2019 Annual Groundwater Monitoring and Corrective Action Report

JH Campbell Power Plant
Pond 3 North and 3 South CCR Unit

West Olive, Michigan

January 2020

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Prepared For
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Executive Summary

On behalf of Consumers Energy, TRC has prepared this report for the JH Campbell (JHC) Pond 3 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, Unit 3 North and 3 South 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-15012, JHC-MW-15013, JHC-MW-15015 and JHC-MW-15016;
- Calcium at JHC-MW-15015 and JHC-MW-15016;
- Sulfate at JHC-MW-15012, JHC-MW-15013, JHC-MW-15015 and JHC-MW-15016; and
- Total dissolved solids (TDS) at JHC-MW-15015 and JHC-MW-15016.

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) Ponds 3 North and 3 South at the JH Campbell Power Plant Site (JHC Pond 3). 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 JHC Pond 3. Assessment monitoring is ongoing at Pond 3 as specified in §257.95. Data that have been collected and evaluated in 2019, including assessment monitoring data from November 2018, are presented in this report.

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, Unit 3 North and 3 South 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-15012, JHC-MW-15013, JHC-MW-15015 and JHC-MW-15016;
- Calcium at JHC-MW-15015 and JHC-MW-15016;
- Sulfate at JHC-MW-15012, JHC-MW-15013, JHC-MW-15015 and JHC-MW-15016; and
- Total dissolved solids (TDS) at JHC-MW-15015 and JHC-MW-15016.

As discussed in the *2018 Annual Groundwater Monitoring Report for the JH Campbell Power Plant Units 3 North and 3 South CCR Unit* (TRC, January 2019) (2018 Annual Report) Consumers Energy initiated an Assessment Monitoring Program for the JHC Pond 3 CCR unit 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 Pond 3 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 have 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 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. Dry ash from all of the generating units is stored in silos until it is placed into the facility or is sold and shipped off site.

This report focuses on the former Pond 3 CCR Unit.

1.3 Geology/Hydrogeology

The upgradient/background wells are located to the north-northwest of the 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 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.

[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.

Section 2
Groundwater Monitoring

2.1 Monitoring Well Network

In accordance with 40 CFR 257.91, Consumers Energy established a groundwater monitoring system for Pond 3, which currently consists of 12 monitoring wells (6 background monitoring wells and 6 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.

Six Background Monitoring Wells:

- JHC-MW-15023 through JHC-MW-15028

Due to the cessation of hydraulic loading and decommissioning of Pond 1-2 and Pond 3, the groundwater flow direction changed significantly from the previous baseline and assessment monitoring events such that groundwater flow is generally toward the south at Pond 1-2 and to the south/southwest at Pond 3. As a result, several of the monitoring wells installed in 2015 were no longer located in the downgradient direction. In response, as documented in the 2018 Annual Report, Consumers Energy installed five new downgradient wells on December 3 through December 5, 2018 and collected additional data from these new wells to reassess groundwater flow and ensure a sufficient number of wells were appropriately located to assess groundwater quality downgradient from the Pond 1-2 and Pond 3 CCR Units.

As a result of the post-decommissioning changes in groundwater flow direction Pond 3 monitoring wells JHC-MW-15015 and JHC-MW-15016 are no longer positioned downgradient of groundwater flow across the Pond 3 area. Since these wells were historically located downgradient of Pond 3 when flow was radially outward, they will continue to be sampled and evaluated as part of the assessment monitoring program to evaluate groundwater quality post-CCR removal. An updated groundwater monitoring network certification is included as Appendix A.

Monitoring wells JHC-MW-18001 through JHC-MW-18003 were installed on the west and southwest edges of former Pond 3. Data collected from these wells in 2018 and 2019 confirms that the monitoring wells are appropriately positioned to assess groundwater quality downgradient from the former Pond 3 CCR Unit. As such, these wells have been added to the

Pond 3 monitoring system and will serve as downgradient monitoring wells in the assessment monitoring program. The Pond 3 monitoring wells now consist of:

Pond 3 Downgradient Monitoring Wells:

- JHC-MW-18001
- JHC-MW-18002
- JHC-MW-18003
- JHC-MW-15013

Other Pond 3 Assessment Monitoring Wells (currently located upgradient):

- JHC-MW-15015
- JHC-MW-15016

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 during 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. 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 B.

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 C.

2.3 Semiannual Groundwater Monitoring

Per §257.95(d), 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 6 downgradient monitoring wells for the Appendix III and Appendix IV constituents and field parameters. In addition, quarterly sampling was conducted in February 28 and March 12, 2019 and August 13, 2019 at JHC-MW-18001, JHC-MW-18002, and JHC-MW-18003 in order to assess groundwater flow conditions and groundwater quality at the new wells and establish a dataset with sufficient number of samples (minimum of 4) to statistically evaluate the data.

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 (Pond 3 analytical results). The quarterly monitoring data collected from the new wells in February/March and August are included in the October 2019 statistical evaluation summary included in Appendix G.

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 D.

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 Pond 3.

Section 3
Statistical Evaluation

Assessment monitoring is continuing at the JHC Pond 3 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 evaluations details are provided in Appendix C (*November 2018 Assessment Monitoring Data Summary and Statistical Evaluation),* Appendix E *(June 2018 Statistical Evaluation of Initial Assessment Monitoring Event)*, Appendix F *(April 2019 Assessment Monitoring Data Summary and Statistical Evaluation),* and Appendix G *(October 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 C and E). Therefore, assessment monitoring continued in 2019.

The statistical data comparison for the third (April 2019) and fourth (September 2019, which includes the new downgradient monitoring wells installed in 2018) 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). Therefore, Consumers Energy has continued assessment monitoring.

Overall, the statistical assessments have confirmed that no Appendix IV constituents are present at statistically significant levels above the GWPSs. In addition, all of the concentrations in the three downgradient monitoring wells are below the GWPS. Due to the changes in groundwater

flow direction subsequent to pond decommissioning, monitoring wells JHC-MW-15015 and JHC-MW-15016 are no longer downgradient of groundwater flow across the Pond 3 area. However, as discussed in Section 2.1, they will continue to be sampled and evaluated as part of the assessment monitoring program and used to evaluate groundwater quality post-CCR removal. A summary of the confidence intervals for April 2019 and October 2019 are provided in Table 5 and Table 6, respectively.

Per §257.95(e), Consumers Energy can return to detection monitoring at Pond 3 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 Pond 3 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 Pond 3 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). Pond 3 has been decommissioned and CCRs have been removed. The semiannual assessment monitoring analysis completed to-date indicates that no Appendix IV constituents are present at statistically significant levels exceeding the GWPSs. Therefore, Consumers Energy has continued semiannual assessment monitoring at Pond 3 and continues to evaluate groundwater quality post-CCR removal. Data that has been collected and evaluated in 2019, including assessment monitoring data from November 2018, are presented in this report.

Per §257.95(e), Consumers Energy can return to detection monitoring at the Pond 3 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 scheduled for the second and fourth calendar quarters of 2020.

Section 6
References

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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 Ponds 3N/3S – 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
Pond 3							
JHC-MW-15013	4/29/2019	1.10	-9.8	7.0	395	15.6	9.4
	10/10/2019	0.17	-82.9	7.2	793	17.0	3.0
JHC-MW-15015	4/29/2019	1.29	-20.0	7.1	727	10.8	15.5
	10/10/2019	0.14	-110.9	7.2	786	12.9	0.5
JHC-MW-15016	4/29/2019	1.18	-10.3	6.9	869	12.5	18.0
	10/10/2019	0.13	-46.0	7.2	792	14.0	2.1
JHC-MW-18001	4/25/2019	0.82	-91.1	8.3	921	10.4	4.0
	10/10/2019	0.57	-109.3	8.1	584	17.0	0.6
JHC-MW-18002	4/25/2019	1.57	-4.9	7.3	501	10.1	6.6
	10/10/2019	0.40	-10.0	7.3	620	19.0	2.7
JHC-MW-18003	4/25/2019	0.18	16.3	6.9	1,533	10.7	6.2
	10/10/2019	0.30	-31.5	6.9	924	18.3	4.2

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
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 Ponds 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

							Sample Location:	JHC-MW-15013		JHC-MW-15015		JHC-MW-15016	
							Sample Date:	4/29/2019	10/10/2019	4/29/2019	10/10/2019	4/29/2019	10/10/2019
Constituent	Unit	UTL	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^		downgradient					
Appendix III													
Boron	ug/L	51	NC	**500**	**500**	7,200		320	300	**1,000**	**1,300**	**2,100**	**4,200**
Calcium	mg/L	46	NC	NC	NC	500		46	100	100	110	110	110
Chloride	mg/L	43	250**	250	250	500		16	17	< 20	14	26	16
Fluoride	ug/L	1,000	4,000	NC	NC	NC		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	14	**250****	**250**	**250**	**500**		30	230	38	39	23	26
Total Dissolved Solids	mg/L	258	**500****	**500**	**500**	**500**		190	490	430	430	470	450
pH, Field	SU	4.8 - 9.2	6.5 - 8.5**	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0		7.0	7.2	7.1	7.2	6.9	7.2
Appendix IV													
Antimony	ug/L	2	6	6.0	6.0	130		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	1	10	10	10	10		< 1.0	1.1	< 1.0	< 1.0	2.6	< 1.0
Barium	ug/L	35	2,000	2,000	2,000	820		25	53	44	49	99	88
Beryllium	ug/L	1	4	4.0	4.0	18		< 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
Chromium	ug/L	2	100	100	100	11		2.0	7.3	< 1.0	4.3	2.5	1.6
Cobalt	ug/L	15	NC	40	100	100		< 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
Lead	ug/L	1	NC	4.0	4.0	39		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	10	NC	170	350	0.20#		< 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
Molybdenum	ug/L	5	NC	**73**	210	3,200		8.5	7.2	**140**	**110**	42	27
Radium-226	pCi/L	NA	NC	NC	NC	NC		0.121	0.485	< 0.0921	0.207	0.239	0.322
Radium-228	pCi/L	NA	NC	NC	NC	NC		< 0.377	0.960	< 0.419	< 0.432	< 0.482	< 0.482
Radium-226/228	pCi/L	1.93	5	NC	NC	NC		< 0.377	1.45	< 0.419	< 0.432	0.711	0.540
Selenium	ug/L	5	50	50	50	**5.0**		< 1.0	< 1.0	< 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

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.
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^ - 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 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.

Table 4
Summary of Groundwater Sampling Results (Analytical): April 2019 - October 2019
JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

							Sample Location:	JHC-MW-18001		JHC-MW-18002		JHC-MW-18003	
							Sample Date:	4/25/2019	10/10/2019	4/25/2019	10/10/2019	4/25/2019	10/10/2019
Constituent	Unit	UTL	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^		downgradient					
Appendix III													
Boron	ug/L	51	NC	**500**	**500**	7,200		300	390	290	330	270	**510**
Calcium	mg/L	46	NC	NC	NC	500		77	66	57	68	160	140
Chloride	mg/L	43	250**	250	250	500		11	2.2	15	17	11	10
Fluoride	ug/L	1,000	4,000	NC	NC	NC		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	14	**250****	**250**	**250**	**500**		130	82	83	58	**450**	**340**
Total Dissolved Solids	mg/L	258	**500****	**500**	**500**	**500**		430	360	310	430	**810**	**660**
pH, Field	SU	4.8 - 9.2	6.5 - 8.5**	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0		8.3	8.1	7.3	7.3	6.9	6.9
Appendix IV													
Antimony	ug/L	2	6	6.0	6.0	130		< 1.0	< 1.0	< 1.0	2.7	< 1.0	< 1.0
Arsenic	ug/L	1	10	10	10	10		1.4	1.5	< 1.0	< 1.0	< 1.0	1.4
Barium	ug/L	35	2,000	2,000	2,000	820		440	390	110	130	120	130
Beryllium	ug/L	1	4	4.0	4.0	18		< 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	0.24	< 0.20	< 0.20
Chromium	ug/L	2	100	100	100	11		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	15	NC	40	100	100		< 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
Lead	ug/L	1	NC	4.0	4.0	39		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	10	NC	170	350	0.20#		< 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
Molybdenum	ug/L	5	NC	**73**	210	3,200		8.1	17	10	15	12	12
Radium-226	pCi/L	NA	NC	NC	NC	NC		0.321	0.296	0.144	0.198	0.270	< 0.161
Radium-228	pCi/L	NA	NC	NC	NC	NC		0.345	0.406	< 0.610	< 0.413	0.623	< 0.556
Radium-226/228	pCi/L	1.93	5	NC	NC	NC		0.667	0.702	< 0.610	< 0.413	0.892	< 0.556
Selenium	ug/L	5	50	50	50	**5.0**		1.3	**18**	**26**	**31**	< 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

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.
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.

Table 5

Summary of Groundwater Protection Standard Exceedances – April 2019

JH Campbell Pond 3N/3S – RCRA CCR Monitoring Program

West Olive, Michigan

Constituent	Units	GWPS	JHC-MW-15015		JHC-MW-15016	
			LCL	UCL	LCL	UCL
Molybdenum	ug/L	100	11.0	170	-11.2	103

Notes:

ug/L - micrograms per Liter.

GWPS - Groundwater Protection Standard as established in TRC's Technical Memorandum dated October 15, 2018.

UCL - Upper Confidence Limit (α = 0.01) of the downgradient data set.

LCL - Lower Confidence Limit (α = 0.01) of the downgradient data set.

Indicates a statistically significant exceedance of the GWPS. An exceedance occurs when the LCL is greater than the GWPS.

Table 6

Summary of Groundwater Protection Standard Exceedances – October 2019

JH Campbell Pond 3N/3S – RCRA CCR Monitoring Program

West Olive, Michigan

Constituent	Units	GWPS	JHC-MW-15015		JHC-MW-15016	
			LCL	UCL	LCL	UCL
Molybdenum	ug/L	100	3.8	140	12.7	99

Notes:

ug/L - micrograms per Liter.

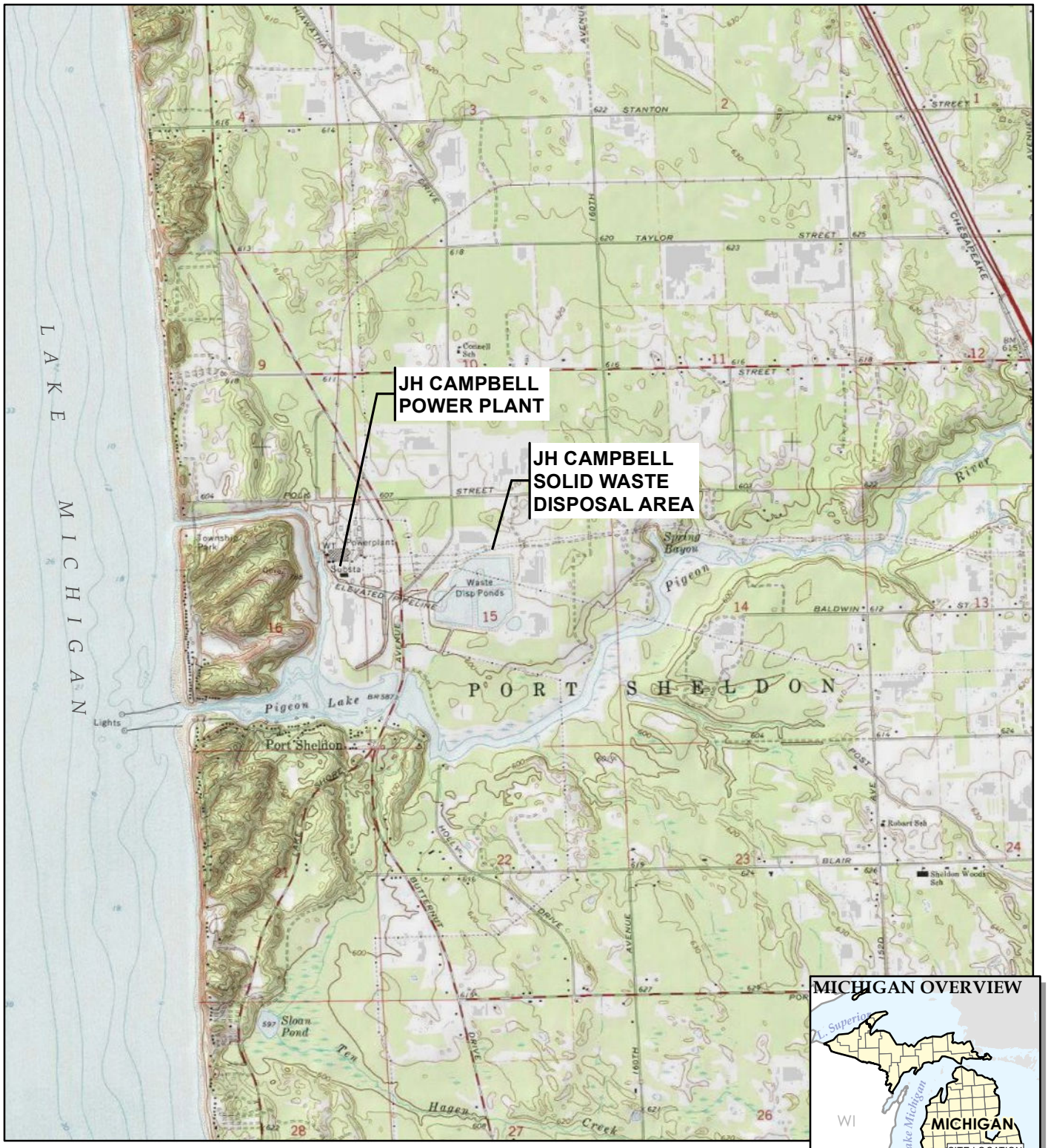
GWPS - Groundwater Protection Standard as established in TRC's Technical Memorandum dated October 15, 2018.

UCL - Upper Confidence Limit (α = 0.01) of the downgradient data set.

LCL - Lower Confidence Limit (α = 0.01) of the downgradient data set.

Indicates a statistically significant exceedance of the GWPS. An exceedance occurs when the LCL is greater than the GWPS.

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
www.trccompanies.com

TRC - GIS

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

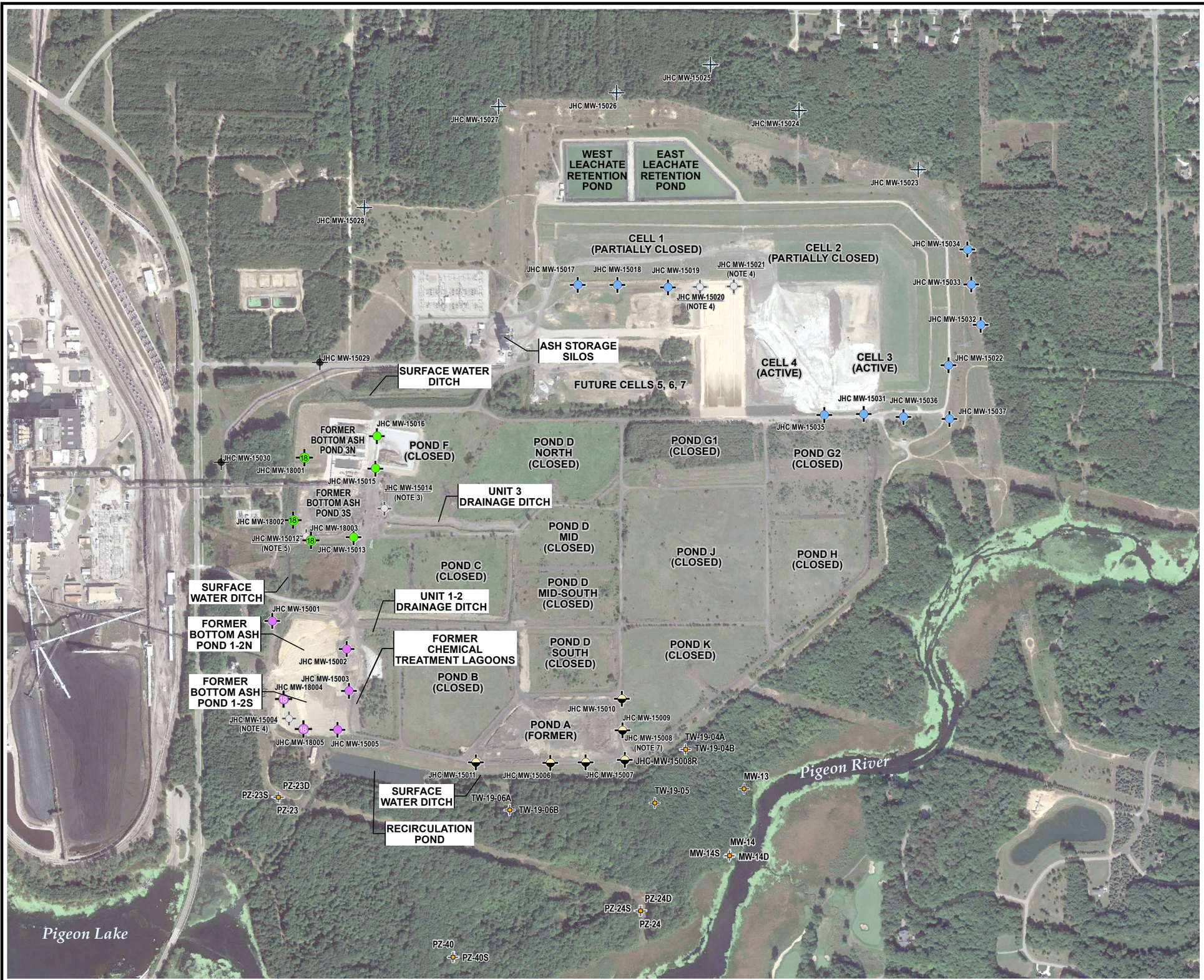
FIGURE 1

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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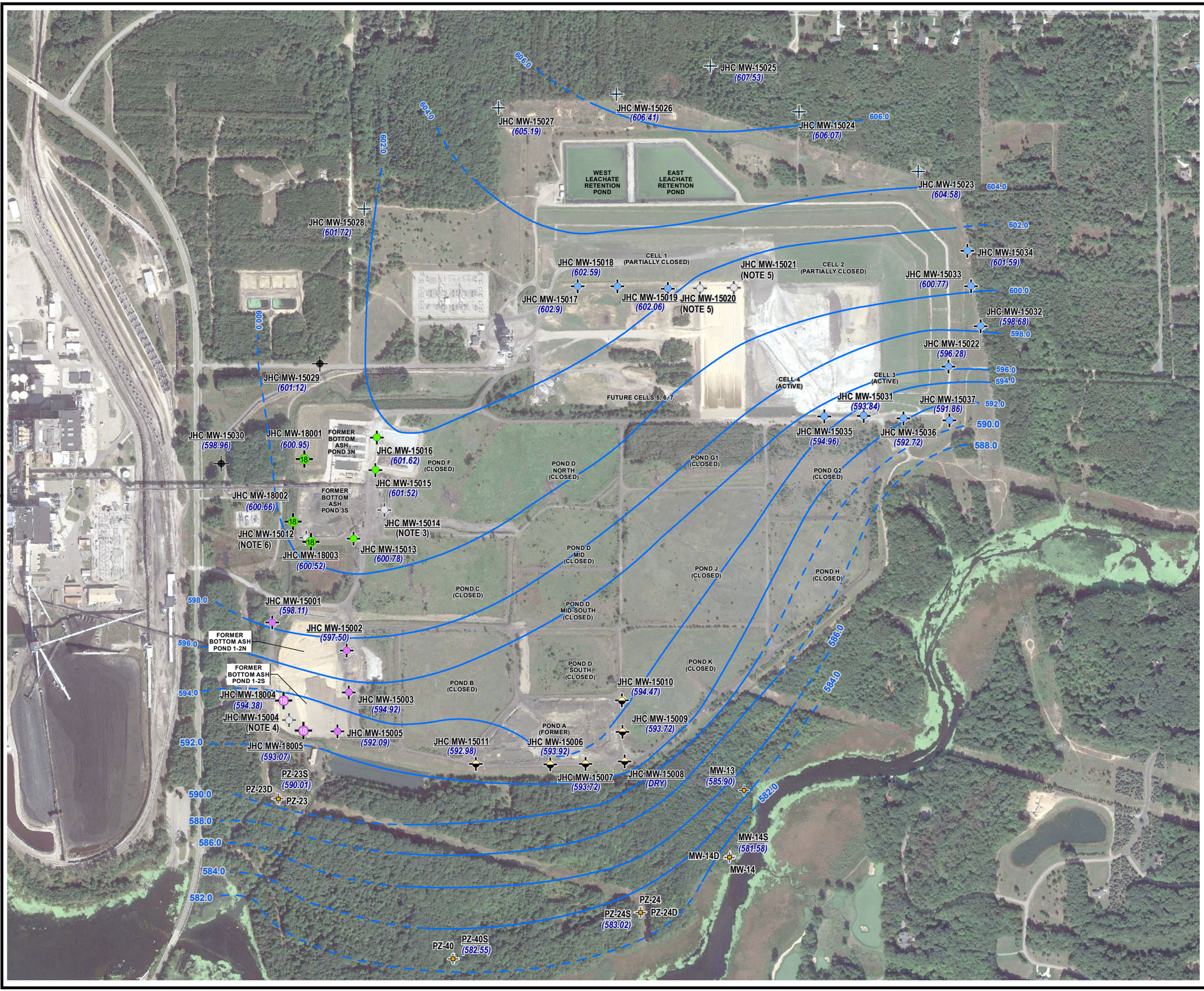
FILE NO.: 322174-001-030.mxd



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		

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

FILE NO.: 322174-001-024.mxd

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

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")
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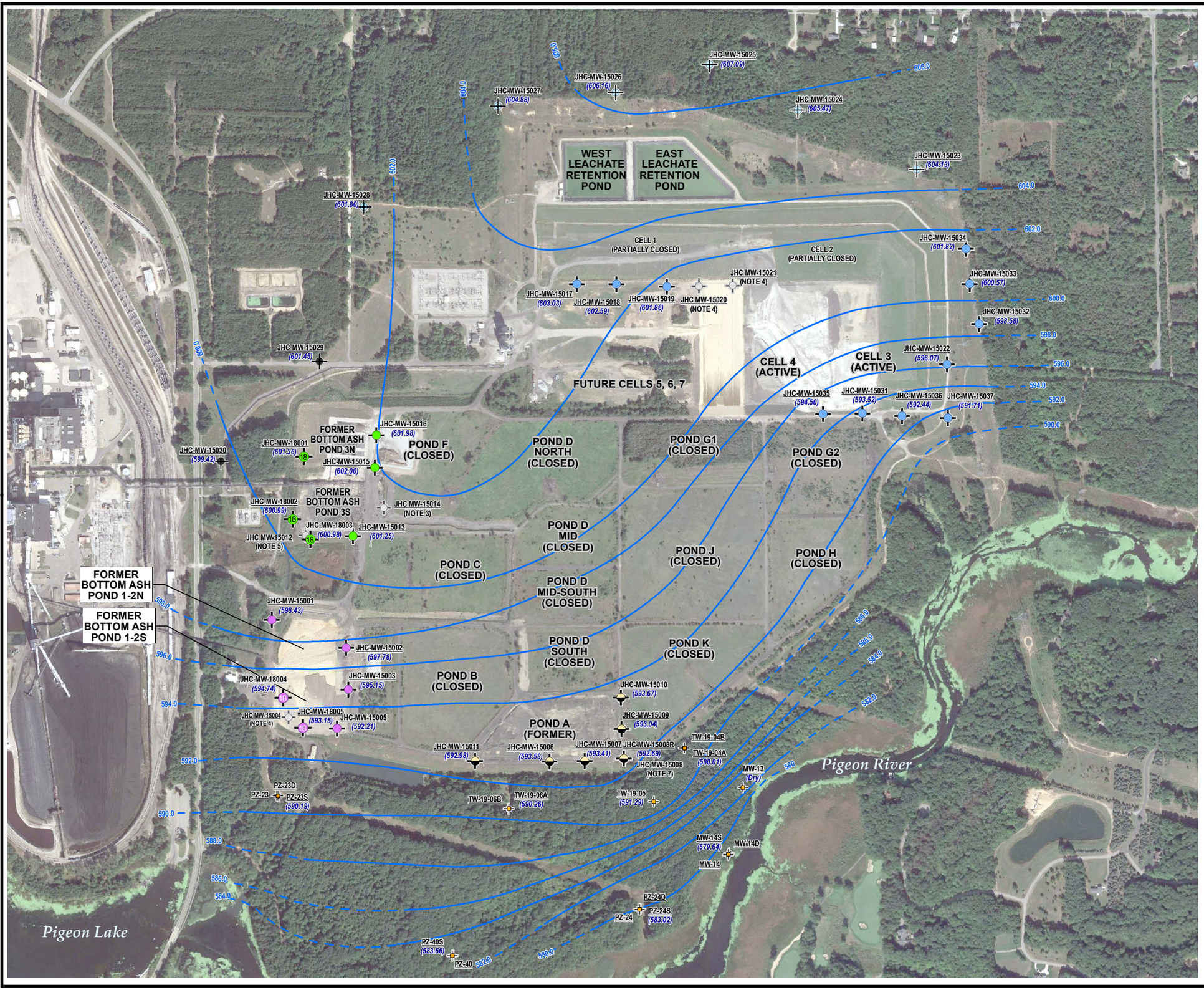

LEGEND

- 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.
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.

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
Groundwater Monitoring System Certification

Consumers Energy
Count on Us®

A CMS Energy Company

Date: January 27, 2020

To: Operating Record

From: Harold D. Register, Jr., P.E.

RE: Groundwater Monitoring System Certification, §257.91(f)
JH Campbell Power Plant, Pond 3 North and 3 South CCR Unit

Introduction

According to Title 40 Code of Federal Regulations (40 CFR) Part 257, Subpart D, §257.91(f); the owner or operator of a Coal Combustion Residual (CCR) management unit must obtain a certification from a qualified professional engineer stating that the groundwater monitoring system at the CCR management unit has been designed and constructed to meet the requirements of §257.91. Additionally, §257.91(a) details a performance standard requiring the system monitor the uppermost aquifer and include a minimum of at least one upgradient and three downgradient monitoring wells, and that if the uppermost aquifer monitoring system includes the minimum number of wells, the basis supporting use of only the minimum.

Groundwater Monitoring System

A groundwater monitoring system has been established for the JH Campbell Pond 3 North and 3 South CCR Unit, which established the following locations for determining background groundwater quality and detection monitoring. The downgradient monitoring network accurately represents the quality of groundwater passing the waste boundary and ensures detection of groundwater contamination in the uppermost aquifer based on the groundwater flow regime and the limit of the practical length of the unit extending only 1,000 feet and acreage limited to approximately twelve acres.

Background:

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

Downgradient Monitoring Wells:
JHC-MW-18001
JHC-MW-18002
JHC-MW-18003
JHC-MW-15013

Other Assessment Monitoring Wells (currently located upgradient)[1]:
JHC-MW-15015
JHC-MW-15016

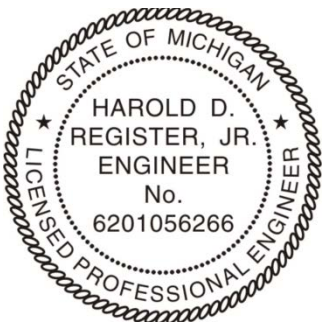
Provided herein, as required by §257.91(f), is certification from a qualified professional engineer that the groundwater monitoring system at Consumers Energy JH Campbell Pond 3 North and 3 South CCR Unit meets the requirements of §257.91.

CERTIFICATION

Professional Engineer Certification Statement [40 CFR 257.94(e)2]

I hereby certify that having reviewed the *2018 Annual Groundwater Monitoring Report* and *2019 Annual Groundwater Monitoring and Corrective Action Report* for the JH Campbell Pond 3 North and 3 South CCR Unit, and being familiar with the provisions of Title 40 of the Code of Federal Regulations §257.91 (40 CFR Part 257.91), I attest that this Groundwater Monitoring System has been designed and constructed to meet the requirements of 40 CFR 257.91. The report is accurate and has been prepared in accordance with good engineering practices, including the consideration of applicable industry standards, and with the requirements of 40 CFR Part 257.91.

Harold D. Register J.
Signature



01/27/2020

January 27, 2020
Date of Certification

Harold D. Register, Jr., P.E.
Name

6201056266
Professional Engineer Certification Number

[1] JHC-MW-15015 and JHC-MW-15016 were located downgradient when the pond was active. These wells are now located upgradient of groundwater flow across the pond after groundwater flow equilibrated post-decommissioning. Although these wells are no longer downgradient, groundwater chemistry at these wells contributed to the initiation of assessment monitoring and they will continue to be used to monitor post-decommissioning changes in groundwater quality.

Appendix B
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.	Personnel	Drilling Equipment:
N: 517558.9 E: 12636031.7	Logged By - Paula Lancaster Driller - Roger Christiansen	Geoprobe 7822 DT

Civil Town/City/or Village:	County:	State:	Water Level Observations:
West Olive	Ottawa	MI	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
1 GP	66		0	**FILL** mostly ash and gravel.				
				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.				
2 GP	80		5	Changes to yellowish brown (10YR 5/4), moist at 3.8 feet below ground surface.				
				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		30	Changes to fine to medium sand, dark yellowish brown (10YR 6/6) at 27.0 feet below ground surface. 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.	SP			
7 GP	73			**SAND** mostly medium sand, little coarse sand, few fine sand, little fine gravel, dark yellowish brown (10YR 4/6), dry, loose. 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.				
8 GP	65		35					
				▼	SW			
9 GP	65		40	Changes to mostly medium sand, trace to few coarse sand, trace fine gravel, wet at 39.25 feet below ground surface. Changes to mostly fine to medium sand at 39.5 feet below ground surface. Changes to mostly medium sand, trace coarse sand, trace fine sand, dark brown (10YR 4/6), loose at 40.0 feet below ground surface.				
10 AU	0		45	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:

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 C
November 2018 Assessment Monitoring Data Summary

1540 Eisenhower Place
Ann Arbor, MI 48108

734.971.7080 PHONE
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, Bottom Ash Pond Unit 3 North and 3 South 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) Bottom Ash Pond Unit 3 North and 3 South (collectively Unit 3). During the statistical analysis 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 Unit 3. 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, in addition to December 2018 groundwater monitoring results from several newly installed monitoring wells.

Assessment Monitoring Sampling Summary

TRC conducted the second semiannual assessment monitoring event for Appendix III and IV constituents at the Unit 3 CCR Unit in accordance with the *JH Campbell Monitoring Program Sample Analysis Plan* (SAP) (ARCADIS, 2016). The semiannual assessment monitoring event was completed

[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).

on November 12 through November 16, 2018. Monitoring wells JHC-MW-15013, JHC-MW-15015, JHC-MW-15016 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. As discussed in the 2018 Annual Report, downgradient monitoring well JHC-MW-15012 had been damaged and decommissioned during CCR removal activities on October 10, 2018, and was not sampled in November 2018. Given that groundwater flow changes have occurred such that JHC-MW-15015 and JHC-MW-15016 are located hydraulically upgradient of Unit 3 and JHC-MW-15012 has been removed, additional downgradient monitoring wells have been installed at Unit 3 and are being used to reassess the monitoring well network at Unit 3, as discussed below.

TRC personnel collected static water level measurements. Static water elevation data are summarized in Table 1 and 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 during the event, in accordance with the SAP. The analytical results from the background monitoring wells are summarized in Table 3, and the analytical results from the downgradient monitoring wells are summarized in Table 4.

Due to the cessation of hydraulic loading to Unit 1-2 and Bottom Ash Ponds 3 North and 3 South (Unit 3), the groundwater flow direction changed significantly from the previous baseline and assessment monitoring events. In response, as documented in the 2018 Annual Report, CEC installed five new downgradient wells on December 3 through December 5, 2018 to reassess groundwater flow and ensure sufficient wells were appropriately located to assess groundwater quality downgradient from the Unit 1-2 and Unit 3 CCR Units. JHC-MW-18001 through JHC-MW-18003 were installed on the west and southwest edges of former Unit 3 and JHC-MW-18004 and JHC-MW-18005 were installed on the south and southwest edges of the former Unit 1-2 (as shown on Figure 1). The 2018 wells were sampled for Appendix III and Appendix IV constituents on December 7 through December 12, 2018. The summary of data collected at the newly installed monitoring wells is included in Attachment A. After groundwater flow patterns in the immediate vicinity of the CCR unit have equilibrated and have been confirmed, data collected from the new monitoring wells will be used to determine which monitoring wells are appropriately positioned to assess groundwater quality downgradient from the Unit 3 CCR Unit.

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. The groundwater mounding previously observed in the immediate vicinity of Unit 1-2 and Unit 3 is no longer apparent subsequent to completing decommissioning activities at both units in September and October 2018, respectively. Slight mounding is still observed in the vicinity of Pond A as groundwater continues to equilibrate in response to permanent discontinuation of hydraulic loading in June 2018. 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 site-wide groundwater flow is generally consistent with the previous monitoring events since the background sampling events commenced in December 2015. Groundwater flow in the immediate vicinity of Unit 3 is consistent with the April 2018 monitoring event which, at the time, exhibited groundwater conditions during a temporary cessation in hydraulic loading. 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.

While the general overall groundwater flow direction measured across the JHC site during these assessment monitoring events is similar to that identified in previous monitoring events, groundwater flow changes were observed in the immediate vicinity of Unit 3 during the November 2018 event as a result of permanent cessation of hydraulic loading and completion of pond deconstruction activities such that the groundwater flow is predominantly toward the west-southwest instead of radially outward from Unit 3. The initial data collected from the newly installed wells indicates that they are in the downgradient direction, while JHC-MW-15015 and JHC-MW-15016 are predominantly upgradient of groundwater flow from Unit 3 (Attachment A Figure A1). As such, the Unit 3 groundwater monitoring system is in the process of being re-evaluated and groundwater flow conditions are being confirmed using the data from the new wells, and will be re-established, as appropriate, to assess groundwater quality downgradient from the Unit 3 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 B.

Assessment Monitoring Statistical Evaluation

Following the second semiannual assessment monitoring 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 is 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 (TRC, January 2019).

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 C. For each Appendix IV constituent, the concentrations were first compared directly to the GWPSs. Constituent-well combinations that included a direct exceedance of the GWPSs 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 Unit 3 downgradient monitoring wells in November 2018. In addition, the December 2018 concentrations of Appendix III and Appendix IV constituents at the new downgradient wells are below the GWPSs (using direct comparison), with several Appendix III and Appendix IV concentrations above the background UTLs, as shown in Attachment A Table A3. 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 Unit 3 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.

Sincerely,

TRC

Graham Crockford
Program Manager

Sarah B. Holmstrom
Hydrogeologist/Project Manager

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

Attachments

Table 1.	Summary of Groundwater Elevation Data
Table 2.	Summary of Field Parameter Results
Table 3.	Summary of Background Wells Groundwater Sampling Results (Analytical)
Table 4.	Summary of Groundwater Sampling Results (Analytical)
Table 5.	Summary of Groundwater Protection Standard Exceedances – November 2018
Figure 1.	Monitoring Well Network and Site Plan
Figure 2.	Groundwater Contour Map – November 2018
Attachment A	JH Campbell Bottom Ash Pond Unit 3 December 2018 Groundwater Data Summary
Attachment B	Data Quality Reviews
Attachment C	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 Unit 3N/3S – 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
Unit 3							
JHC-MW-15013	11/14/2018	0.56	-90.5	7.5	356	18.3	4.0
JHC-MW-15015	11/14/2018	0.53	2.2	7.3	631	11.7	1.6
JHC-MW-15016	11/15/2018	0.31	24.4	7.2	1,084	12.0	6.3

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 Unit 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	**JHC-MW-15013**	**JHC-MW-15015**	**JHC-MW-15016**
						Sample Date:	11/14/2018	11/14/2018	11/15/2018
Constituent	Unit	UTL	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient		
Appendix III									
Boron	ug/L	51	NC	500	500	7,200	318	270	340
Calcium	mg/L	46	NC	NC	NC	500	44.5	128	112
Chloride	mg/L	43	250**	250	250	500	16.9	89.5	73.8
Fluoride	ug/L	1,000	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	14	250**	250	250	500	32.9	99.4	23.5
Total Dissolved Solids	mg/L	258	**500****	**500**	**500**	**500**	198	**626**	**512**
pH, Field	SU	4.8 - 9.2	6.5 - 8.5**	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	7.5	7.3	7.2
Appendix IV									
Antimony	ug/L	2	6	6.0	6.0	130	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	1	10	10	10	10	< 1.0	< 1.0	4.6
Barium	ug/L	35	2,000	2,000	2,000	820	22.1	71.7	94.5
Beryllium	ug/L	1	4	4.0	4.0	18	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	0.2	5	5.0	5.0	3.5	< 0.20	< 0.20	< 0.20
Chromium	ug/L	2	100	100	100	11	2.3	< 1.0	< 1.0
Cobalt	ug/L	15	NC	40	100	100	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	1,000	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000
Lead	ug/L	1	NC	4.0	4.0	39	< 1.0	< 1.0	< 1.0
Lithium	ug/L	10	NC	170	350	440	< 10	< 10	< 10
Mercury	ug/L	0.2	2	2.0	2.0	0.20#	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	5	NC	**73**	210	3,200	12.2	37.9	**80.0**
Radium-226	pCi/L	NA	NC	NC	NC	NC	0.626	< 0.528	0.514
Radium-228	pCi/L	NA	NC	NC	NC	NC	< 0.955	0.922	1.29
Radium-226/228	pCi/L	1.93	5	NC	NC	NC	< 1.14	< 1.34	1.80
Selenium	ug/L	5	50	50	50	**5**	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	2	2.0	2.0	3.7	< 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 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.

Table 5

Summary of Groundwater Protection Standard Exceedances – November 2018

JH Campbell Unit 3N/3S – RCRA CCR Monitoring Program

West Olive, Michigan

Constituent	Units	GWPS	JHC-MW-15016	
			LCL	UCL
Molybdenum	ug/L	100	0.10	100

Notes:

ug/L - micrograms per Liter.

GWPS - Groundwater Protection Standard as established in TRC's Technical Memorandum dated October 15, 2018.

UCL - Upper Confidence Limit (α = 0.01) of the downgradient data set.

LCL - Lower Confidence Limit (α = 0.01) of the downgradient data set.

Indicates a statistically significant exceedance of the GWPS. An exceedance occurs when the LCL is greater than the GWPS.

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		
APPROVED BY:	G. CROCKFORD		**FIGURE 1**
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

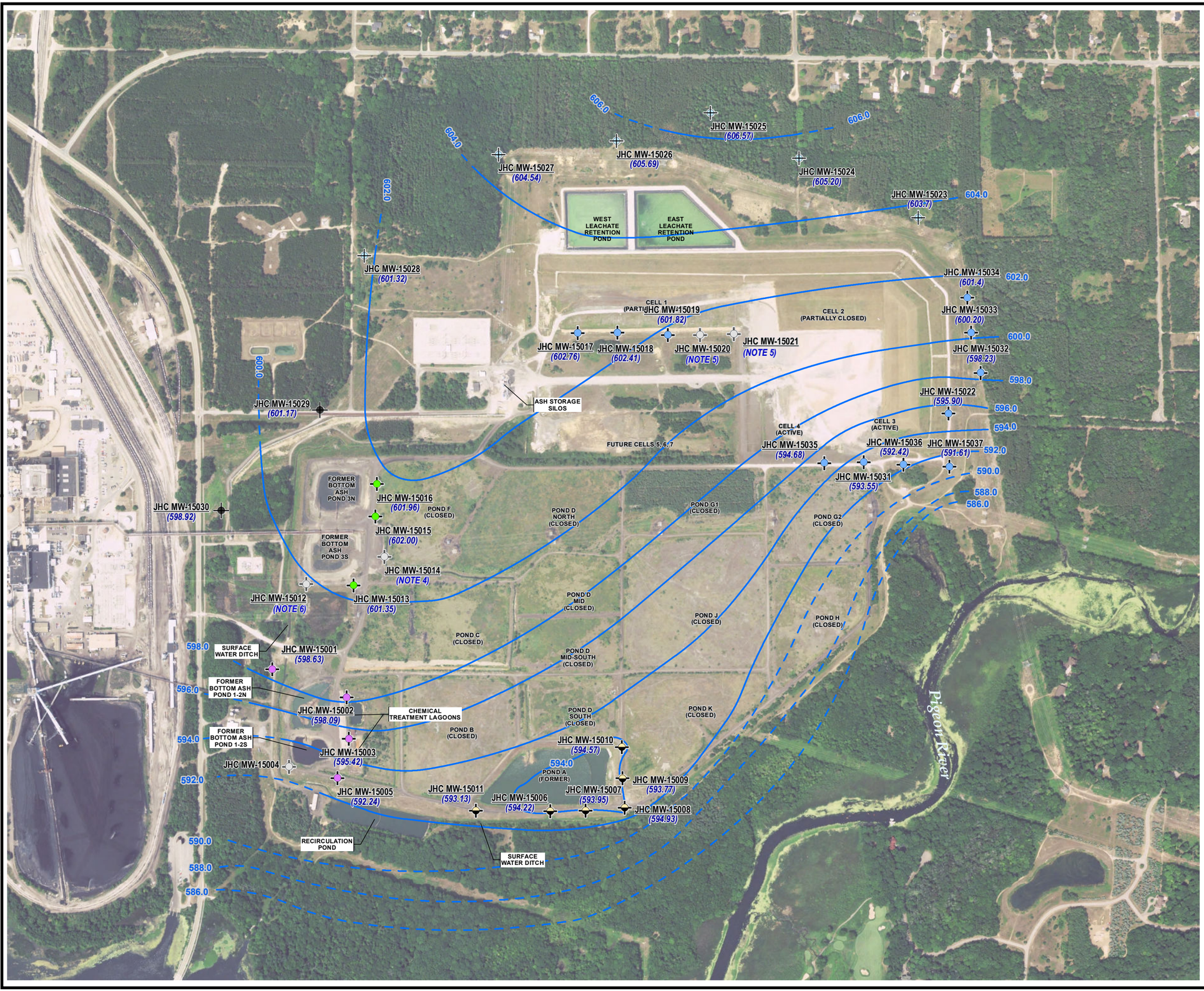
Plot Date: 3/12/2019, 11:06:55 AM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\290806-001-015.mxd
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

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.

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		

TRC
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Ann Arbor, MI 48108-3284
Phone: 734.971.7080
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FILE NO.: 290806-001-019.mxd

Attachment A
JH Campbell Bottom Ash Pond Unit 3 December 2018 Groundwater Data Summary

Technical Memorandum

Date:	March 14, 2019
To:	Bethany Swanberg, CEC
cc:	Brad Runkel, CEC JR Register, CEC Michelle Marion, CEC Graham Crockford, TRC
From:	Sarah Holmstrom, TRC
Project No.:	290806.0000.0000
Subject:	CEC: JH Campbell Bottom Ash Pond Unit 3 December 2018 Groundwater Data Summary

Project Number: 290806.0000.0000 Ph 1, Task 3

In June 2017, decommissioning of the Unit 3 North at the Consumers Energy Company (CEC) JH Campbell (JHC) Power Plant Site began with recovery of CCR from the pond for beneficial reuse prior to backfilling with clean fill. The above-grade concrete treatment tanks were constructed within the footprint of the Unit 3 North pond area to manage bottom ash and became operational in July 2018. In addition, hydraulic loading was ceased at Unit 1-2 and Pond A in June 2018 and the southern portion of Unit 3 in July 2018 (when the concrete tanks were in service). Due to this cessation of hydraulic loading, groundwater flow characteristics in the vicinity of the Units 3 North and 3 South (collectively Unit 3) and Units 1-2 North and 1-2 South (Unit 1-2) bottom ash ponds changed significantly between the initiation of monitoring in accordance with the CCR Rule (December 2015) and the initiation of semiannual assessment monitoring (June 2018).

In addition, one of the Unit 3 downgradient monitoring wells (JHC-MW-15012) had been damaged during CCR removal activities on October 10, 2018 and was decommissioned during that time. Following the completion of the CCR removal activities, three additional monitoring wells were installed along the west and southwest edges of JHC Unit 3 and two additional monitoring wells were installed along the south and southwest edges of JHC Unit 1-2 during the week of December 3, 2018 in order to replace the decommissioned well and reassess groundwater flow in the vicinity of JHC Unit 3 and JHC Unit 1-2. As such, the JHC Unit 3 groundwater monitoring system is being re-evaluated subsequent to the completion of the CCR removal activities and permanent discontinuation of hydraulic loading. After groundwater flow patterns in the immediate vicinity of the CCR unit

have equilibrated post-deconstruction, data collected from the new monitoring wells will be used to determine which monitoring wells are appropriately positioned to assess groundwater quality downgradient from the Unit 3 CCR Unit.

This technical memorandum provides a summary of the initial groundwater data collected from the new monitoring wells installed in the vicinity of Unit 3 during December 2018.

Groundwater Sampling Summary

TRC collected groundwater samples from the newly installed monitoring wells JHC-MW-18001 through JHC-MW-18003 on December 3 through December 7, 2018 in accordance with the *JH Campbell Monitoring Program Sample Analysis Plan* (SAP) (ARCADIS, 2016).

TRC personnel collected static water level measurements from the three newly installed wells near Unit 3, two newly installed wells near Unit 1-2, and a subset of preexisting monitoring wells located near Unit 1-2 and Unit 3. Static water elevation data are summarized in Table A1 and groundwater potentiometric elevation data are shown on Figure A1. 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 A2.

The groundwater samples were analyzed for Appendix III and Appendix IV parameters by Pace Analytical Services, LLC (Pace) in accordance with the SAP. The analytical results are summarized in Table A3.

Groundwater Flow Direction

Groundwater elevation data collected during the December 2018 sampling event were generally similar to data collected in November 2018. Groundwater elevations measured across the area of Unit 1-2 and Unit 3 during the December 2018 sampling event are provided in Table A1 and were used to construct a groundwater contour map (Figure A1). The groundwater flow in this area of the site is predominantly toward the west-southwest instead of radially outward from Unit 3, and predominantly toward the south in the vicinity of Unit 1-2.

The general flow direction is similar to that identified in April and November 2018. JHC-MW-18001, located on the west perimeter of the former Unit 3, is in line with the western groundwater flow component. JHC-MW-18002 and JHC-MW-18003 are positioned downgradient of the southwesterly flow component across Unit 3. The initial data collected from the newly installed wells indicates that they are in the downgradient direction, while JHC-MW-15015 and JHC-MW-15016 are predominantly upgradient of groundwater flow from Unit 3. As such, the Unit 3 groundwater monitoring system is in the process of being re-evaluated and groundwater flow conditions are being confirmed using the

data from the new wells, and will be re-established, as appropriate, to assess groundwater quality downgradient from the Unit 3 CCR Unit.

Data Quality

Analytical data were found to be usable for assessment monitoring. The Data Quality Review for this event is included as Attachment A1.

Analytical Results Summary

Although the groundwater monitoring system is being reassessed while groundwater flow conditions are confirmed, prior to incorporating the new wells into the assessment monitoring well network, the concentrations of the Appendix III and IV constituents in each of the new wells were compared to the potentially relevant criteria in Table A3. Since these wells were just installed in December 2018, adequate background has not been established at these locations to perform statistical evaluation of the data. However, in order to evaluate groundwater quality at the new downgradient monitoring wells in the context of the assessment monitoring program, the results were also compared against the Appendix III upper tolerance limits (UTLs) and Appendix IV groundwater protection standards (GWPSs) previously established for the site. The results from the new wells show several Appendix III and Appendix IV concentrations exceed the background UTLs, but are well below the GWPSs.

Once groundwater flow is confirmed, the groundwater monitoring system will be re-established using the new wells in 2019, as appropriate, to assess groundwater quality downgradient from the Unit 3 CCR Unit moving forward.

Attachments

Table A1.	Summary of Groundwater Elevation Data – December 2018
Table A2.	Summary of Field Parameter Results – December 2018
Table A3.	Summary of Groundwater Sampling Results (Analytical) – December 2018
Figure A1.	Groundwater Contour Map – December 2018
Attachment A1	Data Quality Review

Tables

Table A1
Summary of Groundwater Elevation Data – December 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 Depth (ft BGS)			Screen Interval Elevation (ft)			Borehole Terminus Depth (ft BGS)	Borehole Terminus Elevation (ft)	December 7, 2018	
												Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Unit 1N, 1S, 2N, 2S													
JHC-MW-15002[1]	618.18	621.27[1]	Sand	28.0	to	38.0	590.2	to	580.2	38.0	580.18	23.30	597.97
JHC-MW-15003[1]	623.16	627.20[1]	Sand	28.0	to	38.0	595.2	to	585.2	38.0	585.16	31.89	595.31
JHC-MW-15005[1]	606.22	609.99[1]	Sand	27.0	to	37.0	579.2	to	569.2	40.0	566.22	17.69	592.30
JHC-MW-18004[2]	602.92	605.72	Sand	6.0	to	16.0	596.9	to	586.9	16.0	586.92	11.02	594.70
JHC-MW-18005[2]	600.30	603.16	Sand	5.0	to	15.0	595.3	to	585.3	15.0	585.30	9.77	593.39
Unit 3N, 3S													
JHC-MW-15013	632.40	635.25	Sand	28.0	to	38.0	604.4	to	594.4	38.0	594.40	34.30	600.95
JHC-MW-15015	632.46	635.20	Sand	28.0	to	38.0	604.5	to	594.5	40.0	592.46	33.45	601.75
JHC-MW-18001[2]	609.09	611.98	Sand	6.0	to	16.0	603.1	to	593.1	17.0	592.09	10.96[3]	601.02
JHC-MW-18002[2]	605.53	608.93	Sand	3.5	to	13.5	602.0	to	592.0	15.0	590.53	8.22[3]	600.71
JHC-MW-18003[2]	605.36	608.78	Sand	3.5	to	13.5	601.9	to	591.9	15.0	590.36	8.00	600.78

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) - Surface elevation and TOC resurveyed December 2018 due to construction activities.

(2) - JHC-MW-18001, JHC-MW-18002, JHC-MW-18003, JHC-MW-18004 & JHC-MW-18005 were installed on December 3 through December 5, 2018.

(3) - The static water levels for JHC-MW-18001 and JHC-MW-18002 were collected on December 12, 2018.

Table A2

Summary of Field Parameter Results –November & December 2018

JH Campbell Unit 3N/3S – 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
Unit 3							
JHC-MW-18001	12/12/2018	0.70	-3.9	8.4	290	13.0	6.2
JHC-MW-18002	12/12/2018	0.33	31.6	7.7	272	12.0	4.2
JHC-MW-18003	12/7/2018	0.61	50.4	7.4	872	13.2	9.5

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

SU - Standard units

umhos/cm - Micromhos per centimeter.

°C - Degrees Celcius

NTU - Nephelometric Turbidity Unit.

Table A3
Summary of Groundwater Sampling Results (Analytical): December 2018
JH Campbell Unit 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

								Sample Location:	JHC-MW-18001	JHC-MW-18002	JHC-MW-18003
								Sample Date:	12/12/2018	12/12/2018	12/7/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	UTL	GWPS				
Appendix III											
Boron	ug/L	NC	500	500	7,200	**51**	NA		**304**	**301**	**197**
Calcium	mg/L	NC	NC	NC	500	**46**	NA		**52.9**	45.9	**63.6**
Chloride	mg/L	250**	250	250	500	43	NA		13.4	14.9	15.3
Fluoride	ug/L	4,000	NC	NC	NC	1,000	NA		< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250**	250	250	500	**14**	NA		**51.7**	**35.6**	**116**
Total Dissolved Solids	mg/L	500**	500	500	500	**258**	NA		**344**	244	**326**
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	4.8 - 9.2	NA		8.4	7.7	7.4
Appendix IV											
Antimony	ug/L	6	6.0	6.0	130	2	6		< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	10	10	10	1	10		< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	2,000	2,000	820	**35**	2,000		**225**	**79.5**	**81.5**
Beryllium	ug/L	4	4.0	4.0	18	1	4		< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5.0	5.0	3.5	0.2	5		< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11	2	100		< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100	15	15		< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NC	NC	NC	1,000	4,000		< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	39	1	15		< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440	10	40		< 10	< 10	< 10
Mercury	ug/L	2	2.0	2.0	0.20#	0.2	2		< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	73	210	3,200	**5**	100		**9.6**	**12.4**	**10.9**
Radium-226	pCi/L	NC	NC	NC	NC	NA	NA		< 0.886	0.631	< 0.757
Radium-228	pCi/L	NC	NC	NC	NC	NA	NA		< 0.955	< 0.711	0.833
Radium-226/228	pCi/L	5	NC	NC	NC	1.93	5		< 1.84	< 1.30	< 1.54
Selenium	ug/L	50	50	50	**5**	**5**	50		1.6	**18.3**	< 1.0
Thallium	ug/L	2	2.0	2.0	3.7	2	2		< 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.
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.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/Regional Screening Level and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
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.

Figure

TRC - GIS

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

Plot Date: 3/14/2019, 09:47:43 AM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_26976732\322174-001-001.mxd

JHC MW-15025 (NM)
JHC MW-15026 (NM)
JHC MW-15027 (NM)
JHC MW-15024 (NM)
JHC MW-15023 (NM)
JHC MW-15028 (NM)
JHC MW-15029 (NM)
JHC MW-15030 (NM)
JHC MW-18001 (601.02)
JHC MW-15016 (NM)
JHC MW-15015 (601.75)
JHC MW-15014 (NOTE 3)
JHC MW-18002 (600.71)
JHC MW-15012 (NOTE 5)
JHC MW-18003 (600.78)
JHC MW-15013 (600.95)
JHC MW-15001 (NM)
JHC MW-15002 (597.97)
JHC MW-18004 (594.70)
JHC MW-15003 (595.31)
JHC MW-15004 (NOTE 4)
JHC MW-18005 (593.39)
JHC MW-15005 (592.30)
JHC MW-15011 (NM)
JHC MW-15006 (NM)
JHC MW-15007 (NM)
JHC MW-15008 (NM)
JHC MW-15009 (NM)
JHC MW-15010 (NM)
JHC MW-15035 (NM)
JHC MW-15036 (NM)
JHC MW-15031 (NM)
JHC MW-15037 (NM)
JHC MW-15022 (NM)
JHC MW-15032 (NM)
JHC MW-15033 (NM)
JHC MW-15034 (NM)
JHC MW-15017 (NM)
JHC MW-15018 (NM)
JHC MW-15019 (NM)
JHC MW-15020 (NOTE 4)
JHC MW-15021 (NOTE 4)

WEST LEACHATE RETENTION POND
EAST LEACHATE RETENTION POND
CELL 1 (PARTIALLY CLOSED)
CELL 2 (PARTIALLY CLOSED)
CELL 3 (ACTIVE)
CELL 4 (ACTIVE)
FUTURE CELLS 5, 6, 7
ASH STORAGE SILOS
FORMER BOTTOM ASH POND 3N
FORMER BOTTOM ASH POND 3S
FORMER BOTTOM ASH POND 1-2N
FORMER BOTTOM ASH POND 1-2S
POND F (CLOSED)
POND D NORTH (CLOSED)
POND D MID (CLOSED)
POND D MID-SOUTH (CLOSED)
POND D SOUTH (CLOSED)
POND A (FORMER)
POND B (CLOSED)
POND C (CLOSED)
POND G1 (CLOSED)
POND G2 (CLOSED)
POND J (CLOSED)
POND H (CLOSED)
POND K (CLOSED)
SURFACE WATER DITCH
UNIT 1-2 DRAINAGE DITCH
CHEMICAL TREATMENT LAGOONS
RECIRCULATION POND
SURFACE WATER DITCH
Pigeon River
600.0
601.0
599.0
598.0
597.0
596.0
595.0
594.0
593.0
592.0

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)
- *(601.75)* GROUNDWATER ELEVATION (FT, NAVD 1988)
- *(NM)* NOT MEASURED
- GROUNDWATER ELEVATION CONTOUR (1' INTERVAL, DASHED WHERE INFERRED)

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.
7. GROUNDWATER ELEVATIONS DISPLAYED IN FEET RELATIVE TO THE NORTH AMERICAN VERTICAL DATUM OF 1988.

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 DECEMBER 2018

DRAWN BY:	S. MAJOR	PROJ NO.:	322174-001
CHECKED BY:	K. LOWERY		
APPROVED BY:	S. HOLMSTROM		**FIGURE A1**
DATE:	MARCH 2019		

TRC
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FILE NO.: 322174-001-001.mxd

Attachment A1
Data Quality Review

Laboratory Data Quality Review
Groundwater Monitoring Event December 2018
CEC JH Campbell
Unit 3

Groundwater samples were collected by TRC for the December 2018 sampling event. Samples were analyzed for anions, alkalinity, total dissolved solids, and total metals by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and for radium by Pace located in Greensburg, Pennsylvania. The antimony and selenium analyses were subcontracted by Pace in Grand Rapids, MI to the Pace facility in Indianapolis, Indiana. The laboratory analytical results are reported in laboratory reports 4621061, 4621063, 4621163, and 4621166.

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

- JHC-MW-18001
- JHC-MW-18002
- JHC-MW-18003

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Alkalinity	SM 2320B-11
Total Dissolved Solids (TDS)	SM 2540C-11
Total Metals	SW-846 6020A, SW-846 6010C, SW-846 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 Quality Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund 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;
- 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), 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 tracers 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 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 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:

- Sample receipt: The cooler temperatures for several coolers in all reviewed laboratory reports were >6°C (7.9-13.3 °C). Although the coolers were hand delivered to the laboratory and were received by the laboratory on the same day they were collected, the

coolers did not contain ice upon receipt; thus, the positive and nondetect results for alkalinity, anions, and TDS in all samples in this data set were potentially impacted, as summarized in the attached table.

- A method blank was analyzed with each analytical batch. Target analytes were not detected in the method blanks.
- One equipment blank (EB-09) and one field blank (FB-09) were collected. Target analytes were not detected in the equipment blank and field blank.
- LCS recoveries were within laboratory control limits for all analytes.
- MS and/or MSDs were performed on samples JHC-MW-18003 for anions, mercury, metals, alkalinity, and radium, and on sample JHC-MW-18001 for anions. The MS/MSD recoveries and relative percent differences (RPDs), where applicable, were within the acceptance limits with the following exceptions:
  - The recovery for sulfate in the MS performed on sample JHC-MW-18003 was below the lower laboratory control limit. Potential low bias exists for the results for sulfate in the samples in this batch, as summarized in the attached table.
  - The recovery for chloride in the MS performed on sample JHC-MW-18001 was below the lower laboratory control limit. Potential low bias exists for the results for chloride in the samples in this batch, as summarized in the attached table.
- Laboratory duplicates were performed sample JHC-MW-18003 for anions, TDS, and alkalinity, and sample JHC-MW-18001 for anions. All criteria were met.
- The field duplicate pair samples submitted with this data set were JHC-MW-18002 and Dup-09. RPDs between the parent and duplicate samples were within the QC limits for all analytes.
- Carrier and tracer recoveries, where applicable, were within 30-110%.

Attachment A

Summary of Data Non-Conformances for Unit 3 Groundwater Analytical Data

JH Campbell - RCRA CCR Monitoring Program

West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
Dup-09_20181212	12/12/2018	Fluoride, Chloride, Sulfate, Total Alkalinity, Bicarbonate Alkalinity, Carbonate Alkalinity, TDS	Coolers were received with temperature >6°C and no ice in coolers. Sample results may be biased low.
FB-09_20181212	12/12/2018		
JHC-MW-18001_20181212	12/12/2018		
JHC-MW-18002_20181212	12/12/2018		
EB-09	12/7/2018		
JHC-MW-18003_20181207	12/7/2018		
JHC-MW-18003_20181207	12/7/2018	Sulfate	MS recovery below the lower laboratory control limit. Sample results may be biased low.
Dup-09_20181212	12/12/2018	Chloride	MS recovery below the lower laboratory control limit. Sample results may be biased low.
JHC-MW-18001_20181212	12/12/2018		
JHC-MW-18002_20181212	12/12/2018		

Attachment B
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 RL of 50 mg/L is below all project criteria; therefore, data usability is not affected.
    - 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 **B**

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 Unit 3

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 4620351 and 4620352. The laboratory analytical results for sample JHC-MW-15013 are reported in laboratory reports 4620347 and 4620348.

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

- JHC-MW-15015
- JHC-MW-15016
- JHC-MW-15013

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, when available. 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 three of the six coolers received at the laboratory on 11/15/18 (associated with sample JHC-MW-15016_20181115) were >6°C (ranging from 7.3-9.3°C). However, the coolers were hand delivered to the courier/received on the same day as sample collection and contained ice upon receipt; thus, there was no adverse impact to data usability.
- No target analytes were detected in the method blank.
- One equipment blank (EB#04_20181114) was collected and the following analytes were detected:
  - Chloride at 2.1 mg/L and barium at 1.7 µg/L; there was no impact on data usability since the sample results were <5x the blank concentration.
- LCS recoveries were within laboratory control limits.
- MS/MSDs were performed on sample JHC-MW-15015_20181114 for radium, metals, and anions, and MS analysis was performed on sample JHC-MW-15015_20181114 for alkalinity. The relative percent differences (RPDs) were within the QC limits.
  - The chloride recoveries in the MS/MSD analyses were below the lower laboratory control limits. The positive results for chloride in samples JHC-MW-15015_20181114 and JHC-MW-15016_20181115 may be biased low. (see attached table). However, data were within the range of historical concentrations.
  - The boron recoveries in the MS/MSD analyses were below the lower laboratory control limits. However, the result for boron in the parent sample was >4x the spike added; thus, there was no adverse impact on data usability.
- Laboratory duplicate analyses were performed on the sample JHC-MW-15015_20181114 for anions, alkalinity, and TDS; the RPDs between the parent and duplicate sample were within the QC limits.
- There were no field duplicates associated with laboratory reports 4620351 and 4620352.
- The field duplicate pair samples were Dup#04_20181114 and JHC-MW-15013_20181114. The RPD for chromium in the field duplicate pair Dup#04_20181114 and MW-15013_20181114 was 32.8% (above the 30% acceptance limit). The samples associated with this field duplicate pair were samples JHC-MW-15013_20181114, and Dup#04_20181114. Potential uncertainties exist for the positive chromium results in samples Dup#04_20181114 and JHC-MW-15013_20181114 (see attached table). However, data were within the range of historical results.
- The RL for TDS (50 mg/L) exceeded the project limit of 1 mg/L in the equipment blank (EB#04_20181114). This does not affect data usability since this is a QC sample.
- Carrier and tracer recoveries, where applicable, were within 30-110%.

Attachment B
Summary of Data Non-Conformances
JH Campbell Unit 3 Downgradient – RCRA CCR Monitoring Program
West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15015_20181114	11/14/2018	Chloride	MS/MSD recoveries below lower laboratory control limits. Results may be biased low; however, data were within the range of historical concentrations.
JHC-MW-15016_20181115	11/15/2018		
JHC-MW-15013_20181114	11/14/2018	Chromium	RPD for the field duplicate pair exceeded 30%. Potential uncertainty exists due to the field duplicate variability; however, data were within the range of historical concentrations.
DUP#04_20181114	11/14/2018		

Notes:

MS/MSD: Matrix Spike/Matrix Spike Duplicate

Attachment C
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 Bottom Ash Pond Unit 3 North and 3 South CCR Unit, 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 Protections 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) Bottom Ash Pond Unit 3 North and 3 South (Unit 3). 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.

[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).

The statistical evaluation of the second semiannual assessment monitoring event data indicates that no constituents are present at statistically significant levels exceeding the GWPSs in downgradient monitoring wells at the JHC Unit 3 CCR unit. This result is 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.

Assessment Monitoring Statistical Evaluation

The compliance well network at the JHC Unit 3 CCR Unit consists of three monitoring wells (JHC-MW-15013, JHC-MW-15015, and JHC-MW-15016) located on the eastern perimeter of the bottom ash ponds. Former downgradient monitoring well JHC-MW-15012 was decommissioned on October 10, 2018 during deconstruction of Bottom Ash Pond Unit 3 South; therefore, statistical analysis for JHC-MW-15012 terminates at the June 2018 monitoring event.

Following the second semiannual assessment monitoring events, compliance well data for the JHC Unit 3 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 and 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

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

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 for each well were first compared directly to the GWPS, as shown on Table C1. Parameter-well combinations that included a direct exceedance of the GWPS within the past 8 events (August 2016 through November 2018) were retained for further analysis. Molybdenum in JHC-MW-15016 at JHC Unit 3 had a single, individual result exceeding the GWPS during the April 2018 monitoring event.

A significant change in groundwater flow conditions was observed in the vicinity of monitoring well JHC-MW-15016, located east of the northern portion of JHC Unit 3. The groundwater flow direction changed from radially outward to predominantly southwest across the northern portion of JHC Unit 3 following: 1) the cessation of hydraulic loading and removal of CCR at the Unit 3 North Bottom Ash Pond (April through June 2017); 2) temporary cessation of hydraulic loading in the JHC Unit 3 South Bottom Ash Pond between March 14 and April 26, 2018; and 3) construction of the concrete pad over top of the former Unit 3 North Bottom Ash Pond (May through July 2018). As a result of these changes in site conditions and groundwater flow changes, monitoring well JHC-MW-15016 was no longer positioned downgradient from the JHC Unit 3. Also, during this timeframe (between the last background monitoring event in August 2017 and the initial assessment monitoring event in April 2018) an increase in the molybdenum concentrations in groundwater collected from monitoring well JHC-MW-15016 was observed.

Considering that JHC-MW-15016 was hydraulically upgradient from JHC Unit 3 and CCR had been removed from Unit 3 North Bottom Ash Pond at the time of the assessment monitoring sampling events in April and July 2018, it is likely that the groundwater quality measured at monitoring well JHC-MW-15016, during those events is more representative of groundwater flowing toward the CCR unit from the northeast, prior to being influenced by the JHC Unit 3 CCR unit. As such, the molybdenum groundwater data is considered suspect for the purposes of assessing groundwater quality influenced by the JHC Unit 3 CCR unit. However, CCR removal activities in the southern portion of JHC Unit 3 were recently completed in October 2018, groundwater conditions are still re-equilibrating, and the groundwater monitoring system is being re-assessed to account for post-deconstruction groundwater conditions. As a result, the April and July 2018 molybdenum data have been retained in the assessment monitoring data set for this assessment monitoring data evaluation in order to remain conservative while hydrogeological conditions are stabilizing. Additional data from the new and existing wells located in the vicinity of the JHC Unit 3 CCR unit will be collected and used to further assess stabilized groundwater flow and characteristics.

Groundwater data were then evaluated utilizing Sanitas™ statistical software. Sanitas™ is a software tool that is commercially available for performing statistical evaluation consistent with procedures outlined in the Unified Guidance. Within the Sanitas™ statistical program, confidence limits were selected to perform the statistical comparison of compliance data to a fixed standard. Parametric and

non-parametric confidence intervals were calculated, as appropriate, for each of the CCR Appendix IV parameters using a 99 percent confidence level, i.e., a significance level (α) of 0.01. The following narrative describes the methods employed, the results obtained and the Sanitas™ output files are included as an attachment.

The statistical data evaluation included the following steps:

- Review of data quality checklists for the data sets;
- Graphical representation of the monitoring data as time versus concentration by well-constituent pair;
- Outlier testing of individual data points that appear from the graphical representations as potential outliers;
- Evaluation of visual trends apparent in the graphical representations for statistical significance;
- Evaluation of percentage of non-detects for each well-constituent pair;
- Distribution of the data; and
- Calculation of the confidence intervals for each cumulative dataset.

The results of these evaluations are presented and discussed below.

Initially, the baseline (December 2015 through August 2017) results and assessment monitoring results (April through November 2018) for molybdenum in JHC-MW-15016 were observed visually for a potential trend. Due to the changes in site conditions discussed above, no outliers were removed and potential trends in data will continue to be assessed as more data are collected. Data from each round were evaluated for completeness, overall quality, and usability and were deemed appropriate for the purposes of the CCR assessment monitoring program. The Sanitas™ software was then used to test compliance for molybdenum at the downgradient monitoring wells using the confidence interval method for the most recent eight sampling events. Eight independent sampling events provide the appropriate density of data as recommended per the Unified Guidance yet are collected recently enough to provide an indication of current condition. The test was run with a per-well significance of $\alpha = 0.01$. The software outputs are included in Attachment C1 along with data reports showing the values used for the evaluation. The percentage of non-detect observations are also included in Attachment C1. Non-detect data was handled in accordance with the Stats Plan for the purposes of calculating the confidence intervals.

The Sanitas™ software generates an output that includes graphs of the parametric or non-parametric confidence intervals for each well along with notes on data transformations, as appropriate. The JHC-MW-15016 data set was found to be normally distributed with a Cohen's square root adjustment, as noted on the confidence interval graph. The confidence interval test compares the lower confidence limit to the GWPS. The evaluation of the Appendix IV constituents shows no statistically

significant exceedances of the GWPSs. This result is 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.

Sincerely,

TRC

Graham Crockford
Program Manager

Sarah B. Holmstrom
Project Hydrogeologist

Attachments

Table C1.	Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
Attachment C1	Sanitas™ Output

Table

Table C1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Unit 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15012 (1)											
						Sample Date:	12/8/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/20/2017	8/15/2017	9/26/2017	4/27/2018	4/27/2018	6/19/2018	6/19/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient												
Appendix III																	Field Dup		Field Dup
Boron	ug/L	NC	NA	51	NA		178	164	160	171	253	212	249	159	180	--	--	205	202
Calcium	mg/L	NC	NA	46	NA		36.2	48.5	58.7	67.3	87.8	41.4	37.7	30.5	30.9	--	--	34.5	34.3
Chloride	mg/L	250*	NA	43	NA		13.4	24.4	23.8	25.2	21.8	17.8	16.7	15.0	15.0	--	--	15.7	15.7
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
Sulfate	mg/L	250*	NA	14	NA		31.8	38.3	51.7	37.8	64.2	32.9	29.2	32.8	29.6	--	--	30.6	30.7
Total Dissolved Solids	mg/L	500*	NA	258	NA		190	240	300	280	430	200	250	174	158	--	--	186	226
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.5	7.6	7.3	7.7	7.0	7.7	7.6	7.6	7.6	7.5	--	7.7	--
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		68	62	63	54	122	86	79.9	66.7	--	53.2	53.2	104	98.7
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		2	2	2	2	2	2	< 1.0	< 1.0	--	< 1.0	1.4	1.9	2.0
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
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	12	7	13	7	5.2	5.5	--	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.285	< 0.207	< 0.124	< 0.406	< 0.182	< 0.258	0.828	0.461	--	< 0.653	< 0.698	< 0.516	< 0.591
Radium-228	pCi/L	NC	NA	NA	NA		< 0.483	0.674	< 0.585	< 0.647	< 0.861	< 0.374	< 0.656	< 0.880	--	< 0.770	< 0.866	< 0.966	1.40
Radium-226/228	pCi/L	5	NA	1.93	5		< 0.483	0.813	< 0.585	< 0.647	< 0.861	< 0.374	< 1.43	< 1.30	--	< 1.42	< 1.56	< 1.48	1.73
Selenium	ug/L	50	NA	5	50		< 1	7	4	3	7	3	< 1.0	< 1.0	--	3.2	2.9	1.3	1.5
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) JHC-MW-15012 was decommissioned on October 10, 2018.

Table C1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Unit 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15013													
						Sample Date:	12/8/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/20/2017	6/20/2017	8/15/2017	8/15/2017	9/26/2017	9/26/2017	4/30/2018	6/19/2018	11/14/2018	11/14/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient															
Appendix III														Field Dup		Field Dup		Field Dup				Field Dup
Boron	ug/L	NC	NA	51	NA		141	160	128	139	163	187	208	207	153	171	147	151	--	258	318	312
Calcium	mg/L	NC	NA	46	NA		37.8	50.1	50.8	61.7	44.3	40.5	34.8	33.3	30.0	30.5	31.5	33.6	--	37.4	44.5	43.8
Chloride	mg/L	250*	NA	43	NA		13.3	24.8	27.2	24.9	23.8	17.6	16.8	16.8	15.2	15.3	15.2	15.2	--	16.2	16.9	17.0
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		31.0	35.2	46.1	43.0	42.1	30.8	29.5	29.5	33.4	33.5	30.9	30.9	--	34.8	32.9	32.3
Total Dissolved Solids	mg/L	500*	NA	258	NA		190	230	280	260	230	220	164	158	184	274	212	178	--	230	198	190
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.8	7.6	7.5	7.4	7.2	7.6	7.5	--	7.6	--	7.7	--	7.7	7.7	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	< 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		16	14	19	18	18	18	20.3	20.0	15.4	15.3	--	--	16.1	21.4	22.1	22.4
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		3	3	2	2	2	4	1.6	1.6	< 1.0	< 1.0	--	--	1.5	2.9	2.3	3.2
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	9	9	9	< 5	< 5.0	< 5.0	5.3	5.9	--	--	6.6	< 5.0	12.2	11.7
Radium-226	pCi/L	NC	NA	NA	NA		< 0.219	< 0.302	0.187	< 0.341	< 0.223	< 0.320	< 0.840	< 0.517	0.489	< 0.573	--	--	< 0.518	< 0.548	0.626	0.834
Radium-228	pCi/L	NC	NA	NA	NA		0.489	< 0.530	< 0.528	< 0.601	< 0.685	0.393	0.876	1.06	< 0.689	< 0.764	--	--	< 0.670	< 0.990	< 0.955	< 0.847
Radium-226/228	pCi/L	5	NA	1.93	5		0.578	< 0.53	< 0.528	< 0.601	< 0.685	0.548	< 1.53	< 1.27	0.990	< 1.34	--	--	< 1.19	< 1.54	< 1.14	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	< 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) JHC-MW-15012 was decommissioned on October 10, 2018.

Table C1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Unit 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15015											
						Sample Date:	12/7/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/20/2017	8/16/2017	9/27/2017	4/30/2018	6/19/2018	11/14/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient											
Appendix III																		
Boron	ug/L	NC	NA	51	NA		469	280	238	348	355	371	697	439	518	--	194	270
Calcium	mg/L	NC	NA	46	NA		57.5	80.6	54.4	128	60.1	80	52.3	59.0	58.8	--	57.3	128
Chloride	mg/L	250*	NA	43	NA		15.1	18.1	10.5	96.9	12.3	36.4	30.8	17.6	15.1	--	22.0	89.5
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		34.1	32.2	13.4	52.2	30.1	48.8	40.5	34.1	28.8	--	54.6	99.4
Total Dissolved Solids	mg/L	500*	NA	258	NA		260	260	250	740	240	360	346	222	328	--	362	626
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.4	7.2	7.3	7.0	7.2	7.5	7.3	7.3	7.3	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
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		30	36	27	59	34	46	34.9	31.1	--	24.5	36.7	71.7
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	2	1	2	5	< 1.0	< 1.0	--	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	< 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	10.3	< 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**		6	8	8	75	15	11	65.0	15.2	--	11.7	11.2	37.9
Radium-226	pCi/L	NC	NA	NA	NA		< 0.273	< 0.206	< 0.167	< 0.281	< 0.214	< 0.260	< 0.466	< 0.550	--	< 0.708	< 0.506	< 0.528
Radium-228	pCi/L	NC	NA	NA	NA		0.845	< 0.630	< 0.488	< 0.565	< 0.636	0.582	< 0.789	< 0.774	--	< 0.809	< 0.750	0.922
Radium-226/228	pCi/L	5	NA	1.93	5		0.945	< 0.63	< 0.488	< 0.565	< 0.636	0.764	< 1.26	< 1.32	--	< 1.52	< 1.26	< 1.34
Selenium	ug/L	50	NA	5	50		8	1	1	3	18	5	22.0	7.5	--	< 1.0	17.9	< 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) JHC-MW-15012 was decommissioned on October 10, 2018.

Table C1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Unit 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15016											
						Sample Date:	12/7/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/20/2017	8/16/2017	9/27/2017	4/30/2018	7/18/2018	11/15/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient											
Appendix III																		
Boron	ug/L	NC	NA	51	NA		279	306	258	258	207	296	170	171	279	--	291	340
Calcium	mg/L	NC	NA	46	NA		37.9	62.4	51.9	65.6	50.9	103	48.5	61.1	75.9	--	74.4	112
Chloride	mg/L	250*	NA	43	NA		13.5	13.4	7.51	11.5	12.1	78.8	28.2	24.5	21.8	--	43.6	73.8
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
Sulfate	mg/L	250*	NA	14	NA		22.8	21.2	9.71	32.4	31.0	26.8	41.2	56.0	62.6	--	31.9	23.5
Total Dissolved Solids	mg/L	500*	NA	258	NA		210	230	260	240	230	470	280	278	492	--	396	512
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.5	7.3	7.4	7.4	7.1	7.4	7.6	7.3	7.3	6.8	6.9	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
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	1.8	< 1.0	4.6
Barium	ug/L	2,000	NA	35	2,000		35	44	43	32	38	79	7.7	38.8	--	70.2	56.2	94.5
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		2	1	1	1	2	4	< 1.0	2.5	--	< 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**		10	10	11	8	15	< 5	< 5.0	30.7	--	**122**	100	80.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.265	< 0.212	< 0.159	< 0.387	< 0.291	< 0.332	< 0.582	< 0.754	--	< 0.898	< 0.647	0.514
Radium-228	pCi/L	NC	NA	NA	NA		0.822	< 0.547	0.519	0.555	< 0.532	0.886	< 0.636	< 0.659	--	< 0.951	1.61	1.29
Radium-226/228	pCi/L	5	NA	1.93	5		0.875	< 0.547	0.552	0.682	< 0.532	1.05	< 1.22	< 1.41	--	< 1.85	1.88	1.80
Selenium	ug/L	50	NA	5	50		< 1	< 1	1	< 1	2	3	< 1.0	2.2	--	< 1.0	2.2	< 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) JHC-MW-15012 was decommissioned on October 10, 2018.

Attachment C1
Sanitas™ Output

Summary Report

Constituent: Antimony, Total Analysis Run 2/20/2019 12:38 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/7/2015 and 11/15/2018, a summary of the selected data set:

Observations = 33
ND/Trace = 33
Wells = 3
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-15013	11	11	1	1	1	1	0	0	NaN
JHC-MW-15015	11	11	1	1	1	1	0	0	NaN
JHC-MW-15016	11	11	1	1	1	1	0	0	NaN

Summary Report

Constituent: Arsenic, Total Analysis Run 2/20/2019 12:38 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/7/2015 and 11/15/2018, a summary of the selected data set:

Observations = 33
ND/Trace = 29
Wells = 3
Minimum Value = 1
Maximum Value = 4.6
Mean Value = 1.133
Median Value = 1
Standard Deviation = 0.6377
Coefficient of Variation = 0.5627
Skewness = 5.125

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15013	11	11	1	1	1	1	0	0	NaN
JHC-MW-15015	11	9	1	1	1	1	0	0	NaN
JHC-MW-15016	11	9	1	4.6	1.4	1	1.088	0.7772	2.626

Summary Report

Constituent: Barium, Total Analysis Run 2/20/2019 12:38 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/7/2015 and 11/15/2018, a summary of the selected data set:

Observations = 33
ND/Trace = 0
Wells = 3
Minimum Value = 7.7
Maximum Value = 94.5
Mean Value = 35.38
Median Value = 32
Standard Deviation = 20.6
Coefficient of Variation = 0.5823
Skewness = 1.161

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15013	11	0	14	22.25	18.02	18	2.567	0.1424	0.1554
JHC-MW-15015	11	0	24.5	71.7	39.17	34.9	14.39	0.3674	1.266
JHC-MW-15016	11	0	7.7	94.5	48.95	43	24.39	0.4983	0.3704

Summary Report

Constituent: Beryllium, Total Analysis Run 2/20/2019 12:38 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/7/2015 and 11/15/2018, a summary of the selected data set:

Observations = 33
ND/Trace = 33
Wells = 3
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-15013	11	11	1	1	1	1	0	0	NaN
JHC-MW-15015	11	11	1	1	1	1	0	0	NaN
JHC-MW-15016	11	11	1	1	1	1	0	0	NaN

Summary Report

Constituent: Cadmium, Total Analysis Run 2/20/2019 12:38 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/7/2015 and 11/15/2018, a summary of the selected data set:

Observations = 33
ND/Trace = 33
Wells = 3
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-15013	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15015	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15016	11	11	0.2	0.2	0.2	0.2	0	0	NaN

Summary Report

Constituent: Chromium, Total Analysis Run 2/20/2019 12:38 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/7/2015 and 11/15/2018, a summary of the selected data set:

Observations = 33
ND/Trace = 10
Wells = 3
Minimum Value = 1
Maximum Value = 5
Mean Value = 1.829
Median Value = 1.5
Standard Deviation = 1.059
Coefficient of Variation = 0.579
Skewness = 1.309

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15013	11	1	1	4	2.341	2	0.8663	0.3701	0.2987
JHC-MW-15015	11	5	1	5	1.555	1	1.209	0.778	2.359
JHC-MW-15016	11	4	1	4	1.591	1	0.97	0.6097	1.543

Summary Report

Constituent: Cobalt, Total Analysis Run 2/20/2019 12:38 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/7/2015 and 11/15/2018, a summary of the selected data set:

Observations = 33
ND/Trace = 33
Wells = 3
Minimum Value = 6
Maximum Value = 15
Mean Value = 14.18
Median Value = 15
Standard Deviation = 2.627
Coefficient of Variation = 0.1853
Skewness = -2.846

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15013	11	11	6	15	14.18	15	2.714	0.1913	-2.846
JHC-MW-15015	11	11	6	15	14.18	15	2.714	0.1913	-2.846
JHC-MW-15016	11	11	6	15	14.18	15	2.714	0.1913	-2.846

Summary Report

Constituent: Fluoride Analysis Run 2/20/2019 12:38 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/7/2015 and 11/15/2018, a summary of the selected data set:

Observations = 36
ND/Trace = 36
Wells = 3
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-15013	12	12	1000	1000	1000	1000	0	0	NaN
JHC-MW-15015	12	12	1000	1000	1000	1000	0	0	NaN
JHC-MW-15016	12	12	1000	1000	1000	1000	0	0	NaN

Summary Report

Constituent: Lead, Total Analysis Run 2/20/2019 12:38 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/7/2015 and 11/15/2018, a summary of the selected data set:

Observations = 33
ND/Trace = 33
Wells = 3
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-15013	11	11	1	1	1	1	0	0	NaN
JHC-MW-15015	11	11	1	1	1	1	0	0	NaN
JHC-MW-15016	11	11	1	1	1	1	0	0	NaN

Summary Report

Constituent: Lithium, Total Analysis Run 2/20/2019 12:38 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/7/2015 and 11/15/2018, a summary of the selected data set:

Observations = 33
ND/Trace = 32
Wells = 3
Minimum Value = 10
Maximum Value = 10.3
Mean Value = 10.01
Median Value = 10
Standard Deviation = 0.05222
Coefficient of Variation = 0.005218
Skewness = 5.48

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15013	11	11	10	10	10	10	0	0	NaN
JHC-MW-15015	11	10	10	10.3	10.03	10	0.09045	0.009021	2.846
JHC-MW-15016	11	11	10	10	10	10	0	0	NaN

Summary Report

Constituent: Mercury, Total Analysis Run 2/20/2019 12:38 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/7/2015 and 11/15/2018, a summary of the selected data set:

Observations = 33
ND/Trace = 33
Wells = 3
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-15013	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15015	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15016	11	11	0.2	0.2	0.2	0.2	0	0	NaN

Summary Report

Constituent: Molybdenum, Total Analysis Run 2/20/2019 12:38 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/7/2015 and 11/15/2018, a summary of the selected data set:

Observations = 33
ND/Trace = 7
Wells = 3
Minimum Value = 5
Maximum Value = 122
Mean Value = 22.33
Median Value = 10
Standard Deviation = 30.26
Coefficient of Variation = 1.355
Skewness = 2.063

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15013	11	5	5	11.95	6.923	5.6	2.42	0.3496	0.859
JHC-MW-15015	11	0	6	75	24	11.7	24.4	1.017	1.319
JHC-MW-15016	11	2	5	122	36.06	11	43.1	1.195	1.098

Summary Report

Constituent: Radium-226 Analysis Run 2/20/2019 12:38 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/7/2015 and 11/15/2018, a summary of the selected data set:

Observations = 33
ND/Trace = 29
Wells = 3
Minimum Value = 0.159
Maximum Value = 0.898
Mean Value = 0.423
Median Value = 0.341
Standard Deviation = 0.2093
Coefficient of Variation = 0.4947
Skewness = 0.6142

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15013	11	8	0.187	0.84	0.4326	0.341	0.2174	0.5025	0.5999
JHC-MW-15015	11	11	0.167	0.708	0.3781	0.281	0.179	0.4735	0.4476
JHC-MW-15016	11	10	0.159	0.898	0.4583	0.387	0.239	0.5216	0.4888

Summary Report

Constituent: Radium-226/228 Analysis Run 2/20/2019 12:38 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/7/2015 and 11/15/2018, a summary of the selected data set:

Observations = 33
ND/Trace = 21
Wells = 3
Minimum Value = 0.488
Maximum Value = 1.88
Mean Value = 1.01
Median Value = 0.945
Standard Deviation = 0.4441
Coefficient of Variation = 0.4397
Skewness = 0.4256

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15013	11	7	0.528	1.54	0.9273	0.685	0.4189	0.4518	0.3737
JHC-MW-15015	11	9	0.488	1.52	0.9753	0.945	0.3737	0.3832	0.04595
JHC-MW-15016	11	5	0.532	1.88	1.127	1.05	0.5404	0.4794	0.2871

Summary Report

Constituent: Radium-228 Analysis Run 2/20/2019 12:38 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/7/2015 and 11/15/2018, a summary of the selected data set:

Observations = 33
ND/Trace = 21
Wells = 3
Minimum Value = 0.393
Maximum Value = 1.61
Mean Value = 0.7385
Median Value = 0.67
Standard Deviation = 0.248
Coefficient of Variation = 0.3358
Skewness = 1.559

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15013	11	8	0.393	0.99	0.6885	0.67	0.2078	0.3018	0.3054
JHC-MW-15015	11	8	0.488	0.922	0.7082	0.75	0.1354	0.1913	-0.09394
JHC-MW-15016	11	5	0.519	1.61	0.8188	0.659	0.3528	0.4308	1.202

Summary Report

Constituent: Selenium, Total Analysis Run 2/20/2019 12:38 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

For observations made between 12/7/2015 and 11/15/2018, a summary of the selected data set:

Observations = 33
ND/Trace = 18
Wells = 3
Minimum Value = 1
Maximum Value = 22
Mean Value = 3.418
Median Value = 1
Standard Deviation = 5.425
Coefficient of Variation = 1.587
Skewness = 2.466

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15013	11	10	1	1	1	1	0	0	NaN
JHC-MW-15015	11	2	1	22	7.764	5	7.897	1.017	0.7736
JHC-MW-15016	11	6	1	3	1.491	1	0.7231	0.485	0.9579

Summary Report

Constituent: Thallium, Total Analysis Run 2/20/2019 12:38 PM
Client: Consumers Energy Data: JHC_Sanitas_19.02.18

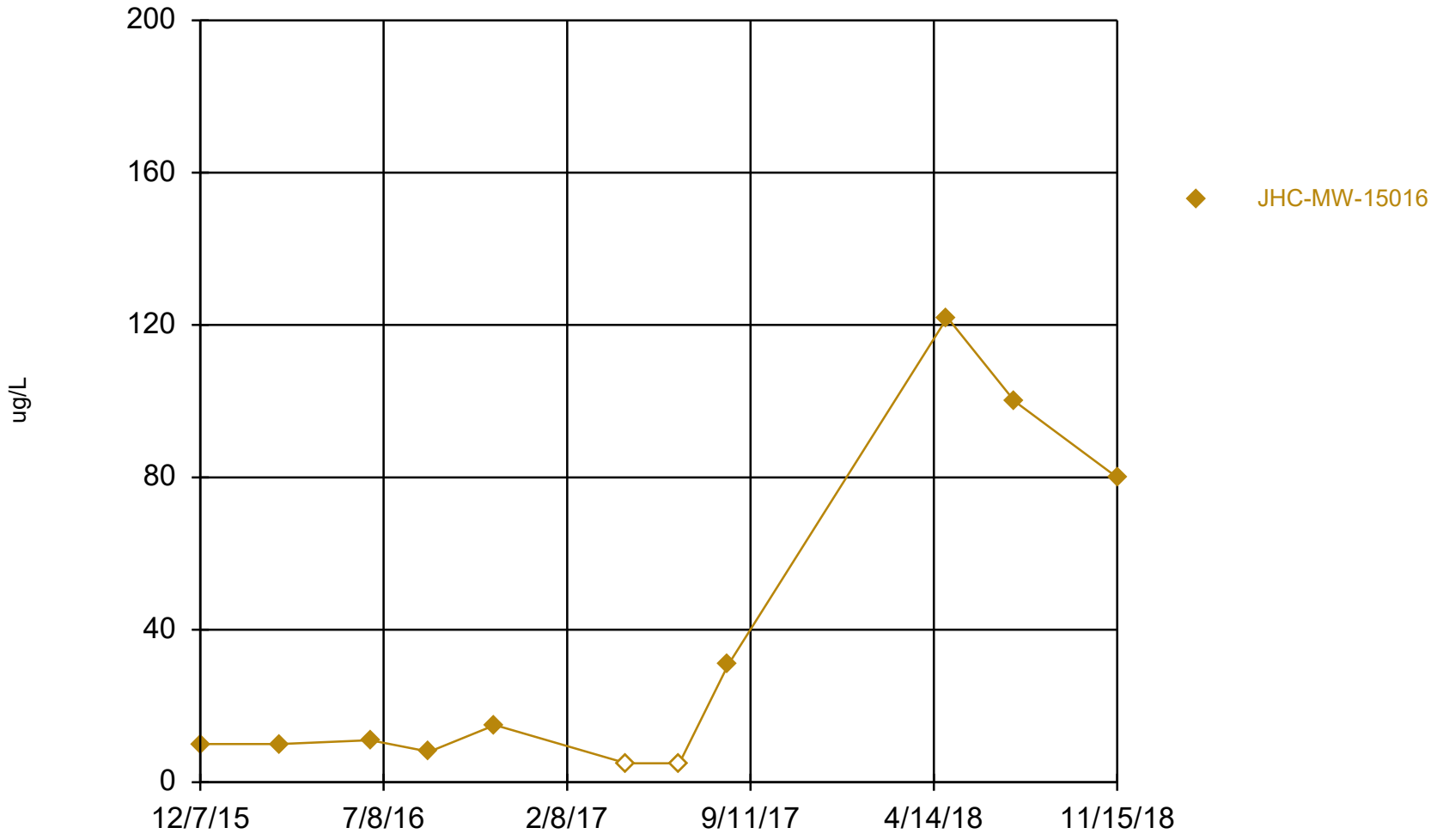
For observations made between 12/7/2015 and 11/15/2018, a summary of the selected data set:

Observations = 33
ND/Trace = 33
Wells = 3
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-15013	11	11	2	2	2	2	0	0	NaN
JHC-MW-15015	11	11	2	2	2	2	0	0	NaN
JHC-MW-15016	11	11	2	2	2	2	0	0	NaN

Hollow symbols indicate censored values.

Time Series

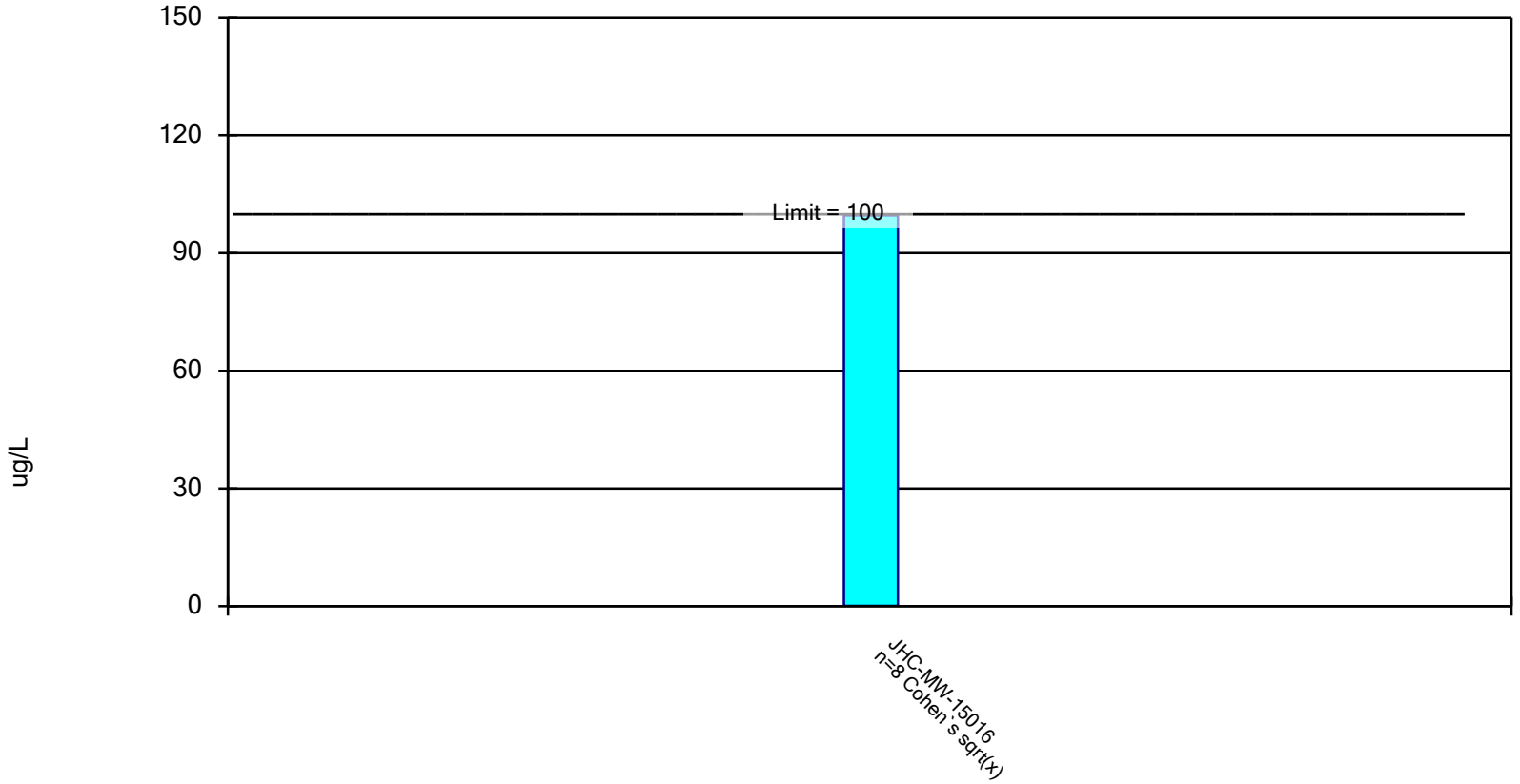


Constituent: Molybdenum, Total Analysis Run 2/20/2019 12:37 PM

Client: Consumers Energy Data: JHC_Sanitas_19.02.18

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Molybdenum, Total Analysis Run 2/20/2019 12:36 PM

Client: Consumers Energy Data: JHC_Sanitas_19.02.18

Confidence Interval

Constituent: Molybdenum, Total (ug/L) Analysis Run 2/20/2019 12:36 PM

Client: Consumers Energy Data: JHC_Sanitas_19.02.18

	JHC-MW-15016
8/31/2016	8
11/16/2016	15
4/19/2017	<5
6/20/2017	<5
8/16/2017	30.7
4/30/2018	122
7/18/2018	100
11/15/2018	80
Mean	45.71
Std. Dev.	47.58
Upper Lim.	99.57
Lower Lim.	0.1012

Appendix D
Data Quality Reviews

Laboratory Data Quality Review
Groundwater Sample Event February and March 2019
CEC JH Campbell Unit 3

Groundwater samples were collected by TRC for the February and March 2019 JH Campbell Unit 3 sampling events. Samples were analyzed for anions, total metals, alkalinity, total dissolved solids, and pH by Eurofins Test America Laboratories (Eurofins TA), located in Irvine, CA and for radium by Eurofins TA in St. Louis, MO. The laboratory analytical results are reported in laboratory reports 440-235149-1, 440-235153-1, 440-236314-1, and 440-236315-1.

During the February and March 2019 sampling events, a groundwater sample was collected from each of the following wells:

- JHC-MW-15013
- JHC-MW-15015
- JHC-MW-15016
- JHC-MW-18001
- JHC-MW-18002
- JHC-MW-18003

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Chloride, Fluoride, Sulfate)	EPA 300.0
Total Dissolved Solids	SM 2540C-11
Total Metals	SW846 6010C/6020A/7470A
Radium (Radium-226, Radium-228, Total Radium)	EPA 903.1, EPA 904.0
Alkalinity (Total, Carbonate, Bicarbonate)	SM 2320B-11
pH	SM 4500 H + B

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

Data Quality Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund 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;
- Data for matrix spike (MS) and matrix spike duplicate (MSD) samples, when performed on project samples. 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;
- 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 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 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:

- The holding times were met for all parameters for all samples with the following exception:
  - Samples JHC-MW-15013, JHC-MW-15015, JHC-MW-15016, JHC-MW-18001, DUP-2, EB-2, and FB-2 were analyzed for pH outside the 15-minute holding time requirement; these pH results may be estimated since they were analyzed 7 to 8 days after sample collection.
- Target analytes were not detected in the method blanks, equipment blank (EB-2), and field blank (FB-2).
- LCS recoveries for all target analytes were within laboratory control limits.
- The field duplicate pair samples were DUP-2 and JHC-MW-15013, and DUP-3 and JHC-MW-18003. The relative percent differences (RPDs) between the parent and duplicate sample were within the acceptance limits.
- MS/MSD analyses were performed on sample JHC-MW-15016 for radium, anions, metals, and mercury; on sample DUP-3 for metals by SW846 method 6020; and on sample JHC-MW-18002 for mercury; the percent recoveries (%Rs) and RPDs were within the acceptance limits with the following exception:
  - The recovery of calcium in the MS was above the acceptance criteria. However, the calcium concentration in the parent sample JHC-MW-15016 was >4x the spike concentration; therefore, the laboratory control limits are not applicable. Data usability was not affected.
- Laboratory duplicate analysis was performed on sample JHC-MW-15016 for pH, alkalinity, and TDS; and on sample JHC-MW-18003 for alkalinity; the RPDs were within the acceptance limit.
- Carrier and tracer recoveries, where applicable, were within 30-110%.
- The RLs for nondetect results for chloride, boron, and TDS in field blank (FB-2) and in equipment blank (EB-2) exceeded the project-required RLs. This does not affect data usability since these are QC samples.

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 Unit 3

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) 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) 440-239941-2, 440-240198-2, 440-239944-2, 440-239935-2, 440-239939-2, and 440-240186-2.

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

- JHC-MW-150013
- JHC-MW-150015
- JHC-MW-150016
- JHC-MW-18001
- JHC-MW-18002
- JHC-MW-18003

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 6010B/6020A/7470A
Radium (Ra-226, Ra-228, Combined Ra-226 & Ra-228)	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, 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) and/or the LCS duplicate (LCSDs) samples. The LCSs and/or LCSDs are used to assess the accuracy and precision of the analytical method using a clean matrix;
- Data for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. 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 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 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, when available. 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

- Holding time criteria were met for all analytes with the exception of alkalinity. Samples JHC-MW-18001, JHC-MW-18002, and JHC-MW-18003 were analyzed one day past the 14-day holding time criteria. These results may be estimated, biased low, as summarized in the attached table.
- No target analytes were detected in the method blanks.
- One equipment blank (EB-04) was collected. Magnesium was detected at 0.037 mg/L; there was no impact on data usability since the sample results were >5x the blank concentration.
- LCS and/or LCSD percent recoveries (%Rs) and relative percent differences (RPDs) were within laboratory control limits.
- MS/MSD analyses were performed on sample JHC-MW-18003 for metals and anions. All criteria were met; however, the %Rs of sulfate, magnesium, and/or calcium in the MS and/or /MSD were outside of the acceptance criteria. However, the concentrations of these analytes in the parent sample JHC-MW-18003 were >4x the spike concentrations; therefore, the laboratory control limits were not applicable. Data usability was not affected.
- Laboratory duplicate analyses were performed on sample JHC MW 18003 for alkalinity and TDS; RPDs between the parent and duplicate sample were within the QC limits.
- There were no field duplicates available with this data set. Data for blind field duplicates met all criteria for the field duplicate pair samples collected from the background data set and the other data sets collected concurrently during the April 2019 monitoring event.
- Carrier recoveries for radium, where applicable, were within laboratory control criteria.

Attachment A

Summary of Data Non-Conformances
JH Campbell Unit 3 Downgradient – RCRA CCR Monitoring Program
West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-18001	4/25/2019	Total Alkalinity, Bicarbonate Alkalinity, Carbonate Alkalinity	Holding time exceeded; results may be biased low.
JHC-MW-18002	4/25/2019		
JHC-MW-18003	4/25/2019		

Laboratory Data Quality Review
Groundwater Monitoring Event August 2019
Consumers Energy JH Campbell Pond 3

Groundwater samples were collected by TRC for the August 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 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) 240-117432-1 and 240-117432-2.

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

- JHC-MW-18001
- JHC-MW-18002
- JHC-MW-18003

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 LCS duplicates (LCSDs), where applicable. The LCS/LCSDs are used to assess the accuracy and precision 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 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, where applicable. 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

- Holding time criteria were met.

- Target analytes were not detected in the laboratory method blanks with one exception. Radium-228 was detected at 0.5648 pCi/L in MB-160-440082/5-A. However, data usability was not affected since radium-228 was not detected in the associated sample.
- One field blank (FB-2) and one equipment blank (EB-2) were collected; no analytes were detected in either blank.
- LCS/LCSD recoveries and relative percent differences (RPDs), where applicable, were within laboratory control limits.
- MS/MSDs were performed on sample JHC-MW-18002 for metals and anions and sample JHC-MW-18003 for anions. The recoveries and RPDs were within the QC limits in sample JHC-MW-18003.
  - The recoveries of calcium in the MS/MSD performed on sample JHC-MW-18002 were above the the acceptance criteria. However, the calcium concentration in the parent sample JHC-MW-18002 was >4x the spike concentration; therefore, the laboratory control limits for calcium were not applicable. Data usability was not affected.
- Laboratory duplicate analysis was performed for TDS on sample JHC-MW-18002; the RPD between the parent and duplicate sample was within the QC limit.
- The field duplicate pair samples were Dup-2 and JHC-MW-18003. All criteria were met.
- Carrier recoveries, where applicable, were within 40-110%.

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 Pond 3

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 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) 240-120345-1 and 240-120345-2.

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

- JHC-MW-150013
- JHC-MW-150015
- JHC-MW-150016
- JHC-MW-18001
- JHC-MW-18002
- JHC-MW-18003

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 (Ra-226, Ra-228, Combined Ra-226 & Ra-228)	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, 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) and/or LCS duplicate (LCSD) samples, where applicable. The LCSs and/or LCSDs are used to assess the accuracy and precision of the analytical method using a clean matrix;
- Data for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. 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 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 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, when available. 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

- A method blank was analyzed with each analytical batch. Target analytes were not detected in the method blank samples.

- One equipment blank (EB-4) and one field blank (FB-4) were collected. Target analytes were not detected in these blank samples with the following exceptions. Normalized absolute difference comparisons between blanks and samples that are <1.96 may indicate a false positive sample result.
  - Boron was detected in EB-4 at 0.082 mg/L. Potential false positive exists for the positive results for boron in select associated samples as summarized in the attached table, Attachment A.
  - Chromium was detected in EB-4 at 0.0016 mg/L. Potential false positive exists for the positive results for chromium in select samples as summarized in the attached table, Attachment A.
  - Lead was detected in EB-4 at 0.0024 mg/L. However, data usability not affected since lead was not detected in the associated samples.
  - Radium-226 was detected in EB-4 at 0.158 +/- 0.0936 pCi/L. Potential false positive exists for the positive results for radium-226 in select associated samples 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 sample JHC-MW-18002 for metals and anions. All recoveries and RPDs were within the QC limits.
- Laboratory duplicate analysis was performed on sample JHC-MW-18002 for alkalinity and TDS; the RPD between the parent and duplicate sample was within the QC limit.
- The field duplicate pair samples were DUP-4 and JHC-MW-15016. All criteria were met.
- 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 for Landfill Groundwater Analytical Data
JH Campbell Power Plant Landfill Bottom Ash Pond Unit 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15013	10/10/2019	Boron	Detection in equipment blank (EB-4). Results <5x the blank result; indicates possible false positive results.
JHC-MW-18001	10/10/2019		
JHC-MW-18002	10/10/2019		
JHC-MW-15013	10/10/2019	Chromium	Detection in equipment blank (EB-4). Results <5x the blank result; indicates possible false positive results.
JHC-MW-15015	10/10/2019		
JHC-MW-15016	10/10/2019		
DUP-4	10/10/2019		
JHC-MW-15013	10/10/2019	Radium 226	Detection in equipment blank (EB-4). Normalized absolute difference between blank and samples <1.96; indicates possible false positive results.
JHC-MW-15015	10/10/2019		
JHC-MW-15016	10/10/2019		
JHC-MW-18001	10/10/2019		
JHC-MW-18002	10/10/2019		
DUP-4	10/10/2019		

Appendix E
June 2018 Statistical Evaluation of Initial Assessment Monitoring Sampling Event

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January 14, 2019

Bethany Swanberg
Environmental Services
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1945 W. Parnall Road
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Subject: Statistical Evaluation of Initial Assessment Monitoring Sampling Event,
JH Campbell Bottom Ash Pond Unit 3 North and 3 South CCR Unit, 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 Unit 3 North and 3 South CCR Unit* (2018 Annual Report) for the JH Campbell (JHC) site in West Olive, Michigan, that boron, calcium, sulfate and total dissolved solids were observed at concentrations within groundwater at one or more downgradient monitoring well(s) with potential statistically significant increases (SSIs) above background concentration levels. TRC performed 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 Unit 3 North and 3 South CCR Unit (Unit 3) 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 Appendix IV constituents with MCLs and the higher of the EPA Regional Screening Level (RSL) or background level for

[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 with RSLs. The JHC Unit 3 monitoring system was subsequently sampled for the Appendix III and Appendix IV constituents within 90 days from the initial Appendix IV sampling event (June 2018, with monitoring well JHC-MW-15016 sampled in July 2018 following active construction in the area). 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 are present at statistically significant levels exceeding the GWPSs in downgradient monitoring wells at the JHC Unit 3 CCR unit.

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. Currently, there are no active CCR surface impoundments at the JHC solid waste disposal facility. Figure 1 is a site location map showing the facility and the surrounding area. Site features are shown on Figure 2.

CEC provided notification of initiation of closure on April 5, 2017 to the Michigan Department of Environmental Quality (MDEQ) to implement the certified closure plan by removal of CCR under the self-implementing requirements and schedule of the CCR Rule. Groundwater monitoring is also ongoing throughout the JHC site in accordance with the MDEQ-approved Hydrogeological Monitoring Plan (HMP)[2] for the Dry Ash Landfill, which includes additional monitoring downgradient from the JHC Unit 3 CCR unit.

Groundwater Monitoring System

In accordance with 40 CFR 257.91, CEC established a groundwater monitoring system for the JHC Unit 3, which consists of 10 monitoring wells (six background monitoring wells and four downgradient monitoring wells) that are screened in the uppermost aquifer. Six monitoring wells located north-northwest of the JHC Unit 3 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

[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.

groundwater monitoring program at three other CCR units on the JHC site. The four downgradient monitoring wells are JHC-MW-15012, JHC-MW-15013, JHC-MW-15015 and JHC-MW-15016. The monitoring well locations are shown on Figure 2.

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. While the general overall groundwater flow direction measured across the JHC site during these assessment monitoring events is similar to that identified in previous monitoring events, groundwater flow changes were observed in the immediate vicinity of Unit 3 during the April 2018 event as a result of temporary cessation of hydraulic loading between March 14 and April 26, 2018. During the timeframe that hydraulic loading had been discontinued, the groundwater flow was predominantly toward the west instead of radially outward from JHC Unit 3 (Figure 3). Although the groundwater flow returned to the typical radial flow pattern around JHC Unit 3 in June 2018 (Figure 4), during the continuation of active hydraulic loading, it is expected that groundwater flow will change again once hydraulic loading is permanently discontinued at JHC Unit 3.

In addition, one of the downgradient monitoring wells (JHC-MW-15012) had been damaged during CCR removal activities in October 2018 (after the completion of the initial assessment monitoring events) and was decommissioned during that time. Following to the completion of the CCR removal activities, three additional monitoring wells were installed along the west and southwest edges of JHC Unit 3 during the week of December 3, 2018 in order to replace the decommissioned well and reassess groundwater flow in the vicinity of JHC Unit 3.

As such, the JHC Unit 3 groundwater monitoring system will be re-evaluated subsequent to the completion of the CCR removal activities and permanent discontinuation of hydraulic loading. After groundwater flow patterns in the immediate vicinity of the CCR unit have equilibrated post-deconstruction, data collected from the new monitoring wells will be used to determine which monitoring wells are appropriately positioned to assess groundwater quality downgradient from the Unit 3 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 events, compliance well data for the JHC Unit 3 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 for each well were first compared directly to the GWPS, as shown on Table 1. Parameter-well combinations that included a direct exceedance of the GWPS were retained for further analysis. Molybdenum in JHC-MW-15016 at JHC Unit 3 had a single, individual result exceeding the GWPS during the April 2018 monitoring event.

A significant change in groundwater flow conditions was observed in the vicinity of monitoring well JHC-MW-15016, located east of the northern portion of JHC Unit 3; where groundwater flow changed from radially outward to predominantly southwest across the northern portion of JHC Unit 3 following the cessation of hydraulic loading and removal of CCR at the Unit 3 North Bottom Ash Pond (April through June 2017); temporary cessation of hydraulic loading in the JHC Unit 3 South Bottom Ash Pond between March 14 and April 26, 2018; in addition to construction of the concrete pad over top of the former Unit 3 North Bottom Ash Pond (May through July 2018). As a result of this groundwater flow change, monitoring well JHC-MW-15016 was no longer positioned downgradient from the JHC Unit 3. Also, during this timeframe (between the last background monitoring event in August 2017 and the initial assessment monitoring event in April 2018) an increase in the molybdenum concentration was observed in groundwater collected from monitoring well JHC-MW-15016.

Considering that JHC-MW-15016 was hydraulically upgradient from JHC Unit 3 and CCR had been removed from Unit 3 North at the time of the assessment monitoring sampling events, it is likely that the groundwater quality measured at monitoring well JHC-MW-15016 in April and July 2018, is more representative of groundwater flowing toward the CCR unit from the northeast, prior to being influenced by the JHC Unit 3 CCR unit. As such, the molybdenum groundwater data is considered suspect for the purposes of assessing groundwater quality influenced by the JHC Unit 3 CCR unit. However, CCR removal activities in the southern portion of JHC Unit 3 were recently completed in October 2018, groundwater conditions are still re-equilibrating and the groundwater monitoring system is being re-assessed to account for post-deconstruction groundwater conditions. Because hydrogeologic conditions are in the process of stabilizing, in order to be conservative, the April and July 2018 molybdenum data have been kept in the assessment monitoring data set pending the collection of additional data from the new and existing wells located in the vicinity of the JHC Unit 3 CCR unit that will be used to further assess stabilized groundwater flow and characteristics.

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

Groundwater data were then evaluated utilizing Sanitas™ statistical software. Sanitas™ is a software tool that is commercially available for performing statistical evaluation consistent with procedures outlined in the Unified Guidance. Within the Sanitas™ statistical program, confidence limits were selected to perform the statistical comparison of compliance data to a fixed standard. Parametric and non-parametric confidence intervals were calculated, as appropriate, for each of the CCR Appendix IV parameters using a 99 percent confidence level, i.e., a significance level (α) of 0.01. The following narrative describes the methods employed, the results obtained and the Sanitas™ output files are included as an attachment.

The statistical data evaluation included the following steps:

- Review of data quality checklists for the data sets for CCR Appendix IV constituents;
- Graphical representation of the monitoring data as time versus concentration by well-constituent pair;
- Outlier testing of individual data points that appear from the graphical representations as potential outliers;
- Evaluation of visual trends apparent in the graphical representations for statistical significance;
- Evaluation of percentage of non-detects for each well-constituent pair;
- Distribution of the data; and
- Calculation of the confidence intervals for each cumulative dataset.

The results of these evaluations are presented and discussed below.

Initially, the baseline (December 2015 through August 2017) results and the two assessment monitoring results (April and June 2018) for molybdenum in JHC-MW-15016 were observed visually for a potential trend. No outliers or trends were identified. The Sanitas™ software was then used to test compliance for molybdenum at the downgradient monitoring wells using the confidence interval method for the most recent 8 sampling events. Eight independent sampling events provide the appropriate density of data as recommended per the Unified Guidance yet are collected recently enough to provide an indication of current condition. The test was run with a per-well significance of $\alpha = 0.01$. The software outputs are included in Attachment A along with data reports showing the values used for the evaluation. The percentage of non-detect observations are also included in Attachment A. Non-detect data was handled in accordance with the Stats Plan for the purposes of calculating the confidence intervals.

The Sanitas™ software generates an output that includes graphs of the parametric or non-parametric confidence intervals for each well along with notes on data transformations, as appropriate. The JHC-MW-15016 data set was found to be normally distributed. The confidence interval test compares

the lower confidence limit to the GWPS. The calculated upper and lower confidence limits and comparison of the lower confidence limits to the GWPSs are also summarized in Table 2.

The statistical evaluation of the Appendix IV data shows there are no GWPS exceedances in groundwater at the JHC Unit 3. 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 enter this statistical evaluation of the assessment monitoring data into the operating record by January 14, 2019. The notification of the GWPS exceedances to the state will be posted by CEC to a public CCR compliance website as required by §257.105(h)(8) by February 13, 2019. By April 14, 2019, in accordance with §257.95(g)(3), an assessment of corrective measures will be initiated. This assessment will be completed no later than September 11, 2019 in accordance with the timeframes provided in §257.96(a)(1).

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
Table 2.	Summary of Groundwater Protection Standard Exceedances – 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

Tables

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to July 2018
JH Campbell Unit 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15012											
						Sample Date:	12/8/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/20/2017	8/15/2017	9/26/2017	4/27/2018	4/27/2018	6/19/2018	6/19/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient												
Appendix III																	Field Dup		Field Dup
Boron	ug/L	NC	NA	51	NA		178	164	160	171	253	212	249	159	180	--	--	205	202
Calcium	mg/L	NC	NA	46	NA		36.2	48.5	58.7	67.3	87.8	41.4	37.7	30.5	30.9	--	--	34.5	34.3
Chloride	mg/L	250*	NA	43	NA		13.4	24.4	23.8	25.2	21.8	17.8	16.7	15.0	15.0	--	--	15.7	15.7
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
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.5	7.6	7.3	7.7	7.0	7.7	7.6	7.6	7.6	7.5	--	7.7	--
Sulfate	mg/L	250*	NA	14	NA		31.8	38.3	51.7	37.8	64.2	32.9	29.2	32.8	29.6	--	--	30.6	30.7
Total Dissolved Solids	mg/L	500*	NA	258	NA		190	240	300	280	430	200	250	174	158	--	--	186	226
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		68	62	63	54	122	86	79.9	66.7	--	53.2	53.2	104	98.7
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		2	2	2	2	2	2	< 1.0	< 1.0	--	< 1.0	1.4	1.9	2.0
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
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	12	7	13	7	5.2	5.5	--	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA		< 0.285	< 0.207	< 0.124	< 0.406	< 0.182	< 0.258	0.828	0.461	--	< 0.653	< 0.698	< 0.516	< 0.591
Radium-226/228	pCi/L	5	NA	1.93	5		< 0.483	0.813	< 0.585	< 0.647	< 0.861	< 0.374	< 1.43	< 1.30	--	< 1.42	< 1.56	< 1.48	1.73
Radium-228	pCi/L	5	NA	NA	NA		< 0.483	0.674	< 0.585	< 0.647	< 0.861	< 0.374	< 0.656	< 0.880	--	< 0.770	< 0.866	< 0.966	1.40
Selenium	ug/L	50	NA	5	50		< 1	7	4	3	7	3	< 1.0	< 1.0	--	3.2	2.9	1.3	1.5
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.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to July 2018
JH Campbell Unit 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15013												
						Sample Date:	12/8/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/20/2017	6/20/2017	8/15/2017	8/15/2017	9/26/2017	9/26/2017	4/30/2018	6/19/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient													
Appendix III														Field Dup		Field Dup		Field Dup		
Boron	ug/L	NC	NA	51	NA		141	160	128	139	163	187	208	207	153	171	147	151	--	258
Calcium	mg/L	NC	NA	46	NA		37.8	50.1	50.8	61.7	44.3	40.5	34.8	33.3	30.0	30.5	31.5	33.6	--	37.4
Chloride	mg/L	250*	NA	43	NA		13.3	24.8	27.2	24.9	23.8	17.6	16.8	16.8	15.2	15.3	15.2	15.2	--	16.2
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
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.8	7.6	7.5	7.4	7.2	7.6	7.5	--	7.6	--	7.7	--	7.7	7.7
Sulfate	mg/L	250*	NA	14	NA		31	35.2	46.1	43	42.1	30.8	29.5	29.5	33.4	33.5	30.9	30.9	--	34.8
Total Dissolved Solids	mg/L	500*	NA	258	NA		190	230	280	260	230	220	164	158	184	274	212	178	--	230
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		16	14	19	18	18	18	20.3	20.0	15.4	15.3	--	--	16.1	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
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		3	3	2	2	2	4	1.6	1.6	< 1.0	< 1.0	--	--	1.5	2.9
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
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	9	9	9	< 5	< 5.0	< 5.0	5.3	5.9	--	--	6.6	< 5.0
Radium-226	pCi/L	5	NA	NA	NA		< 0.219	< 0.302	0.187	< 0.341	< 0.223	< 0.32	< 0.840	< 0.517	0.489	< 0.573	--	--	< 0.518	< 0.548
Radium-226/228	pCi/L	5	NA	1.93	5		0.578	< 0.53	< 0.528	< 0.601	< 0.685	0.548	< 1.53	< 1.27	0.990	< 1.34	--	--	< 1.19	< 1.54
Radium-228	pCi/L	5	NA	NA	NA		0.489	< 0.53	< 0.528	< 0.601	< 0.685	0.393	0.876	1.06	< 0.689	< 0.764	--	--	< 0.670	< 0.990
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.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to July 2018
JH Campbell Unit 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15015										
						Sample Date:	12/7/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/20/2017	8/16/2017	9/27/2017	4/30/2018	6/19/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient										
Appendix III																	
Boron	ug/L	NC	NA	51	NA		469	280	238	348	355	371	697	439	518	--	194
Calcium	mg/L	NC	NA	46	NA		57.5	80.6	54.4	128	60.1	80	52.3	59.0	58.8	--	57.3
Chloride	mg/L	250*	NA	43	NA		15.1	18.1	10.5	96.9	12.3	36.4	30.8	17.6	15.1	--	22.0
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		7.4	7.2	7.3	7.0	7.2	7.5	7.3	7.3	7.3	7.1	7.3
Sulfate	mg/L	250*	NA	14	NA		34.1	32.2	13.4	52.2	30.1	48.8	40.5	34.1	28.8	--	54.6
Total Dissolved Solids	mg/L	500*	NA	258	NA		260	260	250	740	240	360	346	222	328	--	362
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		30	36	27	59	34	46	34.9	31.1	--	24.5	36.7
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	2	1	2	5	< 1.0	< 1.0	--	1.1	< 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	10.3	< 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	8	8	75	15	11	65.0	15.2	--	11.7	11.2
Radium-226	pCi/L	5	NA	NA	NA		< 0.273	< 0.206	< 0.167	< 0.281	< 0.214	< 0.26	< 0.466	< 0.550	--	< 0.708	< 0.506
Radium-226/228	pCi/L	5	NA	1.93	5		0.945	< 0.63	< 0.488	< 0.565	< 0.636	0.764	< 1.26	< 1.32	--	< 1.52	< 1.26
Radium-228	pCi/L	5	NA	NA	NA		0.845	< 0.63	< 0.488	< 0.565	< 0.636	0.582	< 0.789	< 0.774	--	< 0.809	< 0.750
Selenium	ug/L	50	NA	5	50		8	1	1	3	18	5	22.0	7.5	--	< 1.0	17.9
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.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to July 2018
JH Campbell Unit 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15016										
						Sample Date:	12/7/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/20/2017	8/16/2017	9/27/2017	4/30/2018	7/18/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient										
Appendix III																	
Boron	ug/L	NC	NA	51	NA		279	306	258	258	207	296	170	171	279	--	291
Calcium	mg/L	NC	NA	46	NA		37.9	62.4	51.9	65.6	50.9	103	48.5	61.1	75.9	--	74.4
Chloride	mg/L	250*	NA	43	NA		13.5	13.4	7.51	11.5	12.1	78.8	28.2	24.5	21.8	--	43.6
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
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.5	7.3	7.4	7.4	7.1	7.4	7.6	7.3	7.3	6.8	6.9
Sulfate	mg/L	250*	NA	14	NA		22.8	21.2	9.71	32.4	31	26.8	41.2	56.0	62.6	--	31.9
Total Dissolved Solids	mg/L	500*	NA	258	NA		210	230	260	240	230	470	280	278	492	--	396
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	--	1.8	< 1.0
Barium	ug/L	2,000	NA	35	2,000		35	44	43	32	38	79	7.7	38.8	--	70.2	56.2
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	1	1	2	4	< 1.0	2.5	--	< 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**		10	10	11	8	15	< 5	< 5.0	30.7	--	**122**	100
Radium-226	pCi/L	5	NA	NA	NA		< 0.265	< 0.212	< 0.159	< 0.387	< 0.291	< 0.332	< 0.582	< 0.754	--	< 0.898	< 0.647
Radium-226/228	pCi/L	5	NA	1.93	5		0.875	< 0.547	0.552	0.682	< 0.532	1.05	< 1.22	< 1.41	--	< 1.85	1.88
Radium-228	pCi/L	5	NA	NA	NA		0.822	< 0.547	0.519	0.555	< 0.532	0.886	< 0.636	< 0.659	--	< 0.951	1.61
Selenium	ug/L	50	NA	5	50		< 1	< 1	1	< 1	2	3	< 1.0	2.2	--	< 1.0	2.2
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.

Table 2
Summary of Groundwater Protection Standard Exceedances – June 2018
JH Campbell Unit 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

Constituent	Units	GWPS	JHC-MW-15016	
			LCL	UCL
Molybdenum	ug/L	100	3.9	71

Notes:

ug/L - micrograms per Liter.

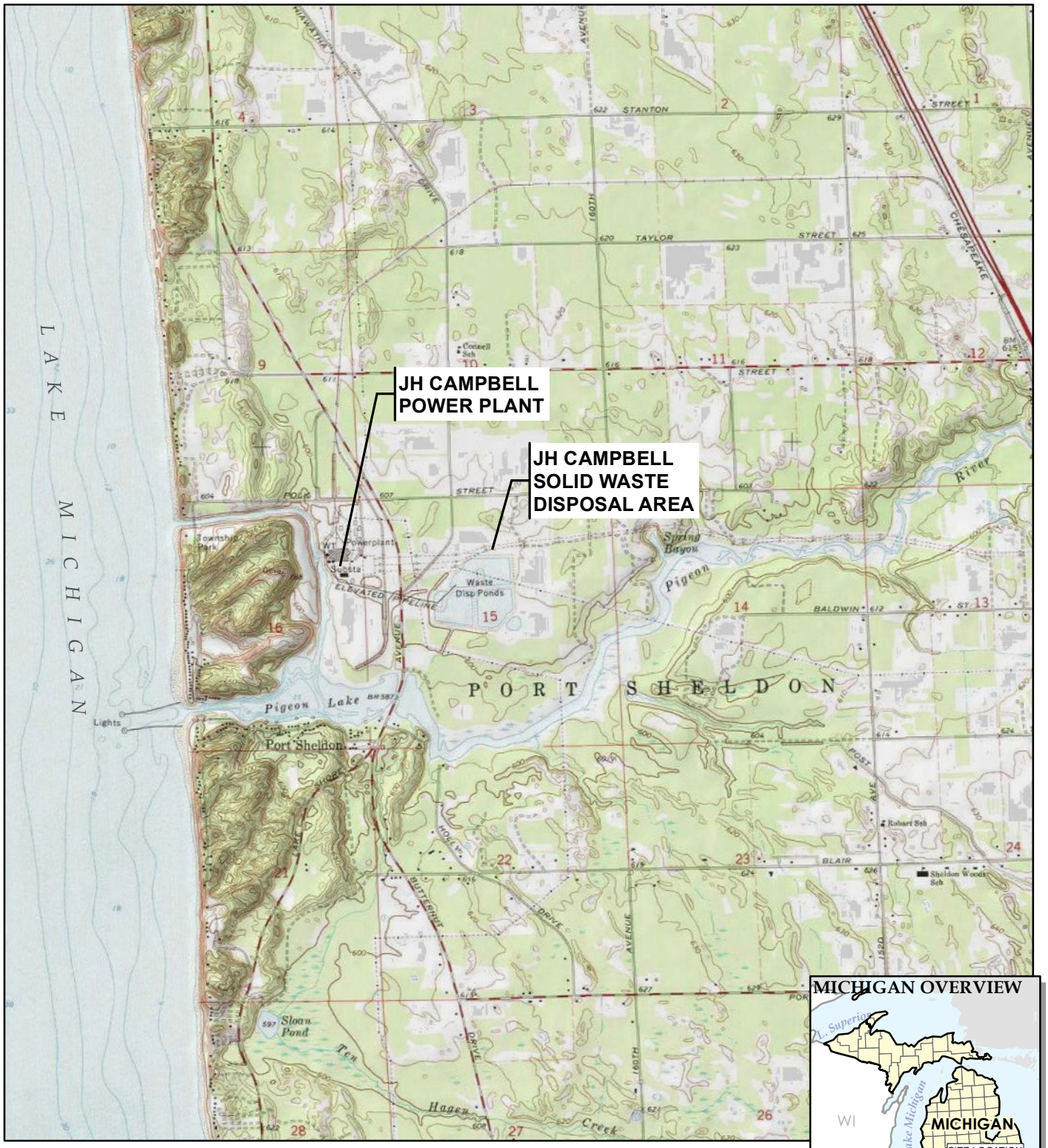
GWPS - Groundwater Protection Standard as established in TRC's Technical Memorandum dated October 15, 2018.

UCL - Upper Confidence Limit (α = 0.01) of the downgradient data set.

LCL - Lower Confidence Limit (α = 0.01) of the downgradient data set.

Indicates a statistically significant exceedance of the GWPS. An exceedance occurs when the LCL is greater than the GWPS.

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

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		**FIGURE 2**
APPROVED BY:	G. CROCKFORD		
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

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

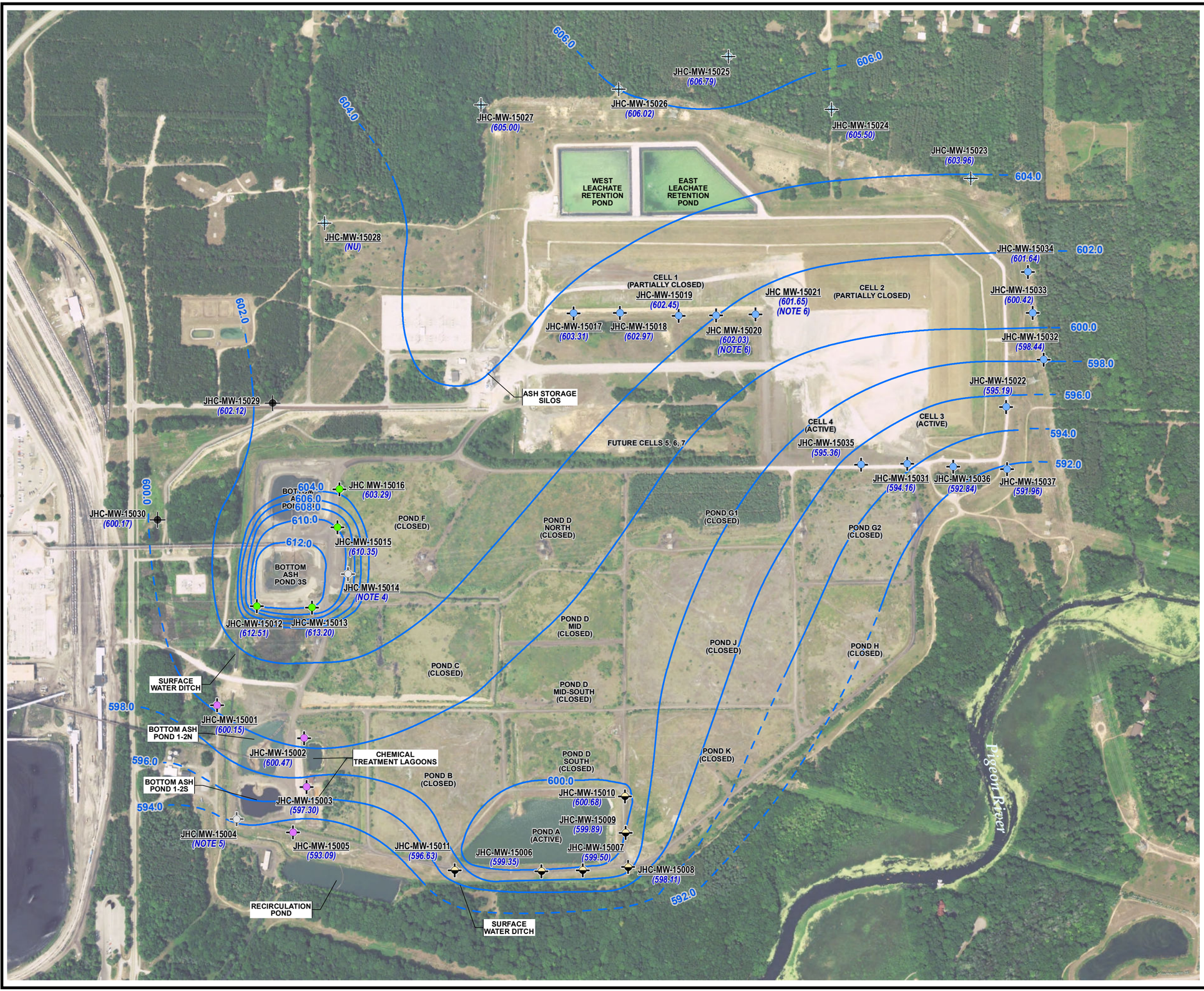
Plot Date: 11/28/2018, 13:36:00 PM by SMAJOR -- LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\290806-001-007.mxd
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

TRC - GIS

TRC - GIS

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

Plot Date: 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
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www.trcsolutions.com

FILE NO.: 290806-001-010.mxd

Attachment A
Sanitas™ Output

Summary Report

Constituent: Antimony, Total Analysis Run 11/26/2018 1:29 PM
Client: Consumers Energy Data: JHC_Unit_3_Sanitas

For observations made between 12/8/2015 and 7/19/2018, a summary of the selected data set:

Observations = 40
ND/Trace = 39
Wells = 4
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-15012	10	9	1	1	1	1	0	0	NaN
JHC-MW-15013	10	10	1	1	1	1	0	0	NaN
JHC-MW-15015	10	10	1	1	1	1	0	0	NaN
JHC-MW-15016	10	10	1	1	1	1	0	0	NaN

Summary Report

Constituent: Arsenic, Total Analysis Run 11/26/2018 1:29 PM
Client: Consumers Energy Data: JHC_Unit_3_Sanitas

For observations made between 12/8/2015 and 7/19/2018, a summary of the selected data set:

Observations = 40
ND/Trace = 37
Wells = 4
Minimum Value = 1
Maximum Value = 1.8
Mean Value = 1.02
Median Value = 1
Standard Deviation = 0.1265
Coefficient of Variation = 0.124
Skewness = 6.085

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15012	10	10	1	1	1	1	0	0	NaN
JHC-MW-15013	10	10	1	1	1	1	0	0	NaN
JHC-MW-15015	10	8	1	1	1	1	0	0	NaN
JHC-MW-15016	10	9	1	1.8	1.08	1	0.253	0.2342	2.667

Summary Report

Constituent: Barium, Total Analysis Run 11/26/2018 1:29 PM
Client: Consumers Energy Data: JHC_Unit_3_Sanitas

For observations made between 12/8/2015 and 7/19/2018, a summary of the selected data set:

Observations = 40
ND/Trace = 0
Wells = 4
Minimum Value = 7.7
Maximum Value = 122
Mean Value = 43.38
Median Value = 36.35
Standard Deviation = 26.12
Coefficient of Variation = 0.6022
Skewness = 0.9917

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15012	10	0	53.2	122	75.62	67.35	22.09	0.2921	0.9888
JHC-MW-15013	10	0	14	21.4	17.6	18	2.266	0.1288	0.0893
JHC-MW-15015	10	0	24.5	59	35.92	34.45	10.04	0.2796	1.248
JHC-MW-15016	10	0	7.7	79	44.39	40.9	20.18	0.4546	0.1103

Summary Report

Constituent: Beryllium, Total Analysis Run 11/26/2018 1:29 PM
Client: Consumers Energy Data: JHC_Unit_3_Sanitas

For observations made between 12/8/2015 and 7/19/2018, a summary of the selected data set:

Observations = 40
ND/Trace = 40
Wells = 4
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-15012	10	10	1	1	1	1	0	0	NaN
JHC-MW-15013	10	10	1	1	1	1	0	0	NaN
JHC-MW-15015	10	10	1	1	1	1	0	0	NaN
JHC-MW-15016	10	10	1	1	1	1	0	0	NaN

Summary Report

Constituent: Cadmium, Total Analysis Run 11/26/2018 1:29 PM
Client: Consumers Energy Data: JHC_Unit_3_Sanitas

For observations made between 12/8/2015 and 7/19/2018, a summary of the selected data set:

Observations = 40
ND/Trace = 40
Wells = 4
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-15012	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15013	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15015	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15016	10	10	0.2	0.2	0.2	0.2	0	0	NaN

Summary Report

Constituent: Chromium, Total Analysis Run 11/26/2018 1:29 PM
Client: Consumers Energy Data: JHC_Unit_3_Sanitas

For observations made between 12/8/2015 and 7/19/2018, a summary of the selected data set:

Observations = 40
ND/Trace = 10
Wells = 4
Minimum Value = 1
Maximum Value = 5
Mean Value = 1.819
Median Value = 1.975
Standard Deviation = 0.9555
Coefficient of Variation = 0.5254
Skewness = 1.459

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15012	10	2	1	2	1.715	2	0.451	0.2629	-0.9141
JHC-MW-15013	10	1	1	4	2.3	2	0.9018	0.3921	0.4282
JHC-MW-15015	10	4	1	5	1.61	1	1.26	0.7826	2.2
JHC-MW-15016	10	3	1	4	1.65	1	1.001	0.6069	1.403

Summary Report

Constituent: Cobalt, Total Analysis Run 11/26/2018 1:29 PM
Client: Consumers Energy Data: JHC_Unit_3_Sanitas

For observations made between 12/8/2015 and 7/19/2018, a summary of the selected data set:

Observations = 40
ND/Trace = 40
Wells = 4
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-15012	10	10	15	15	15	15	0	0	NaN
JHC-MW-15013	10	10	15	15	15	15	0	0	NaN
JHC-MW-15015	10	10	15	15	15	15	0	0	NaN
JHC-MW-15016	10	10	15	15	15	15	0	0	NaN

Summary Report

Constituent: Fluoride Analysis Run 11/26/2018 1:29 PM
Client: Consumers Energy Data: JHC_Unit_3_Sanitas

For observations made between 12/8/2015 and 7/19/2018, a summary of the selected data set:

Observations = 44
ND/Trace = 44
Wells = 4
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-15012	11	11	1000	1000	1000	1000	0	0	NaN
JHC-MW-15013	11	11	1000	1000	1000	1000	0	0	NaN
JHC-MW-15015	11	11	1000	1000	1000	1000	0	0	NaN
JHC-MW-15016	11	11	1000	1000	1000	1000	0	0	NaN

Summary Report

Constituent: Lead, Total Analysis Run 11/26/2018 1:29 PM
Client: Consumers Energy Data: JHC_Unit_3_Sanitas

For observations made between 12/8/2015 and 7/19/2018, a summary of the selected data set:

Observations = 40
ND/Trace = 40
Wells = 4
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-15012	10	10	1	1	1	1	0	0	NaN
JHC-MW-15013	10	10	1	1	1	1	0	0	NaN
JHC-MW-15015	10	10	1	1	1	1	0	0	NaN
JHC-MW-15016	10	10	1	1	1	1	0	0	NaN

Summary Report

Constituent: Lithium, Total Analysis Run 11/26/2018 1:29 PM
Client: Consumers Energy Data: JHC_Unit_3_Sanitas

For observations made between 12/8/2015 and 7/19/2018, a summary of the selected data set:

Observations = 40
ND/Trace = 39
Wells = 4
Minimum Value = 10
Maximum Value = 10.3
Mean Value = 10.01
Median Value = 10
Standard Deviation = 0.04743
Coefficient of Variation = 0.00474
Skewness = 6.085

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15012	10	10	10	10	10	10	0	0	NaN
JHC-MW-15013	10	10	10	10	10	10	0	0	NaN
JHC-MW-15015	10	9	10	10.3	10.03	10	0.09487	0.009458	2.667
JHC-MW-15016	10	10	10	10	10	10	0	0	NaN

Summary Report

Constituent: Mercury, Total Analysis Run 11/26/2018 1:29 PM
Client: Consumers Energy Data: JHC_Unit_3_Sanitas

For observations made between 12/8/2015 and 7/19/2018, a summary of the selected data set:

Observations = 40
ND/Trace = 40
Wells = 4
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-15012	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15013	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15015	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15016	10	10	0.2	0.2	0.2	0.2	0	0	NaN

Summary Report

Constituent: Molybdenum, Total Analysis Run 11/26/2018 1:29 PM
Client: Consumers Energy Data: JHC_Unit_3_Sanitas

For observations made between 12/8/2015 and 7/19/2018, a summary of the selected data set:

Observations = 40
ND/Trace = 10
Wells = 4
Minimum Value = 5
Maximum Value = 122
Mean Value = 16.99
Median Value = 8
Standard Deviation = 26.23
Coefficient of Variation = 1.544
Skewness = 2.885

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15012	10	3	5	13	7.27	6.25	2.958	0.4069	1.108
JHC-MW-15013	10	5	5	9	6.42	5.3	1.849	0.2879	0.6796
JHC-MW-15015	10	0	6	75	22.61	11.45	25.26	1.117	1.483
JHC-MW-15016	10	2	5	122	31.67	10.5	42.76	1.35	1.455

Summary Report

Constituent: Radium-226/228 Analysis Run 11/26/2018 1:29 PM
Client: Consumers Energy Data: JHC_Unit_3_Sanitas

For observations made between 12/8/2015 and 6/20/2018, a summary of the selected data set:

Observations = 39
ND/Trace = 28
Wells = 4
Minimum Value = 0.374
Maximum Value = 1.85
Mean Value = 0.94
Median Value = 0.813
Standard Deviation = 0.4141
Coefficient of Variation = 0.4405
Skewness = 0.4798

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15012	10	8	0.374	1.605	0.9658	0.837	0.4658	0.4823	0.2273
JHC-MW-15013	10	7	0.528	1.54	0.8895	0.643	0.4214	0.4738	0.61
JHC-MW-15015	10	8	0.488	1.52	0.9388	0.8545	0.3727	0.397	0.2525
JHC-MW-15016	9	5	0.532	1.85	0.9687	0.875	0.4575	0.4723	0.7366

Summary Report

Constituent: Selenium, Total Analysis Run 11/26/2018 1:29 PM
Client: Consumers Energy Data: JHC_Unit_3_Sanitas

For observations made between 12/8/2015 and 7/19/2018, a summary of the selected data set:

Observations = 40
ND/Trace = 18
Wells = 4
Minimum Value = 1
Maximum Value = 22
Mean Value = 3.531
Median Value = 1
Standard Deviation = 4.992
Coefficient of Variation = 1.414
Skewness = 2.538

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15012	10	3	1	7	3.145	3	2.294	0.7293	0.7791
JHC-MW-15013	10	9	1	1	1	1	0	0	NaN
JHC-MW-15015	10	1	1	22	8.44	6.25	7.981	0.9457	0.6394
JHC-MW-15016	10	5	1	3	1.54	1	0.7427	0.4823	0.8119

Summary Report

Constituent: Thallium, Total Analysis Run 11/26/2018 1:29 PM
Client: Consumers Energy Data: JHC_Unit_3_Sanitas

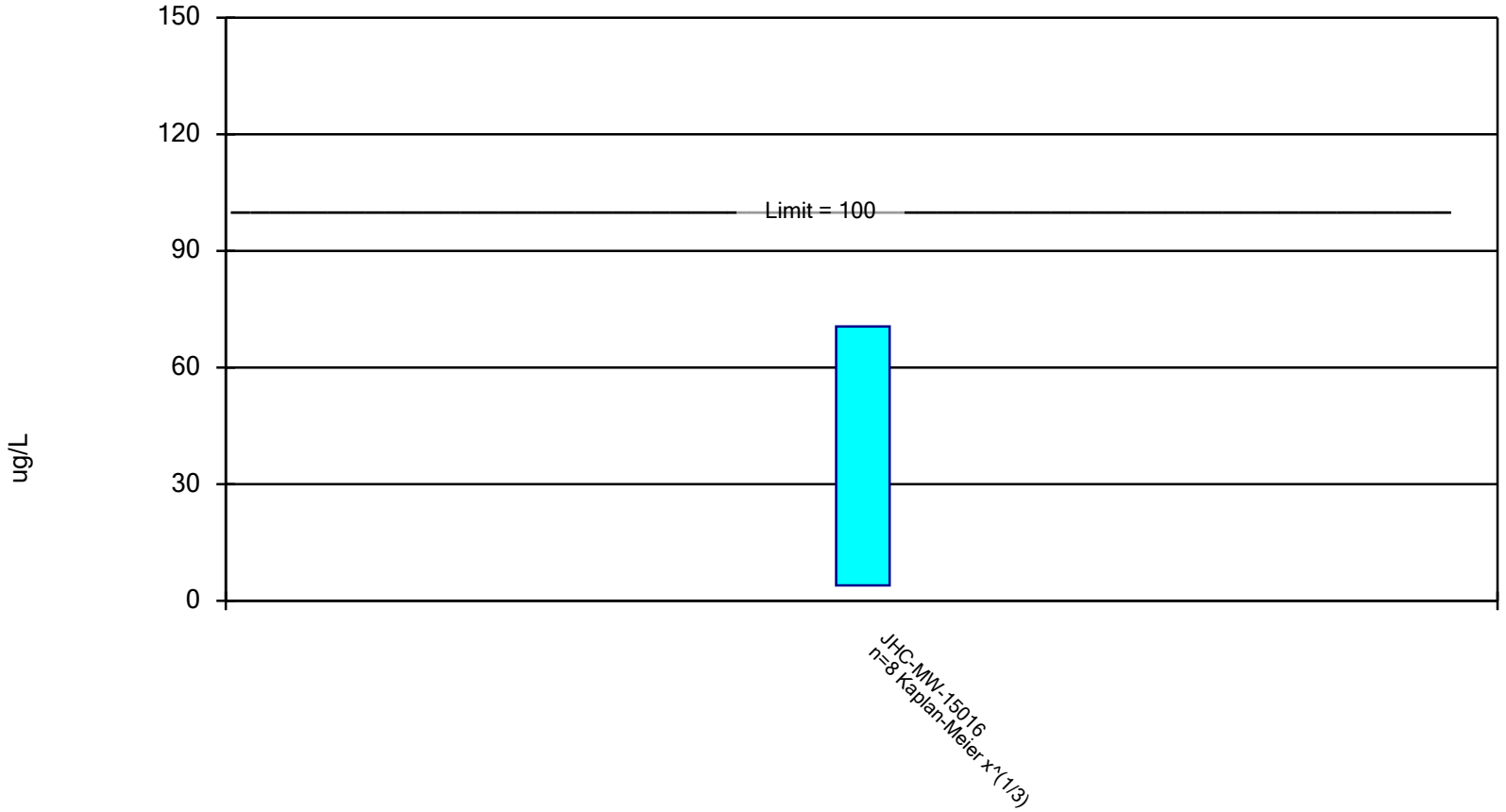
For observations made between 12/8/2015 and 7/19/2018, a summary of the selected data set:

Observations = 40
ND/Trace = 40
Wells = 4
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-15012	10	10	2	2	2	2	0	0	NaN
JHC-MW-15013	10	10	2	2	2	2	0	0	NaN
JHC-MW-15015	10	10	2	2	2	2	0	0	NaN
JHC-MW-15016	10	10	2	2	2	2	0	0	NaN

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Molybdenum, Total Analysis Run 11/27/2018 4:39 PM

Client: Consumers Energy Data: JHC_Unit_3_Sanitas

Confidence Interval

Constituent: Molybdenum, Total (ug/L) Analysis Run 11/27/2018 4:40 PM

Client: Consumers Energy Data: JHC_Unit_3_Sanitas

	JHC-MW-15016
6/24/2016	11
9/1/2016	8
11/17/2016	15
4/20/2017	<5
6/21/2017	<5
8/16/2017	30.7
5/1/2018	122
7/19/2018	100
Mean	36.46
Std. Dev.	47.23
Upper Lim.	70.53
Lower Lim.	3.937

Appendix F
April 2019 Assessment Monitoring Statistical Evaluation

1540 Eisenhower Pl.
Ann Arbor, MI 48108

T 734.971.7080
TRCcompanies.com

Technical Memorandum

Date: June 10, 2019

To: Bethany Swanberg, Consumers Energy

cc: Brad Runkel, Consumers Energy
JR Register, 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 Bottom Ash Pond 3 North and 3 South CCR Unit, 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 Protections 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) Bottom Ash Pond 3 North and 3 South (Pond 3). 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 and the Sanitas™ output files are included as an attachment.

The statistical evaluation of the first semiannual assessment monitoring event data for 2019 indicates that no constituents are present at statistically significant levels exceeding the GWPSs in downgradient monitoring wells at the JHC Pond 3 CCR unit. This result is consistent with the results

[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).

of the previous assessment monitoring data statistical evaluation and concentrations remain above background levels. 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 Pond 3 CCR Unit consists of three monitoring wells (JHC-MW-15013, JHC-MW-15015, and JHC-MW-15016) located on the eastern perimeter of the bottom ash ponds. Former downgradient monitoring well JHC-MW-15012 was decommissioned on October 10, 2018 during deconstruction of Bottom Ash Pond 3 South; therefore, statistical analysis for JHC-MW-15012 terminates at the June 2018 monitoring event.

Following the first semiannual assessment monitoring event for 2019, compliance well data for the JHC Pond 3 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 and 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 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).

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

For each detected Appendix IV constituent, the concentrations for each well were first compared directly to the GWPS, as shown on Table A1. Parameter-well combinations that included a direct exceedance of the GWPS within the past 8 events (April 2017 through April 2019) were retained for further analysis. Molybdenum in JHC-MW-15015 and JHC-MW-15016 at JHC Pond 3 had individual results exceeding the GWPS.

A significant change in groundwater flow conditions was observed in the vicinity of monitoring well JHC-MW-15016, located east of the northern portion of JHC Pond 3. The groundwater flow direction changed from radially outward to predominantly southwest across the northern portion of JHC Pond 3 following: 1) the cessation of hydraulic loading and removal of CCR at the Pond 3 North Bottom Ash Pond (April through June 2017); 2) temporary cessation of hydraulic loading in the JHC Pond 3 South Bottom Ash Pond between March 14 and April 26, 2018; and 3) construction of the concrete pad over top of the former Pond 3 North Bottom Ash Pond (May through July 2018). As a result of these changes in site conditions and groundwater flow changes, monitoring well JHC-MW-15016 was no longer positioned downgradient from the JHC Pond 3. Also, during this timeframe (between the last background monitoring event in August 2017 and the initial assessment monitoring event in April 2018) an increase in the molybdenum concentrations in groundwater collected from monitoring well JHC-MW-15016 was observed.

Considering that JHC-MW-15016 was hydraulically upgradient from JHC Pond 3 and CCR had been removed from Pond 3 North Bottom Ash Pond at the time of the assessment monitoring sampling events in April and July 2018, it is likely that the groundwater quality measured at monitoring well JHC-MW-15016, during those events is more representative of groundwater flowing toward the CCR unit from the northeast, prior to being influenced by the JHC Pond 3 CCR unit. As such, the molybdenum groundwater data is considered suspect for the purposes of assessing groundwater quality influenced by the JHC Pond 3 CCR unit. However, CCR removal activities in the southern portion of JHC Pond 3 were recently completed in October 2018, groundwater conditions are still re-equilibrating, and the groundwater monitoring system is being re-assessed to account for post-deconstruction groundwater conditions. As a result, the April and July 2018 molybdenum data have been retained in the assessment monitoring data set for this assessment monitoring data evaluation in order to remain conservative while hydrogeological conditions are stabilizing. Additional data from the new and existing wells located in the vicinity of the JHC Pond 3 CCR unit will be collected and used to further assess stabilized groundwater flow and characteristics.

Groundwater data for the two monitoring wells with individual results exceeding a GWPS by direct comparison were then evaluated utilizing Sanitas™ statistical software. Sanitas™ is a software tool that is commercially available for performing statistical evaluation consistent with procedures outlined in the Unified Guidance. Within the Sanitas™ statistical program, confidence limits were selected to perform the statistical comparison of compliance data to a fixed standard. Parametric and non-parametric confidence intervals were calculated, as appropriate, for each of the CCR Appendix IV parameters using a 99 percent confidence level, i.e., a significance level (α) of 0.01. The following

narrative describes the methods employed, the results obtained and the Sanitas™ output files are included as an attachment.

The statistical data evaluation included the following steps:

- Review of data quality checklists for the data sets;
- Graphical representation of the monitoring data as time versus concentration by well-constituent pair;
- Outlier testing of individual data points that appear from the graphical representations as potential outliers;
- Evaluation of visual trends apparent in the graphical representations for statistical significance;
- Evaluation of percentage of non-detects for each well-constituent pair;
- Distribution of the data; and
- Calculation of the confidence intervals for each cumulative dataset.

The results of these evaluations are presented and discussed below.

Initially, the baseline (December 2015 through August 2017) results and assessment monitoring results (April 2018 through April 2019) for molybdenum in JHC-MW-15015 and JHC-M-15016 were observed visually for a potential trend. Due to the changes in site conditions discussed above, no outliers were removed and potential trends in data will continue to be assessed as more data are collected. Data from each round were evaluated for completeness, overall quality, and usability and were deemed appropriate for the purposes of the CCR assessment monitoring program. The Sanitas™ software was then used to test compliance for molybdenum at the downgradient monitoring wells using the confidence interval method for the most recent eight sampling events. Eight independent sampling events provide the appropriate density of data as recommended per the Unified Guidance yet are collected recently enough to provide an indication of current condition. The test was run with a per-well significance of $\alpha = 0.01$. The software outputs are included in Attachment B1 along with data reports showing the values used for the evaluation. The percentage of non-detect observations are also included in Attachment 1. Non-detect data was handled in accordance with the Stats Plan for the purposes of calculating the confidence intervals.

The Sanitas™ software generates an output that includes graphs of the parametric or non-parametric confidence intervals for each well along with notes on data transformations, as appropriate. The JHC-MW-15016 data set was found to be normally distributed with a Cohen's adjustment, as noted on the confidence interval graph and JHC-MW-15015 utilized a non-parametric confidence interval due to a non-normal data set as noted on the graph. The confidence interval test compares the lower confidence limit to the GWPS. The evaluation of the Appendix IV constituents shows no statistically significant exceedances of the GWPSs. This result is consistent with the results of the initial assessment monitoring data statistical evaluation and concentrations remain above background

levels. 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.

Attachments

Table A1.	Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
Attachment 1	Sanitas™ Output

Table

Table B1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
JH Campbell Unit 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15012 (1)												
					Sample Date:	12/8/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/20/2017	8/15/2017	9/26/2017	4/27/2018	4/27/2018	6/19/2018	6/19/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												
Appendix III																Field Dup		Field Dup
Boron	ug/L	NC	NA	51	NA	178	164	160	171	253	212	249	159	180	--	--	205	202
Calcium	mg/L	NC	NA	46	NA	36.2	48.5	58.7	67.3	87.8	41.4	37.7	30.5	30.9	--	--	34.5	34.3
Chloride	mg/L	250*	NA	43	NA	13.4	24.4	23.8	25.2	21.8	17.8	16.7	15.0	15.0	--	--	15.7	15.7
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
Sulfate	mg/L	250*	NA	14	NA	31.8	38.3	51.7	37.8	64.2	32.9	29.2	32.8	29.6	--	--	30.6	30.7
Total Dissolved Solids	mg/L	500*	NA	258	NA	190	240	300	280	430	200	250	174	158	--	--	186	226
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.5	7.6	7.3	7.7	7.0	7.7	7.6	7.6	7.6	7.5	--	7.7	--
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	68	62	63	54	122	86	79.9	66.7	--	53.2	53.2	104	98.7
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	2	2	2	2	2	2	< 1.0	< 1.0	--	< 1.0	1.4	1.9	2.0
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
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	12	7	13	7	5.2	5.5	--	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.285	< 0.207	< 0.124	< 0.406	< 0.182	< 0.258	0.828	0.461	--	< 0.653	< 0.698	< 0.516	< 0.591
Radium-228	pCi/L	NC	NA	NA	NA	< 0.483	0.674	< 0.585	< 0.647	< 0.861	< 0.374	< 0.656	< 0.880	--	< 0.770	< 0.866	< 0.966	1.40
Radium-226/228	pCi/L	5	NA	1.93	5	< 0.483	0.813	< 0.585	< 0.647	< 0.861	< 0.374	< 1.43	< 1.30	--	< 1.42	< 1.56	< 1.48	1.73
Selenium	ug/L	50	NA	5	50	< 1	7	4	3	7	3	< 1.0	< 1.0	--	3.2	2.9	1.3	1.5
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) JHC-MW-15012 was decommissioned on October 10, 2018.
(2) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.

Table B1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
JH Campbell Unit 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15013															
					Sample Date:	12/8/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/20/2017	6/20/2017	8/15/2017	8/15/2017	9/26/2017	9/26/2017	4/30/2018	6/19/2018	11/14/2018	11/14/2018	2/27/2019	2/27/2019	4/29/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient																	
Appendix III													Field Dup		Field Dup		Field Dup				Field Dup		Field Dup	
Boron	ug/L	NC	NA	51	NA	141	160	128	139	163	187	208	207	153	171	147	151	--	258	318	312	330	330	320
Calcium	mg/L	NC	NA	46	NA	37.8	50.1	50.8	61.7	44.3	40.5	34.8	33.3	30.0	30.5	31.5	33.6	--	37.4	44.5	43.8	45	45	46
Chloride	mg/L	250*	NA	43	NA	13.3	24.8	27.2	24.9	23.8	17.6	16.8	16.8	15.2	15.3	15.2	15.2	--	16.2	16.9	17	18	18	16
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	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	31.0	35.2	46.1	43.0	42.1	30.8	29.5	29.5	33.4	33.5	30.9	30.9	--	34.8	32.9	32.3	30	30	30
Total Dissolved Solids	mg/L	500*	NA	258	NA	190	230	280	260	230	220	164	158	184	274	212	178	--	230	198	190	220	220	190
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.8	7.6	7.5	7.4	7.2	7.6	7.5	--	7.6	--	7.7	--	7.7	7.7	7.5	--	7.7 (2)	--	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	< 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	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000	16	14	19	18	18	18	20.3	20.0	15.4	15.3	--	--	16.1	21.4	22.1	22.4	25	23	25
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	< 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	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100	3	3	2	2	2	4	1.6	1.6	< 1.0	< 1.0	--	--	1.5	2.9	2.3	3.2	< 1.0	< 1.0	2.0
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	< 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	< 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	< 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	< 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	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	**100**	< 5	< 5	9	9	9	< 5	< 5.0	< 5.0	5.3	5.9	--	--	6.6	< 5.0	12.2	11.7	11	10	8.5
Radium-226	pCi/L	NC	NA	NA	NA	< 0.219	< 0.302	0.187	< 0.341	< 0.223	< 0.320	< 0.840	< 0.517	0.489	< 0.573	--	--	< 0.518	< 0.548	0.626	0.834	< 0.101	0.0854	0.121
Radium-228	pCi/L	NC	NA	NA	NA	0.489	< 0.530	< 0.528	< 0.601	< 0.685	0.393	0.876	1.06	< 0.689	< 0.764	--	--	< 0.670	< 0.990	< 0.955	< 0.847	< 0.373	<0.423	< 0.377
Radium-226/228	pCi/L	5	NA	1.93	5	0.578	< 0.53	< 0.528	< 0.601	< 0.685	0.548	< 1.53	< 1.27	0.990	< 1.34	--	--	< 1.19	< 1.54	< 1.14	1.47	0.402	0.436	< 0.377
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	< 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	< 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) JHC-MW-15012 was decommissioned on October 10, 2018.
(2) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.

Table B1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
JH Campbell Unit 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	**JHC-MW-15015**												
						Sample Date:	12/7/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/20/2017	8/16/2017	9/27/2017	4/30/2018	6/19/2018	11/14/2018	2/27/2019	4/29/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient												
Appendix III																			
Boron	ug/L	NC	NA	51	NA		469	280	238	348	355	371	697	439	518	--	194	270	860	1,000
Calcium	mg/L	NC	NA	46	NA		57.5	80.6	54.4	128	60.1	80	52.3	59.0	58.8	--	57.3	128	110	100
Chloride	mg/L	250*	NA	43	NA		15.1	18.1	10.5	96.9	12.3	36.4	30.8	17.6	15.1	--	22.0	89.5	22	15
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		34.1	32.2	13.4	52.2	30.1	48.8	40.5	34.1	28.8	--	54.6	99.4	41	38
Total Dissolved Solids	mg/L	500*	NA	258	NA		260	260	250	740	240	360	346	222	328	--	362	626	420	430
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.4	7.2	7.3	7.0	7.2	7.5	7.3	7.3	7.3	7.1	7.3	7.3	7.7 (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	< 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		30	36	27	59	34	46	34.9	31.1	--	24.5	36.7	71.7	47	44
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	2	5	< 1.0	< 1.0	--	1.1	< 1.0	< 1.0	1.7	< 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	10.3	< 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**		6	8	8	75	15	11	65.0	15.2	--	11.7	11.2	37.9	**170**	**140**
Radium-226	pCi/L	NC	NA	NA	NA		< 0.273	< 0.206	< 0.167	< 0.281	< 0.214	< 0.260	< 0.466	< 0.550	--	< 0.708	< 0.506	< 0.528	< 0.0793	< 0.0921
Radium-228	pCi/L	NC	NA	NA	NA		0.845	< 0.630	< 0.488	< 0.565	< 0.636	0.582	< 0.789	< 0.774	--	< 0.809	< 0.750	0.922	< 0.360	< 0.419
Radium-226/228	pCi/L	5	NA	1.93	5		0.945	< 0.63	< 0.488	< 0.565	< 0.636	0.764	< 1.26	< 1.32	--	< 1.52	< 1.26	< 1.34	< 0.360	< 0.419
Selenium	ug/L	50	NA	5	50		8	1	1	3	18	5	22.0	7.5	--	< 1.0	17.9	< 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) JHC-MW-15012 was decommissioned on October 10, 2018.
(2) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.

Table B1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019
JH Campbell Unit 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

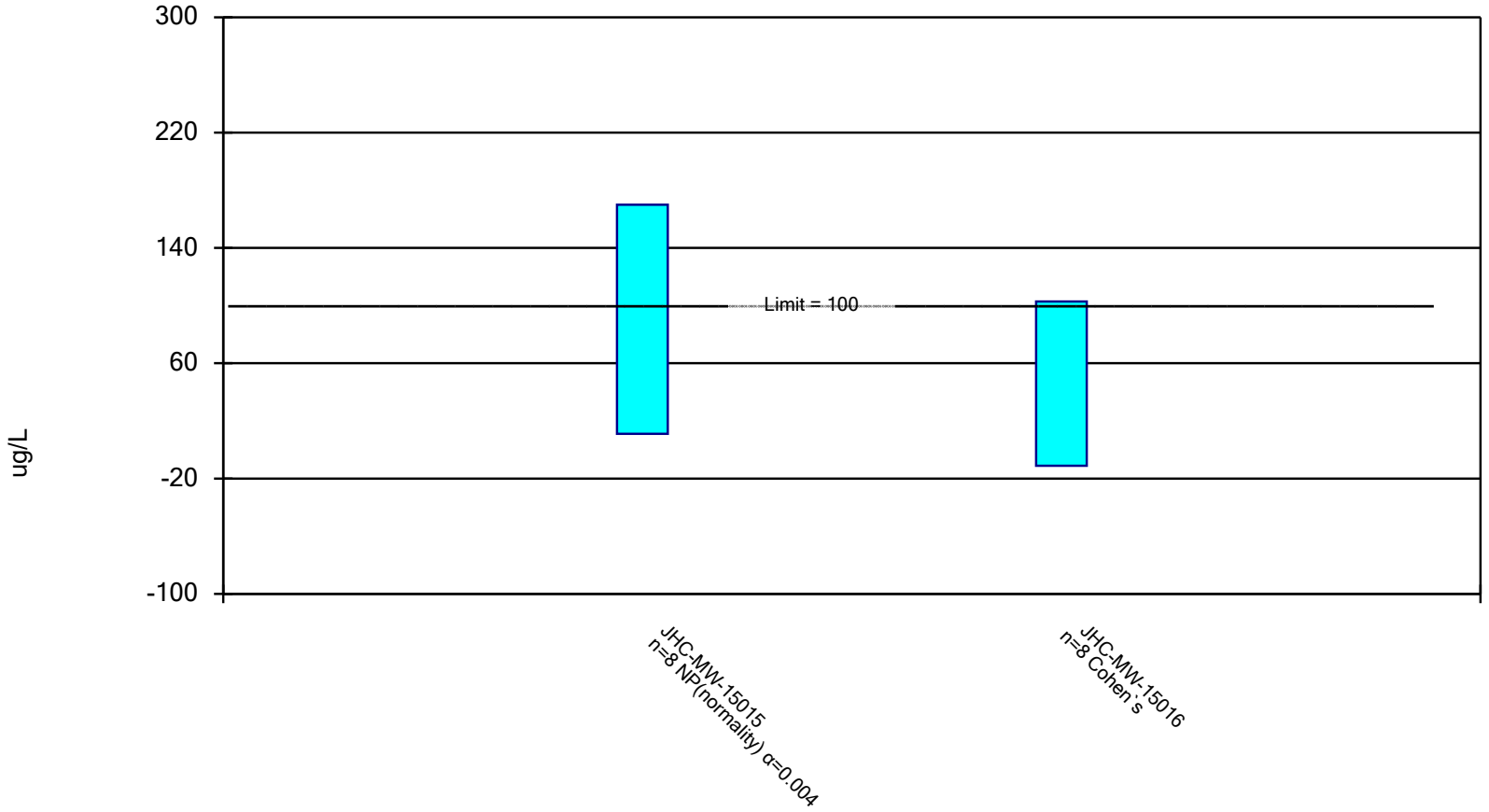
					Sample Location:	JHC-MW-15016												
					Sample Date:	12/7/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/20/2017	8/16/2017	9/27/2017	4/30/2018	7/18/2018	11/15/2018	2/28/2019	4/29/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient													
Appendix III																			
Boron	ug/L	NC	NA	51	NA	279	306	258	258	207	296	170	171	279	--	291	340	1,100	2,100
Calcium	mg/L	NC	NA	46	NA	37.9	62.4	51.9	65.6	50.9	103	48.5	61.1	75.9	--	74.4	112	120	110
Chloride	mg/L	250*	NA	43	NA	13.5	13.4	7.51	11.5	12.1	78.8	28.2	24.5	21.8	--	43.6	73.8	27	26
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	22.8	21.2	9.71	32.4	31.0	26.8	41.2	56.0	62.6	--	31.9	23.5	23	23
Total Dissolved Solids	mg/L	500*	NA	258	NA	210	230	260	240	230	470	280	278	492	--	396	512	530	470
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.5	7.3	7.4	7.4	7.1	7.4	7.6	7.3	7.3	6.8	6.9	7.2	7.6 (2)	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
Arsenic	ug/L	10	NA	1	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	1.8	< 1.0	4.6	< 1.0	2.6
Barium	ug/L	2,000	NA	35	2,000	35	44	43	32	38	79	7.7	38.8	--	70.2	56.2	94.5	110	99
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	2	1	1	1	2	4	< 1.0	2.5	--	< 1.0	< 1.0	< 1.0	3.3	2.5
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	< 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**	10	10	11	8	15	< 5	< 5.0	30.7	--	**122**	100	80.0	44	42
Radium-226	pCi/L	NC	NA	NA	NA	< 0.265	< 0.212	< 0.159	< 0.387	< 0.291	< 0.332	< 0.582	< 0.754	--	< 0.898	< 0.647	0.514	0.149	0.239
Radium-228	pCi/L	NC	NA	NA	NA	0.822	< 0.547	0.519	0.555	< 0.532	0.886	< 0.636	< 0.659	--	< 0.951	1.61	1.29	0.520	< 0.482
Radium-226/228	pCi/L	5	NA	1.93	5	0.875	< 0.547	0.552	0.682	< 0.532	1.05	< 1.22	< 1.41	--	< 1.85	1.88	1.80	0.669	0.711
Selenium	ug/L	50	NA	5	50	< 1	< 1	1	< 1	2	3	< 1.0	2.2	--	< 1.0	2.2	< 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) JHC-MW-15012 was decommissioned on October 10, 2018.
(2) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.

Attachment
Sanitas™ Output

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Molybdenum, Total Analysis Run 6/10/2019 1:43 PM

Client: Consumers Energy Data: JHC_Sanitas_19.06.03

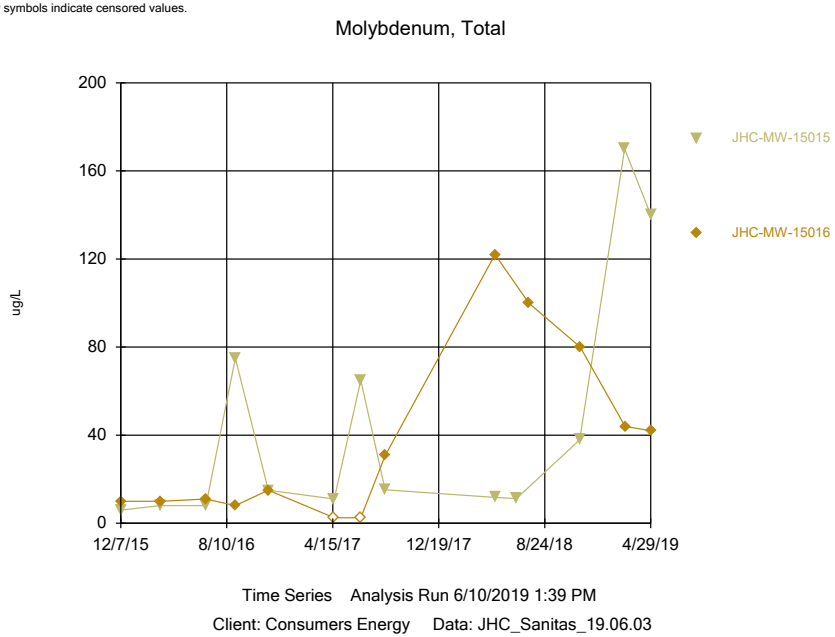
Confidence Interval

Constituent: Molybdenum, Total (ug/L) Analysis Run 6/10/2019 1:43 PM

Client: Consumers Energy Data: JHC_Sanitas_19.06.03

	JHC-MW-15015	JHC-MW-15016
4/19/2017	11	<5
6/20/2017	65	<5
8/16/2017	15.2	30.7
4/30/2018	11.7	122
6/19/2018	11.2	
7/18/2018		100
11/14/2018	37.9	
11/15/2018		80
2/27/2019	170	
2/28/2019		44
4/29/2019	140	42
Mean	57.75	52.96
Std. Dev.	63.35	43.91
Upper Lim.	170	102.8
Lower Lim.	11	-11.18

Hollow symbols indicate censored values.



Time Series Analysis Run 6/10/2019 1:39 PM

Client: Consumers Energy Data: JHC_Sanitas_19.06.03

Appendix G
October 2019 Assessment Monitoring Statistical Evaluation

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Technical Memorandum

Date: December 16, 2019

To: Bethany Swanberg, Consumers Energy

cc: Brad Runkel, Consumers Energy
JR Register, 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 Bottom Ash Pond 3 North and 3 South CCR Unit, 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 Protections 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) Bottom Ash Pond 3 North and 3 South (Pond 3). 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* (2018 Annual 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 for 2019 indicates that no constituents are present at statistically significant levels exceeding the GWPSs in

[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).

downgradient monitoring wells at the JHC Pond 3 CCR unit. This result is consistent with the results of previous assessment monitoring data statistical evaluations and concentrations remain above background levels. 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 Pond 3 CCR Unit consists of six monitoring wells. JHC-MW-15013, JHC-MW-15015, and JHC-MW-15016 are located on the eastern perimeter of the bottom ash ponds. Former downgradient monitoring well JHC-MW-15012 was decommissioned on October 10, 2018 during deconstruction of Bottom Ash Pond Unit 3 South; therefore, statistical analysis for JHC-MW-15012 terminates at the June 2018 monitoring event. Due to the cessation of hydraulic loading to Ponds 1-2 and Pond 3, the groundwater flow direction changed significantly from the previous baseline and assessment monitoring events. In response, as documented in the 2018 Annual Report, Consumers Energy installed three new downgradient wells (JHC-MW-18001 through JHC-MW-18003) on the west and southwest edge of former Pond 3 from December 3 through December 5, 2018 to reassess groundwater flow and ensure sufficient wells are appropriately located to assess groundwater quality downgradient from the Pond 3 CCR Unit. These wells were sampled for Appendix III and Appendix IV constituents in February and March 2019 in addition to the April 2019 semiannual assessment monitoring event. These data confirm that the monitoring wells are appropriately positioned to assess groundwater quality downgradient from Pond 3. Therefore, JHC-MW-18001 through JHC-MW-18003 have been added to the downgradient monitoring network for Pond 3 and are included in this statistical evaluation.

Following the first semiannual assessment monitoring event for 2019, compliance well data for the JHC Pond 3 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 and lower and upper confidence limits.

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

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 for each well were first compared directly to the GWPS, as shown on Table A1. Parameter-well combinations that included a direct exceedance of the GWPS within the past 8 events (June 2017 through October 2019) for JHC-MW-15013, JHC-MW-15015, and JHC-MW-15016 and the past five events (December 2018 through October 2019) for the JHC-MW-18001 through JHC-MW-18003 were retained for further analysis. Molybdenum in JHC-MW-15015 and JHC-MW-15016 at JHC Pond 3 had individual results exceeding the GWPS.

A significant change in groundwater flow conditions was observed in the vicinity of monitoring well JHC-MW-15016, located east of the northern portion of JHC Pond 3. The groundwater flow direction changed from radially outward to predominantly southwest across the northern portion of JHC Pond 3 as a result of the following activities:

- the cessation of hydraulic loading and removal of CCR at the Pond 3 North Bottom Ash Pond (April through June 2017);
- temporary cessation of hydraulic loading in the JHC Pond 3 South Bottom Ash Pond between March 14 and April 26, 2018; and
- construction of the concrete pad over top of the former Pond 3 North Bottom Ash Pond (May through July 2018).

Because of the changes in site conditions and groundwater flow direction, monitoring well JHC-MW-15016 was no longer positioned downgradient from the Pond Unit 3. Also, during this timeframe (between the last background monitoring event in August 2017 and the initial assessment monitoring event in April 2018) an increase in the molybdenum concentrations in groundwater collected from monitoring well JHC-MW-15016 was observed.

Considering that JHC-MW-15016 was hydraulically upgradient from JHC Pond 3 and CCR had been removed from Pond 3 North Bottom Ash Pond at the time of the assessment monitoring sampling events in April and July 2018, it is likely that the groundwater quality measured at monitoring well JHC-MW-15016 during those events is more representative of groundwater flowing toward the CCR unit from the northeast, prior to being influenced by the Pond 3 CCR unit. Similarly, JHC-MW-15015

was hydraulically upgradient of Pond 3 at the time of the assessment monitoring sampling events in February 2019 through October 2019. As such, the molybdenum groundwater data is considered suspect for the purposes of assessing groundwater quality influenced by the Pond 3 CCR unit. CCR removal activities in the southern portion of JHC Pond 3 were completed in October 2018, so groundwater conditions were re-equilibrating at the time of the assessment monitoring sampling events during which the molybdenum concentration in JHC-MW-15015 and JHC-MW-15016 exceeded its GWPS by direct comparison. The groundwater monitoring system is being re-assessed to account for post-deconstruction groundwater conditions. However, the suspect molybdenum data have been retained in the assessment monitoring data set for this assessment monitoring data evaluation in order to remain conservative while hydrogeological conditions are stabilizing and to continue to monitor data quality at those locations post-CCR removal.

Groundwater data for the two monitoring wells with individual results exceeding a GWPS by direct comparison were then evaluated utilizing Sanitas™ statistical software. Sanitas™ is a software tool that is commercially available for performing statistical evaluation consistent with procedures outlined in the Unified Guidance. Within the Sanitas™ statistical program, confidence limits were selected to perform the statistical comparison of compliance data to a fixed standard. Parametric and non-parametric confidence intervals were calculated, as appropriate, for each of the CCR Appendix IV parameters using a 99 percent confidence level, i.e., a significance level (α) of 0.01. The following narrative describes the methods employed, the results obtained and the Sanitas™ output files are included as an attachment.

The statistical data evaluation included the following steps:

- Review of data quality checklists for the data sets;
- Graphical representation of the monitoring data as time versus concentration by well-constituent pair;
- Outlier testing of individual data points that appear from the graphical representations as potential outliers;
- Evaluation of visual trends apparent in the graphical representations for statistical significance;
- Evaluation of percentage of non-detects for each well-constituent pair;
- Distribution of the data; and
- Calculation of the confidence intervals for each cumulative dataset.

The results of these evaluations are presented and discussed below.

Initially, the baseline (December 2015 through August 2017) results and assessment monitoring results (April 2018 through October 2019) for molybdenum in JHC-MW-15015 and JHC-MW-15016 were observed visually for a potential trend. Due to the changes in site conditions discussed above, no outliers were removed and potential trends in data will continue to be assessed as more data are collected. Data from each round were evaluated for completeness, overall quality, and usability and

were deemed appropriate for the purposes of the CCR assessment monitoring program. The Sanitas™ software was then used to test compliance for molybdenum at the downgradient monitoring wells using the confidence interval method for the most recent eight sampling events. Eight independent sampling events provide the appropriate density of data as recommended per the Unified Guidance yet are collected recently enough to provide an indication of current condition. The test was run with a per-well significance of $\alpha = 0.01$. The software outputs are included in Attachment 1 along with data reports showing the values used for the evaluation. The percentage of non-detect observations are also included in Attachment 1. Non-detect data was handled in accordance with the Stats Plan for the purposes of calculating the confidence intervals.

The Sanitas™ software generates an output that includes graphs of the parametric or non-parametric confidence intervals for each well along with notes on data transformations, as appropriate. The data sets with direct exceedances of the GWPS were found to be normally distributed. The confidence interval test compares the lower confidence limit to the GWPS. The evaluation of the Appendix IV constituents shows no statistically significant exceedances of the GWPSs. This result is consistent with the results of the initial assessment monitoring data statistical evaluation and concentrations remain above background levels. 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.

Attachments

Table A1.	Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
Attachment 1	Sanitas™ Output

Table

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15012 (1)												
					Sample Date:	12/8/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/20/2017	8/15/2017	9/26/2017	4/27/2018	4/27/2018	6/19/2018	6/19/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												
Appendix III																Field Dup		Field Dup
Boron	ug/L	NC	NA	51	NA	178	164	160	171	253	212	249	159	180	--	--	205	202
Calcium	mg/L	NC	NA	46	NA	36.2	48.5	58.7	67.3	87.8	41.4	37.7	30.5	30.9	--	--	34.5	34.3
Chloride	mg/L	250*	NA	43	NA	13.4	24.4	23.8	25.2	21.8	17.8	16.7	15.0	15.0	--	--	15.7	15.7
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
Sulfate	mg/L	250*	NA	14	NA	31.8	38.3	51.7	37.8	64.2	32.9	29.2	32.8	29.6	--	--	30.6	30.7
Total Dissolved Solids	mg/L	500*	NA	258	NA	190	240	300	280	430	200	250	174	158	--	--	186	226
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.5	7.6	7.3	7.7	7.0	7.7	7.6	7.6	7.6	7.5	--	7.7	--
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	68	62	63	54	122	86	79.9	66.7	--	53.2	53.2	104	98.7
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	2	2	2	2	2	2	< 1.0	< 1.0	--	< 1.0	1.4	1.9	2.0
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
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	12	7	13	7	5.2	5.5	--	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.285	< 0.207	< 0.124	< 0.406	< 0.182	< 0.258	0.828	0.461	--	< 0.653	< 0.698	< 0.516	< 0.591
Radium-228	pCi/L	NC	NA	NA	NA	< 0.483	0.674	< 0.585	< 0.647	< 0.861	< 0.374	< 0.656	< 0.880	--	< 0.770	< 0.866	< 0.966	1.40
Radium-226/228	pCi/L	5	NA	1.93	5	< 0.483	0.813	< 0.585	< 0.647	< 0.861	< 0.374	< 1.43	< 1.30	--	< 1.42	< 1.56	< 1.48	1.73
Selenium	ug/L	50	NA	5	50	< 1	7	4	3	7	3	< 1.0	< 1.0	--	3.2	2.9	1.3	1.5
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) JHC-MW-15012 was decommissioned on October 10, 2018.
(2) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

Sample Location:						JHC-MW-15013																	
Sample Date:						12/8/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/20/2017	6/20/2017	8/15/2017	8/15/2017	9/26/2017	9/26/2017	4/30/2018	6/19/2018	11/14/2018	11/14/2018	2/27/2019	2/27/2019	4/29/2019	10/10/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient																			
													Field Dup		Field Dup		Field Dup				Field Dup		Field Dup		
Appendix III																									
Boron	ug/L	NC	NA	51	NA	141	160	128	139	163	187	208	207	153	171	147	151	--	258	318	312	330	330	320	300
Calcium	mg/L	NC	NA	46	NA	37.8	50.1	50.8	61.7	44.3	40.5	34.8	33.3	30.0	30.5	31.5	33.6	--	37.4	44.5	43.8	45	45	46	100
Chloride	mg/L	250*	NA	43	NA	13.3	24.8	27.2	24.9	23.8	17.6	16.8	16.8	15.2	15.3	15.2	15.2	--	16.2	16.9	17	18	18	16	17
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	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	31.0	35.2	46.1	43.0	42.1	30.8	29.5	29.5	33.4	33.5	30.9	30.9	--	34.8	32.9	32.3	30	30	30	230
Total Dissolved Solids	mg/L	500*	NA	258	NA	190	230	280	260	230	220	164	158	184	274	212	178	--	230	198	190	220	220	190	490
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.8	7.6	7.5	7.4	7.2	7.6	7.5	--	7.6	--	7.7	--	7.7	7.7	7.5	--	7.7 (2)	--	7.0	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	< 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	< 1.0	< 1.0	1.1
Barium	ug/L	2,000	NA	35	2,000	16	14	19	18	18	18	20.3	20.0	15.4	15.3	--	--	16.1	21.4	22.1	22.4	25	23	25	53
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	< 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	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100	3	3	2	2	2	4	1.6	1.6	< 1.0	< 1.0	--	--	1.5	2.9	2.3	3.2	< 1.0	< 1.0	2.0	7.3
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	< 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	< 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	< 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	< 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	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	**100**	< 5	< 5	9	9	9	< 5	< 5.0	< 5.0	5.3	5.9	--	--	6.6	< 5.0	12.2	11.7	11	10	8.5	7.2
Radium-226	pCi/L	NC	NA	NA	NA	< 0.219	< 0.302	0.187	< 0.341	< 0.223	< 0.320	< 0.840	< 0.517	0.489	< 0.573	--	--	< 0.518	< 0.548	0.626	0.834	< 0.101	0.0854	0.121	0.485
Radium-228	pCi/L	NC	NA	NA	NA	0.489	< 0.530	< 0.528	< 0.601	< 0.685	0.393	0.876	1.06	< 0.689	< 0.764	--	--	< 0.670	< 0.990	< 0.955	< 0.847	< 0.373	< 0.423	< 0.377	0.960
Radium-226/228	pCi/L	5	NA	1.93	5	0.578	< 0.53	< 0.528	< 0.601	< 0.685	0.548	< 1.53	< 1.27	0.990	< 1.34	--	--	< 1.19	< 1.54	< 1.14	1.47	0.402	0.436	< 0.377	1.45
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	< 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	< 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) JHC-MW-15012 was decommissioned on October 10, 2018.
(2) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15015												
					Sample Date:	12/7/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/20/2017	8/16/2017	9/27/2017	4/30/2018	6/19/2018	11/14/2018	2/27/2019	4/29/2019	10/10/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient														
Appendix III																				
Boron	ug/L	NC	NA	51	NA	469	280	238	348	355	371	697	439	518	--	194	270	860	1,000	1,300
Calcium	mg/L	NC	NA	46	NA	57.5	80.6	54.4	128	60.1	80	52.3	59.0	58.8	--	57.3	128	110	100	110
Chloride	mg/L	250*	NA	43	NA	15.1	18.1	10.5	96.9	12.3	36.4	30.8	17.6	15.1	--	22.0	89.5	22	15	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	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	34.1	32.2	13.4	52.2	30.1	48.8	40.5	34.1	28.8	--	54.6	99.4	41	38	39
Total Dissolved Solids	mg/L	500*	NA	258	NA	260	260	250	740	240	360	346	222	328	--	362	626	420	430	430
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.4	7.2	7.3	7.0	7.2	7.5	7.3	7.3	7.3	7.1	7.3	7.3	7.7 (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	< 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	30	36	27	59	34	46	34.9	31.1	--	24.5	36.7	71.7	47	44	49
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	2	5	< 1.0	< 1.0	--	1.1	< 1.0	< 1.0	1.7	< 1.0	4.3
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	10.3	< 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	8	8	75	15	11	65.0	15.2	--	11.7	11.2	37.9	**170**	**140**	**110**
Radium-226	pCi/L	NC	NA	NA	NA	< 0.273	< 0.206	< 0.167	< 0.281	< 0.214	< 0.260	< 0.466	< 0.550	--	< 0.708	< 0.506	< 0.528	< 0.0793	< 0.0921	0.207
Radium-228	pCi/L	NC	NA	NA	NA	0.845	< 0.630	< 0.488	< 0.565	< 0.636	0.582	< 0.789	< 0.774	--	< 0.809	< 0.750	0.922	< 0.360	< 0.419	< 0.432
Radium-226/228	pCi/L	5	NA	1.93	5	0.945	< 0.63	< 0.488	< 0.565	< 0.636	0.764	< 1.26	< 1.32	--	< 1.52	< 1.26	< 1.34	< 0.360	< 0.419	< 0.432
Selenium	ug/L	50	NA	5	50	8	1	1	3	18	5	22.0	7.5	--	< 1.0	17.9	< 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) JHC-MW-15012 was decommissioned on October 10, 2018.
(2) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15016												
						Sample Date:	12/7/2015	3/9/2016	6/23/2016	8/31/2016	11/16/2016	4/19/2017	6/20/2017	8/16/2017	9/27/2017	4/30/2018	7/18/2018	11/15/2018	2/28/2019	4/29/2019	10/10/2019	10/10/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient															
Appendix III																						Field Dup
Boron	ug/L	NC	NA	51	NA		279	306	258	258	207	296	170	171	279	--	291	340	1,100	2,100	4,200	4,200
Calcium	mg/L	NC	NA	46	NA		37.9	62.4	51.9	65.6	50.9	103	48.5	61.1	75.9	--	74.4	112	120	110	110	110
Chloride	mg/L	250*	NA	43	NA		13.5	13.4	7.51	11.5	12.1	78.8	28.2	24.5	21.8	--	43.6	73.8	27	26	16	17
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		22.8	21.2	9.71	32.4	31.0	26.8	41.2	56.0	62.6	--	31.9	23.5	23	23	26	26
Total Dissolved Solids	mg/L	500*	NA	258	NA		210	230	260	240	230	470	280	278	492	--	396	512	530	470	450	450
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.5	7.3	7.4	7.4	7.1	7.4	7.6	7.3	7.3	6.8	6.9	7.2	7.6 (2)	6.9	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	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	1.8	< 1.0	4.6	< 1.0	2.6	< 1.0	< 1.0
Barium	ug/L	2,000	NA	35	2,000		35	44	43	32	38	79	7.7	38.8	--	70.2	56.2	94.5	110	99	88	83
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	1	1	2	4	< 1.0	2.5	--	< 1.0	< 1.0	< 1.0	3.3	2.5	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	< 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**		10	10	11	8	15	< 5	< 5.0	30.7	--	**122**	100	80.0	44	42	27	25
Radium-226	pCi/L	NC	NA	NA	NA		< 0.265	< 0.212	< 0.159	< 0.387	< 0.291	< 0.332	< 0.582	< 0.754	--	< 0.898	< 0.647	0.514	0.149	0.239	0.322	--
Radium-228	pCi/L	NC	NA	NA	NA		0.822	< 0.547	0.519	0.555	< 0.532	0.886	< 0.636	< 0.659	--	< 0.951	1.61	1.29	0.520	< 0.482	< 0.482	--
Radium-226/228	pCi/L	5	NA	1.93	5		0.875	< 0.547	0.552	0.682	< 0.532	1.05	< 1.22	< 1.41	--	< 1.85	1.88	1.80	0.669	0.711	0.540	--
Selenium	ug/L	50	NA	5	50		< 1	< 1	1	< 1	2	3	< 1.0	2.2	--	< 1.0	2.2	< 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	< 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) JHC-MW-15012 was decommissioned on October 10, 2018.
(2) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Ponds 3N/3S – RCRA CCR Monitoring Program
West Olive, Michigan

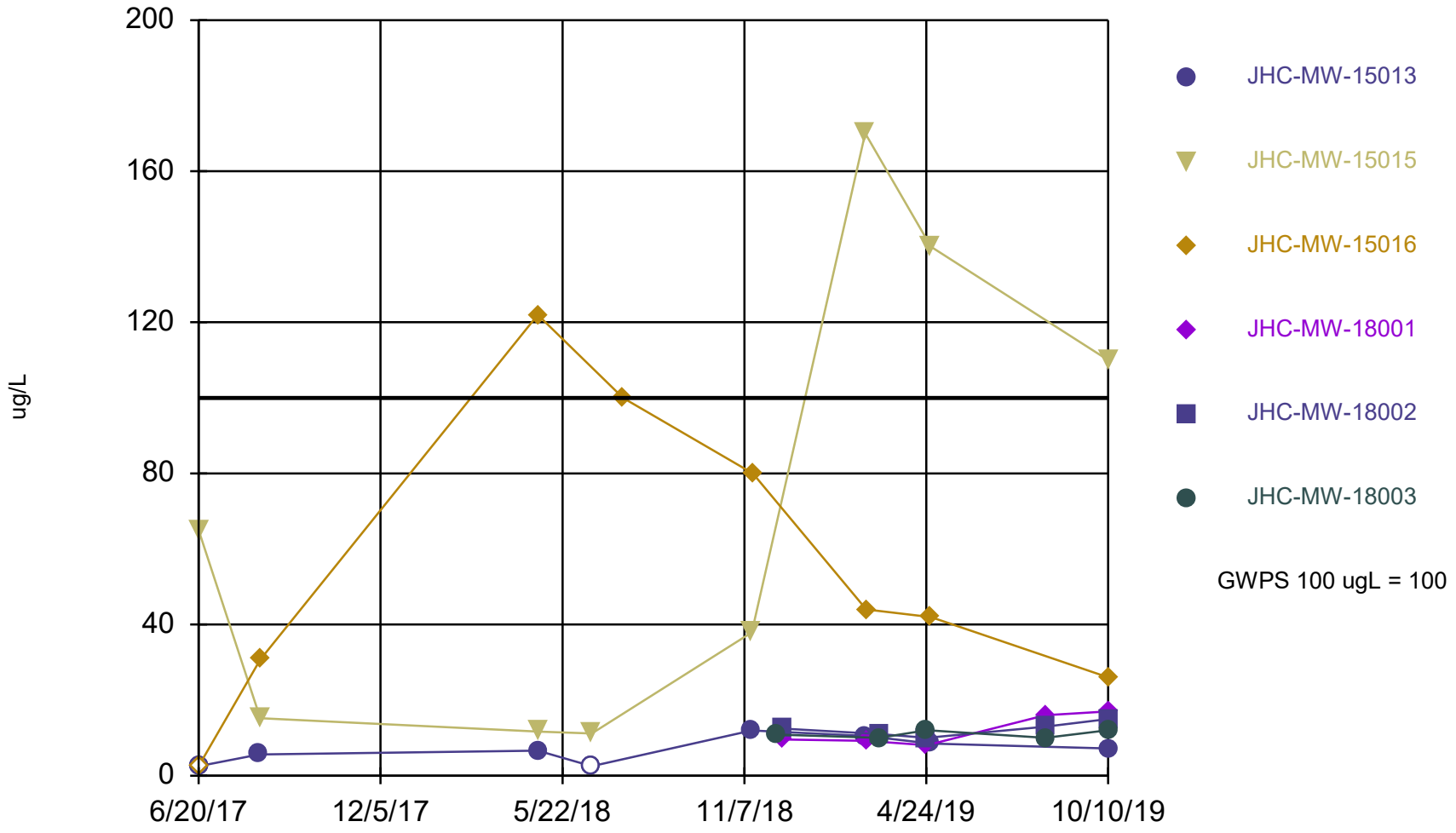
					Sample Location:	JHC-MW-18001					JHC-MW-18002					JHC-MW-18003						
					Sample Date:	12/12/2018	2/28/2019	4/25/2019	8/13/2019	10/10/2019	12/12/2018	3/12/2019	4/25/2019	8/13/2019	10/10/2019	12/7/2018	3/12/2019	3/12/2019	4/25/2019	8/13/2019	8/13/2019	10/10/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient																
																		Field Dup			Field Dup	
Appendix III																						
Boron	ug/L	NC	NA	51	NA	304	310	300	330	390	301	300	290	340	330	197	210	220	270	330	340	510
Calcium	mg/L	NC	NA	46	NA	52.9	69	77	76	66	45.9	54	57	51	68	63.6	200	200	160	100	110	140
Chloride	mg/L	250*	NA	43	NA	13.4	15	11	2.6	2.2	14.9	17	15	18	17	15.3	10	10	11	10	11	10
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	51.7	86	130	140	82	35.6	46	83	67	58	116	640	630	450	250	250	340
Total Dissolved Solids	mg/L	500*	NA	258	NA	344	330	430	460	360	244	270	310	300	430	326	1,100	1,100	810	510	520	660
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	8.4	8.2[(2)]	8.3	8.2	8.1	7.7	7.2	7.3	7.3	7.3	7.4	6.9	--	6.9	7.0	--	6.9
Appendix IV																						
Antimony	ug/L	6	NA	2	6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.0	2.7	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	10	< 1.0	1.5	1.4	1.7	1.5	< 1.0	1.2	< 1.0	1.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.4
Barium	ug/L	2,000	NA	35	2,000	225	360	440	610	390	79.5	96	110	130	130	81.5	150	150	120	100	96	130
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	0.24	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.1	< 1.0	< 1.0	< 1.0	< 1.0	1.1	1.2	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 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	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	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	12	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 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	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	**100**	9.6	9.2	8.1	16	17	12.4	11	10	13	15	10.9	10	10	12	10	10	12
Radium-226	pCi/L	NC	NA	NA	NA	< 0.886	0.177	0.321	0.469	0.296	0.631	0.125	0.144	< 0.195	0.198	< 0.757	0.131	<0.132	0.270	< 0.235	< 0.160	< 0.161
Radium-228	pCi/L	NC	NA	NA	NA	< 0.955	0.561	0.345	0.822	0.406	< 0.711	< 0.356	< 0.610	< 0.607	< 0.413	0.833	< 0.497	0.501	0.623	< 0.570	< 0.360	< 0.556
Radium-226/228	pCi/L	5	NA	1.93	5	< 1.84	0.738	0.667	1.29	0.702	< 1.30	0.428	< 0.610	< 0.607	< 0.413	< 1.54	< 0.497	0.613	0.892	< 0.570	< 0.360	< 0.556
Selenium	ug/L	50	NA	5	50	1.6	2.3	1.3	15	18	18.3	30	26	23	31	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 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.
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) JHC-MW-15012 was decommissioned on October 10, 2018.
(2) Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.

Attachment 1
Sanitas™ Output

Hollow symbols indicate censored values.

Time Series

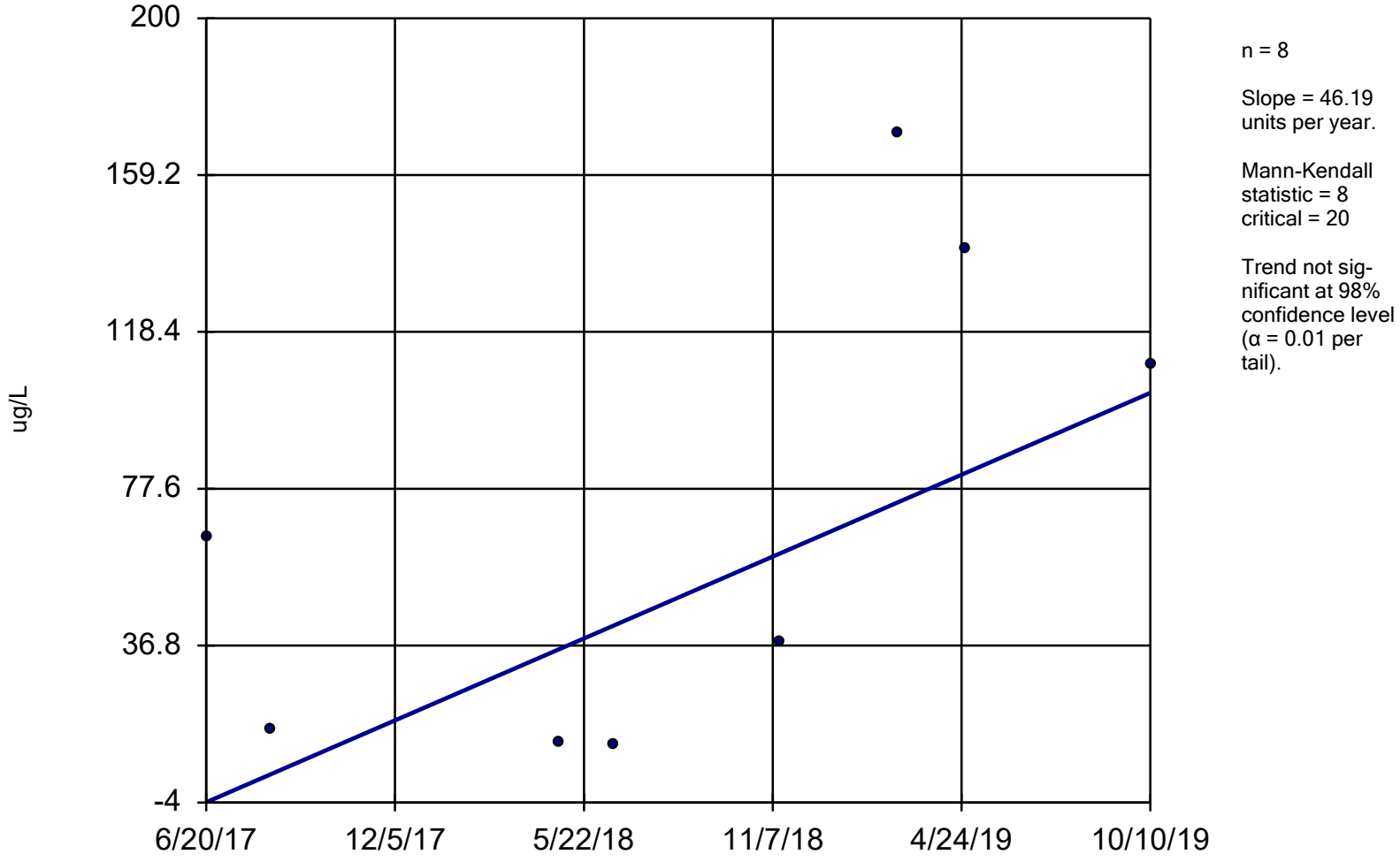


Constituent: Molybdenum, Total Analysis Run 12/9/2019 4:34 PM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

Sen's Slope Estimator

JHC-MW-15015



n = 8

Slope = 46.19 units per year.

Mann-Kendall statistic = 8
critical = 20

Trend not significant at 98% confidence level (α = 0.01 per tail).

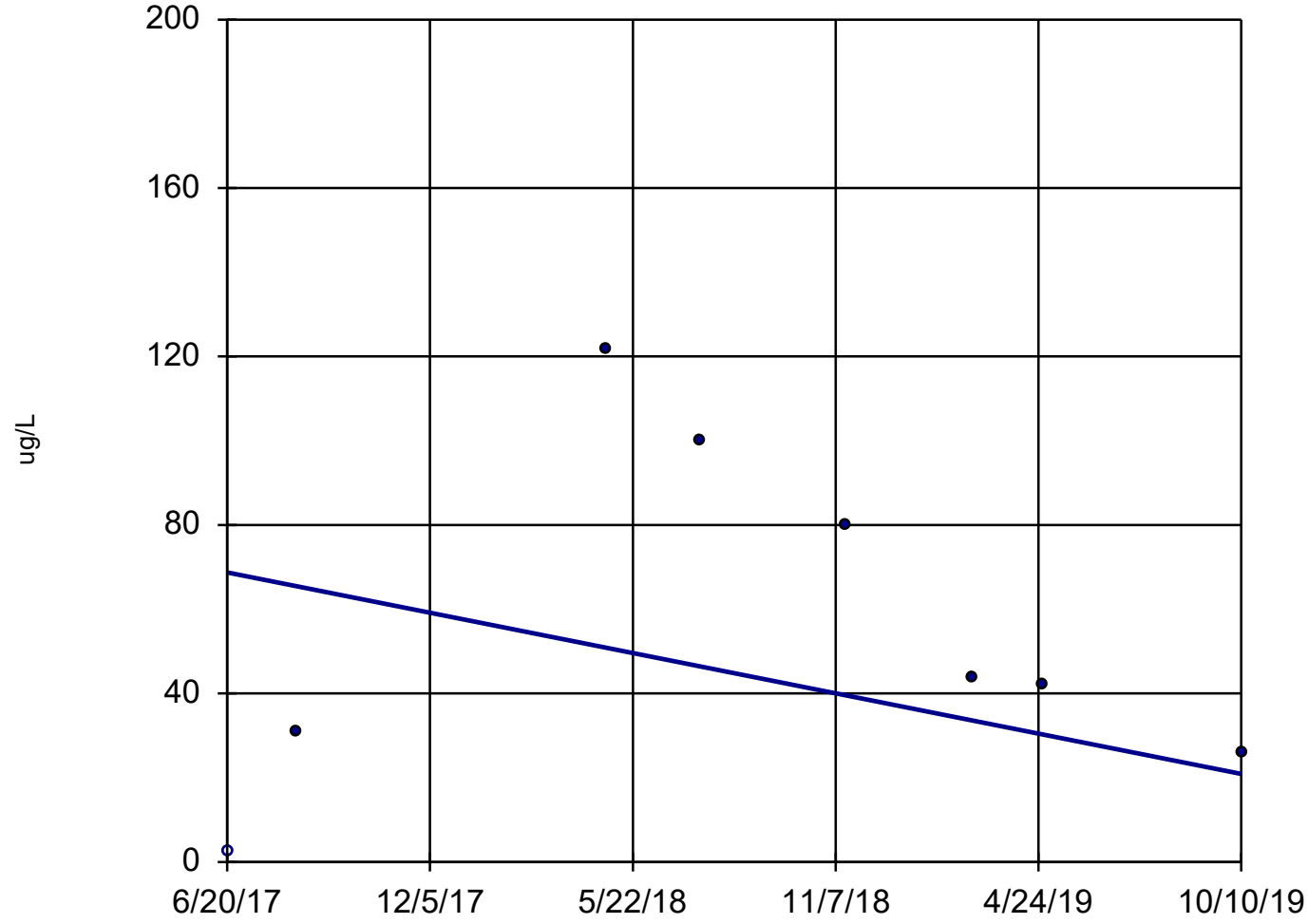
Constituent: Molybdenum, Total Analysis Run 12/9/2019 4:37 PM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

Hollow symbols indicate censored values.

Sen's Slope Estimator

JHC-MW-15016



n = 8

Slope = -20.75 units per year.

Mann-Kendall statistic = -4
critical = -20

Trend not significant at 98% confidence level (α = 0.01 per tail).

Constituent: Molybdenum, Total Analysis Run 12/9/2019 4:37 PM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

Summary Report

Constituent: Molybdenum, Total Analysis Run 12/9/2019 4:38 PM
Client: Consumers Energy Data: JHC_Sanitas_19.11.14

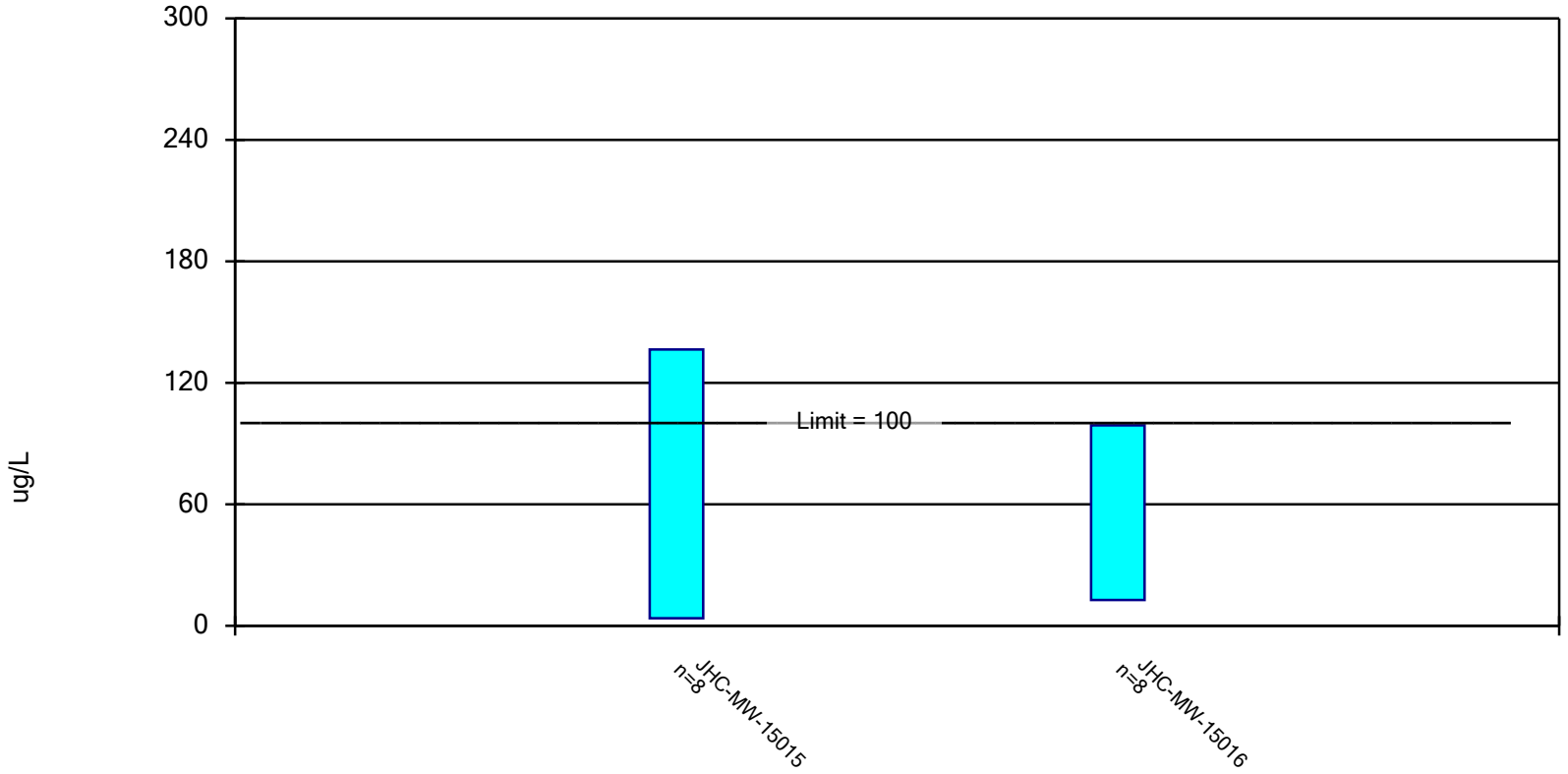
For observations made between 6/20/2017 and 10/10/2019, a summary of the selected data set:

Observations = 39
ND/Trace = 3
Wells = 6
Minimum Value = 2.5
Maximum Value = 170
Mean Value = 31.79
Median Value = 12
Standard Deviation = 41.86
Coefficient of Variation = 1.317
Skewness = 1.922

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15013	8	2	2.5	11.95	6.919	6.9	3.414	0.4935	0.009146
JHC-MW-15015	8	0	11.2	170	70.13	51.45	62.58	0.8924	0.4969
JHC-MW-15016	8	1	2.5	122	55.9	43	40.73	0.7286	0.4277
JHC-MW-18001	5	0	8.1	17	11.98	9.6	4.178	0.3487	0.3761
JHC-MW-18002	5	0	10	15	12.29	12.45	1.922	0.1564	0.2403
JHC-MW-18003	5	0	10	12	10.98	10.9	1.001	0.09117	0.06675

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Molybdenum, Total Analysis Run 11/15/2019 11:53 AM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

Confidence Interval

Constituent: Molybdenum, Total (ug/L) Analysis Run 11/15/2019 11:53 AM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

	JHC-MW-15015	JHC-MW-15016
6/20/2017	65	<5
8/16/2017	15.2	30.7
4/30/2018	11.7	122
6/19/2018	11.2	
7/18/2018		100
11/14/2018	37.9	
11/15/2018		80
2/27/2019	170	
2/28/2019		44
4/29/2019	140	42
10/10/2019	110	26 (D)
Mean	70.13	55.9
Std. Dev.	62.58	40.73
Upper Lim.	136.5	99.07
Lower Lim.	3.793	12.73