	1.9	--	--	4.0	3.0	2.4	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15032												
						Sample Date:	12/4/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/23/2017	8/15/2017	9/26/2017	4/26/2018	6/19/2018	6/19/2018	11/14/2018	4/24/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient													
Appendix III																		Field Dup		
Boron	ug/L	NC	NA	51	NA		73	74	61	72	78	71	56.4	62.4	57.8	--	45.7	44.6	49.4	< 50
Calcium	mg/L	NC	NA	46	NA		11.6	10.2	9.91	11.6	8.85	8.87	7.2	7.0	6.8	--	8.8	8.4	8.1	9.4
Chloride	mg/L	250*	NA	43	NA		1.99	2.14	2.43	2.84	2.55	3.49	2.7	3.0	3.2	--	3.4	3.4	4.2	2.6
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		18.4	18.0	19.4	19.7	16.0	16.1	13.9	16.3	< 2.0	--	11.8	11.6	11.9	11
Total Dissolved Solids	mg/L	500*	NA	258	NA		64	64	79	67	57	66	54	< 50.0	84	--	64	< 50.0	< 50.0	53
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.4	6.2	6.0	5.6	6.2	6.1	6.0	6.1	6.0	5.9(1)	6.3	--	6.2	6.3
Appendix IV																				
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		10	9	9	10	9	9	7.3	9.1	--	7.8	8.8	8.7	7.7	8.3
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	1	< 1	1	1	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.197	< 0.178	< 0.234	< 0.195	< 0.245	< 0.278	< 0.457	< 0.973	--	< 0.514	< 0.464	< 0.722	< 0.748	< 0.118
Radium-228	pCi/L	NC	NA	NA	NA		< 0.566	< 0.466	< 0.509	< 0.498	< 0.654	< 0.441	< 0.893	< 0.923	--	< 0.784	< 0.721	< 1.17	< 0.812	< 0.395
Radium-226/228	pCi/L	5	NA	1.93	5		< 0.566	< 0.466	< 0.509	< 0.498	< 0.654	< 0.441	< 1.35	< 1.90	--	< 1.30	< 1.19	< 1.89	< 1.56	< 0.395
Selenium	ug/L	50	NA	5	50		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
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(1) pH value potentially biased high due to groundwater quality meter malfunction.
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(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15033													
					Sample Date:	12/4/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/20/2017	6/23/2017	8/15/2017	9/26/2017	4/26/2018	4/26/2018	6/19/2018	11/14/2018	4/24/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient													
Appendix III																Field Dup			
Boron	ug/L	NC	NA	51	NA	27	32	35	31	34	33	33.0	30.8	34.1	--	--	33.0	41.8	< 50
Calcium	mg/L	NC	NA	46	NA	16.2	13.1	13.4	13.1	11.5	15.4	12.6	9.6	10.1	--	--	9.0	10.0	10
Chloride	mg/L	250*	NA	43	NA	< 1	1.03	1.98	1.56	1.25	1.82	1.7	1.1	1.4	--	--	3.4	3.2	< 2.0
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	10.4	8.83	10.3	8.86	9.02	10.1	9.0	9.7	< 2.0	--	--	8.1	9.2	9.5
Total Dissolved Solids	mg/L	500*	NA	258	NA	64	66	69	74	54	79	124	126	< 50.0	--	--	68	< 50.0	58
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.0	6.7	6.5	6.1	6.7	6.8	6.8	6.8	6.7	6.8(1)	--	6.7	6.7	6.7
Appendix IV																			
Antimony	ug/L	6	NA	2	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000	< 5	5	6	5	6	6	5.2	4.6	--	4.8	4.3	5.2	6.1	< 5.0
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100	< 1	< 1	< 1	1	1	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.148	< 0.296	< 0.332	< 0.300	< 0.215	< 0.415	0.521	< 0.617	--	< 0.460	< 0.151	< 0.570	< 0.766	< 0.0696
Radium-228	pCi/L	NC	NA	NA	NA	< 0.522	< 0.534	< 0.511	0.537	< 0.356	0.887	< 0.824	< 1.05	--	< 0.732	< 0.792	< 0.845	< 0.729	< 0.306
Radium-226/228	pCi/L	5	NA	1.93	5	< 0.522	< 0.534	< 0.511	0.622	< 0.356	0.887	< 1.30	< 1.67	--	< 1.19	< 0.943	< 1.42	< 1.50	< 0.306
Selenium	ug/L	50	NA	5	50	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15034												
					Sample Date:	12/4/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/20/2017	6/23/2017	8/15/2017	9/26/2017	4/25/2018	6/19/2018	11/14/2018	4/24/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												
Appendix III																		
Boron	ug/L	NC	NA	51	NA	54	69	48	66	70	67	68.1	62.1	51.4	--	62.6	62.5	51
Calcium	mg/L	NC	NA	46	NA	10.3	8.6	6.91	11	8.33	5.83	5.5	5.9	6.0	--	5.8	6.0	5.4
Chloride	mg/L	250*	NA	43	NA	2.48	1.91	4.31	1.56	1.88	1.43	1.5	2.0	2.2	--	3.1	3.5	2.1
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	23.9	18.5	13.2	16.6	16.9	15.1	12.6	16.5	< 2.0	--	12.5	14.4	12
Total Dissolved Solids	mg/L	500*	NA	258	NA	50	62	53	61	48	49	104	60	< 50.0	--	50	< 50.0	< 50
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	6.2	6.2	5.8	5.7	6.0	6.0	6.1	6.1	6.0	6.0(1)	6.0	5.9	5.9
Appendix IV																		
Antimony	ug/L	6	NA	2	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	1.7	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000	8	7	5	6	6	6	5.4	5.5	--	5.3	5.5	6.0	5.5
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100	< 1	< 1	< 1	< 1	< 1	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	1.2
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.256	< 0.193	< 0.244	< 0.267	< 0.283	< 0.307	< 0.607	< 0.763	--	< 0.775	< 0.514	< 0.688	< 0.0948
Radium-228	pCi/L	NC	NA	NA	NA	0.880	< 0.418	0.853	0.819	0.451	0.877	0.905	< 0.760	--	< 0.804	< 1.04	< 0.786	< 0.381
Radium-226/228	pCi/L	5	NA	1.93	5	0.963	< 0.418	1.03	0.858	0.603	0.998	1.49	< 1.52	--	< 1.58	< 1.55	< 1.47	< 0.381
Selenium	ug/L	50	NA	5	50	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15035												
						Sample Date:	12/4/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/23/2017	8/16/2017	9/26/2017	4/27/2018	6/20/2018	11/14/2018	4/24/2019	6/21/2019	6/21/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient													
Appendix III																				Field Dup
Boron	ug/L	NC	NA	51	NA		146	130	81	86	103	123	121	116	126	--	111	78.2	91	--	--
Calcium	mg/L	NC	NA	46	NA		118	111	78.7	72.5	83.3	88.5	82.1	91.3	107	--	90.5	66.6	98	--	--
Chloride	mg/L	250*	NA	43	NA		34.2	31.3	16.7	19	25.4	21.2	28.3	33.9	35.9	--	27.1	20.00	23.00	--	--
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--	--
Sulfate	mg/L	250*	NA	14	NA		39.2	32.4	20.8	21.8	24.9	24.7	28.2	35.4	35.6	--	26.7	18.8	24	--	--
Total Dissolved Solids	mg/L	500*	NA	258	NA		450	400	300	320	320	320	314	578	512	--	342	274	360	--	--
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.0	6.9	7.2	7.3	7.1	7.2	7.2	7.0	7.0	8.0 (1)	7.0	7.3	7.2	7.1	--
Appendix IV																					
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	--	--
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	--	--
Barium	ug/L	2,000	NA	35	2,000		27	21	14	13	16	17	15.8	19.4	--	17.4	18.1	12.3	17	--	--
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	--	--
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	--	--
Chromium	ug/L	100	NA	2	100		15	< 1	1	< 1	2	3	1.1	< 1.0	--	4.8	< 1.0	< 1.0	290 (3)(4)	1.8 (4)	2.5 (4)
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	--	--
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--	--
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	--	--
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	--	--
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	--	--
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0	11	--	--
Radium-226	pCi/L	NC	NA	NA	NA		< 0.151	< 0.156	0.355	< 0.345	< 0.239	< 0.429	< 0.452	< 1.08	--	< 0.733	< 0.548	< 0.850	< 0.101	--	--
Radium-228	pCi/L	NC	NA	NA	NA		0.902	< 0.622	1.04	1.23	1.40	0.764	0.899	0.952	--	0.937	1.27	< 0.914	< 0.357	--	--
Radium-226/228	pCi/L	5	NA	1.93	5		0.929	< 0.622	1.40	1.28	1.47	0.801	< 1.35	< 1.98	--	< 1.41	1.63	< 1.76	< 0.357	--	--
Selenium	ug/L	50	NA	5	50		3	2	< 1	< 1	1	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	--	--
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	--	--

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15036												
					Sample Date:	12/5/2015	3/10/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/23/2017	8/15/2017	9/26/2017	4/27/2018	6/20/2018	11/14/2018	4/24/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												
Appendix III																		
Boron	ug/L	NC	NA	51	NA	54	79	74	70	51	99	87.3	51.7	41.3	--	88.3	79.2	80
Calcium	mg/L	NC	NA	46	NA	46.2	53.9	70.9	61.7	36.1	82.9	69.4	39.6	34.5	--	64.8	51.6	50
Chloride	mg/L	250*	NA	43	NA	19.1	13.9	25.2	20.7	11.9	27.3	27.2	23.4	13.5	--	24.3	14.7	14
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	18.5	16.6	23.6	19.4	12.1	29.2	29.4	20.3	14.9	--	26.1	20.0	19
Total Dissolved Solids	mg/L	500*	NA	258	NA	180	230	300	290	160	340	404	246	300	--	278	216	220
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.6	7.4	7.0	6.8	7.4	7.2	7.3	7.5	7.5	8.1(1)	7.1	7.4	7.4
Appendix IV																		
Antimony	ug/L	6	NA	2	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000	8	8	10	10	6	13	10.9	7.2	--	8.9	11.5	8.2	8.4
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	1.1	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100	< 1	1	1	< 1	1	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.174	0.194	< 0.229	< 0.260	< 0.202	< 0.303	< 0.692	< 0.671	--	< 0.618	< 0.555	0.812	< 0.0882
Radium-228	pCi/L	NC	NA	NA	NA	2.10	< 0.470	0.513	0.367	0.700	< 0.874	< 0.783	< 1.21	--	< 0.626	< 0.743	< 0.670	< 0.384
Radium-226/228	pCi/L	5	NA	1.93	5	2.20	< 0.47	0.623	0.486	0.745	< 0.874	< 1.48	< 1.88	--	< 1.24	< 1.30	0.874	< 0.384
Selenium	ug/L	50	NA	5	50	< 1	< 1	< 1	< 1	< 1	2	< 1.0	< 1.0	--	1.6	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15037													
					Sample Date:	12/4/2015	3/10/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/23/2017	8/15/2017	9/26/2017	4/27/2018	6/20/2018	11/14/2018	4/24/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient													
Appendix III																			
Boron	ug/L	NC	NA	51	NA	107	122	164	153	210	273	263	171	114	--	153	221	150	
Calcium	mg/L	NC	NA	46	NA	71.9	64.6	73.4	78.8	89.7	91.2	94.6	83.8	76.0	--	72.6	103	73	
Chloride	mg/L	250*	NA	43	NA	23.6	32.8	38.6	29.6	30.4	15.3	14.7	25.0	30.3	--	7.9	8.2	6.3	
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	
Sulfate	mg/L	250*	NA	14	NA	38.3	27.9	27.2	35.1	54.6	35.1	41.3	52.3	45.3	--	36.3	50.1	22	
Total Dissolved Solids	mg/L	500*	NA	258	NA	290	260	380	360	400	380	404	408	376	--	360	406	270	
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.3	7.1	7.0	6.8	7.3	7.0	7.2	7.2	7.3	7.9(1)	7.1	7.3	7.3	
Appendix IV																			
Antimony	ug/L	6	NA	2	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	
Arsenic	ug/L	10	NA	1	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	
Barium	ug/L	2,000	NA	35	2,000	13	14	17	16	16	15	15.1	13.4	--	11.5	11.7	14.3	9.7	
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	
Chromium	ug/L	100	NA	2	100	< 1	< 1	3	< 1	1	2	< 1.0	< 1.0	--	< 1.0	< 1.0	1.6	1.7	
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	
Lithium	ug/L	NC	40	10	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	
Molybdenum	ug/L	NC	100	5	100	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0	
Radium-226	pCi/L	NC	NA	NA	NA	< 0.185	< 0.212	< 0.280	< 0.271	< 0.217	< 0.363	< 0.733	< 0.685	--	< 0.549	< 0.648	< 0.578	< 0.0813	
Radium-228	pCi/L	NC	NA	NA	NA	0.801	< 0.750	0.814	1.05	0.512	2.17	0.941	< 1.22	--	< 0.699	< 0.804	< 0.729	< 0.342	
Radium-226/228	pCi/L	5	NA	1.93	5	0.868	< 0.75	0.973	1.14	0.667	2.27	< 1.40	< 1.91	--	< 1.25	< 1.45	< 1.31	0.403	
Selenium	ug/L	50	NA	5	50	25	6	< 1	13	25	11	11.9	14.1	--	1.1	9.9	21.1	3.8	
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Appendix F
October 2019 Assessment Monitoring Statistical Evaluation

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Technical Memorandum

Date: December 13, 2019

To: Bethany Swanberg, Consumers Energy

cc: Brad Runkel, Consumers Energy
JR Register, Consumers Energy
Michelle Marion, Consumers Energy

From: Darby Litz, TRC
Sarah Holmstrom, TRC
Kristin Lowery, TRC

Project No.: 322174.0000.0000 Phase 1 Task 3

Subject: Statistical Evaluation of October 2019 Assessment Monitoring Sampling Event
JH Campbell Dry Ash Landfill, Consumers Energy Company, West Olive, Michigan

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During the statistical evaluation of the initial assessment monitoring event, no Appendix IV constituents were present at statistically significant levels exceeding the Groundwater Protection Standards (GWPSs). Therefore, Consumers Energy Company (Consumers Energy) is continuing semiannual assessment monitoring in accordance with §257.95 of the CCR Rule[1] at the JH Campbell Power Plant (JHC) Dry Ash Landfill. The second semiannual assessment monitoring event for 2019 was conducted on October 7 through October 11, 2019. In accordance with §257.95, the assessment monitoring data must be compared to GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs. GWPSs were established in accordance with §257.95(h), as described in the October 15, 2018 *Groundwater Protection Standards* technical memorandum, which was also included in the *2018 Annual Groundwater Monitoring Report* (TRC, January 2019). The following narrative describes the methods employed and the results obtained .

The statistical evaluation of the second semiannual assessment monitoring event of 2019 data indicate no constituents are present at statistically significant levels that exceed the GWPSs at the Dry Ash Landfill monitoring wells. These results are consistent with the results of the previous assessment monitoring data statistical evaluations and concentrations remain above background levels.

[1] USEPA final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) published April 17, 2015, as amended per Phase One, Part One of the CCR Rule (83 FR 36435).

Consumers Energy will continue semiannual assessment monitoring per §257.95 and execute the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Assessment Monitoring Statistical Evaluation

The compliance well network at the JHC Dry Ash Landfill CCR Unit consists of eleven monitoring wells (JHC-MW-15017 through JHC-MW-15019, JHC-MW-15022, and JHC-MW-15031 through JHC-MW-15037) located on the south and east perimeters of the landfill Cells 1 through 4.

Following the first semiannual assessment monitoring sampling event, compliance well data for the JHC Dry Ash Landfill were evaluated in accordance with the *Groundwater Statistical Evaluation Plan* (Stats Plan) (TRC, October 2017). An assessment monitoring program was developed to evaluate concentrations of CCR constituents present in the uppermost aquifer relative to acceptable levels (i.e., GWPSs). To evaluate whether or not a GWPS exceedance is statistically significant, the difference in concentration observed at the downgradient wells during a given assessment monitoring event compared to the GWPS must be large enough, after accounting for variability in the sample data, that the result is unlikely to have occurred merely by chance. Consistent with the Unified Guidance [2], the preferred method for comparisons to a fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS. Based on the number of historical observations in the representative sample population, the population mean, the population standard deviation, and a selected confidence level (i.e., 99 percent), an upper and lower confidence limit is calculated. The true concentration, with 99 percent confidence, will fall between the lower and upper confidence limits.

The concentrations observed in the downgradient wells are deemed to be a statistically significant exceedance when the 99 percent lower confidence limit of the downgradient data exceeds the GWPS. If the confidence interval straddles the GWPS (i.e. the lower confidence level is below the GWPS but the upper confidence level is above), the statistical test result indicates that there is insufficient confidence that the measured concentrations are different from the GWPS and thus there is no compelling evidence that the measured concentration is a result of a release from the CCR unit versus the inherent variability of the sample data. This statistical approach is consistent with the statistical methods for assessment monitoring presented in §257.93(f) and (g). Statistical evaluation methodologies built into the CCR Rule, and numerous other federal rules, are key in determining whether or not individually measured data points represent a concentration increase over the baseline or a fixed standard (such as a GWPS in an assessment monitoring program).

For each detected Appendix IV constituent, the concentrations from each well were first compared directly to the GWPS, as shown on Table A1. No parameter-well combinations included a direct

[2] USEPA. 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*. Office of Conservation and Recovery. EPA 530/R-09-007.

exceedance of the GWPS within the past 8 events (June 2017 through October 2019) for data that met project data quality objectives[3]. Therefore, no confidence limits were calculated for the Dry Ash Landfill.

The direct comparison of the Appendix IV constituents shows no potential GWPS exceedances. These results are consistent with the results of the initial assessment monitoring data statistical evaluation and Consumers Energy will continue to initiate an assessment of corrective measures per §257.95(g). Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Attachments

Table A1 Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019

[3] Anomalously high chromium results were reported for JHC-MW-15022 and JHC-MW-15035 in April 2019. Reanalysis was conducted with similar results, but the relative percent differ4ence (RPD) was above the acceptance criteria. The two wells were resampled in in June 2019 with results consistent with earlier sampling events. The June 2019 chromium concentrations are used for statistical analysis in lieu of the April 2019 results.

Table

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15017												
						Sample Date:	12/3/2015	3/9/2016	6/22/2016	8/30/2016	11/15/2016	4/18/2017	6/22/2017	8/16/2017	9/27/2017	4/26/2018	6/20/2018	11/13/2018	4/23/2019	10/8/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient												
Appendix III																			
Boron	ug/L	NC	NA	51	NA		386	343	444	321	592	618	407	347	405	--	245	274	340	350
Calcium	mg/L	NC	NA	46	NA		64.9	70.8	68.3	62.5	58.5	52.2	56.0	56.3	44.8	--	44.0	60.9	81	77
Chloride	mg/L	250*	NA	43	NA		66.9	32.3	35.2	56.4	45.1	22.8	70.8	112	119	--	97.0	170	120	60
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		51.0	43.4	49.2	46.1	54.2	75.0	70.3	84.2	101	--	60.6	72.0	100	92
Total Dissolved Solids	mg/L	500*	NA	258	NA		350	280	300	370	320	300	366	476	490	--	348	474	520	280
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.77	6.6	6.3	6.3	6.1	5.8	6.1	6.1	5.2	6.0(1)	6.0	6.1	6.1	6.3
Appendix IV																			
Antimony	ug/L	6	NA	2	6		< 1	< 1	1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		50	57	75	73	127	116	76.4	103	--	79.7	80.0	85.5	70	47
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	0.2	0.3	0.22	0.42	--	0.47	0.54	0.60	0.57	0.24
Chromium	ug/L	100	NA	2	100		< 1	< 1	< 1	1	< 1	< 1	2	< 1.0	--	< 1.0	< 1.0	< 1.0	12	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	6	7	8	11	12	< 5.0	10.6	--	8.3	6.2	28.5	11	10
Radium-226	pCi/L	NC	NA	NA	NA		0.231	< 0.182	0.333	< 0.716	0.283	0.456	< 0.388	< 0.917	--	1.17	< 0.785	< 1.05	0.176	0.259
Radium-228	pCi/L	NC	NA	NA	NA		< 0.800	< 0.659	1.42	1.60	1.73	1.61	1.27	1.51	--	0.773	2.74	< 0.910	0.827	0.384
Radium-226/228	pCi/L	5	NA	1.93	5		< 0.800	< 0.659	1.75	1.81	2.01	2.07	1.64	2.30	--	1.94	3.02	< 1.96	1.00	0.643
Selenium	ug/L	50	NA	5	50		31	19	30	20	34	37	23.5	27.4	--	18.2	18.5	18.8	16	14
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15018																
					Sample Date:	12/3/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/18/2017	6/22/2017	6/22/2017	8/16/2017	8/16/2017	9/27/2017	9/27/2017	4/26/2018	6/20/2018	11/13/2018	4/23/2019	10/8/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient																
Appendix III													Field Dup		Field Dup		Field Dup					
Boron	ug/L	NC	NA	51	NA	110	128	164	137	133	146	159	165	133	139	127	130	--	117	115	130	170
Calcium	mg/L	NC	NA	46	NA	81.3	93.5	78.3	85.0	83.2	65.3	74.5	73.6	62.7	61.0	55.3	57.0	--	44.8	37.6	58	48
Chloride	mg/L	250*	NA	43	NA	46.1	18.2	30.7	41.1	34.5	31.8	43.8	44.4	43.7	43.6	41.5	41.6	--	31.9	33.2	43	44
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	70.8	64.7	75.5	80.2	77.3	73.6	79.8	78.9	88.4	86.2	80.8	81.1	--	62.3	51.1	61	84
Total Dissolved Solids	mg/L	500*	NA	258	NA	360	330	340	400	340	330	336	458	390	350	310	468	--	194	276	320	370
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	6.6	6.5	6.3	6.1	6.3	6.2	6.4	--	6.3	--	6.3	--	6.2(1)	6.1	6.3	6.4	6.0
Appendix IV																						
Antimony	ug/L	6	NA	2	6	< 1	1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000	67	63	69	93	95	83	69.1	65.1	89.7	97.5	--	--	89.0	76.5	79.6	80	130
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20	0.29
Chromium	ug/L	100	NA	2	100	< 1	< 1	2	< 1	< 1	1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	< 15.0	< 15.0	--	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	6.8	6.8	--	--	17.2	19.7	6.7	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.203	0.228	< 0.285	< 0.318	< 0.257	< 0.306	0.420	0.596	0.667	1.15	--	--	< 0.656	< 0.692	< 0.760	0.217	0.348
Radium-228	pCi/L	NC	NA	NA	NA	0.951	1.03	1.03	1.33	< 0.408	1.04	< 0.556	< 0.623	1.24	0.935	--	--	< 0.572	< 1.14	< 0.918	< 0.476	0.390
Radium-226/228	pCi/L	5	NA	1.93	5	1.05	1.26	1.03	1.33	< 0.408	1.22	0.910	1.15	1.91	2.09	--	--	< 1.23	< 1.83	< 1.68	< 0.476	0.739
Selenium	ug/L	50	NA	5	50	13	7	11	14	12	18	15.6	15.7	13.9	13.9	--	--	12.7	9.9	8.2	12	15
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15019												
						Sample Date:	12/3/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/19/2017	6/22/2017	8/16/2017	9/27/2017	4/26/2018	6/20/2018	11/14/2018	4/23/2019	10/8/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient												
Appendix III																			
Boron	ug/L	NC	NA	51	NA		224	197	237	197	256	194	166	180	191	--	195	159	150	150
Calcium	mg/L	NC	NA	46	NA		137	121	125	86.5	106	63.2	85.9	53.1	58.3	--	64.1	30.4	45	34
Chloride	mg/L	250*	NA	43	NA		68.0	44.2	56.0	34.5	28.9	1.25	48.6	27.0	36.7	--	26.2	7.4	14	6.0
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		99.1	56.5	85.1	41.9	50.9	12.7	53.8	42.6	48.8	--	40.8	19.8	25	23
Total Dissolved Solids	mg/L	500*	NA	258	NA		580	440	520	370	420	250	378	268	306	--	286	250	200	280
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.9	6.6	6.6	6.2	6.6	6.3	6.8	6.4	6.4	6.7(1)	6.6	6.0	6.5	6.4
Appendix IV																			
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		53	44	50	38	47	69	41.1	40.0	--	63.6	44.6	53.5	46	58
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	< 1	2	1	1	3	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	8	< 5	7	21	33	7.0	< 5.0	--	11.2	7.7	10.4	12	16
Radium-226	pCi/L	NC	NA	NA	NA		< 0.246	0.436	< 0.184	< 0.297	< 0.253	< 0.316	< 0.601	< 0.856	--	0.402	< 0.717	< 0.838	0.124	0.187
Radium-228	pCi/L	NC	NA	NA	NA		0.839	1.08	1.58	0.874	< 0.715	0.775	0.685	0.947	--	< 0.638	< 0.951	< 0.801	< 0.465	< 0.295
Radium-226/228	pCi/L	5	NA	1.93	5		0.959	1.52	1.72	1.05	< 0.715	0.976	< 1.12	< 1.75	--	0.911	< 1.67	< 1.64	< 0.465	0.327
Selenium	ug/L	50	NA	5	50		6	12	9	14	13	18	18.0	15.8	--	22.2	18.4	24.8	11	11
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15020[2]										
						Sample Date:	12/3/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/19/2017	6/22/2017	8/16/2017	9/27/2017	4/26/2018	6/11/2018	6/11/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient											
Appendix III																		Field Dup
Boron	ug/L	NC	NA	51	NA		262	180	218	192	186	158	170	155	153	--	129	146
Calcium	mg/L	NC	NA	46	NA		75.1	59.7	57.7	58.3	62.3	45.9	50.0	49.1	49.5	--	39.2	42.7
Chloride	mg/L	250*	NA	43	NA		55.2	28.4	45.5	40.5	39.0	26.2	49.4	50.3	54.7	--	35.5	35.3
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		44.6	28.3	30.0	25.9	25.5	19.5	30.4	29.9	29.4	--	24.3	24.4
Total Dissolved Solids	mg/L	500*	NA	258	NA		340	230	280	280	290	220	306	272	278	--	222	254
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.6	6.3	6.2	6.0	6.4	6.2	6.4	6.5	6.5	6.4[1]	6.3	--
Appendix IV																		
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		57	27	40	40	31	32	41.9	38.7	--	31.6	39.2	38.8
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	1	2	< 1	2	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.224	< 0.181	< 0.186	< 0.334	< 0.280	< 0.289	< 0.567	< 0.444	--	< 0.704	< 0.588	< 0.755
Radium-228	pCi/L	NC	NA	NA	NA		< 0.568	0.886	1.83	1.64	0.606	< 0.581	< 0.700	1.92	--	< 1.13	1.48	1.03
Radium-226/228	pCi/L	5	NA	1.93	5		< 0.568	0.943	1.83	1.70	0.624	< 0.581	< 1.27	2.28	--	< 1.83	1.92	< 1.40
Selenium	ug/L	50	NA	5	50		7	4	< 1	7	7	5	5.2	4.5	--	2.9	4.0	4.2
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15021[2]									
						Sample Date:	12/3/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/19/2017	6/22/2017	8/16/2017	9/27/2017	4/26/2018	6/11/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient										
Appendix III																	
Boron	ug/L	NC	NA	51	NA		393	386	287	300	337	231	232	233	182	--	214
Calcium	mg/L	NC	NA	46	NA		61.1	74.2	42.7	50.2	56.9	30.1	32.8	35.7	37.0	--	26.6
Chloride	mg/L	250*	NA	43	NA		62.7	63.0	36.1	40.7	46.8	24.3	33.9	35.2	40.9	--	21.3
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		40.4	43.0	28.7	27.7	33.4	24.7	24.7	30.2	25.9	--	22.1
Total Dissolved Solids	mg/L	500*	NA	258	NA		340	340	250	260	300	190	204	238	280	--	174
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.3	6.1	6.0	6.1	6.3	6.0	6.2	6.3	6.5	6.3[1]	6.0
Appendix IV																	
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		71	70	56	46	54	55	63.3	47.6	--	64.2	57.6
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	< 1	2	< 1	< 1	1	< 1.0	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.268	< 0.200	< 0.171	< 0.324	< 0.270	< 0.221	0.354	0.238	--	< 0.562	< 0.466
Radium-228	pCi/L	NC	NA	NA	NA		0.879	2.03	1.18	1.52	0.571	< 0.536	< 0.729	1.29	--	< 0.888	< 0.818
Radium-226/228	pCi/L	5	NA	1.93	5		1.05	2.11	1.23	1.52	0.592	< 0.536	< 0.866	1.53	--	< 1.45	< 1.28
Selenium	ug/L	50	NA	5	50		3	1	2	3	2	3	2.0	3.3	--	2.7	3.0
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
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(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15022																
					Sample Date:	12/5/2015	3/9/2016	6/23/2016	8/31/2016	11/17/2016	4/19/2017	6/22/2017	8/15/2017	9/27/2017	4/27/2018	6/20/2018	11/14/2018	11/14/2018	4/24/2019	4/24/2019	6/21/2019	10/9/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												Field Dup		Field Dup		
Appendix III																						
Boron	ug/L	NC	NA	51	NA	433	393	329	371	413	444	397	376	340	--	315	376	374	360	360	--	330
Calcium	mg/L	NC	NA	46	NA	109	93.6	102	121	118	115	101	122	103	--	109	109	106	110	110	--	130
Chloride	mg/L	250*	NA	43	NA	11.2	8.68	1.28	3.94	4.67	2.07	1.1	1.6	2.4	--	3.5	3.7	3.8	2.7	2.7	--	< 2.0
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	<1,000	--	< 1,000
Sulfate	mg/L	250*	NA	14	NA	75.3	47.6	24.4	42.1	81.5	26.9	19.2	35.0	43.7	--	26.0	40.6	40.7	37	37	--	37
Total Dissolved Solids	mg/L	500*	NA	258	NA	480	440	380	480	500	440	502	466	406	--	414	358	400	410	400	--	540
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.0	6.9	6.8	6.8	6.8	7.0	7.0	7.0	7.0	7.6 (1)	6.9	7.0	--	7.0	--	7.1	7.0
Appendix IV																						
Antimony	ug/L	6	NA	2	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0
Arsenic	ug/L	10	NA	1	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0
Barium	ug/L	2,000	NA	35	2,000	51	27	21	26	28	26	22.6	26.8	--	20.3	21.2	21.3	22.6	23	22	--	26
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--	< 0.20
Chromium	ug/L	100	NA	2	100	2	1	2	1	2	3	< 1.0	< 1.0	--	1.3	< 1.0	1.7	1.5	82 (3)(4)	63 (4)	2.2 (4)	5.9
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	< 6.0	--	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--	< 1,000
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	< 1.0
Lithium	ug/L	NC	40	10	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	--	< 0.20
Molybdenum	ug/L	NC	100	5	100	6	5	5	6	< 5	5	< 5.0	5.3	--	5.2	< 5.0	6.5	6.0	7.2	6.4	--	5.2
Radium-226	pCi/L	NC	NA	NA	NA	< 0.159	< 0.186	1.12	< 0.219	< 0.224	< 0.26	< 0.426	< 0.861	--	< 0.431	< 0.673	< 0.692	<0.924	< 0.0968	< 0.0955	--	0.190
Radium-228	pCi/L	NC	NA	NA	NA	2.22	< 0.636	1.08	1.26	1.62	1.60	< 0.511	< 1.03	--	< 0.583	< 0.697	0.999	< 0.849	< 0.505	< 0.470	--	< 0.480
Radium-226/228	pCi/L	5	NA	1.93	5	2.29	< 0.636	2.2	1.32	1.75	1.84	< 0.937	< 1.89	--	< 1.01	< 1.37	< 1.35	< 1.77	< 0.505	< 0.470	--	< 0.480
Selenium	ug/L	50	NA	5	50	8	10	< 1	6	9	4	1.3	4.1	--	4.1	2.8	5.6	5.2	7.2	7.4	--	6.4
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15031															
					Sample Date:	12/4/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/22/2017	6/22/2017	8/16/2017	8/16/2017	9/27/2017	9/27/2017	4/27/2018	6/20/2018	11/14/2018	4/24/2019	10/9/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient															
Appendix III													Field Dup		Field Dup		Field Dup				
Boron	ug/L	NC	NA	51	NA	89	117	106	111	102	112	96.5	98.9	97.0	< 100	95.6	99.5	--	108	104	79	85
Calcium	mg/L	NC	NA	46	NA	77.1	94.2	80.3	84.8	70.3	76.3	63.9	66.8	62.5	67.5	68.5	67.2	--	66.9	63.3	59	57
Chloride	mg/L	250*	NA	43	NA	38.6	45.6	40	42.1	37.8	38.3	41.7	41.7	48.1	48.5	47.5	47.1	--	38.9	33.4	24	28
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	36.6	45.8	41.1	40.1	29.8	34.1	35.2	35.1	40.9	41.2	38.9	38.7	--	40.0	34.7	25	26
Total Dissolved Solids	mg/L	500*	NA	258	NA	340	390	380	370	310	340	348	412	454	454	386	452	--	352	268	280	220
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.0	6.7	6.7	6.8	6.8	6.9	6.9	--	6.8	--	6.8	--	7.6(1)	6.8	6.7	6.9	6.9
Appendix IV																					
Antimony	ug/L	6	NA	2	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000	21	23	21	20	18	20	16.6	17.0	19.2	18.9	--	--	15.4	18.9	21.4	14	17
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100	11	1	2	1	2	3	12.3	8.2	1.7	1.1	--	--	< 1.0	< 1.0	24.6	5.4	1.9
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	< 15.0	< 15.0	--	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	1.3	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	< 5.0	< 5.0	--	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.230	< 0.272	< 0.309	< 0.379	< 0.279	0.419	< 1.03	0.393	< 0.423	0.675	--	--	< 0.479	< 0.638	0.849	0.102	0.199
Radium-228	pCi/L	NC	NA	NA	NA	0.922	< 0.424	0.872	1.53	0.759	1.25	< 0.636	< 0.662	< 1.05	< 0.894	--	--	< 0.708	< 1.02	< 0.773	< 0.427	0.600
Radium-226/228	pCi/L	5	NA	1.93	5	1.06	< 0.424	1.01	1.79	0.922	1.67	< 1.67	0.835	< 1.47	1.33	--	--	< 1.19	< 1.66	< 1.50	0.466	0.798
Selenium	ug/L	50	NA	5	50	3	2	1	1	2	2	1.3	1.3	< 1.0	1.9	--	--	4.0	3.0	2.4	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15032													
					Sample Date:	12/4/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/23/2017	8/15/2017	9/26/2017	4/26/2018	6/19/2018	6/19/2018	11/14/2018	4/24/2019	10/8/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient													
Appendix III																	Field Dup			
Boron	ug/L	NC	NA	51	NA	73	74	61	72	78	71	56.4	62.4	57.8	--	45.7	44.6	49.4	< 50	58
Calcium	mg/L	NC	NA	46	NA	11.6	10.2	9.91	11.6	8.85	8.87	7.2	7.0	6.8	--	8.8	8.4	8.1	9.4	7.9
Chloride	mg/L	250*	NA	43	NA	1.99	2.14	2.43	2.84	2.55	3.49	2.7	3.0	3.2	--	3.4	3.4	4.2	2.6	2.3
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	18.4	18.0	19.4	19.7	16.0	16.1	13.9	16.3	< 2.0	--	11.8	11.6	11.9	11	12
Total Dissolved Solids	mg/L	500*	NA	258	NA	64	64	79	67	57	66	54	< 50.0	84	--	64	< 50.0	< 50.0	53	68
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	6.4	6.2	6.0	5.6	6.2	6.1	6.0	6.1	6.0	5.9(1)	6.3	--	6.2	6.3	6.3
Appendix IV																				
Antimony	ug/L	6	NA	2	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000	10	9	9	10	9	9	7.3	9.1	--	7.8	8.8	8.7	7.7	8.3	7.9
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100	< 1	1	< 1	1	1	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.197	< 0.178	< 0.234	< 0.195	< 0.245	< 0.278	< 0.457	< 0.973	--	< 0.514	< 0.464	< 0.722	< 0.748	< 0.118	0.157
Radium-228	pCi/L	NC	NA	NA	NA	< 0.566	< 0.466	< 0.509	< 0.498	< 0.654	< 0.441	< 0.893	< 0.923	--	< 0.784	< 0.721	< 1.17	< 0.812	< 0.395	< 0.347
Radium-226/228	pCi/L	5	NA	1.93	5	< 0.566	< 0.466	< 0.509	< 0.498	< 0.654	< 0.441	< 1.35	< 1.90	--	< 1.30	< 1.19	< 1.89	< 1.56	< 0.395	0.427
Selenium	ug/L	50	NA	5	50	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15033													
					Sample Date:	12/4/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/20/2017	6/23/2017	8/15/2017	9/26/2017	4/26/2018	4/26/2018	6/19/2018	11/14/2018	4/24/2019	10/8/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient										Field Dup				
Appendix III																				
Boron	ug/L	NC	NA	51	NA	27	32	35	31	34	33	33.0	30.8	34.1	--	--	33.0	41.8	< 50	51
Calcium	mg/L	NC	NA	46	NA	16.2	13.1	13.4	13.1	11.5	15.4	12.6	9.6	10.1	--	--	9.0	10.0	10	11
Chloride	mg/L	250*	NA	43	NA	< 1	1.03	1.98	1.56	1.25	1.82	1.7	1.1	1.4	--	--	3.4	3.2	< 2.0	2.6
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	10.4	8.83	10.3	8.86	9.02	10.1	9.0	9.7	< 2.0	--	--	8.1	9.2	9.5	12
Total Dissolved Solids	mg/L	500*	NA	258	NA	64	66	69	74	54	79	124	126	< 50.0	--	--	68	< 50.0	58	71
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.0	6.7	6.5	6.1	6.7	6.8	6.8	6.8	6.7	6.8(1)	--	6.7	6.7	6.7	6.9
Appendix IV																				
Antimony	ug/L	6	NA	2	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000	< 5	5	6	5	6	6	5.2	4.6	--	4.8	4.3	5.2	6.1	< 5.0	5.4
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100	< 1	< 1	< 1	1	1	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.148	< 0.296	< 0.332	< 0.300	< 0.215	< 0.415	0.521	< 0.617	--	< 0.460	< 0.151	< 0.570	< 0.766	< 0.0696	0.167
Radium-228	pCi/L	NC	NA	NA	NA	< 0.522	< 0.534	< 0.511	0.537	< 0.356	0.887	< 0.824	< 1.05	--	< 0.732	< 0.792	< 0.845	< 0.729	< 0.306	< 0.333
Radium-226/228	pCi/L	5	NA	1.93	5	< 0.522	< 0.534	< 0.511	0.622	< 0.356	0.887	< 1.30	< 1.67	--	< 1.19	< 0.943	< 1.42	< 1.50	< 0.306	< 0.333
Selenium	ug/L	50	NA	5	50	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15034													
					Sample Date:	12/4/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/20/2017	6/23/2017	8/15/2017	9/26/2017	4/25/2018	6/19/2018	11/14/2018	4/24/2019	10/8/2019	10/8/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient													
Appendix III																			Field Dup
Boron	ug/L	NC	NA	51	NA	54	69	48	66	70	67	68.1	62.1	51.4	--	62.6	62.5	51	68	65
Calcium	mg/L	NC	NA	46	NA	10.3	8.6	6.91	11	8.33	5.83	5.5	5.9	6.0	--	5.8	6.0	5.4	5.4	5.1
Chloride	mg/L	250*	NA	43	NA	2.48	1.91	4.31	1.56	1.88	1.43	1.5	2.0	2.2	--	3.1	3.5	2.1	< 2.0	< 2.0
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	23.9	18.5	13.2	16.6	16.9	15.1	12.6	16.5	< 2.0	--	12.5	14.4	12	15	15
Total Dissolved Solids	mg/L	500*	NA	258	NA	50	62	53	61	48	49	104	60	< 50.0	--	50	< 50.0	< 50	54	56
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	6.2	6.2	5.8	5.7	6.0	6.0	6.1	6.1	6.0	6.0(1)	6.0	5.9	5.9	6.1	--
Appendix IV																				
Antimony	ug/L	6	NA	2	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	1.7	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000	8	7	5	6	6	6	5.4	5.5	--	5.3	5.5	6.0	5.5	6.5	6.6
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100	< 1	< 1	< 1	< 1	< 1	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	1.2	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.256	< 0.193	< 0.244	< 0.267	< 0.283	< 0.307	< 0.607	< 0.763	--	< 0.775	< 0.514	< 0.688	< 0.0948	0.133	< 0.134
Radium-228	pCi/L	NC	NA	NA	NA	0.880	< 0.418	0.853	0.819	0.451	0.877	0.905	< 0.760	--	< 0.804	< 1.04	< 0.786	< 0.381	< 0.384	< 0.308
Radium-226/228	pCi/L	5	NA	1.93	5	0.963	< 0.418	1.03	0.858	0.603	0.998	1.49	< 1.52	--	< 1.58	< 1.55	< 1.47	< 0.381	< 0.384	< 0.308
Selenium	ug/L	50	NA	5	50	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15035													
					Sample Date:	12/4/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/23/2017	8/16/2017	9/26/2017	4/27/2018	6/20/2018	11/14/2018	4/24/2019	6/21/2019	6/21/2019	10/9/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient														
Appendix III																			Field Dup	
Boron	ug/L	NC	NA	51	NA	146	130	81	86	103	123	121	116	126	--	111	78.2	91	--	--	78
Calcium	mg/L	NC	NA	46	NA	118	111	78.7	72.5	83.3	88.5	82.1	91.3	107	--	90.5	66.6	98	--	--	84
Chloride	mg/L	250*	NA	43	NA	34.2	31.3	16.7	19	25.4	21.2	28.3	33.9	35.9	--	27.1	20.00	23.00	--	--	24
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--	--	< 1,000
Sulfate	mg/L	250*	NA	14	NA	39.2	32.4	20.8	21.8	24.9	24.7	28.2	35.4	35.6	--	26.7	18.8	24	--	--	25
Total Dissolved Solids	mg/L	500*	NA	258	NA	450	400	300	320	320	320	314	578	512	--	342	274	360	--	--	370
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.0	6.9	7.2	7.3	7.1	7.2	7.2	7.0	7.0	8.0(1)	7.0	7.3	7.2	7.1	--	7.2
Appendix IV																				
Antimony	ug/L	6	NA	2	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0
Arsenic	ug/L	10	NA	1	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0
Barium	ug/L	2,000	NA	35	2,000	27	21	14	13	16	17	15.8	19.4	--	17.4	18.1	12.3	17	--	--	16
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20
Chromium	ug/L	100	NA	2	100	15	< 1	1	< 1	2	3	1.1	< 1.0	--	4.8	< 1.0	< 1.0	290 (3)(4)	1.8 (4)	2.5 (4)	4.4
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	--	--	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--	--	< 1,000
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0
Lithium	ug/L	NC	40	10	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	--	--	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20
Molybdenum	ug/L	NC	100	5	100	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0	11	--	--	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.151	< 0.156	0.355	< 0.345	< 0.239	< 0.429	< 0.452	< 1.08	--	< 0.733	< 0.548	< 0.850	< 0.101	--	--	0.203
Radium-228	pCi/L	NC	NA	NA	NA	0.902	< 0.622	1.04	1.23	1.40	0.764	0.899	0.952	--	0.937	1.27	< 0.914	< 0.357	--	--	< 0.567
Radium-226/228	pCi/L	5	NA	1.93	5	0.929	< 0.622	1.40	1.28	1.47	0.801	< 1.35	< 1.98	--	< 1.41	1.63	< 1.76	< 0.357	--	--	< 0.567
Selenium	ug/L	50	NA	5	50	3	2	< 1	< 1	1	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	--	--	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15036													
					Sample Date:	12/5/2015	3/10/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/23/2017	8/15/2017	9/26/2017	4/27/2018	6/20/2018	11/14/2018	4/24/2019	10/8/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient													
Appendix III																			
Boron	ug/L	NC	NA	51	NA	54	79	74	70	51	99	87.3	51.7	41.3	--	88.3	79.2	80	71
Calcium	mg/L	NC	NA	46	NA	46.2	53.9	70.9	61.7	36.1	82.9	69.4	39.6	34.5	--	64.8	51.6	50	55
Chloride	mg/L	250*	NA	43	NA	19.1	13.9	25.2	20.7	11.9	27.3	27.2	23.4	13.5	--	24.3	14.7	14	13
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	18.5	16.6	23.6	19.4	12.1	29.2	29.4	20.3	14.9	--	26.1	20.0	19	24
Total Dissolved Solids	mg/L	500*	NA	258	NA	180	230	300	290	160	340	404	246	300	--	278	216	220	320
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.6	7.4	7.0	6.8	7.4	7.2	7.3	7.5	7.5	8.1(1)	7.1	7.4	7.4	7.5
Appendix IV																			
Antimony	ug/L	6	NA	2	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000	8	8	10	10	6	13	10.9	7.2	--	8.9	11.5	8.2	8.4	9.4
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	1.1	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100	< 1	1	1	< 1	1	1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.174	0.194	< 0.229	< 0.260	< 0.202	< 0.303	< 0.692	< 0.671	--	< 0.618	< 0.555	0.812	< 0.0882	0.160
Radium-228	pCi/L	NC	NA	NA	NA	2.10	< 0.470	0.513	0.367	0.700	< 0.874	< 0.783	< 1.21	--	< 0.626	< 0.743	< 0.670	< 0.384	< 0.441
Radium-226/228	pCi/L	5	NA	1.93	5	2.20	< 0.47	0.623	0.486	0.745	< 0.874	< 1.48	< 1.88	--	< 1.24	< 1.30	0.874	< 0.384	0.442
Selenium	ug/L	50	NA	5	50	< 1	< 1	< 1	< 1	< 1	2	< 1.0	< 1.0	--	1.6	< 1.0	< 1.0	< 1.0	1.9
Thallium	ug/L	2	NA	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) Monitoring wells JHC-MW-15020 and JHC-MW-15021 were decommissioned on June 14th, 2018.
(3) April 2019 result not used for assessment monitoring.
(4) Due to anomalous chromium result and uncertainty that associated data quality objectives were met for the April 2019 analysis, a resample was collected June 21, 2019. The June 2019 result met data quality objectives and did not confirm the April 2019 result; therefore the June 2019 result is used for assessment monitoring in place of the April 2019 data.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Landfill – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15037												
						Sample Date:	12/4/2015	3/10/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/23/2017	8/15/2017	9/26/2017	4/27/2018	6/20/2018	11/14/2018	4/24/2019	10/8/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient												
Appendix III																			
Boron	ug/L	NC	NA	51	NA		107	122	164	153	210	273	263	171	114	--	153	221	150	280
Calcium	mg/L	NC	NA	46	NA		71.9	64.6	73.4	78.8	89.7	91.2	94.6	83.8	76.0	--	72.6	103	73	110
Chloride	mg/L	250*	NA	43	NA		23.6	32.8	38.6	29.6	30.4	15.3	14.7	25.0	30.3	--	7.9	8.2	6.3	4.4
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		38.3	27.9	27.2	35.1	54.6	35.1	41.3	52.3	45.3	--	36.3	50.1	22	46
Total Dissolved Solids	mg/L	500*	NA	258	NA		290	260	380	360	400	380	404	408	376	--	360	406	270	400
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.3	7.1	7.0	6.8	7.3	7.0	7.2	7.2	7.3	7.9(1)	7.1	7.3	7.3	7.3
Appendix IV																			
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		13	14	17	16	16	15	15.1	13.4	--	11.5	11.7	14.3	9.7	14
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1	< 1	3	< 1	1	2	< 1.0	< 1.0	--	< 1.0	< 1.0	1.6	1.7	1.2
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.185	< 0.212	< 0.280	< 0.271	< 0.217	< 0.363	< 0.733	< 0.685	--	< 0.549	< 0.648	< 0.578	< 0.0813	0.232
Radium-228	pCi/L	NC	NA	NA	NA		0.801	< 0.750	0.814	1.05	0.512	2.17	0.941	< 1.22	--	< 0.699	< 0.804	< 0.729	< 0.342	< 0.518
Radium-226/228	pCi/L	5	NA	1.93	5		0.868	< 0.75	0.973	1.14	0.667	2.27	< 1.40	< 1.91	--	< 1.25	< 1.45	< 1.31	0.403	< 0.518
Selenium	ug/L	50	NA	5	50		25	6	< 1	13	25	11	11.9	14.1	--	1.1	9.9	21.1	3.8	16
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
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MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
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