2019 Annual Groundwater Monitoring and Corrective Action Report

JH Campbell Power Plant
Ponds 1-2 North and 1-2 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 JH Campbell (JHC) Pond 1-2 CCR unit to cover the period of January 1, 2019 to December 31, 2019. Pond 1-2 was in assessment monitoring at the beginning and at the end of the period covered by this report. Data that have been collected and evaluated in 2019, including assessment monitoring data from November 2018, are presented in this report.

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 1-2 North and 1-2 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-15001, JHC-MW-15002, JHC-MW-15003, JHC-MW-15004, and JHC-MW-15005;
- Calcium at JHC-MW-15001 and JHC-MW-15004;
- Chloride at JHC-MW-15001;
- pH at JHC-MW-15002 and JHC-MW-15003;
- Sulfate at JHC-MW-15001, JHC-MW-15002, JHC-MW-15003, JHC-MW-15004, andJHC-MW-15005; and
- Total dissolved solids (TDS) at JHC-MW-15001, JHC-MW-15004, and JHC-MW-15005.

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 provided notification that arsenic was present at statistically significant levels above the federal groundwater protection standard (GWPS) established at 10 ug/L (TRC, 2019) in two out of five downgradient monitoring wells at Ponds 1-2 as follows:

- Arsenic at JHC-MW-15002 and JHC-MW-15003.

The *Assessment of Corrective Measures* (ACM) was initiated on April 15, 2019 and was certified and submitted to EGLE on September 11, 2019 in accordance with the schedule in §257.96. The certification for a 60-day time extension to the 90-day completion period of the ACM required per §257.96(a) is included in this report.

The ACM documents that the groundwater nature and extent has been defined, as required in §257.95(g)(1). Although arsenic concentrations exceed the GWPS in on-site groundwater, the property containing the site is owned and operated by Consumers Energy and on-site

groundwater is not used for drinking water. The nearest residential drinking water wells are located north and east of the Dry Ash Landfill (north of the background monitoring wells and upgradient of Ponds 1-2) and to the south-southeast of Pond 1-2, on the opposite side of the Pigeon River. Per §257.96(b), Consumers Energy is continuing to monitor groundwater in accordance with the assessment monitoring program as specified in §257.95. Overall, the assessment monitoring statistical evaluations have confirmed that arsenic is the only Appendix IV constituent present at statistically significant levels above the GWPS and groundwater monitoring downgradient from Ponds 1-2 further demonstrate that there are currently no adverse effects on human health or the environment from either surface water or groundwater due to the CCR management at Ponds 1-2.

Consumers Energy has not selected a remedy pursuant to §257.97. The semiannual progress report describing the progress in selecting and designing the remedy required pursuant to §257.97(a) is included in this report. The "*JH Campbell Generating Facility Bottom Ash Ponds 1-2 Closure Plan,*" prepared by Golder in January 2018 was submitted to and approved by EGLE. Dewatering and removal of ash from Ponds 1-2 for beneficial reuse began in June 2018 and continued through September 2018. CCR removal activities at Ponds 1-2 were completed in October 2018 and Consumers Energy submitted final documentation of CCR removal to EGLE in August 2019. On October 22, 2019 EGLE provided written concurrence that all bottom ash had been removed from Ponds 1-2 based on multiple lines of evidence described in the approved closure work plan.

Consumers Energy will continue to evaluate corrective measures in accordance with §257.96 and §257.97 as outlined in the ACM and will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98, which includes semiannual assessment monitoring in accordance with §257.95 to monitor site groundwater conditions and inform the remedy selection. The next semiannual assessment monitoring events are scheduled to occur in the second and fourth calendar quarters 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 1-2 North and 1-2 South bottom ash pond CCR Unit at the JH Campbell Power Plant Site (JHC Ponds 1-2). 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 JHC Ponds 1-2 to cover the period of January 1, 2019 to December 31, 2019. Ponds 1-2 was in assessment monitoring at the beginning and at the end of the period covered by this report. 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

As discussed in the *2018 Annual Groundwater Monitoring Report for the JH Campbell Power Plant Units 1-2 North and 1-2 South CCR Unit* (2018 Annual Report)(TRC, January 2019), Consumers Energy initiated an Assessment Monitoring Program for the Ponds 1-2 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. After subsequent sampling for Appendix IV constituents, Consumers Energy provided notification that arsenic was present at statistically significant levels above the federal groundwater protection standard (GWPS) established at 10 ug/L (TRC, 2019) in two out of five downgradient monitoring wells at Ponds 1-2 as follows:

- Arsenic at JHC-MW-15002 and JHC-MW-15003.

The CCR Rule 40 CFR §257.96(a) requires that an owner or operator initiate an assessment of corrective measures to prevent further release, to remediate any releases, and to restore impacted areas to original conditions if any Appendix IV constituent has been detected at a

statistically significant level exceeding a GWPS. The *Assessment of Corrective Measures* report (ACM) (TRC, September 2019) was initiated on April 15, 2019 and was certified and submitted on September 11, 2019 in accordance with the schedule in §257.96.

The ACM documents that the groundwater nature and extent has been defined, as required in §257.95(g)(1), based on the site-specific hydrogeology and data collected from existing monitoring wells. Although arsenic concentrations exceed the GWPS in on-site groundwater, an evaluation of risk demonstrates that there are currently no adverse effects on human health or the environment from either surface water or groundwater due to CCR management at Ponds 1-2.

Consumers Energy will continue to evaluate corrective measures in accordance with §257.96 and §257.97 as outlined in the ACM and will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98, which includes semiannual assessment monitoring in accordance with §257.95 as presented in this report.

1.2 Site Overview

The JH Campbell Power 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 solid waste landfill which is regulated under Part 115 of the Natural Resources and Environmental Protection Act (NREPA), PA 451 of 1994, as amended, and monitored in adherence to the facility's EGLE-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 were decommissioned starting in 2017 and replaced with concrete bottom ash treatment tanks. In June 2017, decommissioning of Pond 3 North 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 Pond 3 North area to manage bottom ash and became operational in July 2018. In addition, hydraulic loading was ceased at Ponds 1-2 and Pond A in June 2018 and the southern portion of Pond 3 in July 2018 (when the concrete tanks were in service).

Removal of ash from Ponds 1-2 for beneficial reuse began in June 2018 and continued through September 2018. CCR removal at Pond 3 South began in September 2018 and continued through October 2018. In addition, Pond A has been decommissioned with final cover placed in summer 2019. Groundwater monitoring is being conducted at Pond A during the post-closure period under the *Pond A Hydrogeological Monitoring Plan, JH Campbell Power Plant, West Olive, Michigan* (March 2019; Revised July 2019) (approved by EGLE August 13, 2019), as well as in accordance with the RCRA CCR Rule.

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

The purpose of the dry ash disposal facility is to contain dry bottom and fly ash produced as a result of burning coal for power production. 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 JHC Ponds 1-2 CCR unit.

1.3 Geology/Hydrogeology

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

Section 2
Groundwater Monitoring

2.1 Monitoring Well Network

In accordance with 40 CFR 257.91, Consumers Energy established a groundwater monitoring system for JHC Ponds 1-2, 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 the CCR unit (JHC-MW-15023 through JHC-MW-15028). Background groundwater quality data from these six background wells are additionally used for the CCR groundwater monitoring program at three other 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 Ponds 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 1-2s and to the south/southwest at Pond 3. As a result, several of the monitoring wells 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 sufficient wells were appropriately located to assess groundwater quality downgradient from the Ponds 1-2 and Pond 3 CCR Units.

As a result of the post-decommissioning changes in groundwater flow direction, Ponds 1-2 monitoring wells JHC-MW-15001 (now upgradient), JHC-MW-15002 (now side gradient), and JHC 15003 (now side gradient) are no longer positioned downgradient of groundwater flow across the Ponds 1-2 area. Since these wells were historically located downgradient of Ponds 1-2, 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-18004 through JHC-MW-18005 were installed on the southwest and south edges of former Ponds 1-2. 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 Ponds 1-2 CCR Unit. As such, these wells have been added to the Ponds 1-2

monitoring system and will serve as downgradient monitoring wells in the assessment monitoring program. The Ponds 1-2 monitoring wells now consist of:

Ponds 1-2 Downgradient Monitoring Wells:

- JHC-MW-15005
- JHC-MW-18004
- JHC-MW-18005

Other Ponds Assessment Monitoring Wells (currently located up- or side gradient):

- JHC-MW-15001 (upgradient)
- JHC-MW-15002 (side gradient)
- JHC-MW-15003 (side gradient)

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 as a result of the groundwater table re-equilibrating to a lower elevation subsequent to decommissioning Pond A. JHC-MW-15008R was installed in the vicinity of the decommissioned well JRW-MW-15008 to continue to evaluate groundwater downgradient of Pond A. Well decommissioning, installation, and construction are documented in Appendix 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, 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 all constituents in Appendix III and 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, 2019 and August 13, 2019 at JHC-MW-18004 and JHC-MW-18005 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 well analytical results), and Table 4 (Ponds 1-2 analytical results). The quarterly monitoring data collected from the new wells in February and August are also included in Table 1, Table 2, and Table 4.

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 Ponds 1-2.

Section 3
Statistical Evaluation

Assessment monitoring is continuing at Ponds 1-2 while corrective measures are further evaluated in accordance with §257.96 and §257.97 as outlined in the ACM. The following section summarizes the statistical approach applied to assess the 2019 groundwater data in accordance with the assessment monitoring program. The statistical evaluation details are provided in Appendix 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 Appendix IV 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.

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. As documented in the January 14, 2019 *Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per* §257.95(g), arsenic was present at statistically significant levels above the GWPSs in two of the downgradient wells at Ponds 1-2 based on the statistical data comparison for the first semiannual assessment monitoring event (June 2018) (Appendix E). Therefore, Consumers Energy initiated an Assessment of Corrective Measures (ACM). Assessment monitoring is ongoing.

Overall, the statistical evaluations have confirmed that arsenic is the only Appendix IV constituent present at statistically significant levels above the GWPSs. Ponds 1-2 have been decommissioned and CCRs have been removed. Due to the changes in groundwater flow direction subsequent to pond decommissioning, monitoring wells JHC-MW-15001, JHC-MW-15002 and JHC-MW-15003 are no longer downgradient of groundwater flow across the Ponds 1-2 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.

Groundwater chemistry is currently changing as a result of closure activities performed at Ponds 1-2. As discussed in the ACM, Ponds 1-2 have been decommissioned and CCRs have been removed and groundwater flow direction has changed such that groundwater generally flows to the south-southwest and mounding is no longer observed. The cessation of hydraulic loading and recharge of the aquifer are expected to have changed groundwater conditions, and many Appendix III and Appendix IV constituents may be affected by this change. Groundwater conditions will continue to be monitored while corrective measures continue to be evaluated and a remedy is selected. There is still some uncertainty surrounding how changes in groundwater oxidation-reduction conditions may affect contaminant transport as a result of changing conditions due to CCR removal activities. Groundwater monitoring in 2020 will reduce uncertainty surrounding the potential changes in groundwater oxidation-reduction conditions and the effect on contaminant transport. These observations will be critical for the comparison of corrective measures alternatives.

Section 4
Corrective Action

Consumers Energy provided notification that arsenic was present at statistically significant levels above the federal groundwater protection standard (GWPS) established at 10 ug/L (TRC, 2019) in two out of five downgradient monitoring wells at Ponds 1-2 as follows:

- Arsenic at JHC-MW-15002 and JHC-MW-15003

The CCR Rule 40 CFR §257.96(a) requires that an owner or operator initiate an assessment of corrective measures (ACM) to prevent further release, to remediate any releases, and to restore impacted areas to original conditions if any Appendix IV constituent has been detected at a statistically significant level exceeding a GWPS. The *Assessment of Corrective Measures* (ACM) (TRC, September 2019) was initiated on April 15, 2019 and was certified and submitted to EGLE on September 11, 2019 in accordance with the schedule in §257.96.

4.1 Nature and Extent Groundwater Sampling

Per §257.95(g)(1), in the event that the facility determines, pursuant to §257.93(h), that there is a statistical exceedance of the GWPSs for one or more of the Appendix IV constituents, the facility must characterize the nature and extent of the release of CCR as well as any site conditions that may affect the remedy selected. The nature and extent data consist of Appendix III and IV constituents collected from the background and downgradient CCR monitoring well networks and from supplemental downgradient wells in the HMP monitoring well network. In addition to the existing HMP wells, TRC, on behalf of Consumers Energy, installed shallow and deep step out wells nested with existing downgradient wells MW-14, PZ-23, PZ-24, and PZ-40 (shallow well only) in April 2018 to further characterize the horizontal and vertical distribution of Appendix III and IV constituents in groundwater downgradient from the CCR units. The locations of the additional downgradient step out wells (MW-14S, MW-14D, PZ-23S, PZ-23D, PZ-24S, PZ-24D, PZ-40S) are shown on Figure 2. A summary of the nature and extent groundwater data collected from February through October 2019, including both the April 2019 and October 2019 semiannual events, are provided on Table 7 (Nature and Extent analytical). The soil boring logs and well construction diagrams for the step out monitoring wells utilized for the nature and extent groundwater sampling are included in Appendix B.

As discussed in the ACM, the nature and extent of contamination (e.g. arsenic in groundwater) relative to GWPSs has been defined per the RCRA CCR rule requirements based on the site-specific hydrogeology. The presence of nearby surface water bodies (Recirculation Pond and the Pigeon River) as well as the unimpacted background monitoring wells to the north provide the boundaries for the extent of the GWPS exceedances. In addition, the underlying clay unit

prevents the downward vertical migration of groundwater. Although Michigan Part 201 residential drinking water criteria are exceeded, there are no onsite drinking water wells downgradient from Ponds 1-2 and the closest downgradient drinking water wells are located south and east of the Pigeon River, separated hydraulically by the river. Shallow groundwater has the potential to vent to nearby surface water boundaries that are not used for drinking water. Although several Appendix III and IV constituents exceed the Michigan Part 201 generic groundwater-surface water interface (GSI) criteria in on-site wells, compliance for the GSI pathway is currently met based on data collected from the step out wells and the NPDES outfall at the Recirculation Pond.

4.2 Assessment of Corrective Measures

The ACM was completed on September 11, 2019 as a step towards developing a final remedy. The certification for a 60-day time extension to the 90-day completion period of the ACM required per §257.96(a) is included in Appendix H of this report.

Several groundwater remediation alternatives evaluated in the ACM are considered technically feasible to reduce on-site groundwater concentrations. The following corrective measures were retained for further evaluation for Ponds 1-2:

- Source Removal with Groundwater Monitoring and Institutional Controls;
- Source Removal with Post Source Control/Removal Monitoring;
- Source Removal with Groundwater Capture/Control;
- Source Removal with Impermeable Barrier;
- Source Removal with Active Geochemical Sequestration; and
- Source Removal with Passive Geochemical Sequestration.

Consumers Energy plans to utilize an adaptive management strategy for selecting the final groundwater remedy for Ponds 1-2 in coordination with the specified CCR source material management strategies discussed in the ACM. Under this remedy selection strategy, measures that remove source material, reduce infiltration, and/or minimize the potential for future migration during the closure process may be implemented to address existing conditions followed by monitoring and evaluation of the performance after closure. Adjustments will be made to the corrective measure remedy, as needed, to achieve the remedial goals (e.g. GWPS and/or risk/exposure/pathway-based criteria).

4.3 Remedy Selection

Consumers Energy has not selected a remedy pursuant to §257.97 and R 444 of Part 115. The semiannual progress report describing the progress in selecting and designing the remedy

required pursuant to §257.97(a) is included in Appendix I of this report. Consumers Energy has performed CCR removal at Ponds 1-2 as documented in the "*JH Campbell Generating Facility Bottom Ash Ponds 1-2 Closure Plan,"* (Golder, January 2018). Ponds 1-2 is undergoing closure by removal of CCR in accordance with §257.102(c). The December 2017 "*Bottom Ash Ponds 1-2 Closure Work Plan"* was submitted to and approved by EGLE. Dewatering and removal of ash from Ponds 1-2 for beneficial reuse began in June 2018 and continued through September 2018. CCR removal activities were completed in October 2018 and Consumers Energy submitted final documentation of CCR removal to EGLE in August 2019. On October 22, 2019 EGLE provided written concurrence that all bottom ash had been removed from Ponds 1-2 based on multiple lines of evidence described in the approved closure work plan. Changes in groundwater chemistry continue to be evaluated following the completion of CCR removal at Ponds 1-2. Groundwater monitoring in 2020 will reduce uncertainty surrounding potential changes in redox conditions and the effect on contaminant transport. These observations will be critical for the comparison of corrective measures alternatives.

Section 5
Conclusions and Recommendations

Assessment monitoring is ongoing at the JHC Ponds 1-2 CCR unit while corrective action continues to be assessed. Ponds 1-2 have been decommissioned and CCRs have been removed. Overall, the statistical evaluations have confirmed that arsenic is the only Appendix IV constituent present at statistically significant levels above the GWPSs.

The ACM also documents that groundwater nature and extent have been defined, as required in §257.95(g)(1). Although arsenic concentrations exceed the GWPS in on-site groundwater, an evaluation of risk demonstrates that there are currently no adverse effects on human health or the environment from either surface water or groundwater due to CCR management at Ponds 1-2.

Consumers Energy has also completed the removal of CCR from Ponds 1-2. The ACM report provided a high-level assessment of groundwater remediation technologies that could potentially address site-specific constituents of concern (i.e. arsenic) under known groundwater conditions. Changes in groundwater chemistry continue to be evaluated following the completion of CCR removal at Ponds 1-2. Groundwater monitoring in 2020 will reduce uncertainty surrounding potential changes in groundwater oxidation-reduction conditions and the effect on contaminant transport. These observations will be critical for the comparison of corrective measures alternatives.

Consumers Energy will continue to evaluate corrective measures in accordance with §257.96 and §257.97. The groundwater management remedy for the JHC Ponds 1-2 will be selected as soon as feasible to, at a minimum, meet the federal standards of §257.97(b) of the CCR Rule. Consumers Energy 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 – February 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)			February 26, 2019		April 22, 2019		August 12, 2019		October 7, 2019	
							Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	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	16.70	603.28	15.85	604.13
JHC-MW-15024	613.79	616.62	Sand	606.8	to	596.8	--	--	10.55	606.07	11.59	605.03	11.15	605.47
JHC-MW-15025	614.14	617.17	Sand	607.1	to	597.1	--	--	9.64[2]	607.53	10.65	606.52	10.08	607.09
JHC-MW-15026	615.09	618.04	Sand	607.1	to	597.1	--	--	11.63	606.41	12.21	605.83	11.88	606.16
JHC-MW-15027	614.77	617.30	Sand	604.8	to	594.8	--	--	12.11	605.19	12.51	604.79	12.42	604.88
JHC-MW-15028	611.02	613.80	Sand	603.0	to	593.0	--	--	12.08	601.72	12.30	601.50	12.00	601.80
JHC-MW-15029	608.08	610.95	Sand	600.1	to	590.1	--	--	9.83	601.12	10.18	600.77	9.50	601.45
JHC-MW-15030	604.05	607.17	Sand	600.1	to	590.1	--	--	8.21	598.96	8.94	598.23	7.75	599.42
Pond 1N, 1S, 2N, 2S														
JHC-MW-15001	607.02	609.53	Sand	603.5	to	598.5	11.23	598.30	11.42	598.11	11.70	597.83	11.10	598.43
JHC-MW-15002	618.18	621.27	Sand	590.2	to	580.2	23.70	597.57	23.77	597.50	23.74	597.53	23.49	597.78
JHC-MW-15003	623.16	627.20	Sand	595.2	to	585.2	32.14	595.06	32.28	594.92	32.38	594.82	32.05	595.15
JHC-MW-15005	606.22	609.99	Sand	579.2	to	569.2	17.78[3]	592.21	17.90	592.09	17.98	592.01	17.78	592.21
JHC-MW-18004	602.92	605.72	Sand	596.9	to	586.9	11.10[3]	594.62	11.34	594.38	11.65	594.07	10.98	594.74
JHC-MW-18005	600.30	603.16	Sand	595.3	to	585.3	9.35[3]	593.81	10.09	593.07	10.28	592.88	10.01	593.15
Pond 3N, 3S														
JHC-MW-15013	632.40	635.25	Sand	604.4	to	594.4	34.40	600.85	34.47	600.78	34.58	600.67	34.00	601.25
JHC-MW-15015	632.46	635.20	Sand	604.5	to	594.5	33.75	601.45	33.68	601.52	33.68	601.52	33.20	602.00
JHC-MW-15016	631.81	632.52	Sand	603.8	to	593.8	30.98[3]	601.54	30.90	601.62	30.97	601.55	30.54	601.98
JHC-MW-18001	609.09	611.98	Sand	603.1	to	593.1	11.02[3]	600.96	11.03	600.95	11.22	600.76	10.62	601.36
JHC-MW-18002	605.53	608.93	Sand	602.0	to	592.0	8.25[3]	600.68	8.27	600.66	8.59	600.34	7.94	600.99
JHC-MW-18003	605.36	608.78	Sand	601.9	to	591.9	8.18[3]	600.60	8.26	600.52	8.45	600.33	7.80	600.98
Landfill														
JHC-MW-15017	613.69	616.61	Sand	603.7	to	593.7	--	--	13.71	602.90	14.00	602.61	13.58	603.03
JHC-MW-15018	614.26	617.02	Sand	604.3	to	594.3	--	--	14.43	602.59	14.70	602.32	14.43	602.59
JHC-MW-15019	609.81	612.86	Sand	603.8	to	593.8	--	--	10.80	602.06	11.07	601.79	11.00	601.86
JHC-MW-15022	620.92	623.79	Sand	597.9	to	587.9	--	--	27.51	596.28	28.00	595.79	27.72	596.07
JHC-MW-15031	632.94	635.87	Sand	599.9	to	589.9	--	--	42.03	593.84	42.19	593.68	42.35	593.52
JHC-MW-15032	611.32	614.29	Sand	598.3	to	588.3	--	--	15.61	598.68	16.38	597.91	15.71	598.58
JHC-MW-15033	618.08	620.99	Sand	602.1	to	592.1	--	--	20.22	600.77	21.19	599.80	20.42	600.57
JHC-MW-15034	612.90	615.97	Sand	601.9	to	591.9	--	--	14.38	601.59	14.98	600.99	14.15	601.82
JHC-MW-15035	632.53	634.28	Sand	599.5	to	589.5	--	--	39.32	594.96	39.50	594.78	39.78	594.50
JHC-MW-15036	617.94	618.34	Sand	597.9	to	587.9	--	--	25.62	592.72	25.89	592.45	25.90	592.44
JHC-MW-15037	614.28	616.06	Sand	591.3	to	586.3	--	--	24.20	591.86	24.41	591.65	24.35	591.71
Pond A														
JHC-MW-15006	624.74	627.58	Sand	599.7	to	589.7	33.65	593.93	33.66	593.92	34.08	593.50	34.00	593.58
JHC-MW-15007	624.82	627.70	Sand	602.8	to	592.8	33.97	593.73	33.98	593.72	34.45	593.25	34.29	593.41
JHC-MW-15008	632.43	635.30	Sand	604.4	to	594.4	Dry		Dry		Decommissioned		Decommissioned	
JHC-MW-15008R[4]	632.32	634.67	Sand	597.3	to	587.3	NA	NA	NA	NA	42.05	592.62	41.98	592.69
JHC-MW-15009	632.33	635.32	Sand	602.3	to	592.3	41.72	593.60	41.60	593.72	42.10	593.22	42.28	593.04
JHC-MW-15010	632.55	635.57	Sand	602.6	to	592.6	41.37	594.20	41.10	594.47	41.58	593.99	41.90	593.67
JHC-MW-15011	627.71	630.83	Sand	600.7	to	590.7	37.81	593.02	37.85	592.98	38.07	592.76	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): The static water level data for JHC-MW-15005, JHC-MW-18001, JHC-MW-18002, JHC-MW-18003, JHC-MW-18004, and JHC-MW- 18005 were collected on Feburary 27, 2019; JHC-MW-15016 was sampled on February 28, 2019.

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

Table 2

Summary of Field Parameter Results – February 2019 - October 2019

JH Campbell Ponds 1-2N/1-2S – 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	8.80	9.95
	10/8/2019	0.49	106.0	6.2	97	10.40	4.75
JHC-MW-15024	4/23/2019	1.56	73.7	7.2	321	7.30	3.90
	10/8/2019	0.61	25.3	7.4	261	11.80	3.00
JHC-MW-15025	4/23/2019	7.47	70.1	6.7	140	6.80	14.55
	10/8/2019	2.15	9.8	8.1	370	11.70	2.15
JHC-MW-15026	4/22/2019	5.02	55.8	6.9	136	10.00	7.61
	10/7/2019	3.70	110.5	7.3	140	11.50	11.60
JHC-MW-15027	4/22/2019	5.99	61.0	6.5	79	9.10	8.87
	10/7/2019	4.75	134.6	6.3	70	11.40	3.45
JHC-MW-15028	4/22/2019	7.60	48.0	7.6	81	9.60	4.99
	10/7/2019	6.37	84.5	7.2	87	14.20	3.85
Ponds 1 & 2							
JHC-MW-15001	4/25/2019	1.76	69.5	6.0	440	6.80	3.30
	10/9/2019	0.41	-109.3	6.4	595	19.00	0.85
JHC-MW-15002	4/25/2019	0.17	-106.6	6.9	861	13.60	3.60
	10/9/2019	0.45	-37.0	6.5	732	14.10	4.75
JHC-MW-15003	4/29/2019	1.17	77.0	8.4	330	11.80	10.10
	10/9/2019	0.16	48.8	8.7	843	13.50	0.97
JHC-MW-15005	4/25/2019	5.77	86.3	7.2	1087	7.10	19.95
	10/9/2019	0.95	-9.5	7.3	765	16.00	3.60
JHC-MW-18004	2/28/2019	5.37	104.0	--	632	6.06	--
	4/25/2019	6.05	89.8	7.2	620	8.00	6.90
	8/13/2019	1.85	63.8	7.5	805	16.10	0.45
	10/9/2019	1.55	97.0	7.2	658	16.50	0.24
JHC-MW-18005	2/28/2019	1.31	103.1	--	509	6.51	--
	4/25/2019	2.50	65.5	9.0	397	8.50	2.88
	8/13/2019	1.40	-8.9	8.9	437	15.00	0.90
	10/9/2019	1.43	58.6	8.8	483	14.00	0.46

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

SU - Standard units

umhos/cm - Micromhos per centimeter.

°C - Degrees Celcius

NTU - Nephelometric Turbidity Unit.

-- - Not sampled.

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): February 2019 - October 2019
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15001		JHC-MW-15002		JHC-MW-15003		JHC-MW-15005	
					Sample Date:	4/25/2019	10/9/2019	4/25/2019	10/9/2019	4/29/2019	10/9/2019	4/25/2019	10/9/2019
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	78	150	**3,200**	**1,700**	**1,700**	**3,500**	**2,800**	**1,200**
Calcium	mg/L	NC	NC	NC	500	69	73	85	99	36	110	170	110
Chloride	mg/L	250**	250	250	500	< 2.0	< 2.0	17	20	18	47	28	30
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	**250****	**250**	**250**	500	39	21	190	**280**	75	210	240	130
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	280	350	410	480	200	**580**	**800**	360
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	**6.0**	**6.4**	6.9	6.5	8.4	**8.7**	7.2	7.3
Appendix IV													
Antimony	ug/L	6	6.0	6.0	130	< 1.0	< 1.0	< 1.0	< 1.0	2.2	1.4	4.4	3.3
Arsenic	ug/L	**10**	**10**	**10**	**10**	5.8	6.3	**50**	**57**	10	8.4	1.2	1.4
Barium	ug/L	2,000	2,000	2,000	820	58	95	49	150	42	91	150	190
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
Cadmium	ug/L	5	5.0	5.0	3.5	< 0.20	< 0.20	< 0.20	< 0.20	0.41	2.5	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11	< 1.0	1.2	< 1.0	< 1.0	4.2	11	1.3	1.3
Cobalt	ug/L	NC	**40**	100	100	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	**43**	< 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
Lead	ug/L	NC	4.0	4.0	39	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	3.2	< 1.0	< 1.0
Lithium	ug/L	NC	**170**	350	0.20#	< 10	< 10	96	**240**	< 10	< 10	38	50
Mercury	ug/L	2	2.0	2.0	**0.20**	< 0.20	**0.25**	< 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	15	20	**120**	**900**	**370**
Radium-226	pCi/L	NC	NC	NC	NC	< 0.101	< 0.162	0.233	0.698	< 0.113	0.301	0.169	0.592
Radium-228	pCi/L	NC	NC	NC	NC	< 0.447	< 0.516	0.409	< 0.394	< 0.530	0.421	< 0.350	0.427
Radium-226/228	pCi/L	5	NC	NC	NC	< 0.447	< 0.516	0.642	1.04	< 0.530	0.722	< 0.350	1.02
Selenium	ug/L	**50**	**50**	**50**	**5.0**	< 1.0	< 1.0	< 1.0	< 1.0	2.9	**18**	**140**	**66**
Thallium	ug/L	**2**	**2.0**	**2.0**	3.7	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	2.0	**2.9**

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 EGLE 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.
(1) - Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.

Table 4
Summary of Groundwater Sampling Results (Analytical): February 2019 - October 2019
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-18004				JHC-MW-18005			
					Sample Date:	2/28/2019	4/25/2019	8/13/2019	10/9/2019	2/28/2019	4/25/2019	8/13/2019	10/9/2019
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**900**	**920**	**1,200**	**620**	**660**	**650**	**750**	**660**
Calcium	mg/L	NC	NC	NC	500	55	72	97	73	43	41	43	55
Chloride	mg/L	250**	250	250	500	50	34	35	40	27	25	27	18
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	**250****	**250**	**250**	500	69	100	110	120	89	66	95	110
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	330	380	490	310	280	250	270	330
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.6(1)	7.2	7.5	7.2	8.6 (1)	**9.0**	**8.9**	**8.8**
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
Arsenic	ug/L	**10**	**10**	**10**	**10**	< 1.0	1.1	1.2	1.1	10	8.8	7.4	7.1
Barium	ug/L	2,000	2,000	2,000	820	170	220	680	270	72	73	120	150
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
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
Chromium	ug/L	100	100	100	11	1.2	2.0	1.8	1.3	4.0	2.8	2.3	1.9
Cobalt	ug/L	NC	**40**	100	100	< 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
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
Lithium	ug/L	NC	**170**	350	0.20#	< 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
Molybdenum	ug/L	NC	**73**	**210**	3,200	7.4	8.2	9.0	10	14	14	15	66
Radium-226	pCi/L	NC	NC	NC	NC	< 0.0742	0.110	0.352	0.179	< 0.0795	< 0.0785	< 0.145	0.497
Radium-228	pCi/L	NC	NC	NC	NC	0.589	< 0.430	0.469	0.672	< 0.386	< 0.357	< 0.400	0.456
Radium-226/228	pCi/L	5	NC	NC	NC	0.654	< 0.430	0.822	0.851	< 0.386	< 0.357	< 0.400	0.953
Selenium	ug/L	**50**	**50**	**50**	**5.0**	**12**	**12**	**39**	**33**	**35**	**16**	**11**	**140**
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

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 EGLE 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.

(1) - Field meter reading not usable due to malfunctioning groundwater meter. Displayed value is lab pH reading from an unpreserved bottle.

Table 5

Summary of Groundwater Protection Standard Exceedances – April 2019

JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program

West Olive, Michigan

Constituent	Units	GWPS	JHC-MW-15001		JHC-MW-15002		JHC-MW-15003		JHC-MW-15005	
			LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL
Arsenic	ug/L	10	0.82	7.5	33	130	8.8	29	--	--
Cobalt	ug/L	15	--	--	--	--	6	24	--	--
Lithium	ug/L	40	--	--	5.0	96	--	--	30	51
Molybdenum	ug/L	100	--	--	--	--	--	--	10	885
Selenium	ug/L	50	--	--	--	--	--	--	10	368
Thallium	ug/L	2	--	--	--	--	--	--	2	5.8

Notes:

ug/L - micrograms per Liter.

-- - Not Applicable; well/parameter pair did not directly exceed the GWPS and was not included in further analysis.

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 Unit 1-2N/1-2S – RCRA CCR Monitoring Program

West Olive, Michigan

Constituent	Units	GWPS	JHC-MW-15001		JHC-MW-15002		JHC-MW-15003		JHC-MW-15005		JHC-MW-18005	
			LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL
Arsenic	ug/L	10	0.87	8.1	37	100	6.4	27	--	--	6.2	11
Cobalt	ug/L	15	--	--	--	--	6	42	--	--	--	--
Lithium	ug/L	40	--	--	2.8	130	--	--	31	53	--	--
Molybdenum	ug/L	100	--	--	--	--	17	71	10	890	--	--
Selenium	ug/L	50	--	--	--	--	--	--	13	240	0.42	140
Thallium	ug/L	2	--	--	--	--	--	--	1.2	4	--	--

Notes:

ug/L - micrograms per Liter.

-- - Not Applicable; well/parameter pair did not directly exceed the GWPS and was not included in further analysis.

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 7
Summary of Groundwater Sampling Results (Analytical): February 2019 - October 2019
JH Campbell Nature and Extent Wells – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	**MW-13**	**MW-14**	**MW-14D**		**MW-14S**				
					Sample Date:	4/24/2019	4/23/2019	4/23/2019	10/9/2019	2/15/2019	4/18/2019	4/23/2019	8/12/2019	10/10/2019
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^									
Appendix III														
Boron	ug/L	NC	**500**	**500**	7,200	< 50	66	180	170	27	< 20	< 50	20	< 50
Calcium	mg/L	NC	NC	NC	500	8.5	21	40	39	--	--	2.0	--	2.1
Chloride	mg/L	250**	250	250	500	< 2.0	9.5	20	21	--	--	2.3	--	< 2.0
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	5.3	17	28	32	--	--	4.0	--	3.6
Total Dissolved Solids	mg/L	500**	500	500	500	< 50	130	200	220	--	--	< 50	--	61
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	6.7	6.8	7.9	8.1	**5.8**	**6.1**	**5.5**	**5.6**	**5.7**
Appendix IV														
Antimony	ug/L	6	6.0	6.0	130	1.1	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1	< 1.0
Arsenic	ug/L	10	10	10	10	< 1.0	< 1.0	1.6	1.3	< 1	< 1	< 1.0	< 1	< 1.0
Barium	ug/L	2,000	2,000	2,000	820	8.7	16	46	50	--	--	8.3	--	9.5
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	2.3	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1	< 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	12	< 10	20	18	< 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	20	21	< 5	< 5	< 5.0	< 5	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC	< 0.0808	< 0.0845	< 0.110	0.193	--	--	< 0.0790	--	< 0.145
Radium-228	pCi/L	NC	NC	NC	NC	< 0.373	< 0.352	< 0.347	< 0.713	--	--	< 0.332	--	< 0.445
Radium-226/228	pCi/L	5	NC	NC	NC	< 0.373	< 0.352	< 0.347	0.749	--	--	< 0.332	--	0.501
Selenium	ug/L	50	50	50	5.0	2.6	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1	< 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.
-- - not analyzed.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR), April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 180 mg CaCO3/L as measured at surface water sample SW-01 collected on April 9, 2018 from the Pigeon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.
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 7
Summary of Groundwater Sampling Results (Analytical): February 2019 - October 2019
JH Campbell Nature and Extent Wells – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	PZ-23	PZ-23D		PZ-23S					PZ-24	
					Sample Date:	4/23/2019	4/23/2019	10/9/2019	2/15/2019	4/17/2019	4/23/2019	8/12/2019	10/9/2019	4/24/2019	10/9/2019
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^										
Appendix III															
Boron	ug/L	NC	**500**	**500**	7,200	220	**820**	**800**	37	34	< 50	23	< 50	170	200
Calcium	mg/L	NC	NC	NC	500	39	24	28	--	--	8.6	--	6.4	27	35
Chloride	mg/L	250**	250	250	500	13	22	23	--	--	< 2.0	--	< 2.0	18	14
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	--	--	< 1,000	--	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250**	250	250	500	49	52	52	--	--	5.4	--	3.4	< 2.0	48
Total Dissolved Solids	mg/L	500**	500	500	500	200	130	150	--	--	< 50	--	480	170	250
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.4	**8.6**	**8.7**	7.0	7.1	6.9	6.7	6.6	6.7	7.0
Appendix IV															
Antimony	ug/L	6	6.0	6.0	130	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	10	10	10	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	2,000	2,000	820	14	25	27	--	--	< 5.0	--	< 5.0	20	27
Beryllium	ug/L	4	4.0	4.0	18	< 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
Chromium	ug/L	100	100	100	11	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1	< 1.0	< 1.0	1.2
Cobalt	ug/L	NC	40	100	100	< 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
Lead	ug/L	NC	4.0	4.0	39	< 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
Mercury	ug/L	2	2.0	2.0	**0.20#**	< 0.20	< 0.20	< 0.20	--	--	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	73	210	3,200	10	12	12	8	7	6.5	11	6.0	13	11
Radium-226	pCi/L	NC	NC	NC	NC	< 0.102	< 0.110	< 0.116	--	--	0.119	--	0.136	< 0.0841	0.260
Radium-228	pCi/L	NC	NC	NC	NC	< 0.373	< 0.392	< 0.743	--	--	0.383	--	< 0.637	0.483	< 0.679
Radium-226/228	pCi/L	5	NC	NC	NC	< 0.373	< 0.392	< 0.743	--	--	0.502	--	< 0.637	0.494	< 0.679
Selenium	ug/L	50	50	50	5.0	3.6	< 1.0	< 1.0	1	< 1	< 1.0	< 1	< 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

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NC - no criteria.
-- - not analyzed.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR), April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 180 mg CaCO3/L as measured at surface water sample SW-01 collected on April 9, 2018 from the Pigeon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.
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 7
Summary of Groundwater Sampling Results (Analytical): February 2019 - October 2019
JH Campbell Nature and Extent Wells – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	PZ-24D		PZ-24S					PZ-40	
					Sample Date:	4/24/2019	10/9/2019	2/15/2019	4/18/2019	4/24/2019	8/12/2019	10/10/2019	4/24/2019	10/9/2019
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^									
Appendix III														
Boron	ug/L	NC	**500**	**500**	7,200	250	240	45	31	< 50	32	< 50	170	190
Calcium	mg/L	NC	NC	NC	500	40	40	--	--	4.0	--	2.9	16	15
Chloride	mg/L	250**	250	250	500	18	18	--	--	< 2.0	--	< 2.0	9.3	8.4
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	25	24	--	--	4.5	--	4.0	19	21
Total Dissolved Solids	mg/L	500**	500	500	500	200	180	--	--	< 50	--	< 50	93	86
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.7	7.5	**5.5**	**5.9**	**5.5**	**5.6**	**5.5**	**6.4**	**6.5**
Appendix IV														
Antimony	ug/L	6	6.0	6.0	130	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	10	10	10	8.7	5.4	< 1	< 1	< 1.0	1	1.1	< 1.0	< 1.0
Barium	ug/L	2,000	2,000	2,000	820	61	63	--	--	23	--	34	17	18
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	1	1.5	2	1.6	< 1.0	1.3
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	< 10	< 10	< 10
Mercury	ug/L	2	2.0	2.0	**0.20#**	< 0.20	**0.21**	--	--	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	73	210	3,200	27	22	< 5	< 5	< 5.0	< 5	< 5.0	11	6.4
Radium-226	pCi/L	NC	NC	NC	NC	< 0.0842	0.144	--	--	< 0.0852	--	0.248	< 0.0984	0.222
Radium-228	pCi/L	NC	NC	NC	NC	< 0.359	< 0.668	--	--	< 0.357	--	0.511	< 0.410	< 0.587
Radium-226/228	pCi/L	5	NC	NC	NC	< 0.359	< 0.668	--	--	< 0.357	--	0.759	< 0.410	< 0.587
Selenium	ug/L	50	50	50	5.0	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1	< 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.
-- - not analyzed.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR), April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 180 mg CaCO3/L as measured at surface water sample SW-01 collected on April 9, 2018 from the Pigeon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.
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.

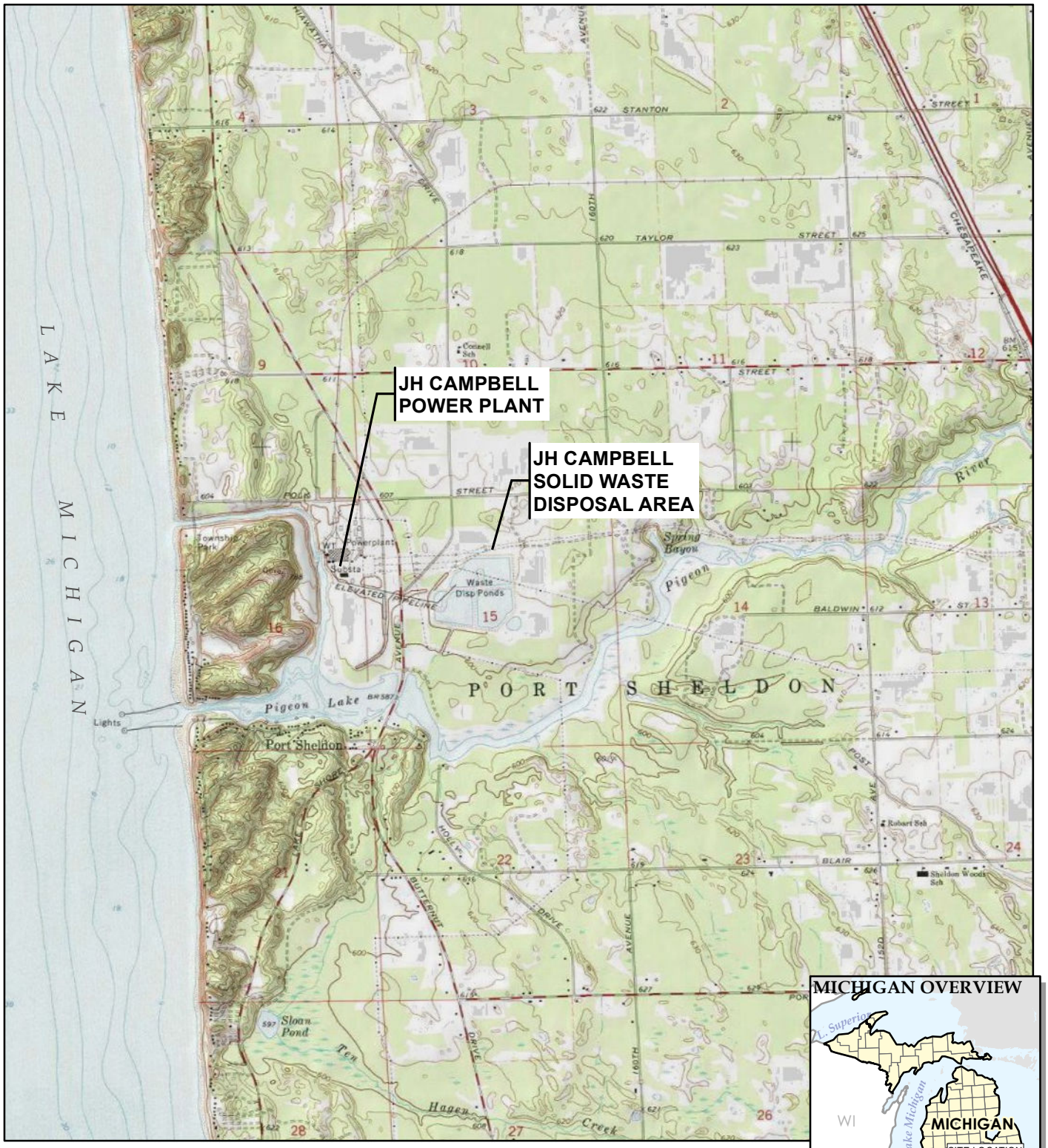
Table 7
Summary of Groundwater Sampling Results (Analytical): February 2019 - October 2019
JH Campbell Nature and Extent Wells – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	PZ-40S				
					Sample Date:	2/15/2019	4/18/2019	4/24/2019	8/12/2019	10/10/2019
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^					
Appendix III										
Boron	ug/L	NC	**500**	**500**	7,200	< 20	< 20	< 50	< 20	< 50
Calcium	mg/L	NC	NC	NC	500	--	--	2.1	--	1.5
Chloride	mg/L	250**	250	250	500	--	--	< 2.0	--	< 2.0
Fluoride	ug/L	4,000	NC	NC	NC	--	--	< 1,000	--	< 1,000
Sulfate	mg/L	250**	250	250	500	--	--	4.4	--	3.4
Total Dissolved Solids	mg/L	500**	500	500	500	--	--	< 50	--	< 50
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	**5.1**	**5.2**	**4.9**	**5.0**	**5.1**
Appendix IV										
Antimony	ug/L	6	6.0	6.0	130	< 1	< 1	< 1.0	< 1	< 1.0
Arsenic	ug/L	10	10	10	10	< 1	< 1	< 1.0	< 1	< 1.0
Barium	ug/L	2,000	2,000	2,000	820	--	--	23	--	23
Beryllium	ug/L	4	4.0	4.0	18	--	--	< 1.0	--	< 1.0
Cadmium	ug/L	5	5.0	5.0	3.5	--	--	< 0.20	--	< 0.20
Chromium	ug/L	100	100	100	11	2	1	1.7	< 1	1.3
Cobalt	ug/L	NC	40	100	100	--	--	< 6.0	--	< 6.0
Fluoride	ug/L	4,000	NC	NC	NC	--	--	< 1,000	--	< 1,000
Lead	ug/L	NC	4.0	4.0	39	--	--	< 1.0	--	< 1.0
Lithium	ug/L	NC	170	350	440	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	2.0	2.0	**0.20#**	--	--	< 0.20	--	< 0.20
Molybdenum	ug/L	NC	73	210	3,200	< 5	< 5	< 5.0	< 5	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC	--	--	< 0.100	--	0.178
Radium-228	pCi/L	NC	NC	NC	NC	--	--	< 0.409	--	< 0.473
Radium-226/228	pCi/L	5	NC	NC	NC	--	--	< 0.409	--	< 0.473
Selenium	ug/L	50	50	50	5.0	< 1	< 1	< 1.0	< 1	< 1.0
Thallium	ug/L	2	2.0	2.0	3.7	--	--	< 2.0	--	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NC - no criteria.
-- - not analyzed.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR), April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 180 mg CaCO3/L as measured at surface water sample SW-01 collected on April 9, 2018 from the Pigeon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

Figures



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

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

0 3,000 6,000
FEET

TRC

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PROJECT:

CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:

SITE LOCATION MAP

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

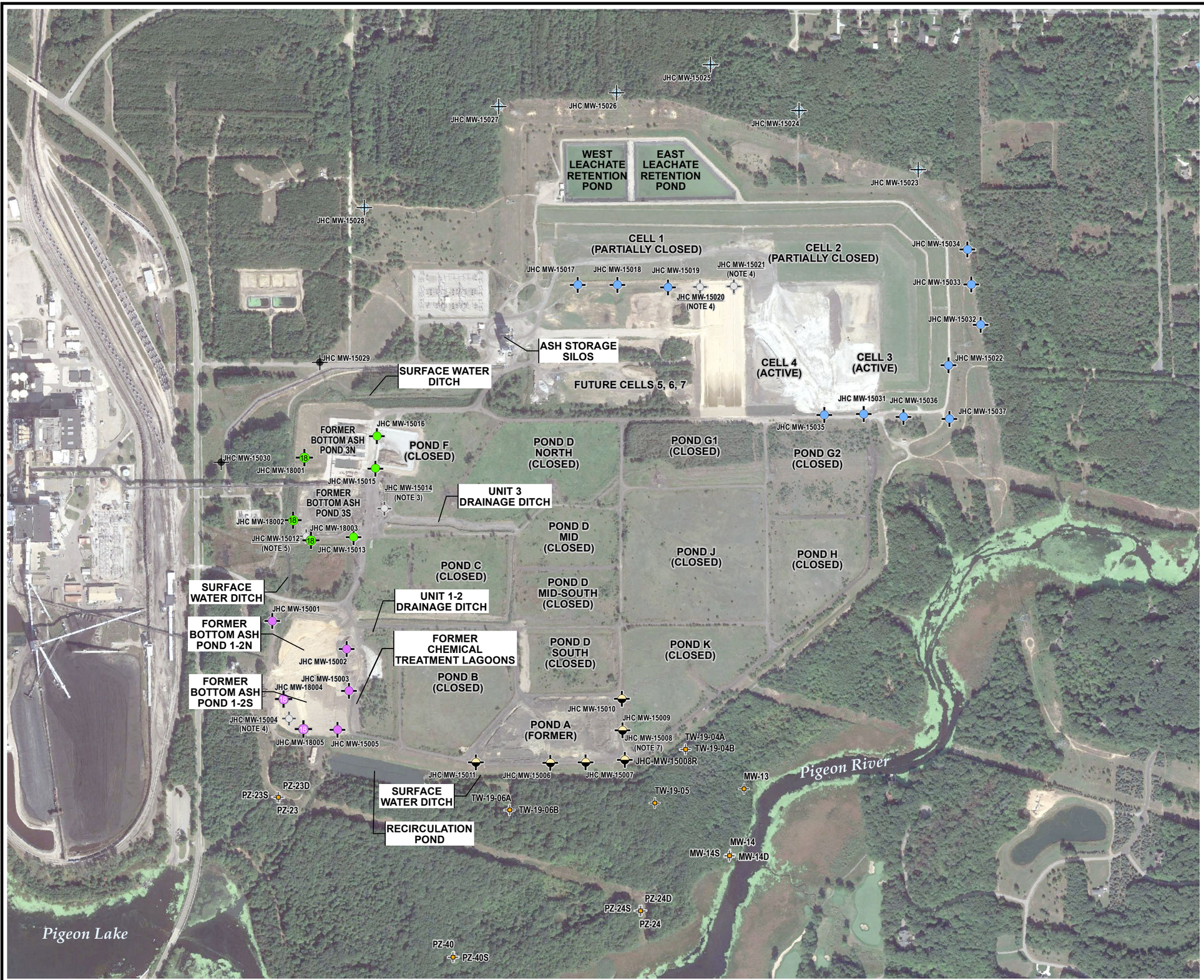
FIGURE 1

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

TRC - GIS

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

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



LEGEND

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

NOTES

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

0 700 1,400 Feet

1 " = 700 '
1:8,400

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

TITLE:
SITE PLAN
WITH CCR MONITORING WELL LOCATIONS

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

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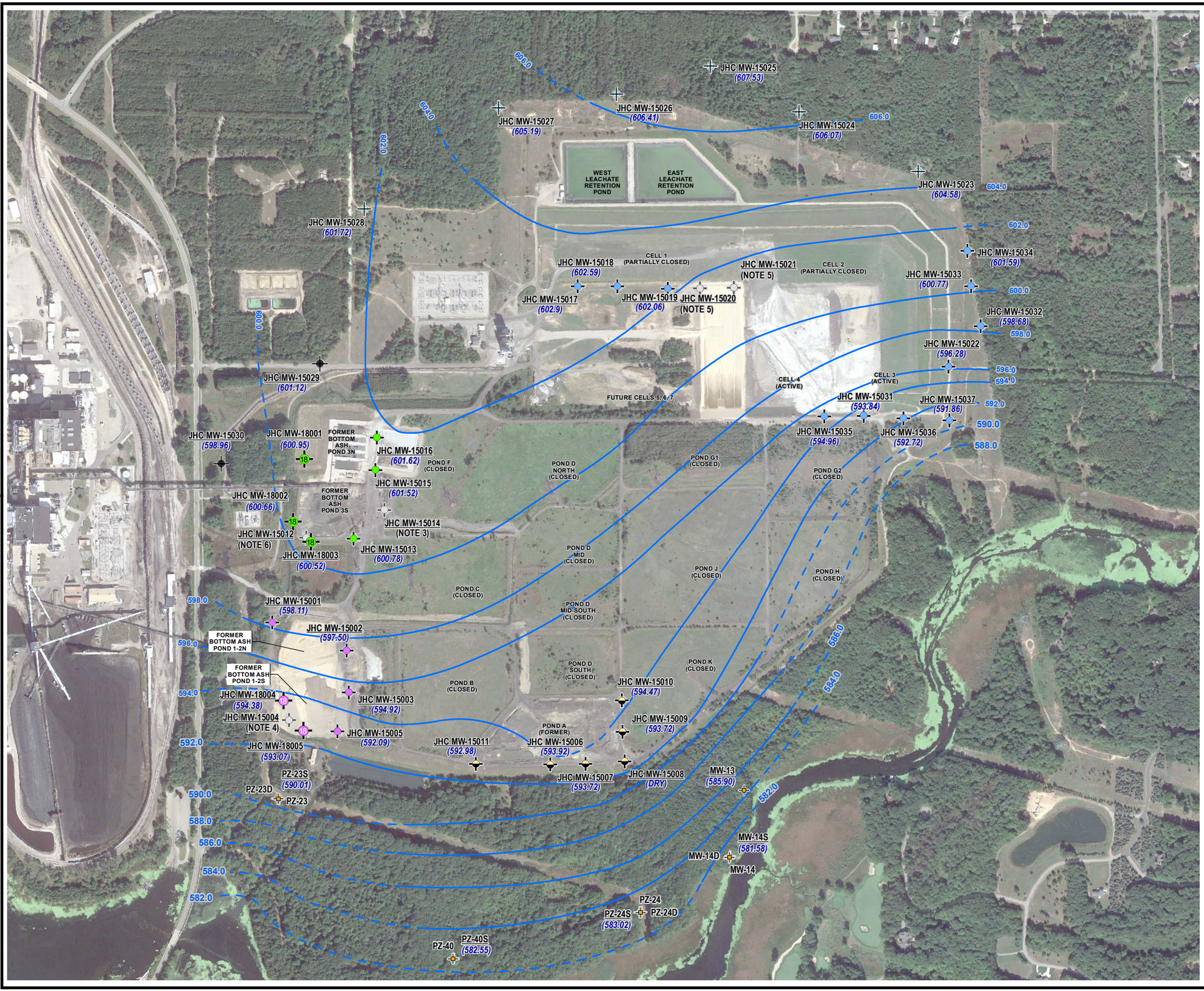
FILE NO.: 322174-001-030.mxd



LEGEND

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

NOTES

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

N

0 700 1,400 Feet

1 " = 700 '

1:8,400

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

TITLE:
GROUNDWATER CONTOUR MAP APRIL 2019

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

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FILE NO.: 322174-001-024.mxd

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

TRC - GIS

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

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

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

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

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

LEGEND

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

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH 12/07/2018.
3. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
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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: July 12, 2019

To: Operating Record

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

RE: Demonstration for 60-Day Extension for Assessment of Corrective Measures
Professional Engineer Certification
JH Campbell Unit 1&2 Bottom Ash Pond and JH Campbell Pond A

Professional Engineer Certification Statement [§257.96(a)]

Consumers Energy has determined that the analysis of the effectiveness of potential corrective measures in meeting all of the requirements and objectives of a selected remedy described in §257.97 cannot be achieved within the 90-day timeline to complete the Assessment of Corrective Measures for JH Campbell Unit 1&2 Bottom Ash Pond and JH Campbell Pond A due to site-specific conditions that are changing based on initiating closure activities. Notification was made September 7, 2018 and September 17, 2018 for JH Campbell Unit 1&2 Bottom Ash Pond and JH Campbell Pond A, respectively, that closure activities had been initiated. Groundwater monitoring data collected to date indicates changing conditions that can influence factors that must be considered in the assessment, including source evaluation, plume delineation, groundwater assessment, and source control. The final published rule allows for a single 60 day extension based on site-specific conditions or circumstances.

I hereby attest that, having reviewed the detection and assessment monitoring documentation and being familiar with the provisions of Title 40 of the Code of Federal Regulations §257.96, that the demonstration justifying a 60-day time extension to the 90-day completion period of the Assessment of Corrective Measures is accurate for JH Campbell Unit 1&2 Bottom Ash Pond and JH Campbell Pond A in accordance with the requirements of §257.96(a). This will now set the deadline for completing the Assessment of Corrective Measures for September 11, 2019.

Harold D. Register, Jr.

Signature

STATE OF MICHIGAN
HAROLD D. REGISTER, JR.
ENGINEER
No. 6201056266
LICENSED PROFESSIONAL ENGINEER

July 12, 2019

Date of Certification

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

Name

07/12/2019

6201056266

Professional Engineer Certification Number

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.

N: 517558.9 E: 12636031.7

Personnel
Logged By - Paula Lancaster
Driller - Roger Christiansen

Drilling Equipment: Geoprobe 7822 DT

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

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

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

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

Signature: Paula C Lancaster

Checked By: Jennifer Reed

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

WELL CONSTRUCTION LOG

WELL NO. JHC MW-15008R

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

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

WELL CONSTRUCTION DIAGRAM

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

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

RISER PIPE LENGTH

SCREEN LENGTH

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

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

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

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 1 HOURS

WATER REMOVED: 100 GALLONS

WATER ADDED: 5 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: Turbid

COLOR BEFORE: yellowish brown

CLARITY AFTER: None

COLOR AFTER: None

ODOR (IF PRESENT): None

WATER LEVEL SUMMARY

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

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER:

REVISED 11/2013

MONITORING WELL DECOMMISSIONING LOG

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

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

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

DECOMMISSIONING PROCEDURE

NOTES:

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

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

NOTES:

ADDITIONAL COMMENTS:

Paula C Lancaster

SIGNED

Sarah B Holmstrom

CHECKED

REVISED 04/2019

WELL CONSTRUCTION LOG

WELL NO. MW-14D

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
Consumers Energy Company: JH Campbell	4/10/18	4/10/18	290806.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns Drilling	Direct Push	587.4	590.35	35.0	2/3.75

Boring Location: Approximately 17 feet SW of MW-14.	Personnel	Drilling Equipment:
N: 516842.4 E: 12636804.0	Logged By - T. Hess Driller - Tom Ulrich	Geoprobe 7822 DT

Civil Town/City/or Village:	County:	State:	Water Level Observations:
West Olive	Ottawa	MI	While Drilling: Date/Time 4/10/18 15:15 ▽ Depth (ft bgs) 6.5 After Drilling: Date/Time 4/11/18 08:13 ▼ Depth (ft bgs) 6.5

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		0	**TOPSOIL** sandy, very dark gray (10YR 3/1).				
				SAND mostly fine to medium sand, yellowish brown (10YR 5/8), dry, loose.				
				Change to light yellowish brown (10YR 6/4) at 2.5 feet.				
2 GP	75		5	Change to yellowish brown (10YR 5/8) at 5.0 feet.				
				Change to trace coarse sand, brown (10YR 5/3), saturated at 6.5 feet.				
3 GP	75		10	Change to trace gravel at 11.5 feet.	SP			
				Change to no gravel at 13.5 feet.				
4 GP	90		15	Change to reddish brown (5YR 4/4) at 14.0 feet.				
				Change to mostly medium to coarse sand, brown (10YR 5/3) at 15.0 feet.				
5 GP	95		20	Change to mostly fine to medum sand at 18.0 feet.				
6 GP	100		25	**SANDY SILT** mostly silt, some fine to medium sand, brown (10YR 5/3), saturated, soft.	ML			
				SAND mostly fine to medium sand, brown (10YR5/3), saturated, loose.				
7 GP	100		30		SP			
				Change to mostly fine to medium sand, some medium to coarse sand at 31.5 feet.				
				Change to trace to few coarse gravel at 33.0 feet.				
			35	**SILTY CLAY** mostly clay, some silt, low plasticity, dark gray (10YR 4/1), dry, hard.	CL-ML			
				End of boring at 35.0 feet below ground surface.				

SOIL BORING WELL CONSTRUCTION LOG 290806.0000.0000.GPJ TRC_CORP_INCHES.GDT 7/16/18

Signature:

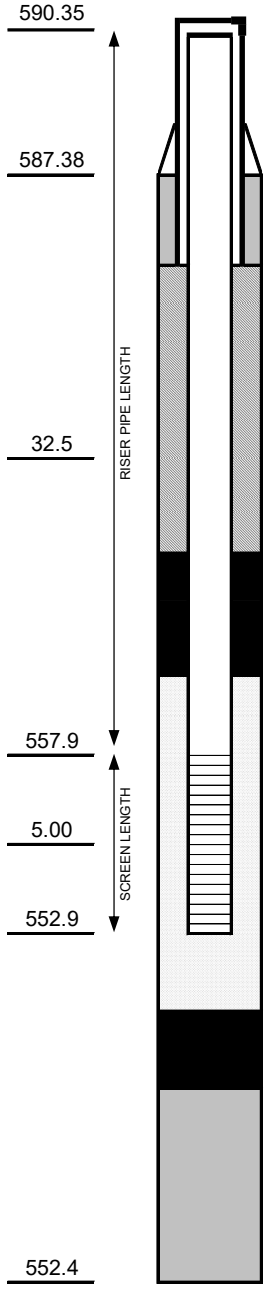
Firm: TRC Environmental Corporation (734) 971-7080
1540 Eisenhower Place Ann Arbor, MI 48108 Fax (734) 971-9022

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: Consumers Energy Company: JH Campbell		WELL ID:	**MW-14D**
PROJ. NO: 290806.0000	DATE INSTALLED: 4/11/2018 INSTALLED BY: Tanner Hess		CHECKED BY: C. Scieszka

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)
590.35	3.0 TOP OF CASING
587.38	0.0 GROUND SURFACE
	2.0 CEMENT SURFACE PLUG
	GROUT/BACKFILL MATERIAL: BENTONITE SLURRY
	GROUT/BACKFILL METHOD: FILL FROM ABOVE
32.5	
	5.0 GROUT
	BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	7.0 BENTONITE SEAL
557.9	29.5 TOP OF SCREEN
	FILTER PACK MATERIAL: WASHED SAND & NATURAL COLLAPSE
5.00	
552.9	34.5 BOTTOM OF SCREEN
	34.5 BOTTOM OF FILTER PACK
	NA BENTONITE PLUG
	BACKFILL MATERIAL: NATURAL COLLAPSE
552.4	35.0 HOLE BOTTOM



NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SOLVENT USED? NO

SCREEN TYPE: 2-INCH PVC, PRE-PACKED

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 3.75 IN. FROM 0 TO 34.5 FT.
2 IN. FROM 34.5 TO 35 FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.58 HOURS

WATER REMOVED: 75 GALLONS

WATER ADDED: 5 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	37.56	T/PVC	4/12/2018	0846
DTB AFTER DEVELOPING:	37.40	T/PVC	4/12/2018	0929
SWE BEFORE DEVELOPING:	9.43	T/PVC	4/12/2018	0846
SWE AFTER DEVELOPING:	9.44	T/PVC	4/12/2018	0929
OTHER SWE:		T/PVC		
OTHER SWE:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

WELL CONSTRUCTION LOG

WELL NO. MW-14S

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
Consumers Energy Company: JH Campbell	4/11/18	4/11/18	290806.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns Drilling	Direct Push	587.4	590.98	9.5	2/3.75

Boring Location: Approximately 8 feet SW of MW-14.	Personnel	Drilling Equipment:
N: 516850.8 E: 12636808.0	Logged By - T. Hess Driller - Tom Ulrich	Geoprobe 7822 DT

Civil Town/City/or Village:	County:	State:	Water Level Observations:
West Olive	Ottawa	MI	While Drilling: Date/Time 4/10/18 15:15 ▽ Depth (ft bgs) 6.5 After Drilling: Date/Time 4/11/18 09:13 ▼ Depth (ft bgs) 6.5

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
GP			0	**TOPSOIL** sandy, very dark gray (10YR 3/1).				Blind drill from 0-9.5 feet, lithology from 0-9.5 feet taken from MW-14D.
			1	**SAND** mostly fine to medium sand, yellowish brown (10YR 5/8), dry, loose.	SP			
			2					
			3	Change to light yellowish brown (10YR 6/4) at 2.5 feet.				
			4					
			5	Change to yellowish brown (10YR 5/8) at 5.0 feet.				
			6					
			7	▼ Change to trace coarse sand, brown (10YR 5/3), saturated at 6.5 feet.				
			8					
			9					
			10	End of boring at 9.5 feet below ground surface.				

SOIL BORING WELL CONSTRUCTION LOG 290806.0000.0000.GPJ TRC_CORP_INCHES.GDT 7/16/18

Signature:

Firm: TRC Environmental Corporation (734) 971-7080
1540 Eisenhower Place Ann Arbor, MI 48108 Fax (734) 971-9022

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: Consumers Energy Company: JH Campbell		WELL ID:	**MW-14S**
PROJ. NO: 290806.0000	DATE INSTALLED: 4/11/2018 INSTALLED BY: Tanner Hess		CHECKED BY: C. Scieszka

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
590.98	3.6	TOP OF CASING
587.36	0.0	GROUND SURFACE
	2.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: NA
		GROUT/BACKFILL METHOD: NA
8.1		RISER PIPE LENGTH
	2.0	GROUT
		BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	4.0	BENTONITE SEAL
582.9	4.5	TOP OF SCREEN
5.00		SCREEN LENGTH
		FILTER PACK MATERIAL: WASHED SAND & NATURAL COLLAPSE
577.9	9.5	BOTTOM OF SCREEN
	9.5	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NA
577.9	9.5	HOLE BOTTOM

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SOLVENT USED? NO

SCREEN TYPE: 2-INCH PVC, PRE-PACKED

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 3.75 IN. FROM 0 TO 9.5 FT.
_____ IN. FROM _____ TO _____ FT.

SURF. CASING DIAMETER: _____ IN. FROM _____ TO _____ FT.
_____ IN. FROM _____ TO _____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.25 HOURS

WATER REMOVED: 25 GALLONS

WATER ADDED: 5 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	13.03	T/PVC	4/12/2018	0926
DTB AFTER DEVELOPING:	13.19	T/PVC	4/12/2018	0949
SWE BEFORE DEVELOPING:	10.19	T/PVC	4/12/2018	0926
SWE AFTER DEVELOPING:	10.30	T/PVC	4/12/2018	0949
OTHER SWE:		T/PVC		
OTHER SWE:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

WELL CONSTRUCTION LOG

WELL NO. PZ-23D

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
Consumers Energy Company: JH Campbell	4/9/18	4/9/18	290806.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns Drilling	Direct Push	603.1	606.17	40.0	2/3.75

Boring Location: Approximately 17 feet ESE of PZ-23. N: 517279.8 E: 12633475.1	Personnel: Logged By - T. Hess; Driller - Tom Ulrich	Drilling Equipment: Geoprobe 7822 DT

Civil Town/City/or Village:	County:	State:	Water Level Observations:
West Olive	Ottawa	MI	While Drilling: Date/Time 4/9/18 10:55 ▽ Depth (ft bgs) 12.3 After Drilling: Date/Time 4/9/18 14:55 ▼ Depth (ft bgs) 12.8

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		0	**TOPSOIL** black (10YR 2/1), organic material present.				
				SAND mostly fine to medium sand, light yellowish brown (10YR 6/4), loose, dry.				
2 GP	85		5					
3 GP	60		10	Change to pale brown (10YR 6/3), mostly fine, wet at 12.5 feet.				
			15	Change to brown (10 YR 5/3) at 15.0 feet.				
4 GP	80			Change to fine to medium sand at 18.0 feet.	SP			
5 GP	90		20	Change to medium to coarse sand at 23.0 feet.				
			25	Change to fine to medium sand at 25.0 feet.				
6 GP	95			2-inch seam of medium to coarse sand at 29.0 feet.				
7 GP	100		30	Change to gray (10YR 5/1) at 30.0 feet.				
8 GP	60		35	**SILTY CLAY** mostly clay, some silt, no to low plasticity, dark gray (10YR 4/1), dry, hard.	CL-ML			
			40	End of boring at 40.0 feet below ground surface.				

SOIL BORING WELL CONSTRUCTION LOG 290806.0000.0000.GPJ TRC_CORP_INCHES.GDT 7/16/18

Signature:

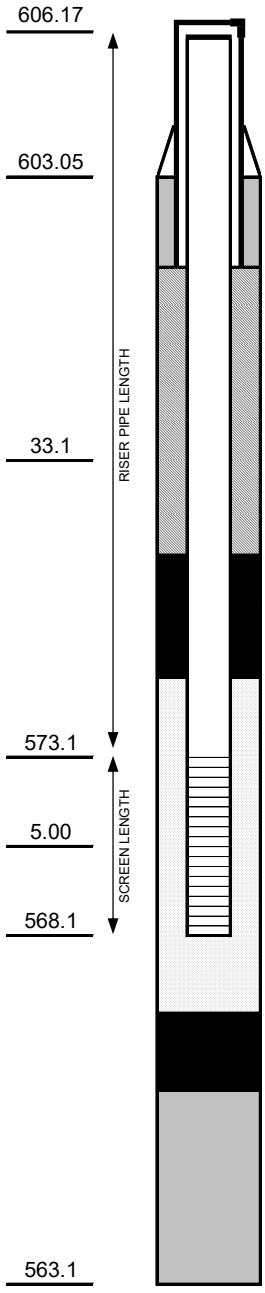
Firm: TRC Environmental Corporation (734) 971-7080
1540 Eisenhower Place Ann Arbor, MI 48108 Fax (734) 971-9022

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: Consumers Energy Company: JH Campbell		WELL ID:	**PZ-23D**
PROJ. NO: 290806.0000	DATE INSTALLED: 4/9/2018 INSTALLED BY: Tanner Hess		CHECKED BY: C. Scieszka

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)



ELEVATION	DEPTH	
606.17	3.1	TOP OF CASING
603.05	0.0	GROUND SURFACE
	3.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: BENTONITE SLURRY
		GROUT/BACKFILL METHOD: FILL FROM ABOVE
33.1		
	12.0	GROUT
		BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	13.0	BENTONITE SEAL
573.1	30.0	TOP OF SCREEN
		FILTER PACK MATERIAL: WASHED SAND & NATURAL COLLAPSE
5.00		
568.1	35.0	BOTTOM OF SCREEN
	35.0	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NATURAL COLLAPSE
563.1	40.0	HOLE BOTTOM

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SOLVENT USED? NO

SCREEN TYPE: 2-INCH PVC, PRE-PACKED

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 3.75 IN. FROM 0 TO 35 FT.
2 IN. FROM 35 TO 40 FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.25 HOURS

WATER REMOVED: 50 GALLONS

WATER ADDED: 4 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	37.83	T/PVC	4/11/2018	1410
DTB AFTER DEVELOPING:	37.36	T/PVC	4/11/2018	1442
SWE BEFORE DEVELOPING:	15.99	T/PVC	4/11/2018	1409
SWE AFTER DEVELOPING:	15.99	T/PVC	4/11/2018	1441
OTHER SWE:		T/PVC		
OTHER SWE:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

WELL CONSTRUCTION LOG

WELL NO. PZ-23S

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
Consumers Energy Company: JH Campbell	4/9/18	4/9/18	290806.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns Drilling	Direct Push	602.8	604.97	16.0	2/3.75

Boring Location: Approximately 8.5 feet ESE of PZ-23.	Personnel	Drilling Equipment:
N: 517281.6 E: 12633466.4	Logged By - T. Hess Driller - Tom Ulrich	Geoprobe 7822 DT

Civil Town/City/or Village:	County:	State:	Water Level Observations:
West Olive	Ottawa	MI	While Drilling: Date/Time 4/9/18 15:10 ▽ Depth (ft bgs) 12.5 After Drilling: Date/Time 4/9/18 15:32 ▼ Depth (ft bgs) 12.2

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
GP			0	**TOPSOIL** black (10YR 2/1), organic material present.				Blind drill from 0-10 feet and 15-16 feet, lithology from 0-10 feet and 15-16 feet taken fom PZ-23D.
				SAND mostly fine to medium sand, light yellowish brown (10YR 6/4), loose, dry.	SP			
			2					
			4					
			6					
			8					
			10					
1 GP	50		12	▼ ▽ Change to pale brown (10YR 6/3), mostly fine, saturated at 12.5 feet.				
			14					
GP				Change to brown (10 YR 5/3) at 15.0 feet.				
			16	End of boring at 16.0 feet below ground surface.				

SOIL BORING WELL CONSTRUCTION LOG 290806.0000.0000.GPJ TRC_CORP_INCHES.GDT 7/16/18

Signature:

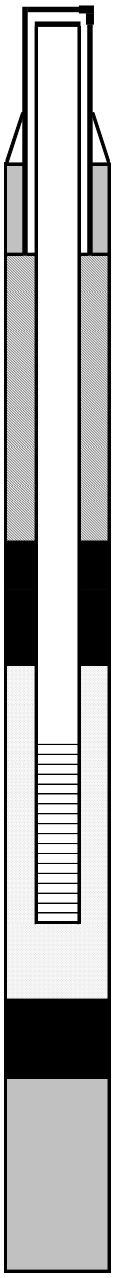
Firm: TRC Environmental Corporation (734) 971-7080
1540 Eisenhower Place Ann Arbor, MI 48108 Fax (734) 971-9022

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME:	Consumers Energy Company: JH Campbell			WELL ID:	**PZ-23S**
PROJ. NO:	290806.0000	DATE INSTALLED: 4/9/2018	INSTALLED BY: Tanner Hess		CHECKED BY: C. Scieszka

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)
604.97	2.1 TOP OF CASING
602.84	0.0 GROUND SURFACE
	2.0 CEMENT SURFACE PLUG
	GROUT/BACKFILL MATERIAL: BENTONITE SLURRY
	GROUT/BACKFILL METHOD: FILL FROM ABOVE
13.1	RISER PIPE LENGTH
	8.0 GROUT
	BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	9.0 BENTONITE SEAL
591.8	11.0 TOP OF SCREEN
5.00	SCREEN LENGTH
	FILTER PACK MATERIAL: WASHED SAND & NATURAL COLLAPSE
586.8	16.0 BOTTOM OF SCREEN
	16.0 BOTTOM OF FILTER PACK
	NA BENTONITE PLUG
	BACKFILL MATERIAL: NA
586.8	16.0 HOLE BOTTOM



NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SOLVENT USED? NO

SCREEN TYPE: 2-INCH PVC, PRE-PACKED

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 3.75 IN. FROM 0 TO 16 FT.
____ IN. FROM ____ TO ____ FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS

WATER REMOVED: 30 GALLONS

WATER ADDED: 5 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	18.35	T/PVC	4/11/2018	1442
DTB AFTER DEVELOPING:	18.25	T/PVC	4/11/2018	1515
SWE BEFORE DEVELOPING:	14.69	T/PVC	4/11/2018	1442
SWE AFTER DEVELOPING:	14.71	T/PVC	4/11/2018	1515
OTHER SWE:		T/PVC		
OTHER SWE:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

WELL CONSTRUCTION LOG

WELL NO. PZ-24D

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
Consumers Energy Company: JH Campbell	4/10/18	4/10/18	290806.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns Drilling	Direct Push	586.6	590.06	35.0	2/3.75

Boring Location: Approximately 14 feet E of PZ-24.	Personnel	Drilling Equipment:
N: 516444.3 E: 12636155.3	Logged By - T. Hess Driller - Tom Ulrich	Geoprobe 7822 DT

Civil Town/City/or Village:	County:	State:	Water Level Observations:
West Olive	Ottawa	MI	While Drilling: Date/Time 4/10/18 12:30 ▽ Depth (ft bgs) 3.5 After Drilling: Date/Time 4/10/18 14:20 ▼ Depth (ft bgs) 3.0

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		0	**SAND** mostly fine to medium sand, strong brown (7.5 YR 4/6), loose, dry.				
				Change to light yellowish brown (10YR 6/4) at 1.0 feet.				
				Change to mostly medium to coarse sand, pale brown (10YR 6/3), saturated at 3.5 feet.				
2 GP	100		5	Change to mostly fine to medium sand at 4.0 feet.				
3 GP	90		10	Change to mostly medium to coarse sand, brown (10YR 5/3) at 10.0 feet.				
4 GP	85		15	Change to mostly fine to medium sand at 15.0 feet.	SP			
5 GP	100		20					
6 GP	90		25	Change to pale brown (10YR 6/3) at 25.0 feet.				
7 GP	100		30	Change to light brownish gray (10YR 6/2) at 30.0 feet.				
				SILTY SAND mostly fine to medium sand, some silt, light brownish gray (10YR 6/2), saturated, loose.	SM			
			35	**SANDY SILT** mostly fine silt, little fine to medium sand, light brownish gray (10YR 6/2), saturated, soft.	ML			
				SILTY CLAY mostly clay, some silt, no to low plasticity, dark gray (10YR 4/1), dry, hard.	CL-ML			
				End of boring at 35.0 feet below ground surface.				

SOIL BORING WELL CONSTRUCTION LOG 290806.0000.0000.GPJ TRC_CORP_INCHES.GDT 7/16/18

Signature:

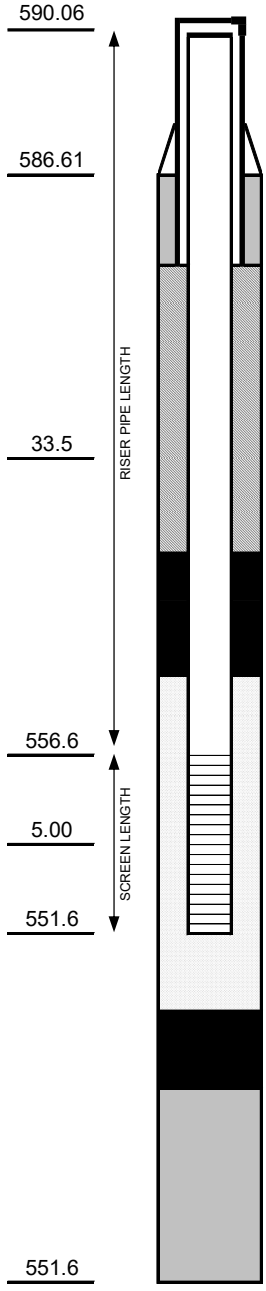
Firm: TRC Environmental Corporation (734) 971-7080
1540 Eisenhower Place Ann Arbor, MI 48108 Fax (734) 971-9022

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME:	Consumers Energy Company: JH Campbell	WELL ID:	**PZ-24D**
PROJ. NO:	290806.0000	DATE INSTALLED: 4/10/2018 INSTALLED BY: Tanner Hess	CHECKED BY: C. Scieszka

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
590.06	3.5	TOP OF CASING
586.61	0.0	GROUND SURFACE
	2.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: NA
		GROUT/BACKFILL METHOD: NA
33.5		RISER PIPE LENGTH
	2.0	GROUT
		BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	4.0	BENTONITE SEAL
556.6	30.0	TOP OF SCREEN
5.00		SCREEN LENGTH
		FILTER PACK MATERIAL: WASHED SAND & NATURAL COLLAPSE
551.6	35.0	BOTTOM OF SCREEN
	35.0	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NA
551.6	35.0	HOLE BOTTOM



NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SOLVENT USED? NO

SCREEN TYPE: 2-INCH PVC, PRE-PACKED

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 3.75 IN. FROM 0 TO 35 FT.
_____ IN. FROM _____ TO _____ FT.

SURF. CASING DIAMETER: _____ IN. FROM _____ TO _____ FT.
_____ IN. FROM _____ TO _____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.42 HOURS

WATER REMOVED: 75 GALLONS

WATER ADDED: 5 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	38.50	T/PVC	4/12/2018	0750
DTB AFTER DEVELOPING:	38.50	T/PVC	4/12/2018	0824
SWE BEFORE DEVELOPING:	6.63	T/PVC	4/12/2018	0750
SWE AFTER DEVELOPING:	6.61	T/PVC	4/12/2018	0824
OTHER SWE:		T/PVC		
OTHER SWE:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

WELL CONSTRUCTION LOG

WELL NO. PZ-24S

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
Consumers Energy Company: JH Campbell	4/10/18	4/10/18	290806.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns Drilling	Direct Push	586.6	590.15	7.0	2/3.75

Boring Location: Approximately 7 feet E of PZ-24.

N: 516441.6 E: 12636148.7

Personnel
Logged By - T. Hess
Driller - Tom Ulrich

Drilling Equipment: Geoprobe 7822 DT

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

Water Level Observations:
While Drilling: Date/Time 4/10/18 12:30 ▽ Depth (ft bgs) 3.5
After Drilling: Date/Time 4/10/18 14:45 ▼ Depth (ft bgs) 3.0

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
GP			0	**SAND** mostly fine to medium sand, strong brown (7.5 YR 4/6), loose, dry.				Blind drill from 0-7 feet, lithology from 0-7 feet taken from PZ-24D.
			1	Change to light yellowish brown (10YR 6/4) at 1.0 feet.				
			2					
			3	▼				
				▽ Change to mostly medium to coarse sand, pale brown (10YR 6/3), saturated at 3.5 feet.	SP			
			4	Change to mostly fine to medium sand at 4.0 feet.				
			5					
			6					
			7	End of boring at 7.0 feet below ground surface.				

SOIL BORING WELL CONSTRUCTION LOG 290806.0000.0000.GPJ TRC_CORP_INCHES.GDT 7/16/18

Signature:

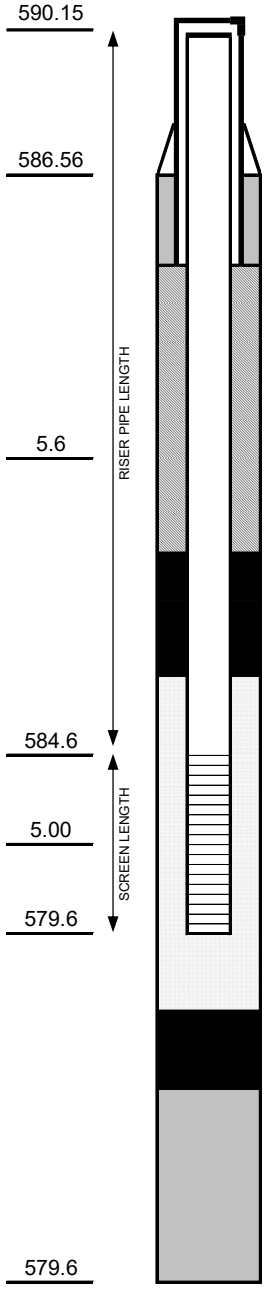
Firm: TRC Environmental Corporation (734) 971-7080
1540 Eisenhower Place Ann Arbor, MI 48108 Fax (734) 971-9022

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: Consumers Energy Company: JH Campbell		WELL ID:	**PZ-24S**
PROJ. NO: 290806.0000	DATE INSTALLED: 4/10/2018 INSTALLED BY: Tanner Hess		CHECKED BY: C. Scieszka

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)
590.15	3.6 TOP OF CASING
586.56	0.0 GROUND SURFACE
	1.0 CEMENT SURFACE PLUG
	GROUT/BACKFILL MATERIAL: NA
	GROUT/BACKFILL METHOD: NA
5.6	
	1.0 GROUT
	BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	2.0 BENTONITE SEAL
584.6	2.0 TOP OF SCREEN
	FILTER PACK MATERIAL: WASHED SAND & NATURAL COLLAPSE
5.00	
579.6	7.0 BOTTOM OF SCREEN
	7.0 BOTTOM OF FILTER PACK
	NA BENTONITE PLUG
	BACKFILL MATERIAL: NA
579.6	7.0 HOLE BOTTOM



NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SOLVENT USED? NO

SCREEN TYPE: 2-INCH PVC, PRE-PACKED

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 3.75 IN. FROM 0 TO 7 FT.
_____ IN. FROM _____ TO _____ FT.

SURF. CASING DIAMETER: _____ IN. FROM _____ TO _____ FT.
_____ IN. FROM _____ TO _____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.17 HOURS

WATER REMOVED: 25 GALLONS

WATER ADDED: 5 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	11.10	T/PVC	4/12/2018	0822
DTB AFTER DEVELOPING:	11.02	T/PVC	4/12/2018	0838
SWE BEFORE DEVELOPING:	6.74	T/PVC	4/12/2018	0822
SWE AFTER DEVELOPING:	6.80	T/PVC	4/12/2018	0838
OTHER SWE:		T/PVC		
OTHER SWE:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

WELL CONSTRUCTION LOG

WELL NO. PZ-40S

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
Consumers Energy Company: JH Campbell	4/10/18	4/10/18	290806.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns Drilling	Direct Push	589.5	593.25	15.0	2/3.75

Boring Location: Approximately 8 feet W of PZ-40.	Personnel	Drilling Equipment:
N: 516097.9 E: 12634760.3	Logged By - T. Hess Driller - Tom Ulrich	Geoprobe 7822 DT

Civil Town/City/or Village:	County:	State:	Water Level Observations:
West Olive	Ottawa	MI	While Drilling: Date/Time 4/10/18 10:20 ▽ Depth (ft bgs) 7.25 After Drilling: Date/Time 4/10/18 10:50 ▼ Depth (ft bgs) 7.0

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		0	**SAND** mostly fine to medium sand, yellowish brown (10YR 5/8), loose, dry.				
			2	Change to light yellowish brown (10YR 6/4) at 2.0 feet.				
			4					
2 GP	80		6	Change to saturated at 7.25 feet.	SP			
			8	Change to mostly medium to coarse sand, yellowish brown (10YR 5/4) at 7.5 feet.				
				Change to light yellowish brown (10YR 6/4) at 8.5 feet.				
			10	Change to mostly medium to coarse sand, brown (10YR 5/3) at 10.0 feet.				
3 GP	75		12					
			14					
				End of boring at 15.0 feet below ground surface.				

SOIL BORING WELL CONSTRUCTION LOG 290806.0000.0000.GPJ TRC_CORP_INCHES.GDT 7/16/18

Signature:

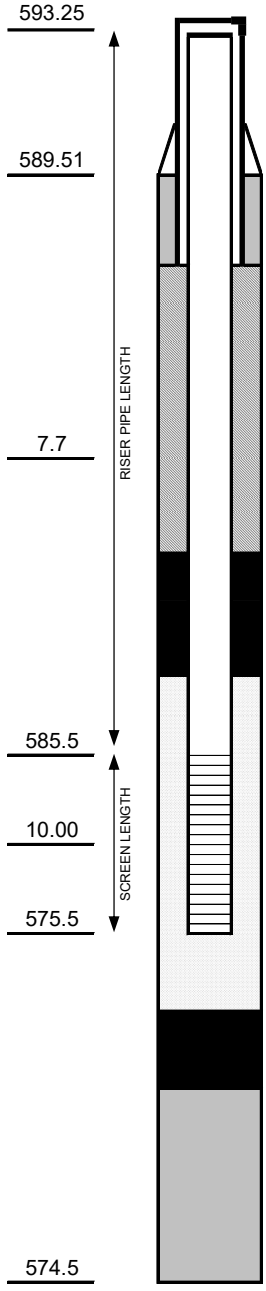
Firm: TRC Environmental Corporation (734) 971-7080
1540 Eisenhower Place Ann Arbor, MI 48108 Fax (734) 971-9022

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: Consumers Energy Company: JH Campbell		WELL ID:	**PZ-40S**
PROJ. NO: 290806.0000	DATE INSTALLED: 4/10/2018 INSTALLED BY: Tanner Hess		CHECKED BY: C. Scieszka

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)
593.25	3.7 TOP OF CASING
589.51	0.0 GROUND SURFACE
	2.0 CEMENT SURFACE PLUG
	GROUT/BACKFILL MATERIAL: NA
	GROUT/BACKFILL METHOD: NA
7.7	
	2.0 GROUT
	BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	3.5 BENTONITE SEAL
585.5	4.0 TOP OF SCREEN
	FILTER PACK MATERIAL: WASHED SAND & NATURAL COLLAPSE
10.00	
575.5	14.0 BOTTOM OF SCREEN
	14.0 BOTTOM OF FILTER PACK
	NA BENTONITE PLUG
	BACKFILL MATERIAL: NATURAL COLLAPSE
574.5	15.0 HOLE BOTTOM



NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SOLVENT USED? NO

SCREEN TYPE: 2-INCH PVC, PRE-PACKED

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 3.75 IN. FROM 0 TO 14 FT.
2 IN. FROM 14 TO 15 FT.

SURF. CASING DIAMETER: ___ IN. FROM ___ TO ___ FT.
___ IN. FROM ___ TO ___ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.25 HOURS

WATER REMOVED: 50 GALLONS

WATER ADDED: 5 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	17.71	T/PVC	4/11/2018	1554
DTB AFTER DEVELOPING:	17.92	T/PVC	4/11/2018	1620
SWE BEFORE DEVELOPING:	10.75	T/PVC	4/11/2018	1553
SWE AFTER DEVELOPING:	10.75	T/PVC	4/11/2018	1620
OTHER SWE:		T/PVC		
OTHER SWE:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

DRILLING AND SAMPLING LOG

HOLE NO. Pz-23

ELEV. 602.9

PROJECT J. H. Campbell Plant, Consumers Power Co. DEPTH 18.6 ft.

FEATURE Groundwater Study DEPTH TO WATER 9.7 ft. 8/5/76

JOB NO. 64-0047-954 DRILLER Balzer Cook LOGGED BY P. D. Lidel

LOCATION

DRILLING CO. Great Lakes Soiltest Services DRILL RIG. Mobil B-40

Completion Date 8/5/76

Drilling Method: Eight-inch hollow stem auger, Standard Penetration Resistance Test and split spoon samples taken every five feet.

DEPTH (ELEV)	CLASS	FIELD DESCRIPTION	SAMPLE NUMBER	RECOVERY	SPT	REMARKS
0						
(602.9)	SP	0.0 - 16.0 Sand, brown, very fine grained, loose and dry at surface becoming more damp toward water table (SP)	1	66	X	1/0/0
			2	100	X	2/2/4
5		0.0 - 0.5 Sand is dark brown due to the presence of organic matter.				Bag sample #1 taken between 7. and 9.0 ft.
10			3	100	X	2/3/3
15			4	33	X	1/1/1
(584.3)		Bottom of Boring - 16.0 ft.				
		Drove 2 in. dia. well screen to 18.6 ft. with 1.0 ft. of casing above ground. Hole sealed with 1/2 bag of bentonite.				
20						
25						
30						

Commonwealth Associates Inc.

SHEET 1 OF 1

DRILLING AND SAMPLING LOG

PZ-24

HOLE NO. →

ELEV. 587.0

PROJECT J. H. Campbell Plant, Consumers Power Co. DEPTH 13.2 ft.

FEATURE Groundwater Study DEPTH TO WATER 4.0 ft. 8/6/76

JOB NO. 64-0047-954 DRILLER Balzer Cook LOGGED BY P. D. Lidel

LOCATION

DRILLING CO. Great Lakes Soiltest Services DRILL RIG. Mobil B-40

Completion Date 8/6/76

Drilling Method: Eight-inch hollow stem auger, Standard Penetration Resistance Test and split spoon samples taken every five feet.

DEPTH (ELEV)	CLASS	FIELD DESCRIPTION	SAMPLE NUMBER	RECOVERY	SPT	REMARKS
0 (587.0)	SP	0.0 - 10.0 Sand, brown, very fine grained, loose, damp above water table, contains some organic matter in upper 0.5 ft. (SP)	1	100	X	1/1/1
5			2	100	X	1/2/2
10			3	33	X	1/1/1
(577.0)		Bottom of Boring - 10.0 ft. Drove 2 in. dia. well screen to 13.2 ft. with 1.0 ft. of casing above ground. Hole sealed with 1/2 bag of bentonite.				
15						
20						
25						
30						

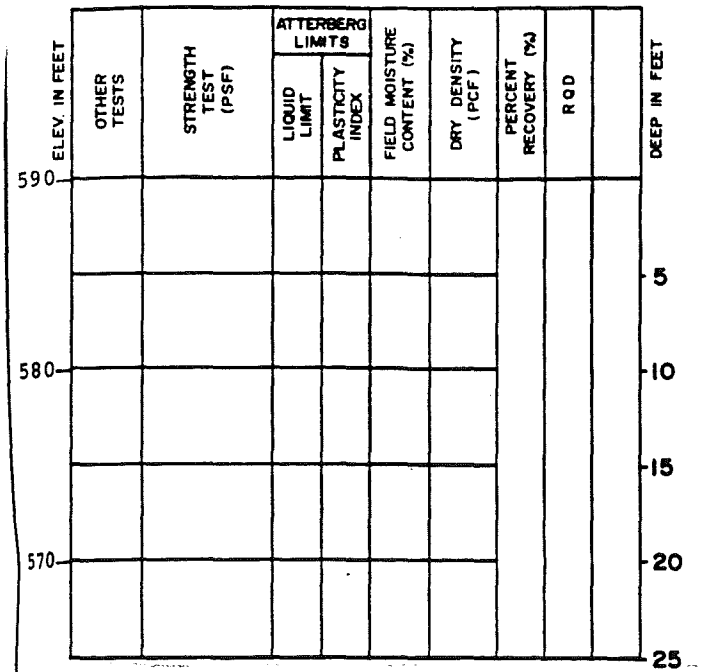
Commonwealth Associates Inc.

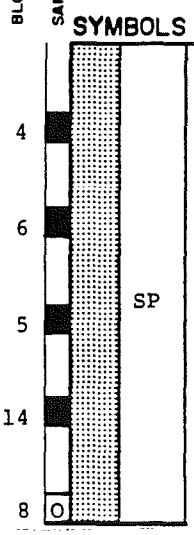
SHEET 1 OF 1

Consumers Power Company
J. H. Campbell Plant
Groundwater Study
W. O. 64-0047-954

BORING PZ-40

SURFACE ELEVATION 590.1
COORDINATE





DESCRIPTION

LIGHT BROWN SAND: fine to medium-grained, trace of coarse sand and fine gravel, very loose to medium dense, 0'-25'.

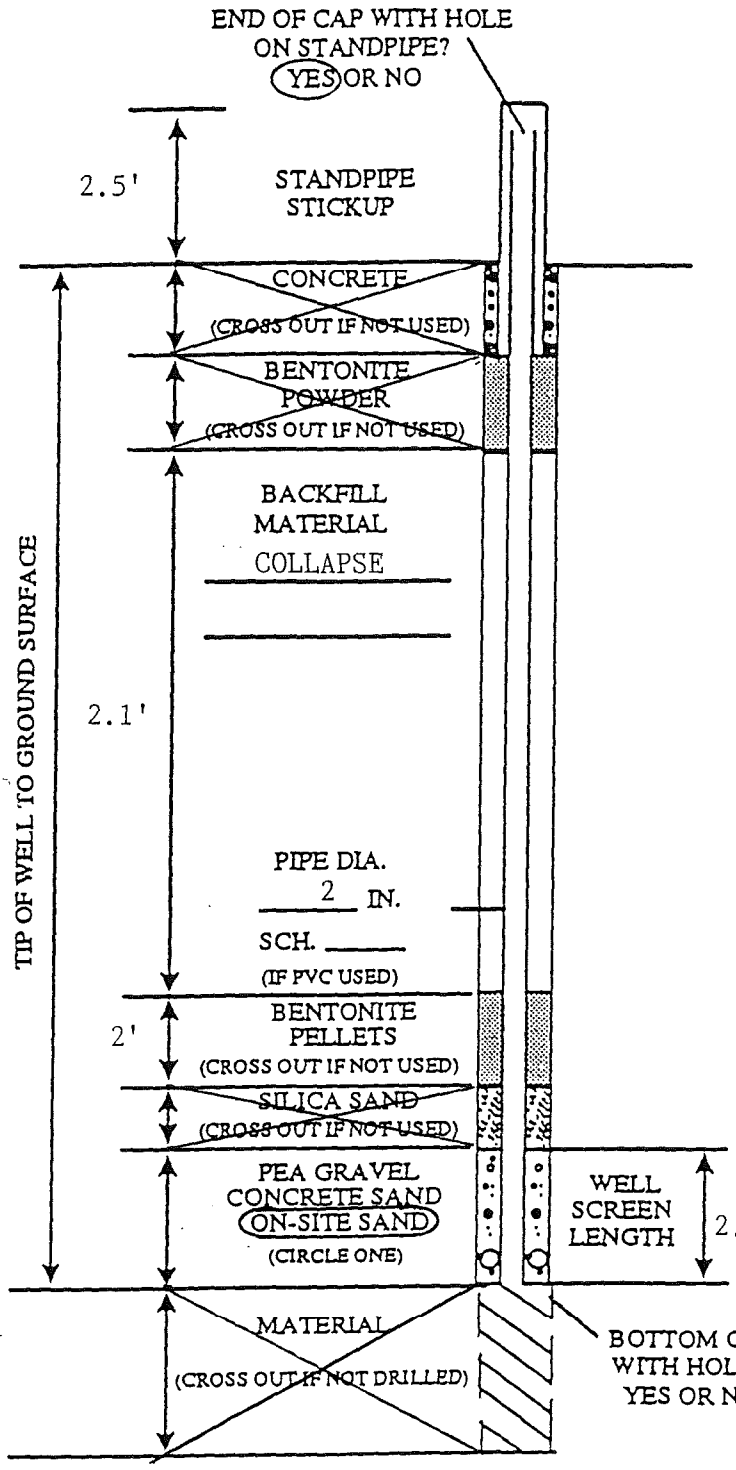
Completed boring at 25'on 9/7/79
Installed PVC standpipe piezometer with bottom of screen at elev. 568.3.

LOG OF BORING

Gilbert/Commonwealth

PLATE

STS Field Well Installation Diagram



1) TYPE OF PIPE
PVC, (GALVANIZED) STAINLESS, OTHER _____

2) TYPE OF PIPE JOINTS
BELLED, (COUPLINGS) THREADED, OTHER _____

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, (STAINLESS) OTHER _____

4) SCREEN SIZE 5'

5) INSTALLED PROTECTOR PIPE W/LOCK? (YES) OR NO

6) WAS SOLVENT USED? YES OR (NO)

7) WAS DRILLING MUD USED?
SOLID AUGER, (HOLLOW STEM AUGER) WATER
REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR (NO)

9) HOW WAS WELL DEVELOPED?
(BAILING) PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT
5 MIN., 15 MIN, (30 MIN) OTHER _____

11) APPROXIMATE WATER VOLUME (REMOVED) OR ADDED?
5 GAL, (10 GAL) 15 GAL, OTHER _____

12) WATER CLARITY BEFORE DEVELOPMENT
(CLEAR) TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
(CLEAR) TURBID, OPAQUE

14) DID THE WATER SMELL? YES OR (NO)

15) WATER LEVEL SUMMARY

1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
_____ FT OR DRY

2) OTHER MEASUREMENTS:

DATE _____, _____ FT FROM T. ST. PIPE
DATE _____, _____ FT FROM T. ST. PIPE
DATE _____, _____ FT FROM T. ST. PIPE
DATE _____, _____ FT FROM T. ST. PIPE

WELL NO. MW 13-96 DATE INSTALLED 1/9/96 DRILL RIG HURRICAN

DRILLER TOM KALINOWSKI DRILL CREW CHRIS POWELL & GREG FOX

JOB/CLIENT CONSUMERS POWER STS PROJECT NO. 72583

(VERSION 1: 05/90 - M11DRAW)

STS Consultants Ltd.

CLIENT: CONSUMERS POWER

LOG OF BORING NUMBER: MW-13-96

PROJECT NAME: J.H. CAMPBELL

ARCHITECT-ENGINEER:

SITE LOCATION: WEST OLIVE, MI

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} (1 2 3 4 5)

PLASTIC LIMIT x — WATER CONTENT x — LIQUID LIMIT x (10 20 30 40 50)

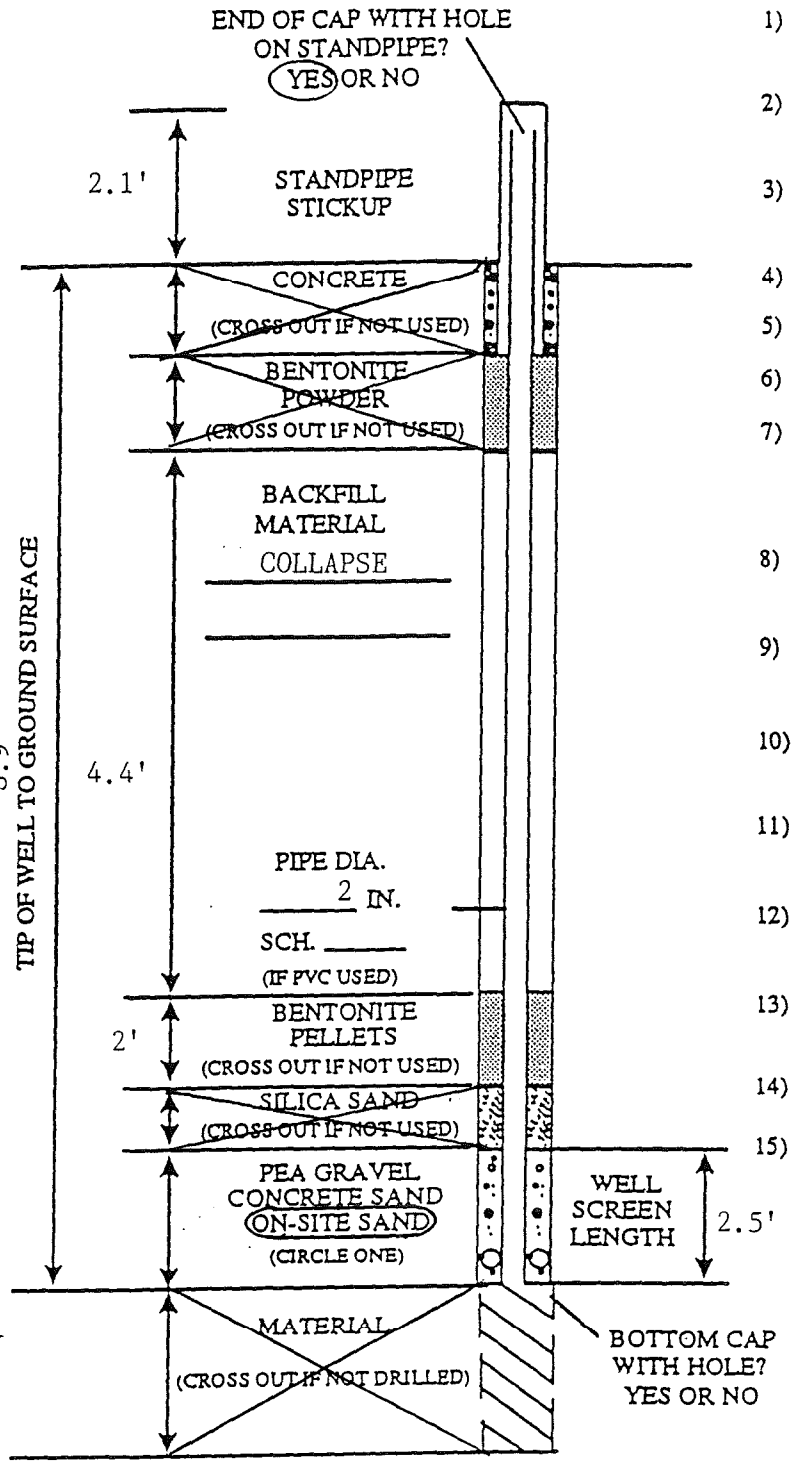
STANDARD PENETRATION BLOWS/FT. (10 20 30 40 50)

DEPTH (FT) / ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION
	1	CS			Organic topsoil, little fine to medium sand - brown - moist. (Pt)
2.5	1A	CS			Clayey silt, little fine to medium sand - brown - soft - moist to wet. (ML)
5.0	2	CS			
7.5	2A	CS			Clayey silt, trace fine sand - gray - very stiff - moist. (ML)
10.0	3	CS			
12.0					END OF BORING Boring advanced with hydraulic push techniques. Monitoring Well installed. Screen set from 5.5' to 8.0'. CS = Continuous Sampler

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 6.5 ft WS OR WD WS	BORING STARTED 01/09/96	STS OFFICE Lansing-07	
WL BCR ACR	BORING COMPLETED 01/09/96	ENTERED BY OAP	SHEET NO. 1 OF 1
WL 6.5 ft @ 1 hr AB	RIG/FOREMAN GEOPROBE/GHF	APP'D BY JSM	STS JOB NO. 72583

STS Field Well Installation Diagram



1) TYPE OF PIPE
PVC, (GALVANIZED) STAINLESS, OTHER _____

2) TYPE OF PIPE JOINTS
BELLED, (COUPLINGS) THREADED, OTHER _____

3) TYPE OF WELL SCREEN
PVC, GALVANIZED, (STAINLESS) OTHER _____

4) SCREEN SIZE 5'

5) INSTALLED PROTECTOR PIPE W/LOCK? (YES) OR NO

6) WAS SOLVENT USED? YES OR (NO)

7) WAS DRILLING MUD USED?
SOLID AUGER, (HOLLOW STEM AUGER) WATER REVERT, BENTONITE

8) DID STANDPIPE COME UP WHEN CASING WAS PULLED?
YES OR (NO)

9) HOW WAS WELL DEVELOPED?
(BAILING) PUMPING, SURGING, COMPRESSED AIR

10) TIME SPENT FOR WELL DEVELOPMENT
5 MIN., 15 MIN, (30 MIN) OTHER _____

11) APPROXIMATE WATER VOLUME (REMOVED) OR ADDED?
5 GAL, (10 GAL) 15 GAL, OTHER _____

12) WATER CLARITY BEFORE DEVELOPMENT
(CLEAR) TURBID, OPAQUE

13) WATER CLARITY AFTER DEVELOPMENT
(CLEAR) TURBID, OPAQUE

14) DID THE WATER SMELL? YES OR (NO)

15) WATER LEVEL SUMMARY
1) DEPTH FROM T. STANDPIPE AFTER DEVELOPMENT?
_____ FT OR DRY

2) OTHER MEASUREMENTS:
DATE _____, _____ FT FROM T, ST. PIPE
DATE _____, _____ FT FROM T, ST. PIPE
DATE _____, _____ FT FROM T, ST. PIPE
DATE _____, _____ FT FROM T, ST. PIPE

WELL NO. MW 14-96 DATE INSTALLED 1-9-96 DRILL RIG HURRICANE

DRILLER TOM KALINOWSKI DRILL CREW CHRIS POWELL & GREG FOX

JOB/CLIENT CONSUMERS POWER CO. STS PROJECT NO. 72583

(VERSION 1: 05/90 - M11DRAW)

Consultants Ltd.

CLIENT: CONSUMERS POWER	LOG OF BORING NUMBER: MW-14-96
PROJECT NAME: J.H. CAMPBELL	ARCHITECT-ENGINEER:

SITE LOCATION: WEST OLIVE, MI

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} (1 2 3 4 5)

PLASTIC LIMIT x — WATER CONTENT x — LIQUID LIMIT x (10 20 30 40 50)

STANDARD PENETRATION BLOWS/FT. (10 20 30 40 50)

DEPTH (FT) / ELEVATION (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE / RECOVERY	DESCRIPTION OF MATERIAL
SURFACE ELEVATION				
	1	CS		Organic topsoil, little fine to medium sand - brown - loose - moist. (Pt)
2.5	1A	CS		Fine to medium sand - brown - medium dense - moist. (SP)
5.0	2	CS		
7.5	3	CS		
10.0				END OF BORING Boring advanced using hydraulic push techniques. Monitoring well installed. Screen set from 6.4' to 8.9'. CS = Continuous Sampler

The stratification lines represent the approximate boundary lines between soil types: in-situ, the transition may be gradual.

WL 7.2 ft WS OR WD WS	BORING STARTED 01/09/96	STS OFFICE Lansing-07	
WL BCR ACR	BORING COMPLETED 01/09/96	ENTERED BY OAP	SHEET NO. 1 OF 1
WL 7.2 ft @ 1 hr AB	RIG/FOREMAN GEOPROBE/GHF	APP'D BY JSM	STS JOB NO. 72583

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 Units 1-2 North and 1-2 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 1-2 North and 1-2 South (collectively Unit 1-2) located in West Olive, Michigan. During the statistical evaluation of the initial assessment monitoring event, arsenic was present in one or more downgradient monitoring wells at statistically significant levels exceeding the Groundwater Protection Standard (GWPS). Therefore, CEC will initiate an Assessment of Corrective Measures (ACM) within 90 days from when the Appendix IV exceedance was determined (no later than April 14, 2019). 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 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 at Unit 1-2 in accordance with the *JH Campbell Monitoring Program Sample Analysis Plan* (SAP) (ARCADIS, 2016). The second semiannual

[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).

assessment monitoring event was performed on November 12 through November 16, 2018. Monitoring wells JHC-MW-15001 through JHC-MW-15005 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-15004 had been decommissioned during CCR removal activities on June 14, 2018, and was not sampled in November 2018. Given that groundwater flow changes have occurred such that JHC-MW-15001 is located hydraulically upgradient of Unit 1-2, JHC-MW-15002 and JHC-MW-15003 are predominately side gradient, and JHC-MW-15004 has been removed, additional downgradient monitoring wells have been installed at Unit 1-2 and are being used to reassess the monitoring well network, as discussed below.

TRC personnel collected static water level measurements from the JHC Unit 1-2 CCR Unit well network. 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 background monitoring wells are summarized in Table 3, and the analytical results for 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 (collectively 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. 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 1-2 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 previous monitoring events since the background sampling events commenced in December 2015. Groundwater flow in the immediate vicinity of Unit 1-2 is predominately toward the south, consistent with the April and June 2018 assessment monitoring events. 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 rounds, groundwater flow changes have occurred in the immediate vicinity of Unit 1-2 as a result of permanent discontinued hydraulic loading and completion of pond deconstruction activities (including CCR removal) at Unit 1-2. Since hydraulic loading has been discontinued, the groundwater flow is predominantly toward the south instead of radially outward. The initial data collected from the newly installed wells indicates that they are in the downgradient direction, while JHC-MW-15001 is upgradient and JHC-MW-15002 and JHC-MW-15003 are predominately side gradient of groundwater flow from Unit 1-2 (Attachment A Figure A1). As such, the Unit 1-2 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 1-2 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 sampling event, the compliance well groundwater concentrations for Appendix IV constituents were compared to the GWPSs to determine if a statistically significant exceedance had occurred in accordance with §257.95. Consistent with the *Unified Guidance*[2], the preferred method for comparisons to a fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS. GWPSs were established in accordance with §257.95(h), as detailed in the October 15, 2018 *Groundwater Protection Standards* technical memorandum, which was also included in 2018 Annual Report (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 second semiannual assessment monitoring event data indicates that the following constituent is present at statistically significant levels exceeding the GWPS in downgradient monitoring wells at the JHC Unit 1-2 CCR unit:

Constituent	**GWPS**	**# Downgradient Wells Observed**
Arsenic	10 ug/L	2 of 4

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 and CEC will continue to initiate an assessment of corrective measures by April 14, 2019, per §257.95(g). CEC will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

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

Sincerely,

TRC

Graham Crockford
Program Manager

Sarah B. Holmstrom
Hydrogeologist/Project Manager

Attachments

Table 1.	Summary of Groundwater Elevation Data
Table 2.	Summary of Field Parameter Results
Table 3.	Summary of Background 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	Unit 1-2 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 1-2N/1-2S – 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 1/2							
JHC-MW-15001	11/13/2018	0.80	-23.2	6.3	464	14.8	3.7
JHC-MW-15002	11/15/2018	9.80	89.8	8.0	361	8.8	5.8
JHC-MW-15003	11/15/2018	0.50	-106.1	8.7	948	14.6	3.9
JHC-MW-15005	11/15/2018	2.33	41.2	7.5	645	17.8	2.3

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 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	**JHC-MW-15001**	**JHC-MW-15002**	**JHC-MW-15003**	**JHC-MW-15005**
					Sample Date:	11/13/2018	11/15/2018	11/15/2018	11/15/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient			
Appendix III									
Boron	ug/L	NC	**500**	**500**	7,200	146	**1,470**	**1,120**	**1,450**
Calcium	mg/L	NC	NC	NC	500	72.1	41.9	115	61.9
Chloride	mg/L	250**	250	250	500	2.7	19.3	16.3	30.6
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	**250****	**250**	**250**	500	59.1	95.2	**294**	133
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	310	222	**644**	334
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	**6.3**	8.0	**8.7**	7.5
Appendix IV									
Antimony	ug/L	6	6.0	6.0	130	< 1.0	< 1.0	2.0	5.1
Arsenic	ug/L	**10**	**10**	**10**	**10**	**12.7**	**60.5**	8.1	1.2
Barium	ug/L	2,000	2,000	2,000	820	84.9	18.4	113	149
Beryllium	ug/L	4	4.0	4.0	18	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5.0	5.0	3.5	< 0.20	< 0.20	1.7	< 0.20
Chromium	ug/L	100	100	100	**11**	< 1.0	< 1.0	**13.6**	< 1.0
Cobalt	ug/L	NC	40	100	100	< 6.0	< 6.0	23.6	< 6.0
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	39	< 1.0	< 1.0	3.3	< 1.0
Lithium	ug/L	NC	170	350	440	< 10	68	< 10	28
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	**73**	**210**	3,200	13.3	9.2	65.3	**222**
Radium-226	pCi/L	NC	NC	NC	NC	< 0.755	< 1.09	< 0.579	< 0.461
Radium-228	pCi/L	NC	NC	NC	NC	< 0.879	1.04	< 0.657	0.967
Radium-226/228	pCi/L	5	NC	NC	NC	< 1.63	< 1.70	< 1.24	1.41
Selenium	ug/L	**50**	**50**	**50**	**5**	< 1.0	2.5	**28.6**	**158**
Thallium	ug/L	2	2.0	2.0	3.7	< 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 5

Summary of Groundwater Protection Standard Exceedances – November 2018

JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program

West Olive, Michigan

Constituent	Units	GWPS	JHC-MW-15001		JHC-MW-15002		JHC-MW-15003		JHC-MW-15005	
			LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL
Arsenic	ug/L	10	0.78	7.1	33	130	11	31	NA	NA
Lithium	ug/L	40	NA	NA	3.8	35	NA	NA	28	51
Molybdenum	ug/L	100	NA	NA	NA	NA	NA	NA	10	222
Selenium	ug/L	50	NA	NA	NA	NA	NA	NA	10	370
Thallium	ug/L	2	NA	NA	NA	NA	NA	NA	2	5.8

Notes:

ug/L - micrograms per Liter.

NA - Not Applicable; well/parameter pair did not directly exceed the GWPS and was not included in further analysis.

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		**FIGURE 1**
APPROVED BY:	G. CROCKFORD		
DATE:	MARCH 2019		

TRC
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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")
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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")
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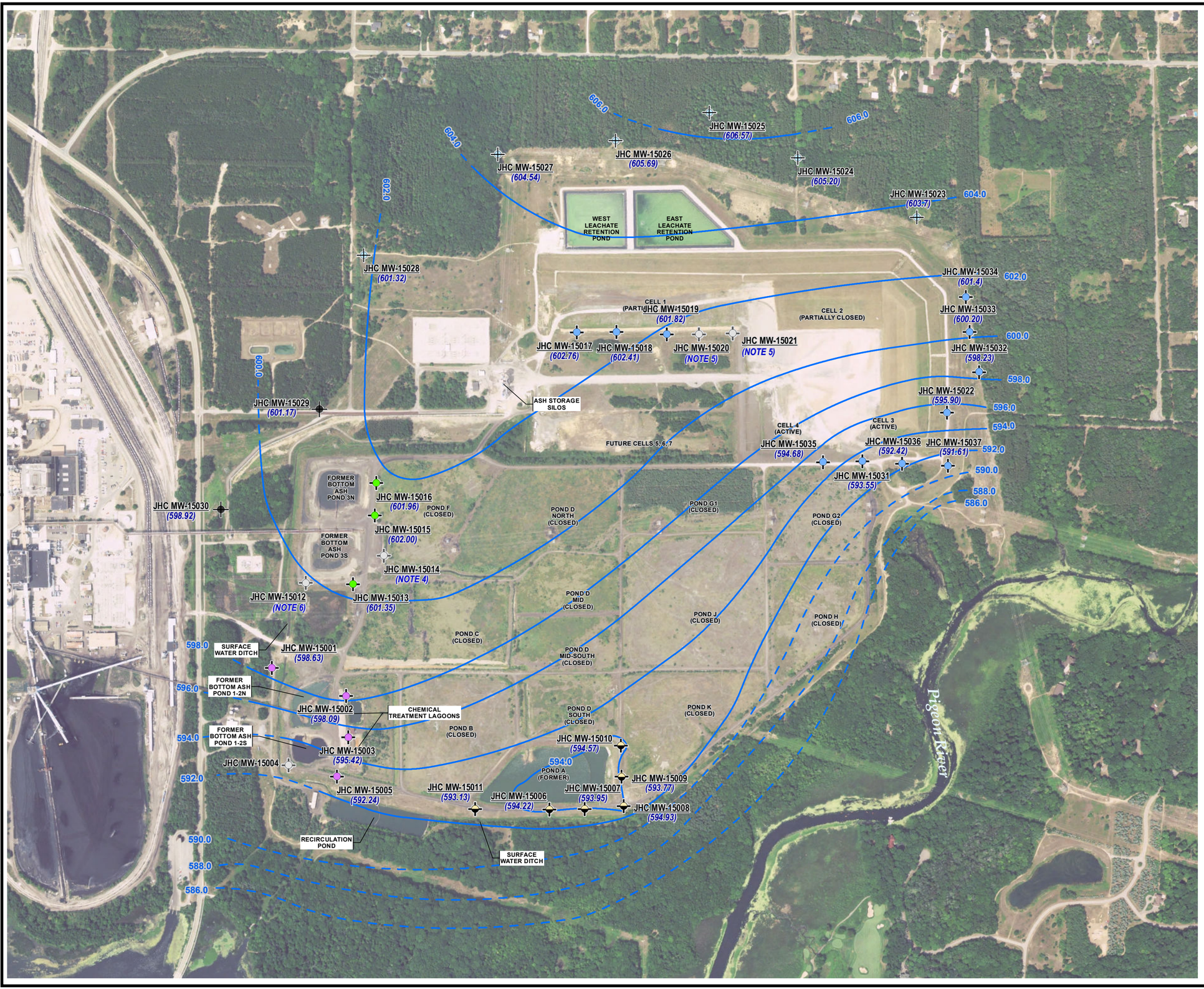

LEGEND

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

NOTES

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

N

0 700 1,400 Feet

1 " = 700 '
1:8,400

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

TITLE:
GROUNDWATER CONTOUR MAP NOVEMBER 2018

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

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FILE NO.: 290806-001-019.mxd

Attachment A
Unit 1-2 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 1-2 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. Removal of ash from Unit 1-2 for beneficial reuse began in June 2018 and continued through September 2018. CCR removal at Unit 3 South began in September 2018 and continued through October 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).

One of the downgradient monitoring wells (JHC-MW-15004) had been decommissioned on June 14, 2018, to accommodate the CCR removal activities. 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

1-2 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 1-2 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 1-2 during December 2018.

Groundwater Sampling Summary

TRC collected groundwater samples from the newly installed monitoring wells JHC-MW-18004 and JHC-MW-18006 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, the 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 constituents 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, with a slight southwesterly flow component, in the vicinity of Unit 1-2.

The general flow direction is similar to that identified in April, June and November 2018. JHC-MW-18004 and JHC-MW-18005, located on the southwest and south perimeters of the former Unit 1-2 CCR Unit, are positioned downgradient of the south flow component across Unit 1-2. The initial data collected from the newly installed wells indicates that they are in the downgradient direction, while JHC-MW-15001 is upgradient and JHC-MW-15002 and JHC-MW-15003 are predominately side gradient of groundwater flow from Unit 1-2 (Figure A1). As such, the Unit 1-2 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 1-2 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 below the GWPSs (using a direct comparison to the standards).

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 1-2 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 1-2N/1-2S – 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 1/2							
JHC-MW-18004	12/7/2018	5.90	76.0	7.0	770	7.2	6.6
JHC-MW-18005	12/7/2018	1.58	90.3	8.8	604	8.2	9.6

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

SU - Standard units

umhos/cm - Micromhos per centimeter.

°C - Degrees Celsius

NTU - Nephelometric Turbidity Unit.

Table A3
Summary of Groundwater Sampling Results (Analytical): December 2018
JH Campbell 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

							Sample Location:	**JHC-MW-18004**	**JHC-MW-18005**
							Sample Date:	12/7/2018	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	**970**	**641**
Calcium	mg/L	NC	NC	NC	500	**46**	NA	**48.9**	**32.5**
Chloride	mg/L	250**	250	250	500	43	NA	25.7	29.8
Fluoride	ug/L	4,000	NC	NC	NC	1,000	NA	< 1,000	< 1,000
Sulfate	mg/L	250**	250	250	500	**14**	NA	**109**	**90.0**
Total Dissolved Solids	mg/L	500**	500	500	500	**258**	NA	**306**	234
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	6.5 - 9.0	4.8 - 9.2	NA	7.0	**8.8**
Appendix IV									
Antimony	ug/L	6	6.0	6.0	130	2	6	< 1.0	< 1.0
Arsenic	ug/L	10	10	10	10	**1**	10	1.0	**9.5**
Barium	ug/L	2,000	2,000	2,000	820	**35**	2,000	**92.6**	**58.1**
Beryllium	ug/L	4	4.0	4.0	18	1	4	< 1.0	< 1.0
Cadmium	ug/L	5	5.0	5.0	3.5	0.2	5	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11	2	100	< 1.0	1.5
Cobalt	ug/L	NC	40	100	100	15	15	< 6.0	< 6.0
Fluoride	ug/L	4,000	NC	NC	NC	1,000	4,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	39	1	15	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440	10	40	< 10	< 10
Mercury	ug/L	2	2.0	2.0	0.20#	0.2	2	< 0.20	< 0.20
Molybdenum	ug/L	NC	73	210	3,200	**5**	100	**7.4**	**18.6**
Radium-226	pCi/L	NC	NC	NC	NC	NA	NA	< 0.695	< 0.567
Radium-228	pCi/L	NC	NC	NC	NC	NA	NA	< 0.708	< 0.760
Radium-226/228	pCi/L	5	NC	NC	NC	1.93	5	< 1.40	< 1.33
Selenium	ug/L	50	50	50	**5**	**5**	50	**7.3**	**42.0**
Thallium	ug/L	2	2.0	2.0	3.7	2	2	< 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_269767\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		

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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
Units 1 & 2

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 4621062 and 4621064.

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

- JHC-MW-18004
- JHC-MW-18005

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 all coolers were >6°C (7.91-13.3 °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-08) and one field blank (FB-08) 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 sample JHC-MW-18004 for anions, mercury, metals, alkalinity, and radium. The MS/MSD recoveries and relative percent differences (RPDs), where applicable, were within the acceptance limits with the following exceptions.
  - The recoveries of born were outside of the acceptance criteria. The boron concentration in sample JHC-MW-18004 was >4x the spike concentration; therefore, the MS/MSD results for boron were not evaluated. Data usability was not affected.
  - The recovery for sulfate in the MS performed on sample JHC-MW-18004 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.
- Laboratory duplicates were performed on sample JHC-MW-18004 for anions, TDS, and alkalinity. All criteria were met.
- The field duplicate pair samples submitted with this data set were JHC-MW-18005 and Dup-08. 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 Units 1 and 2 Groundwater Analytical Data
JH Campbell - RCRA CCR Monitoring Program
West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
Dup-08 EB-08 FB-08 JHC-MW-18004_20181207 JHC-MW-18005_20181207	12/7/2018	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.
Dup-08 JHC-MW-18004_20181207 JHC-MW-18005_20181207	12/7/2018	Sulfate	MS recovery below the lower laboratory control limit. Sample results may be biased low.

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

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

Notes:

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

Laboratory Data Quality Review
Groundwater Monitoring Event November 2018
CEC JH Campbell Units 1 & 2

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 4620347 and 4620348.

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

- JHC-MW-15001
- JHC-MW-15002
- JHC-MW-15003
- JHC-MW-15005
- JHC-MW-15013

Sample JHC-MW-15013 is associated with the Unit 3 groundwater monitoring network.

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 six coolers shipped and received on 11/14/18 was >6°C (10.3°C). The results for fluoride, chloride, sulfate, alkalinity, and TDS in sample JHC-MW-15001_20181113 collected on 11/13/18 and received on 11/14/18 may be biased low (see attached table). Concentrations were within the range of historical results with the exception of chloride, which was below historical concentrations. Samples JHC-MW-15003_20181115, DUP#04_20181114, and FB#04_20181114 were collected on 11/14/18, received on the same day as sample collection, and contained ice upon receipt; thus, there was no adverse impact to data usability.
- The temperatures for three out of six coolers received on 11/15/18 were >6°C (ranging from 7.3-9.3°C). However, the samples were collected on 11/15/18, and the coolers were hand delivered to the courier and contain ice upon receipt; thus, there was no adverse impact to data usability.
- There were no contaminants detected in the reported method blanks with the following exceptions:
    - Ra-226 was detected in the method blank from batch 321901 at a concentration of 0.992 $\pm$ 0.632 pCi/L. There was no impact on data usability since Ra-226 was nondetect in the associated samples JHC-MW-15005_20181115 and EB#03_20181115.
    - The MB data was not provided in the data package for sulfate analyzed on 12/6/18: Sample JHC-MW-15005_20181115 was analyzed 27 minutes beyond the laboratory's 24-hr batch window (starting from the analysis time of the MB). Due to limitations of the laboratory's software, more than one batch QC (i.e. MB) cannot be reported per sample, regardless of analytical date. The laboratory stated that the batch MB was associated with batches of 20 samples; thus, additional QC was not reported by the laboratory for samples that need to be re-analyzed due to instrument verification issues or dilution. The laboratory also stated that instrument verification via calibration blanks and standards was verified daily prior to sample analysis to ensure the instrument was in control. There was no impact on the overall usability of the data for the samples listed above due to this issue.
- Two field blanks (FB#03_20181115 and FB#04_20181115) were collected; no analytes were detected in these blank samples.
- One equipment blank (EB#03_20181115) was collected and the following analyte was detected:
    - Chloride at 2.1 mg/L; the chloride result in sample JHC-MW-15001_20181113, may be a false positive since the result was less than 5x the blank result. The chloride result for JHC-MW-15001 was below the range of historical concentrations.
- LCS recoveries were within laboratory control limits with the following exception:
    - The LCS data was not provided in the data package for the anions analyzed on 12/6/18: Sample JHC-MW-15005_20181115 was analyzed 27 minutes beyond the laboratory's 24-

hr batch window (starting from the analysis time of the MB). Due to limitations of the laboratory's software, more than one batch QC (i.e. LCS) cannot be reported per sample, regardless of analytical date. The laboratory stated that the batch LCS was associated with batches of 20 samples; thus, additional QC was not reported by the laboratory for samples that need to be re-analyzed due to instrument verification issues or dilution. The laboratory also stated that instrument verification via calibration blanks and standards was verified daily prior to sample analysis to ensure the instrument was in control. There was no impact on the overall usability of the data for the samples listed above due to this issue.

- MS/MSDs were performed on sample JHC-MW-15003_20181115 for radium, metals, and anions, and MS analysis was performed on sample JHC-MW-15003_20181115 for alkalinity. The relative percent differences (RPDs) were within the QC limits.
  - The boron recoveries in the MS/MSD analyses performed on sample JHC-MW-15003_20181115 were below the lower laboratory control limits. However, the sample result 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 following samples; RPDs between the parent and duplicate sample were within the QC limits.
  - For anions on samples JHC-MW-15001_20181113 and JHC-MW-15003_20181115
  - For alkalinity and TDS on sample JHC-MW-15003_20181115
- The RLs for chloride (2 mg/L) and TDS (50 mg/L) in field blanks (FB#03_20181115 and FB#04_20181114) and for TDS (50 mg/L) in equipment blank (EB#03_20181115) exceeded the project-required RL of 1 mg/L. This does not affect data usability since these are QC samples.
- The field duplicate pair samples were Dup#03_20181115 and JHC-MW-15002_20181115 and Dup#04_20181114 and JHC-MW-15013_20181114; all criteria were met for field duplicate pair Dup#03_20181115 and JHC-MW-15002_20181115. The RPD for chromium in the field duplicate pair Dup#04_20181114 and JHC-MW-15013_20181114 was 32.8% above the 30% acceptance limit. The samples associated with this field duplicate pair were samples JHC-MW15001_20181113, 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). The chromium results for JHC-MW-15013 were within the range of historical results.
- Carrier and tracer recoveries, where applicable, were within 30-110%.

Attachment B
Summary of Data Non-Conformances
JH Campbell Units 1 & 2 – RCRA CCR Monitoring Program
West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15001_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-15001_20181113	11/13/2018	Chloride	Detection in equipment blank (EB-01). Sample result ≤5X the blank concentration. Result may be a false positive.
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, results were within the range of historical concentrations.
DUP#04_20181114	11/14/2018		

Notes:

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

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 Units 1-2 North and 1-2 South CCR Unit, Consumers Energy Company, West Olive, Michigan

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During the statistical evaluation of the initial assessment monitoring event, arsenic was present in one or more downgradient monitoring wells at statistically significant levels exceeding the Groundwater Protection Standards (GWPSs). Therefore, Consumers Energy Company (CEC) will initiate an Assessment of Corrective Measures (ACM) within 90 days from when the Appendix IV exceedance was determined (no later than April 14, 2019). Currently, 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 1-2 North and 1-2 South (Unit 1-2). The second semiannual assessment monitoring event of 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 detailed 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 the following constituent is present at statistically significant levels exceeding the GWPS in downgradient monitoring wells at the JHC Unit 1-2 CCR unit:

Constituent	GWPS	# Downgradient Wells Observed
Arsenic	10 ug/L	2 of 4

These results are consistent with the results of the initial assessment monitoring data statistical evaluation and CEC will continue to initiate an assessment of corrective measures per §257.95(g). CEC will continue executing 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 1-2 CCR Unit consists of four monitoring wells (JHC-MW-15001, JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005) located on the perimeter of the bottom ash ponds. Former downgradient monitoring well JHC-MW-15004 was decommissioned on June 14, 2018 during deconstruction of Unit 1-2; therefore, statistical analysis for JHC-MW-15004 terminates at the June 2018 monitoring event.

Following the second semiannual assessment monitoring sampling event, compliance well data for the JHC Unit 1-2 were evaluated in accordance with the Groundwater Statistical Evaluation Plan (Stats Plan) (TRC, October 2017). An assessment monitoring program was developed to evaluate concentrations of CCR constituents present in the uppermost aquifer relative to acceptable levels (i.e. GWPSs). In order to decide as to whether or not the GWPSs have been exceeded, the change in concentration observed at the downgradient wells during a given assessment monitoring event must be large enough, after accounting for variability in the sample data, that the result is unlikely to have occurred merely by chance. Consistent with the Unified Guidance[2], the preferred method for comparisons to a fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS. Based on the number of historical observations in the representative sample population, the population mean, the population standard deviation, and a selected confidence level (*i.e.* 99 percent), an upper and lower confidence limit is calculated. The true concentration, with 99 percent confidence, will fall between the lower and upper confidence limits.

The concentrations observed in the downgradient wells are deemed to be a statistically significant exceedance when the 99 percent lower confidence limit of the downgradient data exceeds the GWPS. If the confidence interval straddles the GWPS (i.e. the lower confidence level is below the GWPS but

[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 upper confidence level is above), the statistical test results are inconclusive and there is not compelling evidence that the measured concentration is a result of a release from the CCR unit versus the inherent variability of the sample data. This statistical approach is consistent with the statistical methods for assessment monitoring presented in §257.93(f) and (g). Statistical evaluation methodologies built into the CCR Rule, and numerous other federal rules, are key in determining whether or not individually measured data points represent a concentration increase over the baseline or a fixed standard (such as a GWPS in an assessment monitoring program).

For each detected Appendix IV constituent, the concentrations 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 eight monitoring events (August 2016 through November 2018) were retained for further analysis. Arsenic in JHC-MW-15001 and JHC-MW-15003, arsenic and lithium in JHC-MW-15002, and lithium, molybdenum, selenium, and thallium in JHC-MW-15005 at Unit 1-2 had individual results exceeding the GWPS. Cobalt was detected in JHC-MW-15003 at a concentration of 23.6 ug/L, which exceeds its GWPS. However, this is the only detection of cobalt in the Unit 1-2 wells during either baseline sampling or assessment monitoring, and it qualifies as an outlier. The well will be sampled during the next semiannual assessment monitoring sampling event to confirm whether cobalt is present in groundwater at that monitoring well. Per the Stats Plan and the Unified Guidance, cobalt will be subject to the double quantification rule, where a detection above laboratory reporting limits must be observed for two consecutive events (e.g. initial sample and a resample) to confirm the initial detection and rule out a potential false positive result.

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 the assessment monitoring results (April through November 2018) for these well-constituent pairs were observed visually for potential trends. Potential outliers were noted for lithium (JHC-MW-15002 in November 2018) and molybdenum (JHC-MW-15005 in November 2018), which had not previously exceeded the GWPSs. Groundwater conditions are re-equilibrating following to CCR removal activities at the JHC Unit 1-2 recently completed in September 2018, 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 suspect lithium and molybdenum data from November 2018 have been kept in the assessment monitoring data set pending the collection of additional data. The suspect data will be tested for outliers once stabilized groundwater characteristics have been assessed. 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 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 tests were 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 data sets were found to be normally distributed, except the set for arsenic in JHC-MW-15002 and molybdenum, selenium, and thallium in JHC-MW-15005 for which nonparametric confidence tests were conducted. The confidence interval test compares the lower confidence limit to the GWPS. The statistical evaluation of the Appendix IV constituents shows exceedances for arsenic in JHC-MW-15002 and JHC-MW-15003. These results are consistent with the results of the initial assessment monitoring data statistical evaluation and CEC will continue to initiate an assessment of corrective measures per §257.95(g). CEC will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Although no outliers were identified, the recent data collected during the April, June, and November 2018 assessment monitoring events shows some variation compared to the background data set. The timing of the dissimilarities correlates with CCR removal activities and re-equilibration of groundwater in the vicinity of JHC Unit 1-2 following cessation of hydraulic loading and completion of pond deconstruction. As mentioned above, the JHC Unit 1-2 monitoring system is currently being re-evaluated post-deconstruction to determine which monitoring wells are appropriately positioned to assess groundwater quality downgradient from the JHC Unit 1-2 CCR unit after hydrogeologic conditions re-stabilize.

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 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15001												
					Sample Date:	12/7/2015	3/8/2016	6/21/2016	8/29/2016	11/15/2016	4/19/2017	6/20/2017	8/14/2017	9/25/2017	4/25/2018	6/18/2018	11/13/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												
Appendix III																		
Boron	ug/L	NC	NA	51	NA	396	235	195	271	309	149	368	238	287	--	339	146	
Calcium	mg/L	NC	NA	46	NA	85.6	84.1	80.7	74.0	75.5	70.3	50.7	70.9	68	--	68.6	72.1	
Chloride	mg/L	250*	NA	43	NA	12.3	48.4	152	98.5	105	7.1	51.8	94.8	73.6	--	109	2.7	
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	
Sulfate	mg/L	250*	NA	14	NA	142	46.2	34.9	46.4	68.3	42.1	88	114	129	--	78.9	59.1	
Total Dissolved Solids	mg/L	500*	NA	258	NA	630	190	570	550	560	440	340	562	563	--	596	310	
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	6.6	6.4	6.2	6.0	6.4	6.3	6.2	6.3	6.2	7.2(1)	6.3	6.3	
Appendix IV																		
Antimony	ug/L	6	NA	2	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	
Arsenic	ug/L	10	NA	1	**10**	6	3	3	4	3	4	1.8	2.2	--	< 1.0	1.8	**12.7**	
Barium	ug/L	2,000	NA	35	2,000	160	148	164	148	141	172	106	142	--	71.4	183	84.9	
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	2	2	2	3	2	1.0	1.0	--	< 1.0	< 1.0	< 1.0	
Cobalt	ug/L	NC	6	15	**15**	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	
Lithium	ug/L	NC	40	10	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	
Molybdenum	ug/L	NC	100	5	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	13.3	
Radium-226	pCi/L	NC	NA	NA	NA	< 0.234	< 0.211	0.344	< 0.389	< 0.379	< 0.352	< 1.63	< 0.708	--	< 0.545	< 0.828	< 0.755	
Radium-228	pCi/L	NC	NA	NA	NA	1.67	1.34	2.24	1.56	1.60	2.07	< 0.628	1.20	--	< 0.799	< 1.12	< 0.879	
Radium-226/228	pCi/L	5	NA	1.93	5	1.9	1.53	2.58	1.77	1.89	2.13	< 2.26	1.61	--	< 1.34	< 1.95	< 1.63	
Selenium	ug/L	50	NA	5	**50**	< 1	1	1	< 1	1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	
Thallium	ug/L	2	NA	2	**2**	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) JHC-MW-15004 was decommissioned on June 14th, 2018.

Table C1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

Sample Location:						JHC-MW-15002														
Sample Date:						12/7/2015	3/8/2016	6/21/2016	8/30/2016	11/15/2016	4/19/2017	6/20/2017	6/20/2017	8/14/2017	8/14/2017	9/25/2017	9/25/2017	4/25/2018	4/25/2018	6/19/2018	11/15/2018	11/15/2018
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	661	426	433	831	757	602	768	678	869	946	927	894	--	--	430	1,470	1,360
Calcium	mg/L	NC	NA	46	NA	21.9	35.8	36.4	36.1	18.9	28.0	24.6	25.1	25.7	25.3	30.5	30.6	--	--	75.3	41.9	41.1
Chloride	mg/L	250*	NA	43	NA	13.2	18.5	23.4	17.4	14.4	25.7	20.7	20.7	20.7	20.2	25.8	26.0	--	--	22.3	19.3	19.2
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	33.3	47.8	46.9	54.0	51.4	64.2	52.8	53.3	54.5	53.7	33.9	34.3	--	--	153	95.2	94.5
Total Dissolved Solids	mg/L	500*	NA	258	NA	150	160	180	190	140	190	160	130	236	174	144	148	--	--	356	222	
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	8.8	8.7	8.5	8.6	8.8	8.8	9.2	--	9.2	--	9.6	--	10.2(1)	--	8.3	8.0	--
Appendix IV																						
Antimony	ug/L	6	NA	2	6	< 1	< 1	4	3	1	< 1	3.3	2.9	1.9	2.1	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	**10**	**34**	**40**	**36**	**34**	**46**	**33**	**35.4**	**32.2**	**44.5**	**45.8**	--	--	**129**	**130**	**127**	**60.5**	**59.5**
Barium	ug/L	2,000	NA	35	2,000	10	9	8	8	8	8	7.2	6.3	7.8	7.7	--	--	30.4	30.4	19.8	18.4	18.1
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 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	< 1	< 1	< 1	< 1	1	2	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	**15**	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	< 15.0	< 15.0	--	--	< 15.0	< 15.0	< 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	< 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**	12.1	10.1	< 10	< 10	11	< 10	< 10	< 10	11	< 10	--	--	28	28	19	**68**	**67**
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	93	18	18	16	48	21.4	19.2	19.0	19.0	--	--	12.6	12.7	7.5	9.2	9.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.330	< 0.244	< 0.219	< 0.487	< 0.251	< 0.409	< 0.562	< 0.154	0.749	0.949	--	--	< 0.823	< 0.530	< 0.620	< 1.09	0.921
Radium-228	pCi/L	NC	NA	NA	NA	0.986	< 0.737	< 0.649	2.83	< 0.496	< 0.702	< 0.765	< 0.690	< 0.797	< 0.790	--	--	< 0.729	< 1.33	< 1.58	1.04	0.767
Radium-226/228	pCi/L	5	NA	1.93	5	1.09	< 0.737	< 0.649	2.9	< 0.496	< 0.702	< 1.33	< 0.844	< 1.43	< 1.26	--	--	< 1.55	< 1.86	< 2.20	< 1.70	1.69
Selenium	ug/L	50	NA	5	**50**	< 1	4	< 1	< 1	2	4	7.8	7.3	3.5	5.1	--	--	< 1.0	< 1.0	< 1.0	2.5	2.8
Thallium	ug/L	2	NA	2	**2**	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) JHC-MW-15004 was decommissioned on June 14th, 2018.

Table C1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15003										
					Sample Date:	12/5/2015	3/8/2016	6/21/2016	8/29/2016	11/15/2016	4/18/2017	6/20/2017	8/14/2017	9/25/2017	4/25/2018	6/18/2018	6/18/2018	11/15/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												
Appendix III																	Field Dup	
Boron	ug/L	NC	NA	51	NA	439	455	426	882	1,670	1,280	1,240	1,150	1,120	--	1,170	1,320	1,120
Calcium	mg/L	NC	NA	46	NA	27.9	46.7	38.3	44.3	31.8	34.6	28.8	36.0	30.1	--	60.0	59.1	115
Chloride	mg/L	250*	NA	43	NA	21.7	25.7	28.5	20.1	30.8	27.9	24.0	22.0	19.3	--	37.5	36.6	16.3
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	41.3	52.7	48.1	45.8	63.0	71.8	61.8	61.9	51.9	--	81.9	82.7	294
Total Dissolved Solids	mg/L	500*	NA	258	NA	160	200	190	220	230	260	146	208	136	--	388	344	644
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	9.0	9.3	9.2	9.1	8.6	8.7	9.3	9.3	9.7	9.3	8.9	--	8.7
Appendix IV																		
Antimony	ug/L	6	NA	2	6	< 1	< 1	< 1	< 1	2	1	< 1.0	1.3	--	1.5	1.9	1.8	2.0
Arsenic	ug/L	10	NA	1	**10**	**38**	**31**	**27**	**27**	**36**	**26**	**20.4**	**23.7**	--	**12.4**	**14.1**	**14.3**	8.1
Barium	ug/L	2,000	NA	35	2,000	21	16	15	19	18	16	18.0	18.0	--	42.3	55.7	52.5	113
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	1.7
Chromium	ug/L	100	NA	2	100	2	5	2	1	5	12	12.3	< 1.0	--	< 1.0	< 1.0	< 1.0	13.6
Cobalt	ug/L	NC	6	15	**15**	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 15.0	**23.6**
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	3.3
Lithium	ug/L	NC	40	10	**40**	11.1	< 10	< 10	< 10	11	< 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**	9	11	20	13	24	30	21.1	28.2	--	19.3	53.0	51.2	65.3
Radium-226	pCi/L	NC	NA	NA	NA	< 0.250	< 0.236	< 0.211	< 0.365	< 0.249	< 0.302	< 1.12	1.15	--	< 0.631	< 0.623	< 0.733	< 0.579
Radium-228	pCi/L	NC	NA	NA	NA	< 0.412	< 0.575	< 0.539	< 0.724	< 0.369	0.633	< 0.722	< 0.938	--	< 0.732	< 1.01	< 1.08	< 0.657
Radium-226/228	pCi/L	5	NA	1.93	5	< 0.412	< 0.575	< 0.539	< 0.724	< 0.369	0.769	< 1.84	1.81	--	< 1.36	< 1.63	< 1.81	< 1.24
Selenium	ug/L	50	NA	5	**50**	< 1	3	< 1	< 1	2	3	< 1.0	1.1	--	2.2	4.4	4.5	28.6
Thallium	ug/L	2	NA	2	**2**	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) JHC-MW-15004 was decommissioned on June 14th, 2018.

Table C1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15004[2]									
					Sample Date:	12/5/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/18/2017	6/20/2017	8/14/2017	9/25/2017	4/25/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient									
Appendix III															
Boron	ug/L	NC	NA	51	NA	546	268	412	469	578	260	473	660	376	--
Calcium	mg/L	NC	NA	46	NA	43.1	42.8	45.8	64.6	101	36.9	37.7	51.2	78.6	--
Chloride	mg/L	250*	NA	43	NA	41.6	35.5	26.4	23.7	70.8	46.8	67.5	95.1	41.5	--
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
Sulfate	mg/L	250*	NA	14	NA	55.0	42.5	48.7	47.8	244	58.6	85.6	122	64.6	--
Total Dissolved Solids	mg/L	500*	NA	258	NA	290	220	230	370	560	290	322	402	382	--
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.6	7.3	7.1	6.8	7.3	7.6	7.4	7.6	7.1	7.3
Appendix IV															
Antimony	ug/L	6	NA	2	6	< 1	< 1	1	1	< 1	< 1	< 1.0	< 1.0	--	< 1.0
Arsenic	ug/L	10	NA	1	**10**	**21**	9	**11**	8	6	4	4.8	5.7	--	3.6
Barium	ug/L	2,000	NA	35	2,000	73	65	117	181	241	110	93.2	193	--	162
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 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
Chromium	ug/L	100	NA	2	100	1	1	1	1	1	3	6.9	< 1.0	--	< 1.0
Cobalt	ug/L	NC	6	15	**15**	< 15	< 15	< 15	< 15	< 15	< 15	< 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
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0
Lithium	ug/L	NC	40	10	**40**	< 10	< 10	< 10	12	12	< 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
Molybdenum	ug/L	NC	100	5	**100**	9	8	10	5	10	6	10.1	11.2	--	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.295	0.259	< 0.189	< 0.29	< 0.311	< 0.333	< 0.502	0.915	--	< 0.449
Radium-228	pCi/L	NC	NA	NA	NA	0.422	0.452	0.605	1.62	0.856	0.366	< 0.685	< 0.920	--	< 0.787
Radium-226/228	pCi/L	5	NA	1.93	5	0.702	0.711	0.633	1.85	1.12	0.497	< 1.19	1.66	--	< 1.24
Selenium	ug/L	50	NA	5	**50**	8	2	2	7	1	2	< 1.0	< 1.0	--	5.5
Thallium	ug/L	2	NA	2	**2**	**2.16**	< 2	2	**4**	**3**	< 2	< 2.0	**2.1**	--	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) JHC-MW-15004 was decommissioned on June 14th, 2018.

Table C1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to November 2018
JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15005												
					Sample Date:	12/5/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/18/2017	6/20/2017	8/14/2017	9/25/2017	4/25/2018	6/19/2018	11/15/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												
Appendix III																		
Boron	ug/L	NC	NA	51	NA	275	959	1,370	706	1,500	524	468	546	481	--	227	1,450	
Calcium	mg/L	NC	NA	46	NA	55.0	60.2	55.1	51.6	73.4	56.8	53.6	48.0	40.3	--	61.8	61.9	
Chloride	mg/L	250*	NA	43	NA	27.7	42.0	46.9	19.2	29.3	64.2	50.4	27.1	21.8	--	90.9	30.6	
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	
Sulfate	mg/L	250*	NA	14	NA	51.2	53.0	57.9	46.5	61.8	58.3	66.0	64.9	61.9	--	74.3	133	
Total Dissolved Solids	mg/L	500*	NA	258	NA	270	300	310	230	320	360	306	282	300	--	462	334	
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.3	7.4	7.4	7.3	7.1	7.5	7.4	7.5	7.4	7.4	7.4	7.5	
Appendix IV																		
Antimony	ug/L	6	NA	2	6	4	2	2	3	5	3	3.8	4.2	--	2.2	1.6	5.1	
Arsenic	ug/L	10	NA	1	**10**	4	3	3	5	3	2	3.3	2.5	--	1.7	1.3	1.2	
Barium	ug/L	2,000	NA	35	2,000	99	74	97	72	159	128	113	109	--	407	175	149	
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	4	5	12	2	3	4	3.7	< 1.0	--	< 1.0	3.0	< 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**	**41.3**	25.5	28	31	**49**	38	39	36	--	**61**	35	28	
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**	12	13	25	16	15	18	14.0	10	--	31.2	15.7	**222**	
Radium-226	pCi/L	NC	NA	NA	NA	< 0.277	< 0.355	0.192	< 0.286	< 0.246	0.461	< 0.717	< 0.877	--	0.620	< 0.758	< 0.461	
Radium-228	pCi/L	NC	NA	NA	NA	0.436	< 0.426	< 0.395	1.58	0.745	< 0.383	< 0.728	< 0.856	--	0.700	1.220	0.967	
Radium-226/228	pCi/L	5	NA	1.93	5	0.564	< 0.426	< 0.395	1.78	0.974	0.841	< 1.45	< 1.73	--	1.32	1.91	1.41	
Selenium	ug/L	50	NA	5	**50**	28	12	33	18	**165**	10	15.5	15.7	--	**368**	14	**158**	
Thallium	ug/L	2	NA	2	**2**	**3.04**	< 2	2	2	**4**	< 2	< 2.0	< 2.0	--	**5.8**	**2.1**	< 2.0	

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) JHC-MW-15004 was decommissioned on June 14th, 2018.

Attachment C1
Sanitas™ Output

Summary Report

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

For observations made between 12/5/2015 and 11/15/2018, a summary of the selected data set:

Observations = 44
ND/Trace = 22
Wells = 4
Minimum Value = 1
Maximum Value = 5.1
Mean Value = 1.833
Median Value = 1
Standard Deviation = 1.207
Coefficient of Variation = 0.6584
Skewness = 1.347

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	11	11	1	1	1	1	0	0	NaN
JHC-MW-15002	11	6	1	4	1.736	1	1.116	0.6425	1.01
JHC-MW-15003	11	5	1	2	1.332	1	0.4303	0.3231	0.6864
JHC-MW-15005	11	0	1.6	5.1	3.264	3	1.238	0.3793	0.1616

Summary Report

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

For observations made between 12/5/2015 and 11/15/2018, a summary of the selected data set:

Observations = 44
ND/Trace = 1
Wells = 4
Minimum Value = 1
Maximum Value = 129.5
Mean Value = 21.7
Median Value = 10.25
Standard Deviation = 28.52
Coefficient of Variation = 1.314
Skewness = 2.415

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	11	1	1	12.7	3.864	3	3.231	0.8363	2.027
JHC-MW-15002	11	0	33	129.5	56.22	40	36.5	0.6492	1.483
JHC-MW-15003	11	0	8.1	38	23.98	26	9.526	0.3972	-0.1992
JHC-MW-15005	11	0	1.2	5	2.727	3	1.155	0.4235	0.4151

Summary Report

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

For observations made between 12/5/2015 and 11/15/2018, a summary of the selected data set:

Observations = 44
ND/Trace = 0
Wells = 4
Minimum Value = 6.75
Maximum Value = 407
Mean Value = 81.51
Median Value = 71.7
Standard Deviation = 78.87
Coefficient of Variation = 0.9675
Skewness = 1.639

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	11	0	71.4	183	138.2	148	35.84	0.2593	-0.7409
JHC-MW-15002	11	0	6.75	30.4	12.18	8	7.488	0.6149	1.533
JHC-MW-15003	11	0	15	113	31.85	18	29.72	0.9331	2.086
JHC-MW-15005	11	0	72	407	143.8	113	93.35	0.6491	2.229

Summary Report

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

For observations made between 12/5/2015 and 11/15/2018, a summary of the selected data set:

Observations = 44
ND/Trace = 44
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-15001	11	11	1	1	1	1	0	0	NaN
JHC-MW-15002	11	11	1	1	1	1	0	0	NaN
JHC-MW-15003	11	11	1	1	1	1	0	0	NaN
JHC-MW-15005	11	11	1	1	1	1	0	0	NaN

Summary Report

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

For observations made between 12/5/2015 and 11/15/2018, a summary of the selected data set:

Observations = 44
ND/Trace = 43
Wells = 4
Minimum Value = 0.2
Maximum Value = 1.7
Mean Value = 0.2341
Median Value = 0.2
Standard Deviation = 0.2261
Coefficient of Variation = 0.966
Skewness = 6.405

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15002	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15003	11	10	0.2	1.7	0.3364	0.2	0.4523	1.345	2.846
JHC-MW-15005	11	11	0.2	0.2	0.2	0.2	0	0	NaN

Summary Report

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

For observations made between 12/5/2015 and 11/15/2018, a summary of the selected data set:

Observations = 44
ND/Trace = 18
Wells = 4
Minimum Value = 1
Maximum Value = 13.6
Mean Value = 2.832
Median Value = 1
Standard Deviation = 3.32
Coefficient of Variation = 1.173
Skewness = 2.266

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	11	3	1	3	1.545	1	0.6876	0.4449	0.8
JHC-MW-15002	11	9	1	2	1.091	1	0.3015	0.2764	2.846
JHC-MW-15003	11	3	1	13.6	5.082	2	5.081	0.9999	0.7953
JHC-MW-15005	11	3	1	12	3.609	3	3.105	0.8603	1.877

Summary Report

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

For observations made between 12/5/2015 and 11/15/2018, a summary of the selected data set:

Observations = 44
ND/Trace = 43
Wells = 4
Minimum Value = 6
Maximum Value = 23.6
Mean Value = 14.58
Median Value = 15
Standard Deviation = 2.682
Coefficient of Variation = 0.1839
Skewness = -1.414

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	11	11	6	15	14.18	15	2.714	0.1913	-2.846
JHC-MW-15002	11	11	6	15	14.18	15	2.714	0.1913	-2.846
JHC-MW-15003	11	10	15	23.6	15.78	15	2.593	0.1643	2.846
JHC-MW-15005	11	11	6	15	14.18	15	2.714	0.1913	-2.846

Summary Report

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

For observations made between 12/5/2015 and 11/15/2018, a summary of the selected data set:

Observations = 48
ND/Trace = 48
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-15001	12	12	1000	1000	1000	1000	0	0	NaN
JHC-MW-15002	12	12	1000	1000	1000	1000	0	0	NaN
JHC-MW-15003	12	12	1000	1000	1000	1000	0	0	NaN
JHC-MW-15005	12	12	1000	1000	1000	1000	0	0	NaN

Summary Report

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

For observations made between 12/5/2015 and 11/15/2018, a summary of the selected data set:

Observations = 44
ND/Trace = 43
Wells = 4
Minimum Value = 1
Maximum Value = 3.3
Mean Value = 1.052
Median Value = 1
Standard Deviation = 0.3467
Coefficient of Variation = 0.3295
Skewness = 6.405

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	11	11	1	1	1	1	0	0	NaN
JHC-MW-15002	11	11	1	1	1	1	0	0	NaN
JHC-MW-15003	11	10	1	3.3	1.209	1	0.6935	0.5736	2.846
JHC-MW-15005	11	11	1	1	1	1	0	0	NaN

Summary Report

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

For observations made between 12/5/2015 and 11/15/2018, a summary of the selected data set:

Observations = 44
ND/Trace = 24
Wells = 4
Minimum Value = 10
Maximum Value = 67.5
Mean Value = 18.91
Median Value = 10
Standard Deviation = 14.93
Coefficient of Variation = 0.7893
Skewness = 1.67

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	11	11	10	10	10	10	0	0	NaN
JHC-MW-15002	11	4	10	67.5	18.02	10.5	17.35	0.9628	2.383
JHC-MW-15003	11	9	10	11.1	10.19	10	0.4253	0.04174	1.661
JHC-MW-15005	11	0	25.5	61	37.44	36	10.38	0.2772	1.035

Summary Report

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

For observations made between 12/5/2015 and 11/15/2018, a summary of the selected data set:

Observations = 44
ND/Trace = 44
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-15001	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15002	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15003	11	11	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15005	11	11	0.2	0.2	0.2	0.2	0	0	NaN

Summary Report

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

For observations made between 12/5/2015 and 11/15/2018, a summary of the selected data set:

Observations = 44
ND/Trace = 10
Wells = 4
Minimum Value = 5
Maximum Value = 222
Mean Value = 23.18
Median Value = 14.5
Standard Deviation = 35.18
Coefficient of Variation = 1.518
Skewness = 4.449

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	11	10	5	13.3	5.755	5	2.503	0.4349	2.846
JHC-MW-15002	11	0	7.5	93	24.69	18	25.15	1.019	2.084
JHC-MW-15003	11	0	9	65.3	26.64	21.1	17.42	0.6539	1.223
JHC-MW-15005	11	0	10	222	35.63	15.7	62.11	1.743	2.797

Summary Report

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

For observations made between 12/5/2015 and 11/15/2018, a summary of the selected data set:

Observations = 44
ND/Trace = 37
Wells = 4
Minimum Value = 0.192
Maximum Value = 1.63
Mean Value = 0.5284
Median Value = 0.435
Standard Deviation = 0.3125
Coefficient of Variation = 0.5915
Skewness = 1.307

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	11	10	0.211	1.63	0.5795	0.389	0.4065	0.7015	1.64
JHC-MW-15002	11	9	0.219	1.006	0.5272	0.487	0.2712	0.5144	0.4572
JHC-MW-15003	11	10	0.211	1.15	0.5296	0.365	0.348	0.6571	0.8366
JHC-MW-15005	11	8	0.192	0.877	0.4773	0.461	0.2331	0.4885	0.4158

Summary Report

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

For observations made between 12/5/2015 and 11/15/2018, a summary of the selected data set:

Observations = 44
ND/Trace = 25
Wells = 4
Minimum Value = 0.369
Maximum Value = 2.9
Mean Value = 1.362
Median Value = 1.42
Standard Deviation = 0.6433
Coefficient of Variation = 0.4723
Skewness = 0.1074

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	11	4	1.34	2.58	1.872	1.89	0.3554	0.1899	0.4857
JHC-MW-15002	11	8	0.496	2.9	1.372	1.33	0.7476	0.545	0.6677
JHC-MW-15003	11	9	0.369	1.84	1.041	0.769	0.5877	0.5647	0.326
JHC-MW-15005	11	4	0.395	1.91	1.164	1.32	0.5531	0.4753	-0.1473

Summary Report

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

For observations made between 12/5/2015 and 11/15/2018, a summary of the selected data set:

Observations = 44
ND/Trace = 27
Wells = 4
Minimum Value = 0.369
Maximum Value = 2.83
Mean Value = 0.9704
Median Value = 0.781
Standard Deviation = 0.5331
Coefficient of Variation = 0.5493
Skewness = 1.483

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	11	4	0.628	2.24	1.373	1.34	0.5134	0.3738	0.2232
JHC-MW-15002	11	8	0.496	2.83	1.071	0.797	0.6619	0.6183	1.878
JHC-MW-15003	11	10	0.369	1.08	0.671	0.657	0.2084	0.3106	0.4613
JHC-MW-15005	11	5	0.383	1.58	0.7669	0.728	0.3785	0.4935	0.8804

Summary Report

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

For observations made between 12/5/2015 and 11/15/2018, a summary of the selected data set:

Observations = 44
ND/Trace = 17
Wells = 4
Minimum Value = 1
Maximum Value = 368
Mean Value = 21.05
Median Value = 2
Standard Deviation = 63.29
Coefficient of Variation = 3.007
Skewness = 4.369

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	11	8	1	1	1	1	0	0	NaN
JHC-MW-15002	11	5	1	7.55	2.682	2	2.107	0.7857	1.122
JHC-MW-15003	11	4	1	28.6	4.395	2	8.107	1.844	2.747
JHC-MW-15005	11	0	10	368	76.11	18	112.7	1.481	1.795

Summary Report

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

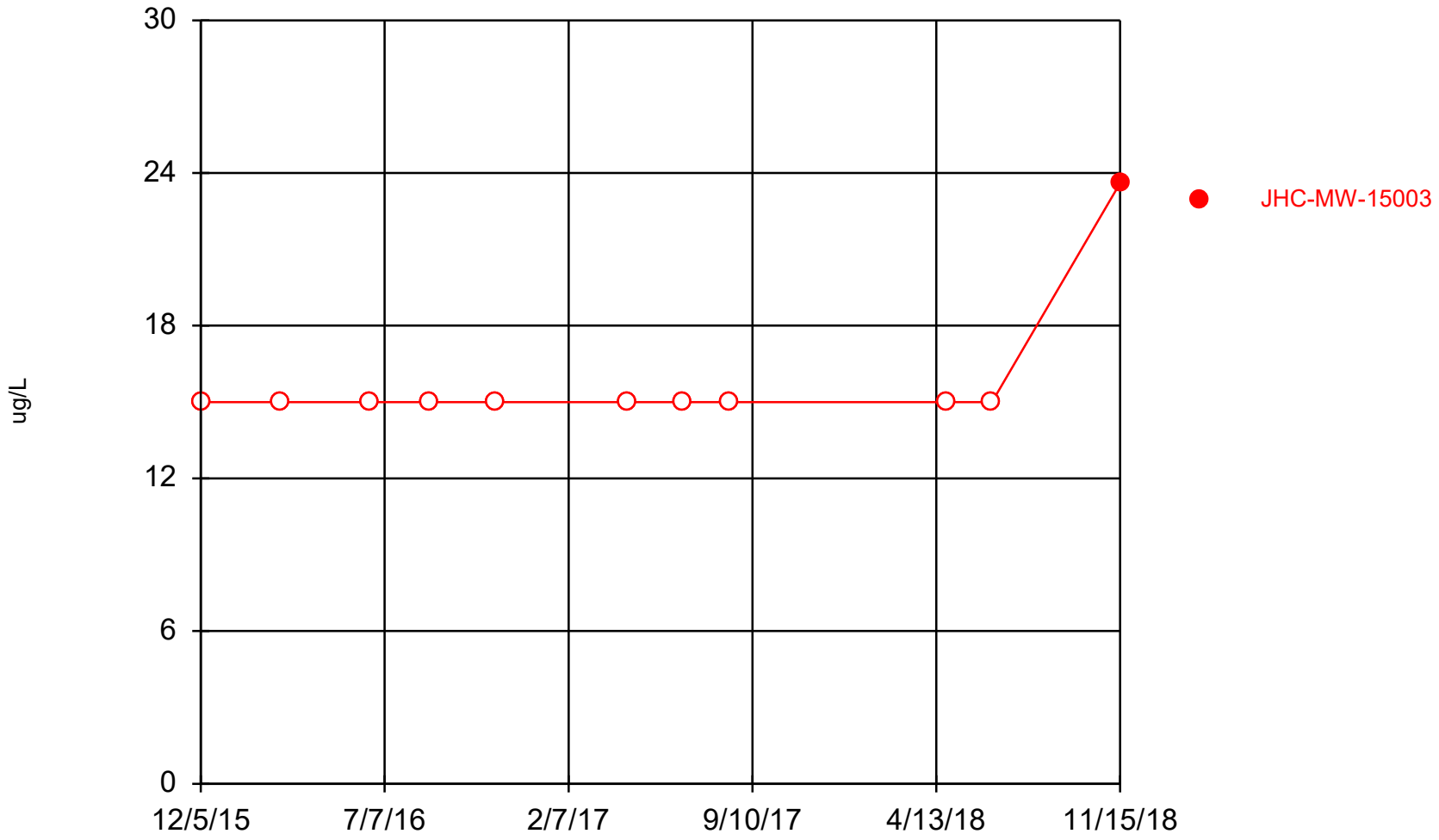
For observations made between 12/5/2015 and 11/15/2018, a summary of the selected data set:

Observations = 44
ND/Trace = 38
Wells = 4
Minimum Value = 2
Maximum Value = 5.8
Mean Value = 2.158
Median Value = 2
Standard Deviation = 0.6548
Coefficient of Variation = 0.3035
Skewness = 4.617

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	11	11	2	2	2	2	0	0	NaN
JHC-MW-15002	11	11	2	2	2	2	0	0	NaN
JHC-MW-15003	11	11	2	2	2	2	0	0	NaN
JHC-MW-15005	11	5	2	5.8	2.631	2	1.231	0.4679	1.83

Hollow symbols indicate censored values.

Time Series

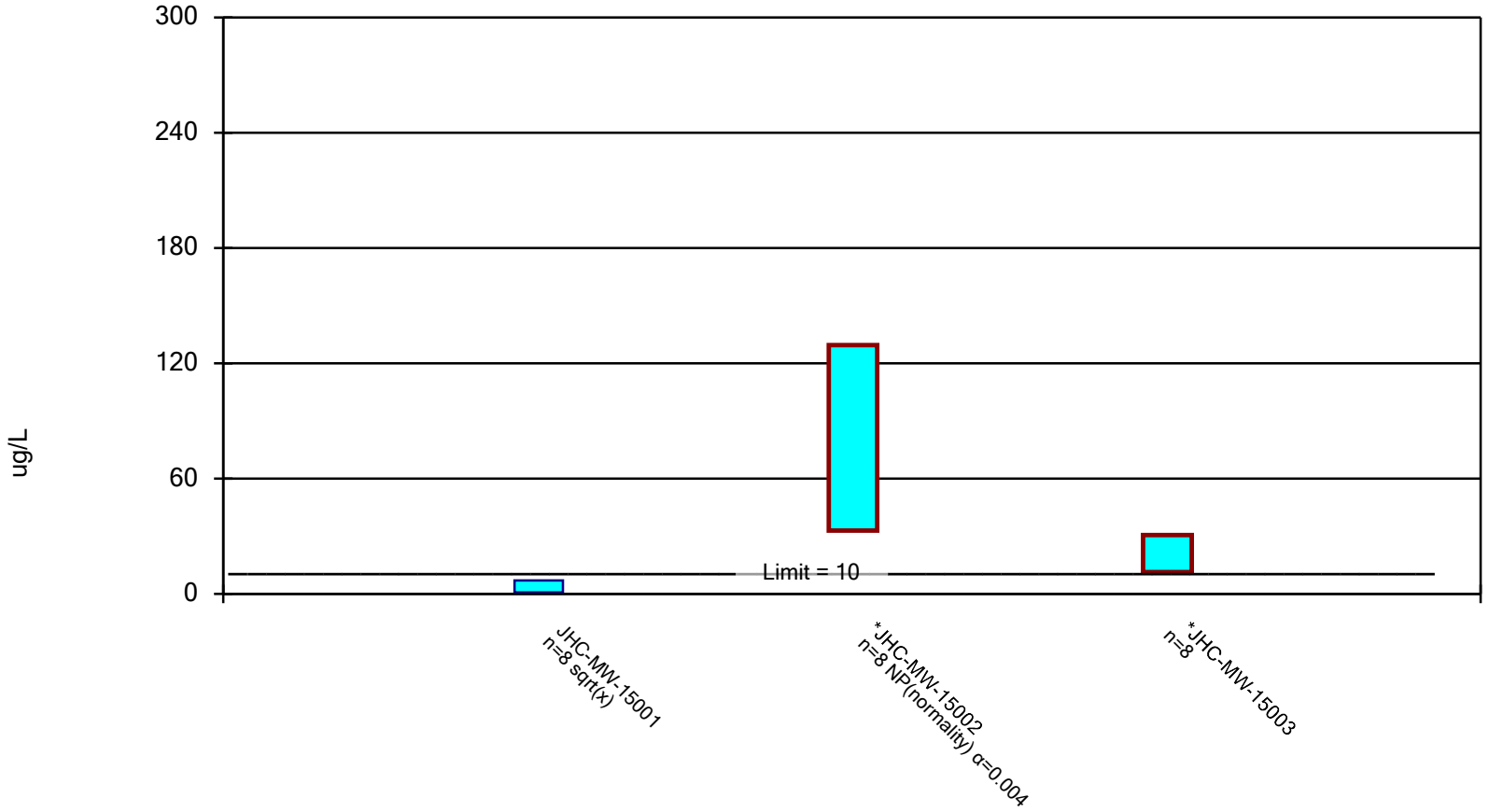


Constituent: Cobalt, Total Analysis Run 2/20/2019 12:42 PM

Client: Consumers Energy Data: JHC_Sanitas_19.02.18

Parametric and Non-Parametric (NP) Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on



Constituent: Arsenic, Total Analysis Run 2/20/2019 12:45 PM

Client: Consumers Energy Data: JHC_Sanitas_19.02.18

Confidence Interval

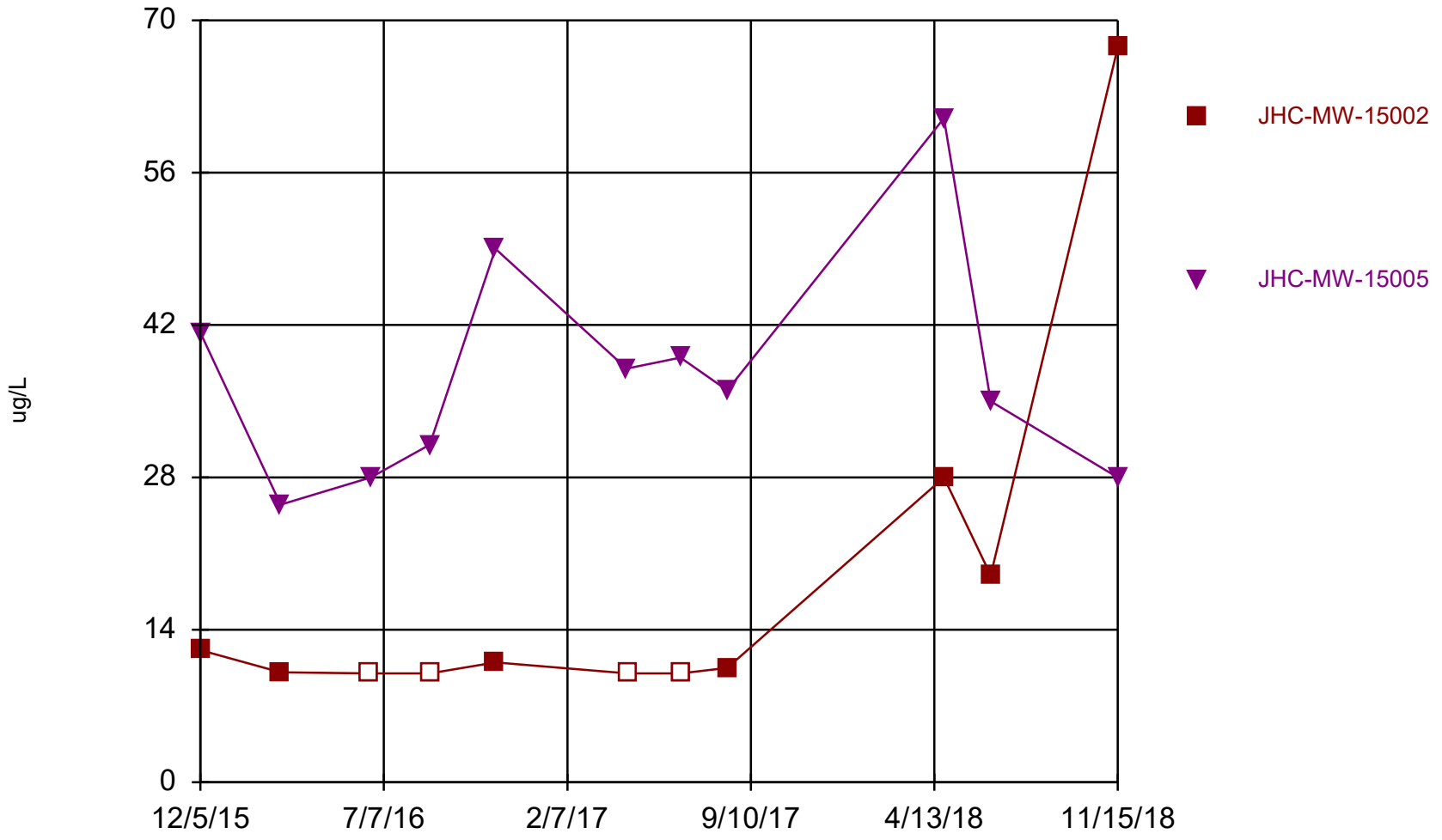
Constituent: Arsenic, Total (ug/L) Analysis Run 2/20/2019 12:45 PM

Client: Consumers Energy Data: JHC_Sanitas_19.02.18

	JHC-MW-15001	JHC-MW-15002	JHC-MW-15003
8/29/2016	4		27
8/30/2016		34	
11/15/2016	3	46	36
4/18/2017			26
4/19/2017	4	33	
6/20/2017	1.8	33.8 (D)	20.4
8/14/2017	2.2	45.15 (D)	23.7
4/25/2018	<1	129.5 (D)	12.4
6/18/2018	1.8		14.2 (D)
6/19/2018		127	
11/13/2018	12.7		
11/15/2018		60 (D)	8.1
Mean	3.75	63.56	20.98
Std. Dev.	3.805	40.93	9.105
Upper Lim.	7.067	129.5	30.63
Lower Lim.	0.7815	33	11.32

Hollow symbols indicate censored values.

Time Series

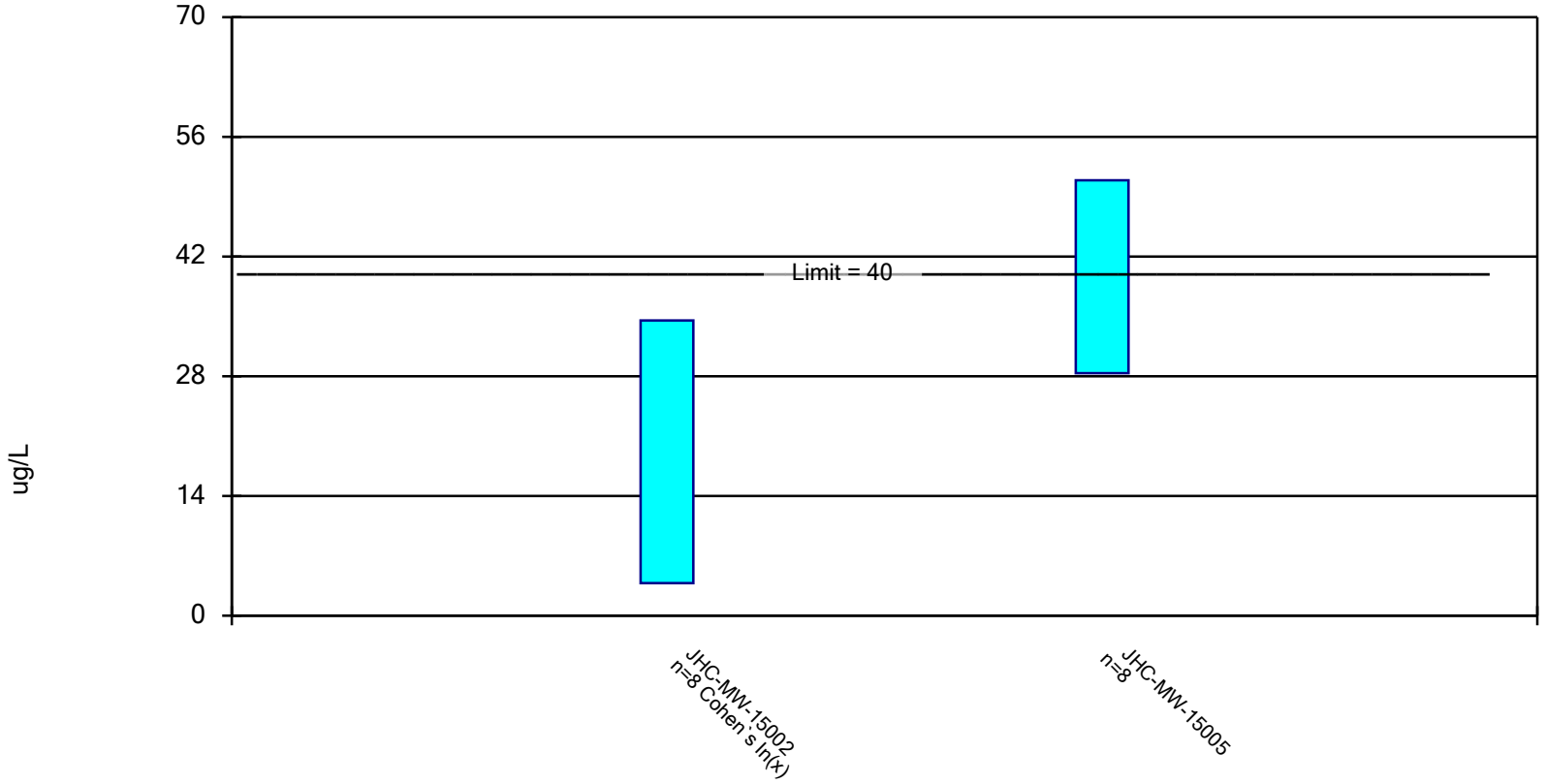


Constituent: Lithium, Total Analysis Run 2/20/2019 12:42 PM

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: Lithium, Total Analysis Run 2/20/2019 12:46 PM

Client: Consumers Energy Data: JHC_Sanitas_19.02.18

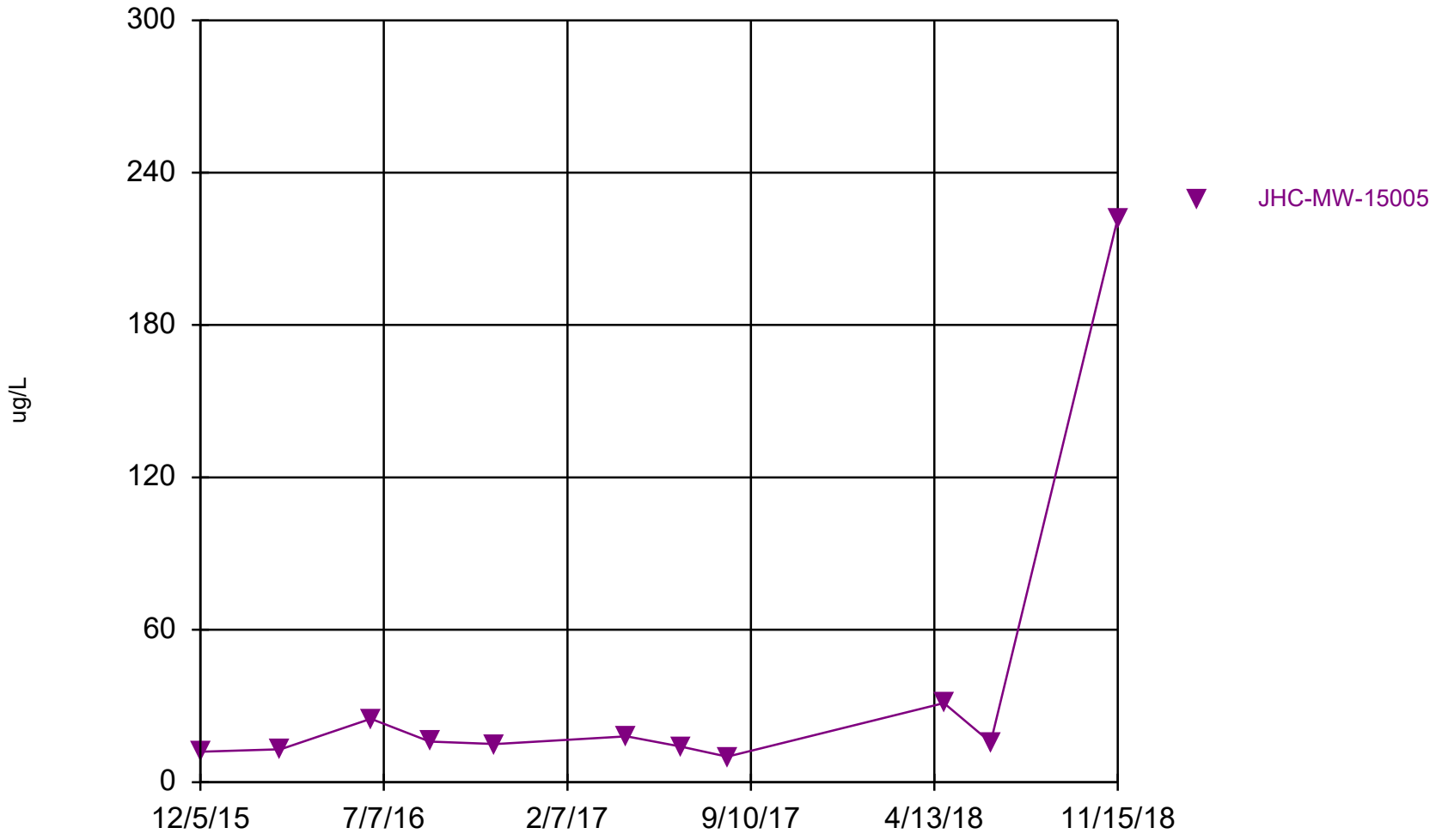
Confidence Interval

Constituent: Lithium, Total (ug/L) Analysis Run 2/20/2019 12:46 PM

Client: Consumers Energy Data: JHC_Sanitas_19.02.18

	JHC-MW-15002	JHC-MW-15005
8/30/2016	<10	31
11/15/2016	11	49
4/18/2017		38
4/19/2017	<10	
6/20/2017	<10 (D)	39
8/14/2017	8 (D)	36
4/25/2018	28 (D)	61
6/19/2018	19	35
11/15/2018	67.5 (D)	28
Mean	18.56	39.63
Std. Dev.	21.4	10.64
Upper Lim.	34.54	50.9
Lower Lim.	3.816	28.35

Time Series

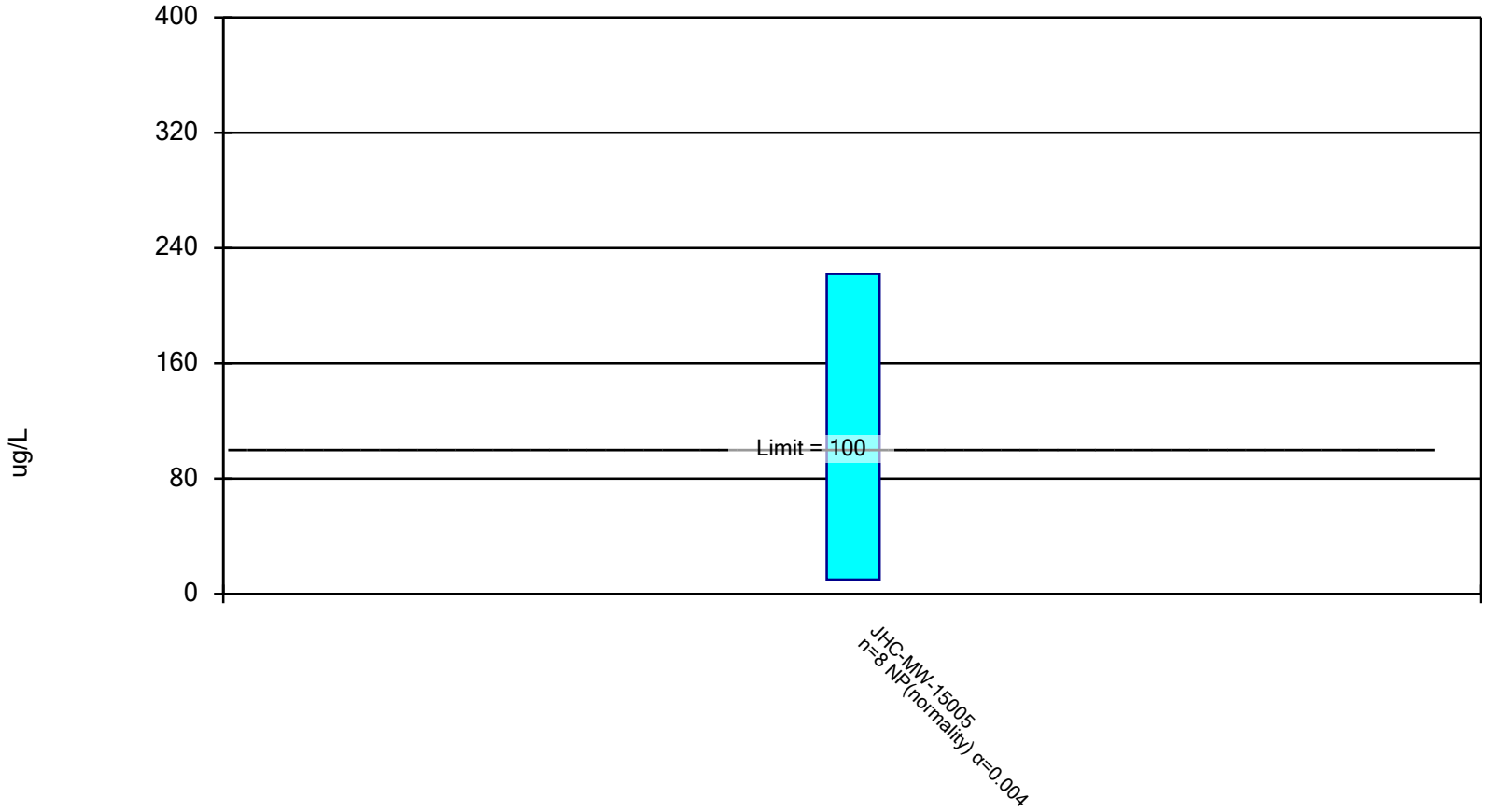


Constituent: Molybdenum, Total Analysis Run 2/20/2019 12:43 PM

Client: Consumers Energy Data: JHC_Sanitas_19.02.18

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: Molybdenum, Total Analysis Run 2/20/2019 12:47 PM

Client: Consumers Energy Data: JHC_Sanitas_19.02.18

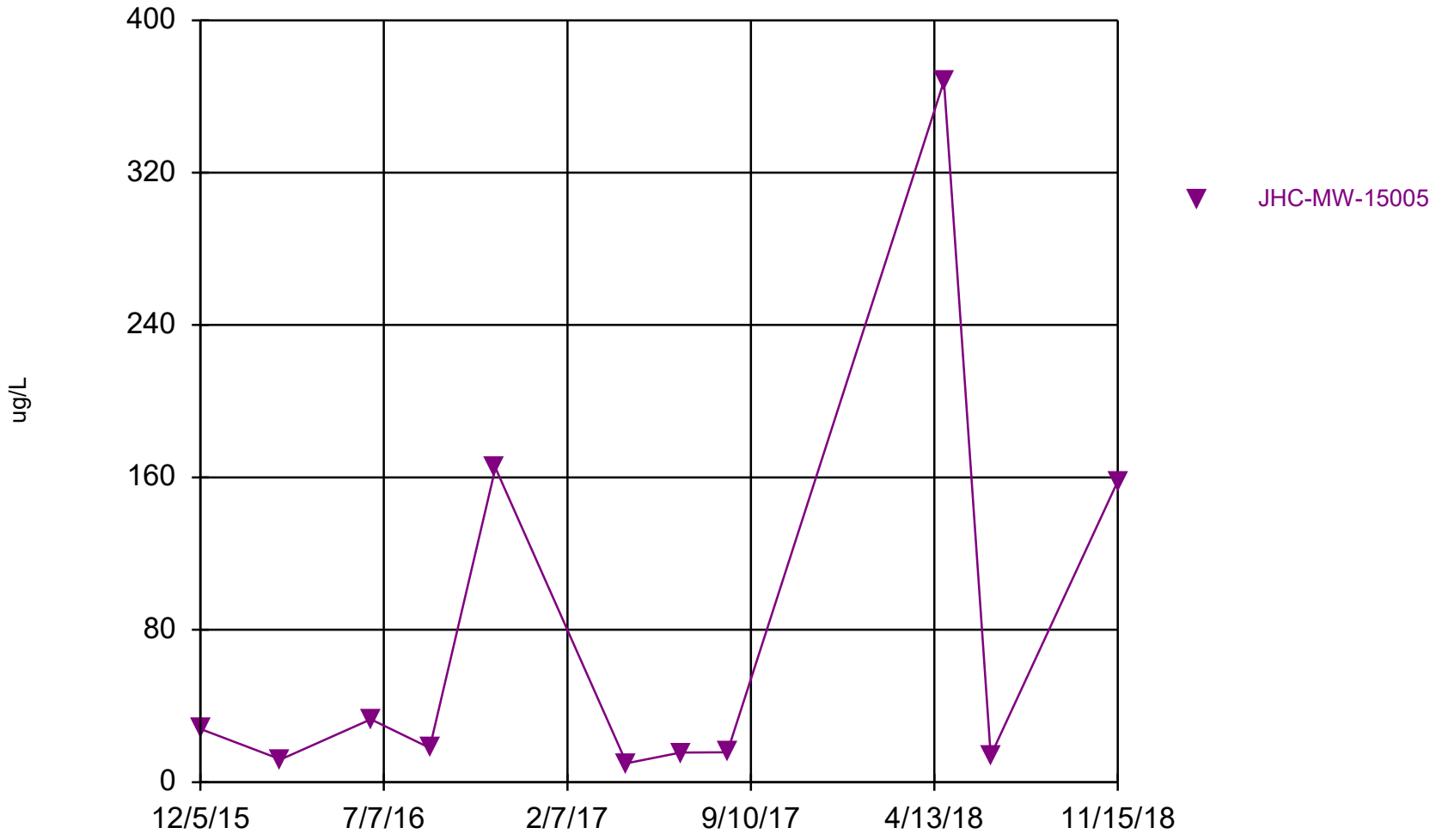
Confidence Interval

Constituent: Molybdenum, Total (ug/L) Analysis Run 2/20/2019 12:47 PM

Client: Consumers Energy Data: JHC_Sanitas_19.02.18

	JHC-MW-15005
8/30/2016	16
11/15/2016	15
4/18/2017	18
6/20/2017	14
8/14/2017	10
4/25/2018	31.2
6/19/2018	15.7
11/15/2018	222
Mean	42.74
Std. Dev.	72.7
Upper Lim.	222
Lower Lim.	10

Time Series

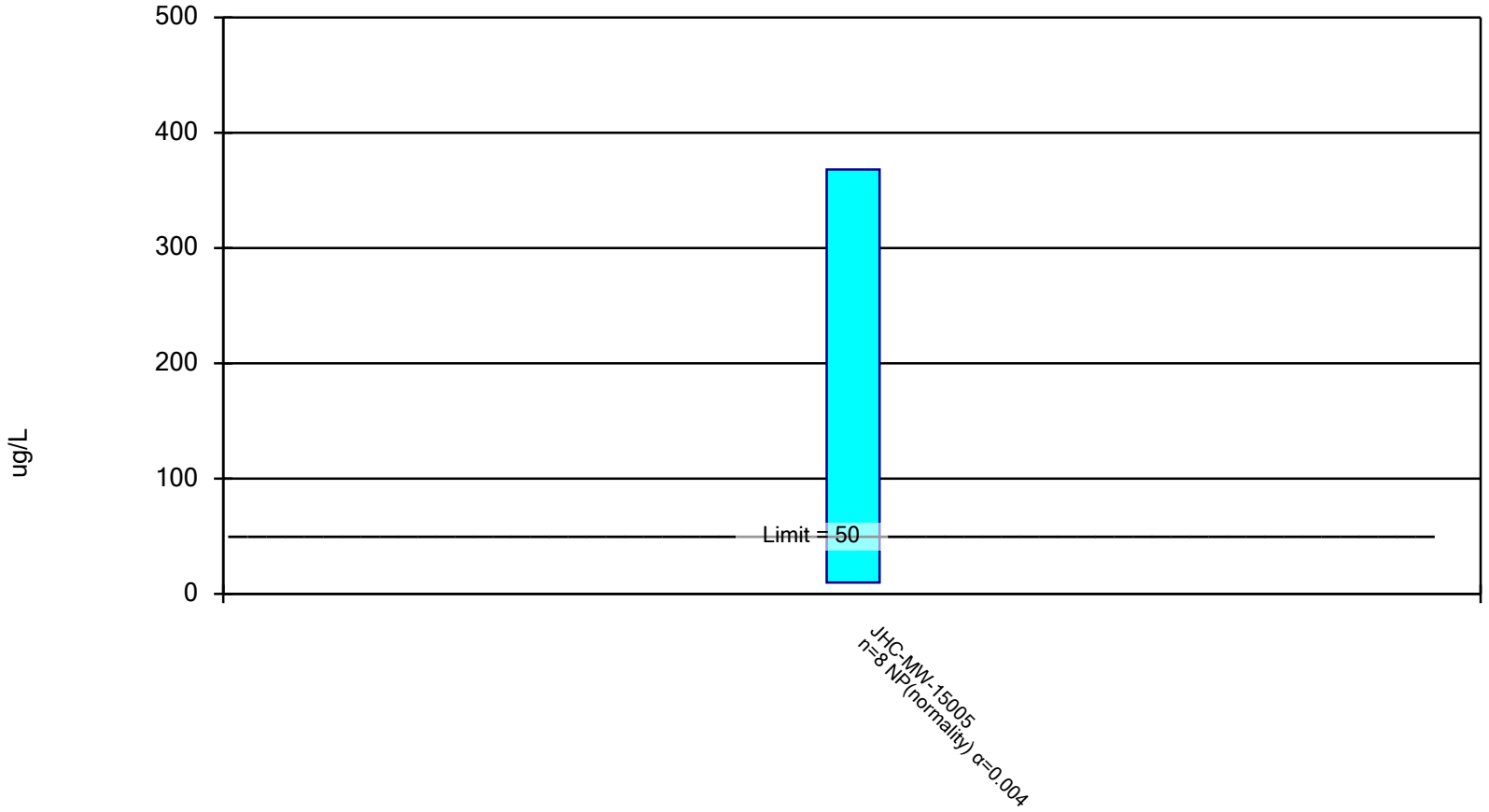


Constituent: Selenium, Total Analysis Run 2/20/2019 12:43 PM

Client: Consumers Energy Data: JHC_Sanitas_19.02.18

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: Selenium, Total Analysis Run 2/20/2019 12:47 PM

Client: Consumers Energy Data: JHC_Sanitas_19.02.18

Confidence Interval

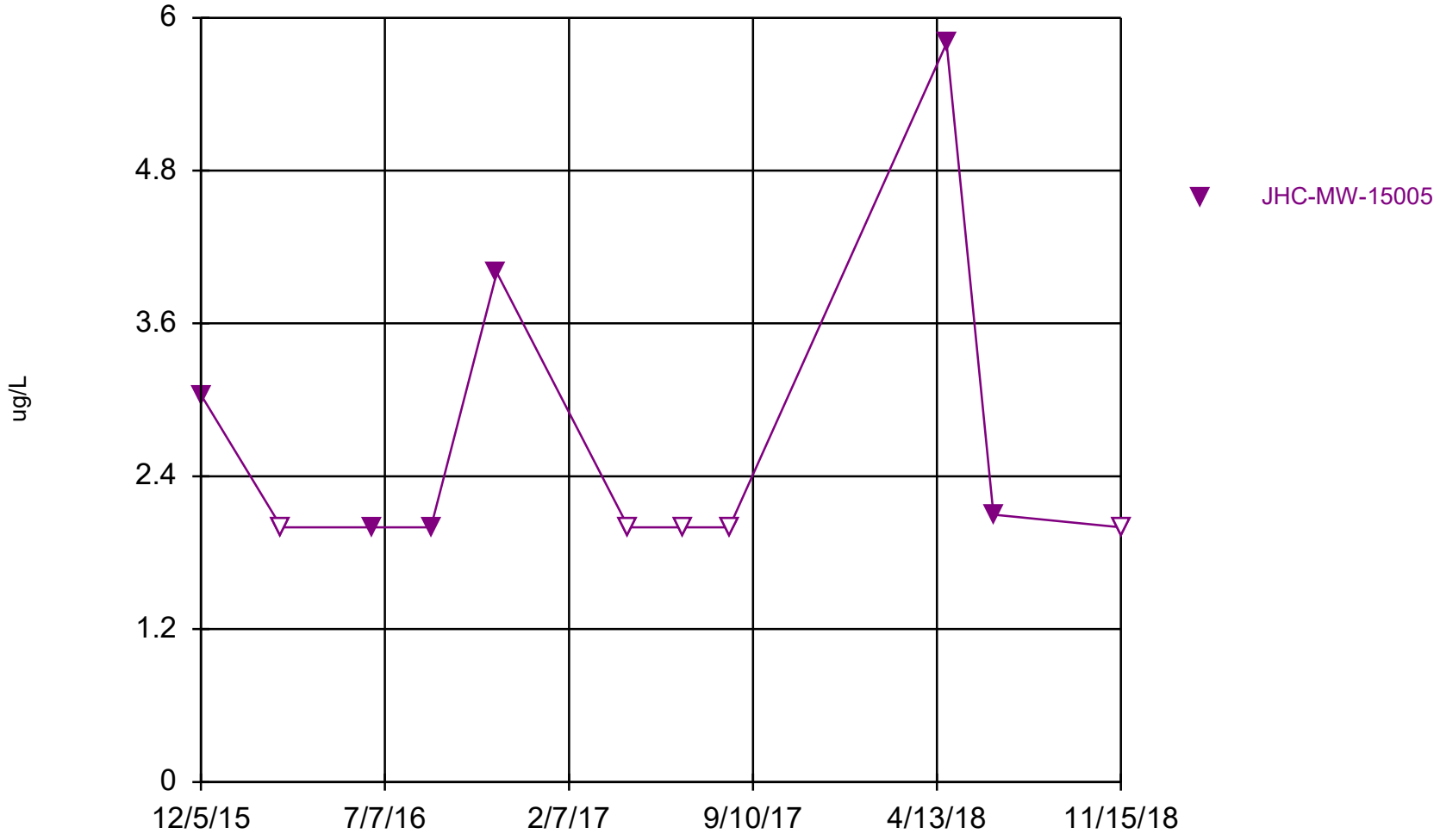
Constituent: Selenium, Total (ug/L) Analysis Run 2/20/2019 12:47 PM

Client: Consumers Energy Data: JHC_Sanitas_19.02.18

	JHC-MW-15005
8/30/2016	18
11/15/2016	165
4/18/2017	10
6/20/2017	15.5
8/14/2017	15.7
4/25/2018	368
6/19/2018	14
11/15/2018	158
Mean	95.53
Std. Dev.	128.6
Upper Lim.	368
Lower Lim.	10

Hollow symbols indicate censored values.

Time Series

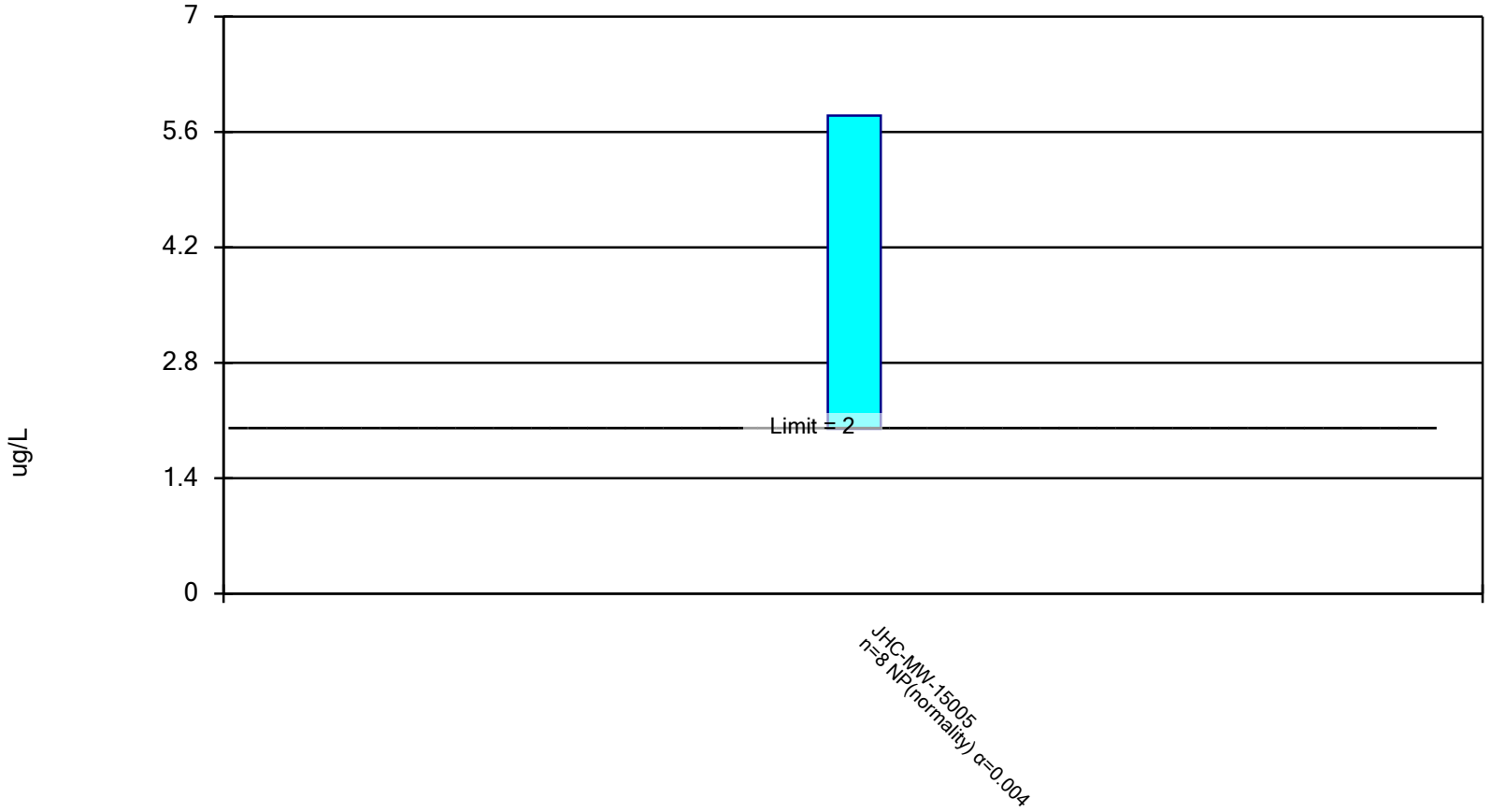


Constituent: Thallium, Total Analysis Run 2/20/2019 12:43 PM

Client: Consumers Energy Data: JHC_Sanitas_19.02.18

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: Thallium, Total Analysis Run 2/20/2019 12:48 PM

Client: Consumers Energy Data: JHC_Sanitas_19.02.18

Confidence Interval

Constituent: Thallium, Total (ug/L) Analysis Run 2/20/2019 12:49 PM

Client: Consumers Energy Data: JHC_Sanitas_19.02.18

	JHC-MW-15005
8/30/2016	2
11/15/2016	4
4/18/2017	<2
6/20/2017	<2
8/14/2017	<2
4/25/2018	5.8
6/19/2018	2.1
11/15/2018	<2
Mean	2.738
Std. Dev.	1.419
Upper Lim.	5.8
Lower Lim.	2

Appendix D
Data Quality Review

Laboratory Data Quality Review
Groundwater Sample Event February 2019
Consumers Energy JH Campbell Ponds 1 and 2

Groundwater samples were collected by TRC for the February 2019 JH Campbell Ponds 1 and 2 sampling event. Samples were analyzed for anions, total metals, alkalinity, total dissolved solids, and pH by Eurofins TestAmerica 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 440-235147-1 and 440-235151-1.

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

- JHC-MW-18004
- JHC-MW-18005

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Chloride, Fluoride, Sulfate)	EPA 300.0
Total Dissolved Solids	SM 2540C
Total Metals	SW846 3005A/6010B/6020A/7470A
Radium (Radium-226, Radium-228, Combined Radium)	EPA 903.0, EPA 904.0
Alkalinity (Total, Carbonate, Bicarbonate)	SM 2320B
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 exceptions:
  - Samples JHC-MW-18004, JHC-MW-18005, DUP-1, EB-1, and FB-1 were analyzed for pH outside the 15-minute holding time requirement; these pH results may be estimated since they were analyzed 7 days after sample collection.
- Target analytes were not detected in the method blanks, equipment blank (EB-1) and field blank (FB-1).
- LCS recoveries for all target analytes were within laboratory control limits.
- The field duplicate pair samples were DUP-1 and JHC-MW-18005. 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-18004 for radium, anions, metals, and mercury; the percent recoveries (%Rs) and RPDs were within the acceptance limits with the following exception:
  - The recoveries of calcium in the MS/MSD were above the acceptance criteria. However, the calcium concentration in the parent sample JHC-MW-18004 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-18004 for pH, alkalinity, and TDS; 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-1) and in equipment blank (EB-1) 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
Consumers Energy JH Campbell Ponds 1 and 2

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) 440-239941-1, 440-239944-1, 440-240198-1, 440-239935-1, 440-239939-1, and 440-240186-1.

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

- JHC-MW-15001
- JHC-MW-15002
- JHC-MW-15003
- JHC-MW-15005
- JHC-MW-18004
- JHC-MW-18005

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 for each analyte spiked 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. 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 15001, JHC-MW-15002, JHC-MW-15005, and JHC-MW-18005 were analyzed one day past the 14-day holding time criteria. These results may be estimated, biased low, as summarized in the attached table.
- Alkalinity could not be performed on samples JHC-MW-18004 and DUP-03 due to limited sample volume.
- No target analytes were detected in the method blanks.
- One field blank (FB-03) and one equipment blank (EB-03) were collected. FB-03 was not submitted for radium analyses. The following analytes were detected in each blank:
  - Calcium (4.9 mg/L), sodium (2.6 mg/L), potassium (2.5 mg/L), and magnesium (2.5 mg/L) were detected in FB-03; and sodium (0.72 mg/L) and magnesium (0.025 mg/L) were detected in EB-03. The sodium, potassium, and/or magnesium results in several samples, as summarized in the attached table, may be false positives since the results were less than 5x the maximum blank result. There was no impact on data usability for calcium since sample results were >5x the maximum blank concentration.
- LCS and/or LCSD percent recoveries (%Rs) and relative percent differences (RPDs) were within laboratory control limits.
- MS/MSDs were performed on sample DUP-03 for anions and JHC-MW-15003 for metals and anions. The RPDs were within the QC limits.
  - The recoveries of chloride in the MS/MSD performed on sample DUP-03 were outside of the acceptance criteria. However, the concentration of chloride in the parent sample was >4x the spike concentration; therefore, the laboratory control limits were not applicable. Data usability was not affected.
  - The recoveries of thallium in the MS and MSD performed on sample JHC-MW-15003 were outside of the acceptance criteria and the recovery for thallium in the post digestion spike (PDS) was acceptable. Potential low bias may exist for the positive and nondetect results for thallium in all groundwater samples in this data set, as summarized in the attached table.
- Laboratory duplicate analyses were performed for TDS on sample JHC-MW-18004, and for alkalinity and TDS on sample JHC-MW-15003; RPDs between the parent and duplicate samples were within the QC limits.
- The field duplicate samples were DUP-03 and JHC-MW-15005; all criteria were met.
- Carrier recoveries for radium analyses, where applicable, were within laboratory control criteria.

Attachment A

Summary of Data Non-Conformances

JH Campbell Ponds 1 & 2 – RCRA CCR Monitoring Program

West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15001	4/25/2019	Total Alkalinity, Bicarbonate Alkalinity, Carbonate Alkalinity	Holding time exceeded; results may be biased low.
JHC-MW-15002	4/25/2019		
JHC-MW-15005	4/25/2019		
JHC-MW-18005	4/25/2019		
JHC-MW-15001	4/25/2019	Thallium	Low recoveries in MS/MSD. Result may be a biased low.
JHC-MW-15002	4/25/2019		
JHC-MW-15003	4/29/2019		
JHC-MW-15005	4/25/2019		
DUP-03	4/25/2019		
JHC-MW-18004	4/25/2019		
JHC-MW-18005	4/25/2019		
JHC-MW-15001	4/25/2019	Sodium	Detection in field blank (FB-03). Sample result ≤5X the blank concentration. Result may be a false positive.
JHC-MW-15002	4/25/2019		
JHC-MW-15003	4/29/2019		
EB-03	4/29/2019		
JHC-MW-15001	4/25/2019	Potassium	Detection in field blank (FB-03). Sample result ≤5X the blank concentration. Result may be a false positive.
JHC-MW-15002	4/25/2019		
JHC-MW-15003	4/29/2019		
JHC-MW-15005	4/25/2019		
DUP-03	4/25/2019		
JHC-MW-18004	4/25/2019		
JHC-MW-18005	4/25/2019		
JHC-MW-15001	4/25/2019	Magnesium	Detection in field blank (FB-03). Sample result ≤5X the blank concentration. Result may be a false positive.
JHC-MW-15002	4/25/2019		
JHC-MW-15003	4/29/2019		
EB-03	4/29/2019		
JHC-MW-18005	4/25/2019		

Notes:

MS/MSD: Matrix spike/matrix spike duplicate.

Laboratory Data Quality Review
Groundwater Monitoring Event August 2019
Consumers Energy JH Campbell Ponds 1 and 2

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) 240-117413-1 and 240-117413-2.

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

- JHC-MW-18004
- JHC-MW-18005

Each sample was analyzed for the following constituents:

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

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

Data Usability Review Procedure

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

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

- Data for laboratory control samples (LCSs) and laboratory control sample duplicates (LCSDs), where applicable. The LCS/LCSDs are used to assess the accuracy and precision, where applicable, 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.
- One field blank (FB-1) and one equipment blank (EB-1) were collected. The following analytes were detected in FB-1: calcium at 94 mg/L, barium at 0.17 mg/L, and mercury at 0.00021 mg/L. The following analytes were detected in EB-1: calcium at 92 mg/L, barium at 0.16 mg/L, TDS at 420 mg/L, chloride at 46 mg/L, and sulfate at 56 mg/L. The presence of TDS in the equipment blank should not impact sample results and there was no impact on

data usability due to mercury blank contamination since mercury was not detected in the associated samples. Potential false positives exist for the results for calcium, barium, chloride, and sulfate in all groundwater samples as noted in the attached table.

- LCS/LCSD recoveries and relative percent differences (RPDs) were within laboratory control limits.
- MS/MSDs were performed on sample JHC-MW-18004 for metals and anions. The RPDs were within the QC limits.
  - The recoveries of calcium in the MS/MSD performed on sample JHC-MW-18004 were outside of the acceptance criteria. However, the calcium concentration in the parent sample JHC-MW-18004 was >4x the spike concentration; therefore, the laboratory control limits for calcium were not applicable. Data usability was not affected.
- Laboratory duplicate analyses were performed for TDS, radium-226, and radium-228 on sample JHC-MW-18004; the RPDs between the parent and duplicate sample was within the QC limits.
- The field duplicate pair samples were Dup-1 and JHC-MW-18005. All criteria were met.
- Carrier recoveries, where applicable, were within 40-110%.

Attachment A

Summary of Data Non-Conformances

JH Campbell Ponds 1 and 2 – RCRA CCR Monitoring Program

West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-18004	8/13/2019	Calcium, Barium, Chloride, Sulfate	Detection in field blank (FB-1) and/or equipment blank (EB-1). Sample result ≤10X the blank concentration. Result may be a false positive.
JHC-MW-18005	8/13/2019		
DUP-1	8/13/2019		

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 Ponds 1 and 2

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) 240-120310-1 and 240-120310-2.

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

- JHC-MW-15001
- JHC-MW-15002
- JHC-MW-15003
- JHC-MW-15005
- JHC-MW-18004
- JHC-MW-18005

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Total Dissolved Solids (TDS)	SM 2540C-11
Total Metals	SW-846 6020, SW-846 6010B, SW-846 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;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;

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

This data usability report addresses the following items:

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

Review Summary

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

- Appendix III and 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-3) and one field blank (FB-3) were collected. Target analytes were not detected in these blank samples with the following exception.
  - Boron was detected in FB-3 at 0.083 mg/L. Potential false positive exists for the positive result for boron in sample JHC-MW-15001, 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 on samples JHC-MW-18004 for metals and anions, and JHC-MW-15002 for anions. All recoveries and RPDs were within the QC limits with the following exceptions.
  - The recovery of calcium was outside of the acceptance criteria in the MSD analysis performed on sample JHC-MW-18004. The calcium concentration in this sample was >4x the spike concentration; therefore, the MS/MSD results for calcium were not evaluated. Data usability was not affected.
- The field duplicate pair samples were DUP-3 and JHC-MW-15003. All criteria were met.
- Laboratory duplicate analysis was performed on sample JHC-MW-18004 for TDS; the RPD was within QC limits.
- Samples did not undergo a 21-day wait period prior to radium-226 analysis; however, combined radium results were < 5 pCi/L so there is no impact on data usability.
- Carrier recoveries, where applicable, were within 40-110%.

Attachment A

Summary of Data Non-Conformances for Landfill Groundwater Analytical Data
JH Campbell Ponds 1 and 2 – RCRA CCR Monitoring Program
West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15001	10/8/2019	Boron	Detection in field blank (FB-3). Result <5x the blank result; indicates possible false positive result.

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

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January 14, 2019

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

Subject: Statistical Evaluation of Initial Assessment Monitoring Sampling Event,
JH Campbell Bottom Ash Pond Units 1-2 North and 1-2 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 Units 1-2 North and 1-2 South CCR Unit* for the JH Campbell (JHC) site in West Olive, Michigan, that boron, calcium, chloride, pH, sulfate and total dissolved solids were observed within groundwater at one or more downgradient monitoring well(s) with potential statistically significant increases (SSIs) above background concentration levels. TRC completed an Alternate Source Demonstration for the parameters listed above and did not find strong enough evidence within 90 days to determine the observation of constituents above background was attributable to an error or source other than the coal combustion residual (CCR) unit.

Therefore, CEC initiated an Assessment Monitoring Program for the Units 1-2 North and 1-2 South CCR Unit (Unit 1-2) pursuant to §257.95 of the CCR Rule [1] that included sampling and analyzing groundwater within the groundwater monitoring system for all constituents listed in Appendix IV. The results from the initial assessment monitoring sampling event were used to establish groundwater protection standards (GWPSs) for the Appendix IV constituents in accordance with §257.95(h), as presented in the October 15, 2018 *Assessment Monitoring Data Summary and Establishment of Groundwater Protection Standards.* The GWPS is established as the higher of the EPA Maximum Contaminant Level (MCL) or statistically derived background level for constituents with MCLs and the higher of the EPA Regional Screening Levels (RSLs) or background level for Appendix IV constituents with RSLs. The

[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).

JHC Unit 1-2 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). 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 the following constituent is present at statistically significant levels exceeding the GWPS in downgradient monitoring wells at the JHC Unit 1-2 CCR unit:

Constituent	GWPS	# Downgradient Wells Observed
Arsenic	10 ug/L	2 of 5

As such, per §257.95(g), the facility must either conduct an alternate source demonstration or initiate an assessment of corrective measures according to §257.96 within 90 days of detecting a statistical exceedance of the GWPSs.

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 September 7, 2018 to the 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 Michigan Department of Environmental Quality (MDEQ)-approved Hydrogeological Monitoring Plan (HMP)[2] for the Dry Ash Landfill, which includes additional monitoring downgradient from the JHC Unit 1-2 CCR unit.

[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 System

In accordance with 40 CFR 257.91, CEC established a groundwater monitoring system for the JHC Unit 1-2, which consists of 11 monitoring wells (six background monitoring wells and five 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 JHC Unit 1-2 provide data on background groundwater quality that has not been affected by the CCR unit (JHC-MW-15023 through JHC-MW-15028). Background groundwater quality data from these six background wells are additionally used for the CCR groundwater monitoring program at three other CCR units on the JHC site.

Groundwater within the uppermost aquifer generally flows to the south-southeast across the Site, with a southwesterly groundwater flow component on the western edge of the Site. Groundwater contour maps were constructed using the static water elevation data from the April 2018 and June 2018 assessment monitoring sampling events are provided as Figures 3 and 4, respectively. While the general overall groundwater flow direction observed across the JHC site during these assessment monitoring events is similar to that identified in previous monitoring rounds, groundwater flow changes have occurred in the immediate vicinity of JHC Unit 1-2 as a result of discontinued hydraulic loading and CCR removal at JHC Unit 1-2. Since hydraulic loading has been discontinued, the groundwater flow is predominantly toward the south instead of radially outward.

In addition, one of the downgradient monitoring wells (JHC-MW-15004) had been decommissioned on June 14, 2018, to accommodate the CCR removal activities. As such, groundwater monitoring at JHC-MW-15004 terminates at the April 2018 sampling event. Subsequent to the completion of the CCR removal activities, two additional monitoring wells were installed along the south and southwest edges of JHC Unit 1-2 during the week of December 3, 2018. The JHC Unit 1-2 monitoring system is currently being re-evaluated post-deconstruction, following equilibration of the water table and installation of the new wells to determine which monitoring wells are appropriately positioned to assess groundwater quality downgradient from the JHC Unit 1-2 CCR unit.

Data Quality

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

Assessment Monitoring Statistical Evaluation

Following the initial and resample assessment monitoring sampling event, compliance well data for the JHC Unit 1-2 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. Arsenic in JHC-MW-15002 and JHC-MW-15003, arsenic and thallium at JHC-MW-15004, and lithium, selenium, and thallium at JHC-MW-15005 at Unit 1-2 had individual results exceeding the GWPS.

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.

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

Initially, the baseline (December 2015 through August 2017) results and the two assessment monitoring results (April and June 2018) for these well-constituent pairs were observed visually for potential trends. No outliers were identified. The Sanitas™ software was then used to test compliance 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 tests were 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 data sets were found to be normally distributed, except the set for JHC-MW-15002 for which a nonparametric confidence test was conducted. 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 parameters shows exceedances for arsenic in JHC-MW-15002 and JHC-MW-15003. The lower confidence limits for arsenic and thallium at JHC-MW-15004, and lithium, selenium, and thallium at JHC-MW-15005, were below their respective GWPS. Per §257.95(g), the facility must either conduct an alternate source demonstration or initiate an assessment of corrective measures according to §257.96 within 90 days of detecting a statistical exceedance of the GWPSs.

Although no outliers were identified, the recent data collected during the April and June 2018 assessment monitoring events shows some variation compared to the background data set. The timing of the dissimilarities correlates with CCR removal activities and re-equilibration of groundwater in the vicinity of JHC Unit 1-2 following cessation of hydraulic loading. As mentioned above, the JHC Unit 1-2 monitoring system is currently being re-evaluated post-deconstruction to determine which monitoring wells are appropriately positioned to assess groundwater quality downgradient from the JHC Unit 1-2 CCR unit after hydrogeologic conditions re-stabilize.

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 June 2018
JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15001									
						Sample Date:	12/7/2015	3/8/2016	6/21/2016	8/29/2016	11/15/2016	4/19/2017	6/20/2017	8/14/2017	9/25/2017	4/25/2018	6/18/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient										
Appendix III																	
Boron	ug/L	NC	NA	51	NA		396	235	195	271	309	149	368	238	287	--	339
Calcium	mg/L	NC	NA	46	NA		85.6	84.1	80.7	74	75.5	70.3	50.7	70.9	68.0	--	68.6
Chloride	mg/L	250*	NA	43	NA		12.3	48.4	152	98.5	105	7.1	51.8	94.8	73.6	--	109
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.6	6.4	6.2	6.0	6.4	6.3	6.2	6.3	6.2	7.2(1)	6.3
Sulfate	mg/L	250*	NA	14	NA		142	46.2	34.9	46.4	68.3	42.1	88.0	114	129	--	78.9
Total Dissolved Solids	mg/L	500*	NA	258	NA		630	190	570	550	560	440	340	562	563	--	596
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**		6	3	3	4	3	4	1.8	2.2	--	< 1.0	1.8
Barium	ug/L	2,000	NA	35	2,000		160	148	164	148	141	172	106	142	--	71.4	183
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	2	2	2	3	2	1.0	1.0	--	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	**40**		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	5	NA	NA	NA		< 0.234	< 0.211	0.344	< 0.389	< 0.379	< 0.352	< 1.63	< 0.708	--	< 0.545	< 0.828
Radium-226/228	pCi/L	5	NA	1.93	5		1.9	1.53	2.58	1.77	1.89	2.13	< 2.26	1.61	--	< 1.34	< 1.95
Radium-228	pCi/L	5	NA	NA	NA		1.67	1.34	2.24	1.56	1.60	2.07	< 0.628	1.20	--	< 0.799	< 1.12
Selenium	ug/L	50	NA	5	**50**		< 1	1	1	< 1	1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	**2**		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) JHC-MW-15004 was decommissioned on June 14th, 2018.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to June 2018
JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

Sample Location:						JHC-MW-15002														
Sample Date:						12/7/2015	3/8/2016	6/21/2016	8/30/2016	11/15/2016	4/19/2017	6/20/2017	6/20/2017	8/14/2017	8/14/2017	9/25/2017	9/25/2017	4/25/2018	4/25/2018	6/19/2018
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	661	426	433	831	757	602	768	678	869	946	927	894	--	--	430
Calcium	mg/L	NC	NA	46	NA	21.9	35.8	36.4	36.1	18.9	28	24.6	25.1	25.7	25.3	30.5	30.6	--	--	75.3
Chloride	mg/L	250*	NA	43	NA	13.2	18.5	23.4	17.4	14.4	25.7	20.7	20.7	20.7	20.2	25.8	26.0	--	--	22.3
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	8.8	8.7	8.5	8.6	8.8	8.8	9.2	--	9.2	--	9.6	--	10.2(1)	--	8.3
Sulfate	mg/L	250*	NA	14	NA	33.3	47.8	46.9	54	51.4	64.2	52.8	53.3	54.5	53.7	33.9	34.3	--	--	153
Total Dissolved Solids	mg/L	500*	NA	258	NA	150	160	180	190	140	190	160	130	236	174	144	148	--	--	356
Appendix IV																				
Antimony	ug/L	6	NA	2	6	< 1	< 1	4	3	1	< 1	3.3	2.9	1.9	2.1	--	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	**10**	**34**	**40**	**36**	**34**	**46**	**33**	**35.4**	**32.2**	**44.5**	**45.8**	--	--	**129**	**130**	**127**
Barium	ug/L	2,000	NA	35	2,000	10	9	8	8	8	8	7.2	6.3	7.8	7.7	--	--	30.4	30.4	19.8
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100	< 1	< 1	< 1	< 1	1	2	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	< 15.0	< 15.0	--	--	< 15.0	< 15.0	< 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	< 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**	12.1	10.1	< 10	< 10	11	< 10	< 10	< 10	11	< 10	--	--	28	28	19
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	93	18	18	16	48	21.4	19.2	19.0	19.0	--	--	12.6	12.7	7.5
Radium-226	pCi/L	5	NA	NA	NA	< 0.33	< 0.244	< 0.219	< 0.487	< 0.251	< 0.409	< 0.562	< 0.154	0.749	0.949	--	--	< 0.823	< 0.530	< 0.620
Radium-226/228	pCi/L	5	NA	1.93	5	1.09	< 0.737	< 0.649	2.9	< 0.496	< 0.702	< 1.33	< 0.844	< 1.43	< 1.26	--	--	< 1.55	< 1.86	< 2.20
Radium-228	pCi/L	5	NA	NA	NA	0.986	< 0.737	< 0.649	2.83	< 0.496	< 0.702	< 0.765	< 0.690	< 0.797	< 0.790	--	--	< 0.729	< 1.33	< 1.58
Selenium	ug/L	50	NA	5	**50**	< 1	4	< 1	< 1	2	4	7.8	7.3	3.5	5.1	--	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	**2**	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

NC - no criteria.

-- - not analyzed.

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

RSL - Regional Screening Level from 83 FR 36435.

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

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

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

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

All metals were analyzed as total unless otherwise specified.

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

(2) JHC-MW-15004 was decommissioned on June 14th, 2018.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to June 2018
JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15003										
						Sample Date:	12/5/2015	3/8/2016	6/21/2016	8/29/2016	11/15/2016	4/18/2017	6/20/2017	8/14/2017	9/25/2017	4/25/2018	6/18/2018	6/18/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient											
Appendix III																		Field Dup
Boron	ug/L	NC	NA	51	NA		439	455	426	882	1,670	1,280	1,240	1,150	1,120	--	1,170	1,320
Calcium	mg/L	NC	NA	46	NA		27.9	46.7	38.3	44.3	31.8	34.6	28.8	36.0	30.1	--	60.0	59.1
Chloride	mg/L	250*	NA	43	NA		21.7	25.7	28.5	20.1	30.8	27.9	24.0	22.0	19.3	--	37.5	36.6
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		9.0	9.3	9.2	9.1	8.6	8.7	9.3	9.3	9.7	9.3	8.9	--
Sulfate	mg/L	250*	NA	14	NA		41.3	52.7	48.1	45.8	63	71.8	61.8	61.9	51.9	--	81.9	82.7
Total Dissolved Solids	mg/L	500*	NA	258	NA		160	200	190	220	230	260	146	208	136	--	388	344
Appendix IV																		
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	2	1	< 1.0	1.3	--	1.5	1.9	1.8
Arsenic	ug/L	10	NA	1	**10**		**38**	**31**	**27**	**27**	**36**	**26**	**20.4**	**23.7**	--	**12.4**	**14.1**	**14.3**
Barium	ug/L	2,000	NA	35	2,000		21	16	15	19	18	16	18.0	18.0	--	42.3	55.7	52.5
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	5	2	1	5	12	12.3	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	**40**		11.1	< 10	< 10	< 10	11	< 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		9	11	20	13	24	30	21.1	28.2	--	19.3	53.0	51.2
Radium-226	pCi/L	5	NA	NA	NA		< 0.25	< 0.236	< 0.211	< 0.365	< 0.249	< 0.302	< 1.12	1.15	--	< 0.631	< 0.623	< 0.733
Radium-226/228	pCi/L	5	NA	1.93	5		< 0.412	< 0.575	< 0.539	< 0.724	< 0.369	0.769	< 1.84	1.81	--	< 1.36	< 1.63	< 1.81
Radium-228	pCi/L	5	NA	NA	NA		< 0.412	< 0.575	< 0.539	< 0.724	< 0.369	0.633	< 0.722	< 0.938	--	< 0.732	< 1.01	< 1.08
Selenium	ug/L	50	NA	5	**50**		< 1	3	< 1	< 1	2	3	< 1.0	1.1	--	2.2	4.4	4.5
Thallium	ug/L	2	NA	2	**2**		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) JHC-MW-15004 was decommissioned on June 14th, 2018.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to June 2018
JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	**JHC-MW-15004**[2]										
					Sample Date:	12/5/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/18/2017	6/20/2017	8/14/2017	9/25/2017	4/25/2018	
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient										
Appendix III																
Boron	ug/L	NC	NA	51	NA	546	268	412	469	578	260	473	660	376	--	
Calcium	mg/L	NC	NA	46	NA	43.1	42.8	45.8	64.6	101	36.9	37.7	51.2	78.6	--	
Chloride	mg/L	250*	NA	43	NA	41.6	35.5	26.4	23.7	70.8	46.8	67.5	95.1	41.5	--	
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	
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.6	7.3	7.1	6.8	7.3	7.6	7.4	7.6	7.1	7.3	
Sulfate	mg/L	250*	NA	14	NA	55	42.5	48.7	47.8	244	58.6	85.6	122	64.6	--	
Total Dissolved Solids	mg/L	500*	NA	258	NA	290	220	230	370	560	290	322	402	382	--	
Appendix IV																
Antimony	ug/L	6	NA	2	6	< 1	< 1	1	1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	
Arsenic	ug/L	10	NA	1	**10**	**21**	9	**11**	8	6	4	4.8	5.7	--	3.6	
Barium	ug/L	2,000	NA	35	2,000	73	65	117	181	241	110	93.2	193	--	162	
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 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	
Chromium	ug/L	100	NA	2	100	1	1	1	1	1	3	6.9	< 1.0	--	< 1.0	
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 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	
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	
Lithium	ug/L	NC	40	10	**40**	< 10	< 10	< 10	12	12	< 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	
Molybdenum	ug/L	NC	100	5	100	9	8	10	5	10	6	10.1	11.2	--	< 5.0	
Radium-226	pCi/L	5	NA	NA	NA	< 0.295	0.259	< 0.189	< 0.29	< 0.311	< 0.333	< 0.502	0.915	--	< 0.449	
Radium-226/228	pCi/L	5	NA	1.93	5	0.702	0.711	0.633	1.85	1.12	0.497	< 1.19	1.66	--	< 1.24	
Radium-228	pCi/L	5	NA	NA	NA	0.422	0.452	0.605	1.62	0.856	0.366	< 0.685	< 0.920	--	< 0.787	
Selenium	ug/L	50	NA	5	**50**	8	2	2	7	1	2	< 1.0	< 1.0	--	5.5	
Thallium	ug/L	2	NA	2	**2**	**2.16**	< 2	2	**4**	**3**	< 2	< 2.0	**2.1**	--	< 2.0	

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

NC - no criteria.

-- - not analyzed.

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

RSL - Regional Screening Level from 83 FR 36435.

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

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

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

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

All metals were analyzed as total unless otherwise specified.

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

(2) JHC-MW-15004 was decommissioned on June 14th, 2018.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to June 2018
JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	**JHC-MW-15005**											
					Sample Date:	12/5/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/18/2017	6/20/2017	8/14/2017	9/25/2017	4/25/2018	6/19/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient											
Appendix III																	
Boron	ug/L	NC	NA	51	NA	275	959	1,370	706	1,500	524	468	546	481	--	227	
Calcium	mg/L	NC	NA	46	NA	55	60.2	55.1	51.6	73.4	56.8	53.6	48.0	40.3	--	61.8	
Chloride	mg/L	250*	NA	43	NA	27.7	42	46.9	19.2	29.3	64.2	50.4	27.1	21.8	--	90.9	
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.3	7.4	7.4	7.3	7.1	7.5	7.4	7.5	7.4	7.4	7.4	
Sulfate	mg/L	250*	NA	14	NA	51.2	53	57.9	46.5	61.8	58.3	66.0	64.9	61.9	--	74.3	
Total Dissolved Solids	mg/L	500*	NA	258	NA	270	300	310	230	320	360	306	282	300	--	462	
Appendix IV																	
Antimony	ug/L	6	NA	2	6	4	2	2	3	5	3	3.8	4.2	--	2.2	1.6	
Arsenic	ug/L	10	NA	1	**10**	4	3	3	5	3	2	3.3	2.5	--	1.7	1.3	
Barium	ug/L	2,000	NA	35	2,000	99	74	97	72	159	128	113	109	--	407	175	
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	4	5	12	2	3	4	3.7	< 1.0	--	< 1.0	3.0	
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**	**41.3**	25.5	28	31	**49**	38	39	36	--	**61**	35	
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	12	13	25	16	15	18	14	10	--	31.2	15.7	
Radium-226	pCi/L	5	NA	NA	NA	< 0.277	< 0.355	0.192	< 0.286	< 0.246	0.461	< 0.717	< 0.877	--	0.620	< 0.758	
Radium-226/228	pCi/L	5	NA	1.93	5	0.564	< 0.426	< 0.395	1.78	0.974	0.841	< 1.45	< 1.73	--	1.32	1.91	
Radium-228	pCi/L	5	NA	NA	NA	0.436	< 0.426	< 0.395	1.58	0.745	< 0.383	< 0.728	< 0.856	--	0.700	1.22	
Selenium	ug/L	50	NA	5	**50**	28	12	33	18	**165**	10	15.5	15.7	--	**368**	14.0	
Thallium	ug/L	2	NA	2	**2**	**3.04**	< 2	2	2	**4**	< 2	< 2.0	< 2.0	--	**5.8**	**2.1**	

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) JHC-MW-15004 was decommissioned on June 14th, 2018.

Table 2
Summary of Groundwater Protection Standard Exceedances – June 2018
JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

Constituent	Units	GWPS	JHC-MW-15002		JHC-MW-15003		JHC-MW-15004		JHC-MW-15005	
			LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL
Arsenic	ug/L	10	33	130	15	31	3.8	9.3	NA	NA
Lithium	ug/L	40	NA	NA	NA	NA	NA	NA	28	51
Selenium	ug/L	50	NA	NA	NA	NA	NA	NA	10	370
Thallium	ug/L	2	NA	NA	NA	NA	1	4	2	4

Notes:

ug/L - micrograms per Liter.

NA - Not Applicable; well/parameter pair did not directly exceed the GWPS and was not included in further analysis.

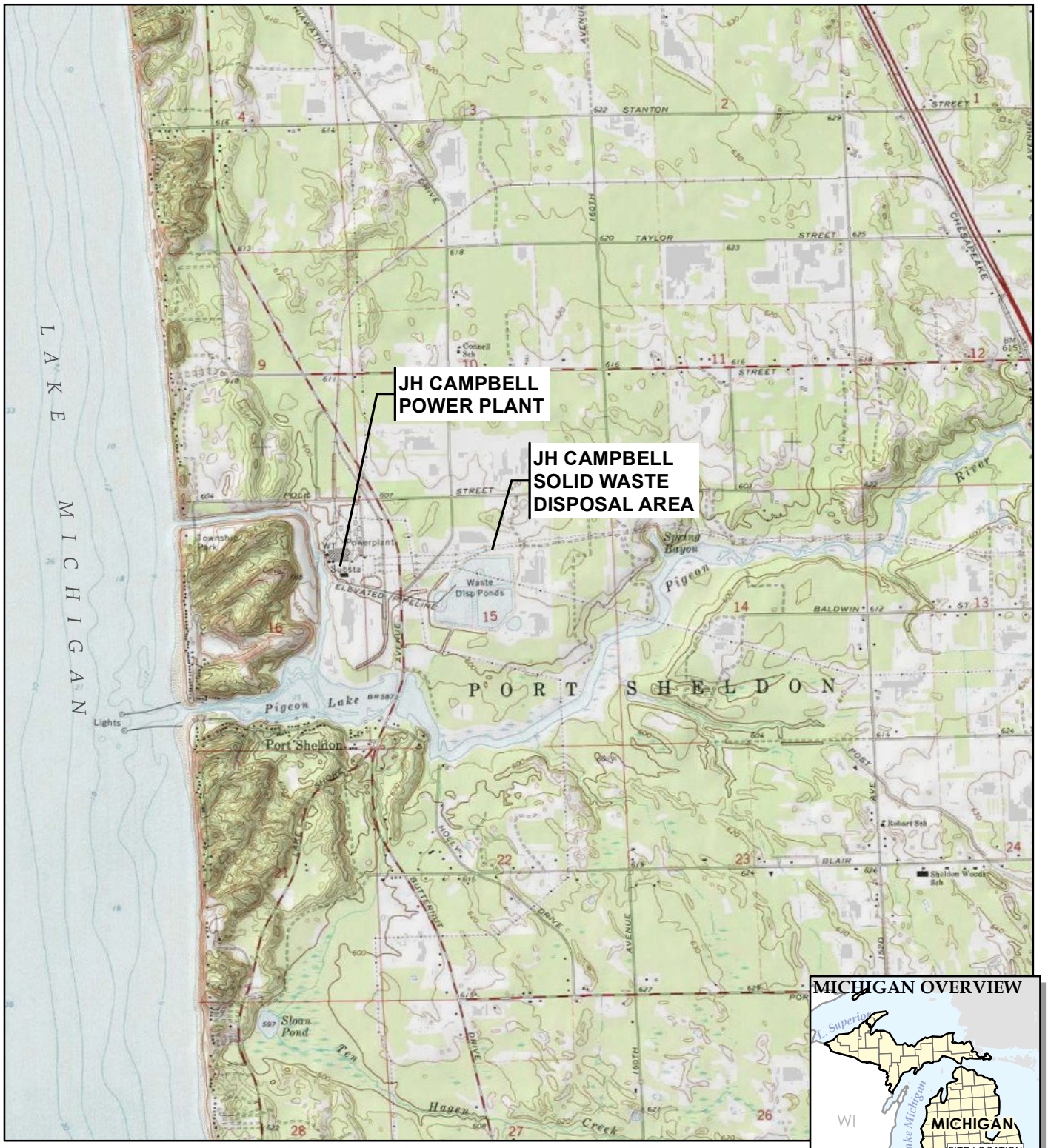
GWPS - Groundwater Protection Standard as established in TRC's Technical Memorandum dated October 15, 2018.

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

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Ann Arbor, MI 48108-3284
Phone: 734.971.7080

TRC - GIS

PROJECT:

CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:

SITE LOCATION MAP

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

FIGURE 1

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

TRC - GIS

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

LEGEND

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

NOTES

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

0 600 1,200 Feet

1 " = 600 '
1:7,200

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

TITLE:
SITE PLAN WITH CCR MONITORING WELL LOCATIONS

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

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FILE NO.: 290806-001-013.mxd

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

TRC - GIS

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

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

LEGEND

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

NOTES

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

0 600 1,200 Feet

1 " = 600 '
1:7,200

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

TITLE:
GROUNDWATER CONTOUR MAP APRIL 24, 2018

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

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FILE NO.: 290806-001-007.mxd

TRC - GIS

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

Plot Date: 11/30/2018, 09:15:20 AM by SMAJOR -- LAYOUT: ANSI B (11"x17")
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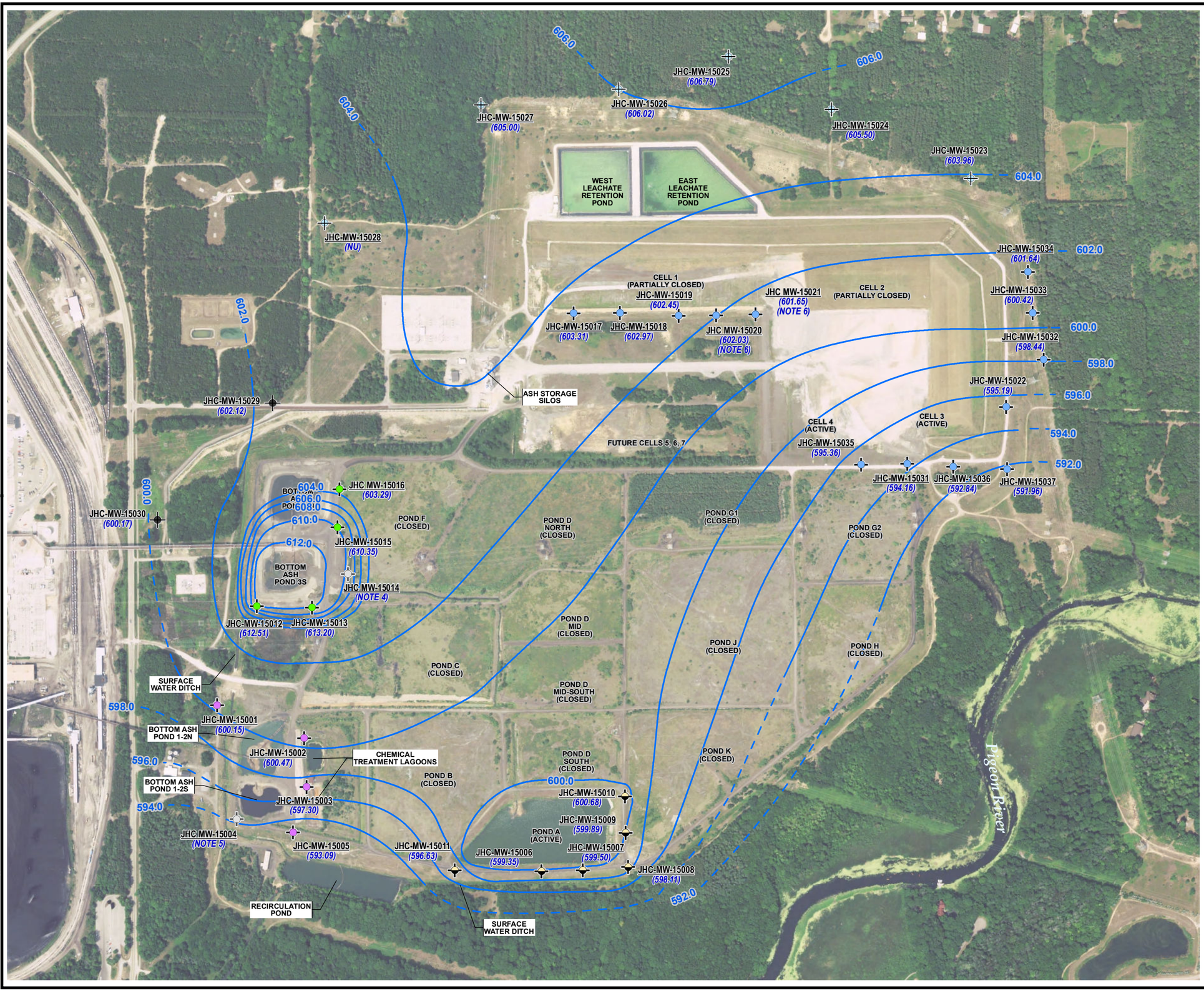

LEGEND

- 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
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Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 290806-001-010.mxd

Attachment A
Sanitas™ Output

Summary Report

Constituent: Antimony, Total Analysis Run 11/26/2018 1:40 PM
Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

For observations made between 12/6/2015 and 6/19/2018, a summary of the selected data set:

Observations = 49
ND/Trace = 27
Wells = 5
Minimum Value = 1
Maximum Value = 5
Mean Value = 1.644
Median Value = 1
Standard Deviation = 1.071
Coefficient of Variation = 0.6514
Skewness = 1.599

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	10	10	1	1	1	1	0	0	NaN
JHC-MW-15002	10	5	1	4	1.81	1	1.147	0.6339	0.8647
JHC-MW-15003	10	5	1	2	1.265	1	0.3888	0.3073	0.9939
JHC-MW-15004	9	7	1	1	1	1	0	0	NaN
JHC-MW-15005	10	0	1.6	5	3.08	3	1.136	0.3689	0.2549

Summary Report

Constituent: Arsenic, Total Analysis Run 11/26/2018 1:40 PM
Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

For observations made between 12/6/2015 and 6/19/2018, a summary of the selected data set:

Observations = 49
ND/Trace = 1
Wells = 5
Minimum Value = 1
Maximum Value = 129.5
Mean Value = 19.3
Median Value = 6
Standard Deviation = 26.78
Coefficient of Variation = 1.388
Skewness = 2.799

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	10	1	1	6	2.98	3	1.434	0.4813	0.7201
JHC-MW-15002	10	0	33	129.5	55.85	38	38.45	0.6885	1.447
JHC-MW-15003	10	0	12.4	38	25.57	26.5	8.367	0.3272	-0.1355
JHC-MW-15004	9	0	3.6	21	8.122	6	5.406	0.6655	1.626
JHC-MW-15005	10	0	1.3	5	2.88	3	1.094	0.3799	0.4191

Summary Report

Constituent: Barium, Total Analysis Run 11/26/2018 1:40 PM
Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

For observations made between 12/6/2015 and 6/19/2018, a summary of the selected data set:

Observations = 49
ND/Trace = 0
Wells = 5
Minimum Value = 6.75
Maximum Value = 407
Mean Value = 90.95
Median Value = 74
Standard Deviation = 80.4
Coefficient of Variation = 0.884
Skewness = 1.307

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	10	0	71.4	183	143.5	148	32.86	0.2289	-1.091
JHC-MW-15002	10	0	6.75	30.4	11.57	8	7.602	0.6571	1.829
JHC-MW-15003	10	0	15	54.1	23.74	18	13.3	0.5601	1.599
JHC-MW-15004	9	0	65	241	137.2	117	60.04	0.4375	0.3878
JHC-MW-15005	10	0	72	407	143.3	111	98.38	0.6865	2.143

Summary Report

Constituent: Beryllium, Total Analysis Run 11/26/2018 1:40 PM
Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

For observations made between 12/6/2015 and 6/19/2018, a summary of the selected data set:

Observations = 49
ND/Trace = 49
Wells = 5
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-15001	10	10	1	1	1	1	0	0	NaN
JHC-MW-15002	10	10	1	1	1	1	0	0	NaN
JHC-MW-15003	10	10	1	1	1	1	0	0	NaN
JHC-MW-15004	9	9	1	1	1	1	0	0	NaN
JHC-MW-15005	10	10	1	1	1	1	0	0	NaN

Summary Report

Constituent: Cadmium, Total Analysis Run 11/26/2018 1:40 PM
Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

For observations made between 12/6/2015 and 6/19/2018, a summary of the selected data set:

Observations = 49
ND/Trace = 49
Wells = 5
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-15001	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15002	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15003	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15004	9	9	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15005	10	10	0.2	0.2	0.2	0.2	0	0	NaN

Summary Report

Constituent: Chromium, Total Analysis Run 11/26/2018 1:40 PM
Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

For observations made between 12/6/2015 and 6/19/2018, a summary of the selected data set:

Observations = 49
ND/Trace = 17
Wells = 5
Minimum Value = 1
Maximum Value = 12.3
Mean Value = 2.549
Median Value = 1
Standard Deviation = 2.829
Coefficient of Variation = 1.11
Skewness = 2.462

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	10	2	1	3	1.6	1.5	0.6992	0.437	0.6578
JHC-MW-15002	10	8	1	2	1.1	1	0.3162	0.2875	2.667
JHC-MW-15003	10	3	1	12.3	4.23	2	4.452	1.052	1.113
JHC-MW-15004	9	2	1	6.9	1.878	1	1.996	1.063	2.056
JHC-MW-15005	10	2	1	12	3.87	3.35	3.143	0.8122	1.824

Summary Report

Constituent: Cobalt, Total Analysis Run 11/26/2018 1:40 PM
Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

For observations made between 12/6/2015 and 6/19/2018, a summary of the selected data set:

Observations = 49
ND/Trace = 49
Wells = 5
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-15001	10	10	15	15	15	15	0	0	NaN
JHC-MW-15002	10	10	15	15	15	15	0	0	NaN
JHC-MW-15003	10	10	15	15	15	15	0	0	NaN
JHC-MW-15004	9	9	15	15	15	15	0	0	NaN
JHC-MW-15005	10	10	15	15	15	15	0	0	NaN

Summary Report

Constituent: Fluoride Analysis Run 11/26/2018 1:40 PM
Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

For observations made between 12/6/2015 and 6/19/2018, a summary of the selected data set:

Observations = 54
ND/Trace = 54
Wells = 5
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-15001	11	11	1000	1000	1000	1000	0	0	NaN
JHC-MW-15002	11	11	1000	1000	1000	1000	0	0	NaN
JHC-MW-15003	11	11	1000	1000	1000	1000	0	0	NaN
JHC-MW-15004	10	10	1000	1000	1000	1000	0	0	NaN
JHC-MW-15005	11	11	1000	1000	1000	1000	0	0	NaN

Summary Report

Constituent: Lead, Total Analysis Run 11/26/2018 1:40 PM
Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

For observations made between 12/6/2015 and 6/19/2018, a summary of the selected data set:

Observations = 49
ND/Trace = 49
Wells = 5
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-15001	10	10	1	1	1	1	0	0	NaN
JHC-MW-15002	10	10	1	1	1	1	0	0	NaN
JHC-MW-15003	10	10	1	1	1	1	0	0	NaN
JHC-MW-15004	9	9	1	1	1	1	0	0	NaN
JHC-MW-15005	10	10	1	1	1	1	0	0	NaN

Summary Report

Constituent: Lithium, Total Analysis Run 11/26/2018 1:40 PM
Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

For observations made between 12/6/2015 and 6/19/2018, a summary of the selected data set:

Observations = 49
ND/Trace = 28
Wells = 5
Minimum Value = 10
Maximum Value = 61
Mean Value = 16.54
Median Value = 10
Standard Deviation = 12.38
Coefficient of Variation = 0.7483
Skewness = 1.88

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	10	10	10	10	10	10	0	0	NaN
JHC-MW-15002	10	4	10	28	13.07	10.3	5.929	0.4537	1.892
JHC-MW-15003	10	8	10	11.1	10.21	10	0.4433	0.04342	1.511
JHC-MW-15004	9	6	10	12	10.44	10	0.8819	0.08444	1.336
JHC-MW-15005	10	0	25.5	61	38.38	37	10.43	0.2717	0.9386

Summary Report

Constituent: Mercury, Total Analysis Run 11/26/2018 1:40 PM
Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

For observations made between 12/6/2015 and 6/19/2018, a summary of the selected data set:

Observations = 49
ND/Trace = 49
Wells = 5
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-15001	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15002	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15003	10	10	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15004	9	9	0.2	0.2	0.2	0.2	0	0	NaN
JHC-MW-15005	10	10	0.2	0.2	0.2	0.2	0	0	NaN

Summary Report

Constituent: Molybdenum, Total Analysis Run 11/26/2018 1:40 PM
Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

For observations made between 12/6/2015 and 6/19/2018, a summary of the selected data set:

Observations = 49
ND/Trace = 11
Wells = 5
Minimum Value = 5
Maximum Value = 93
Mean Value = 16.01
Median Value = 12
Standard Deviation = 15.23
Coefficient of Variation = 0.9514
Skewness = 3.132

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	10	10	5	5	5	5	0	0	NaN
JHC-MW-15002	10	0	7.5	93	26.25	18	25.95	0.9886	1.955
JHC-MW-15003	10	0	9	52.1	22.77	20.55	12.43	0.5457	1.253
JHC-MW-15004	9	1	5	11.2	8.256	9	2.373	0.2875	-0.3736
JHC-MW-15005	10	0	10	31.2	16.99	15.35	6.432	0.3786	1.24

Summary Report

Constituent: Radium-226/228 Analysis Run 11/26/2018 1:40 PM
Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

For observations made between 12/6/2015 and 6/19/2018, a summary of the selected data set:

Observations = 49
ND/Trace = 25
Wells = 5
Minimum Value = 0.369
Maximum Value = 2.9
Mean Value = 1.297
Median Value = 1.33
Standard Deviation = 0.6448
Coefficient of Variation = 0.4971
Skewness = 0.2816

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	10	3	1.34	2.58	1.896	1.895	0.365	0.1925	0.325
JHC-MW-15002	10	8	0.496	2.9	1.339	1.21	0.7799	0.5823	0.7796
JHC-MW-15003	10	8	0.369	1.84	1.021	0.7465	0.6155	0.603	0.4153
JHC-MW-15004	9	2	0.497	1.85	1.067	1.12	0.4725	0.4428	0.4212
JHC-MW-15005	10	4	0.395	1.91	1.139	1.147	0.5766	0.5063	-0.01908

Summary Report

Constituent: Selenium, Total Analysis Run 11/26/2018 1:40 PM
Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

For observations made between 12/6/2015 and 6/19/2018, a summary of the selected data set:

Observations = 49
ND/Trace = 18
Wells = 5
Minimum Value = 1
Maximum Value = 368
Mean Value = 15.62
Median Value = 2
Standard Deviation = 56.67
Coefficient of Variation = 3.628
Skewness = 5.435

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	10	7	1	1	1	1	0	0	NaN
JHC-MW-15002	10	5	1	7.55	2.685	1.5	2.221	0.8272	1.065
JHC-MW-15003	10	4	1	4.45	1.975	1.55	1.195	0.6049	0.8893
JHC-MW-15004	9	2	1	8	3.278	2	2.774	0.8463	0.7835
JHC-MW-15005	10	0	10	368	67.92	16.85	115.3	1.698	2.055

Summary Report

Constituent: Thallium, Total Analysis Run 11/26/2018 1:40 PM
Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

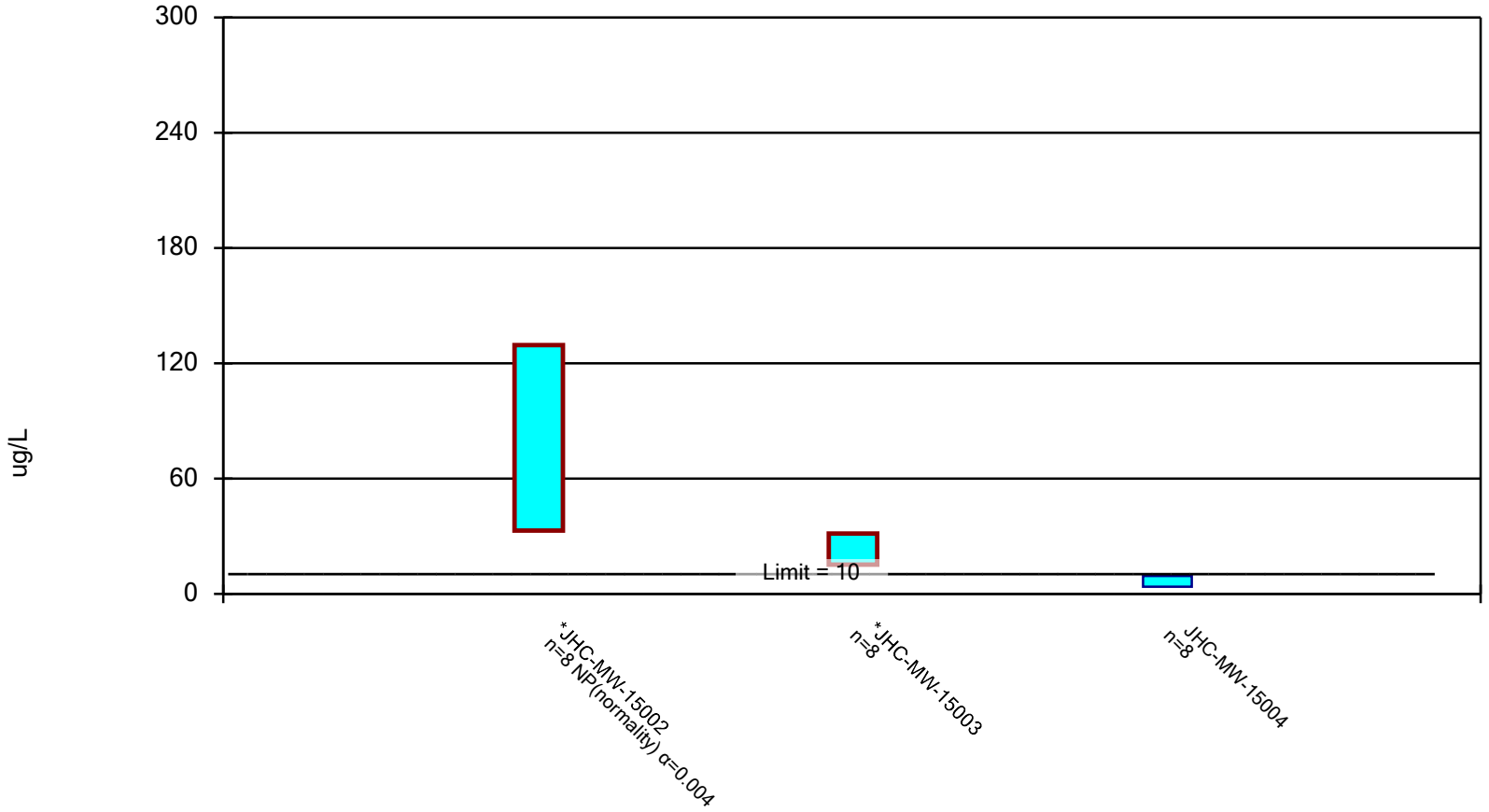
For observations made between 12/6/2015 and 6/19/2018, a summary of the selected data set:

Observations = 49
ND/Trace = 38
Wells = 5
Minimum Value = 2
Maximum Value = 5.8
Mean Value = 2.208
Median Value = 2
Standard Deviation = 0.6838
Coefficient of Variation = 0.3097
Skewness = 3.854

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	10	10	2	2	2	2	0	0	NaN
JHC-MW-15002	10	10	2	2	2	2	0	0	NaN
JHC-MW-15003	10	10	2	2	2	2	0	0	NaN
JHC-MW-15004	9	4	2	4	2.362	2	0.6942	0.2939	1.74
JHC-MW-15005	10	4	2	5.8	2.694	2	1.279	0.4746	1.682

Parametric and Non-Parametric (NP) Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on



Constituent: Arsenic, Total Analysis Run 11/29/2018 10:28 AM

Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

Confidence Interval

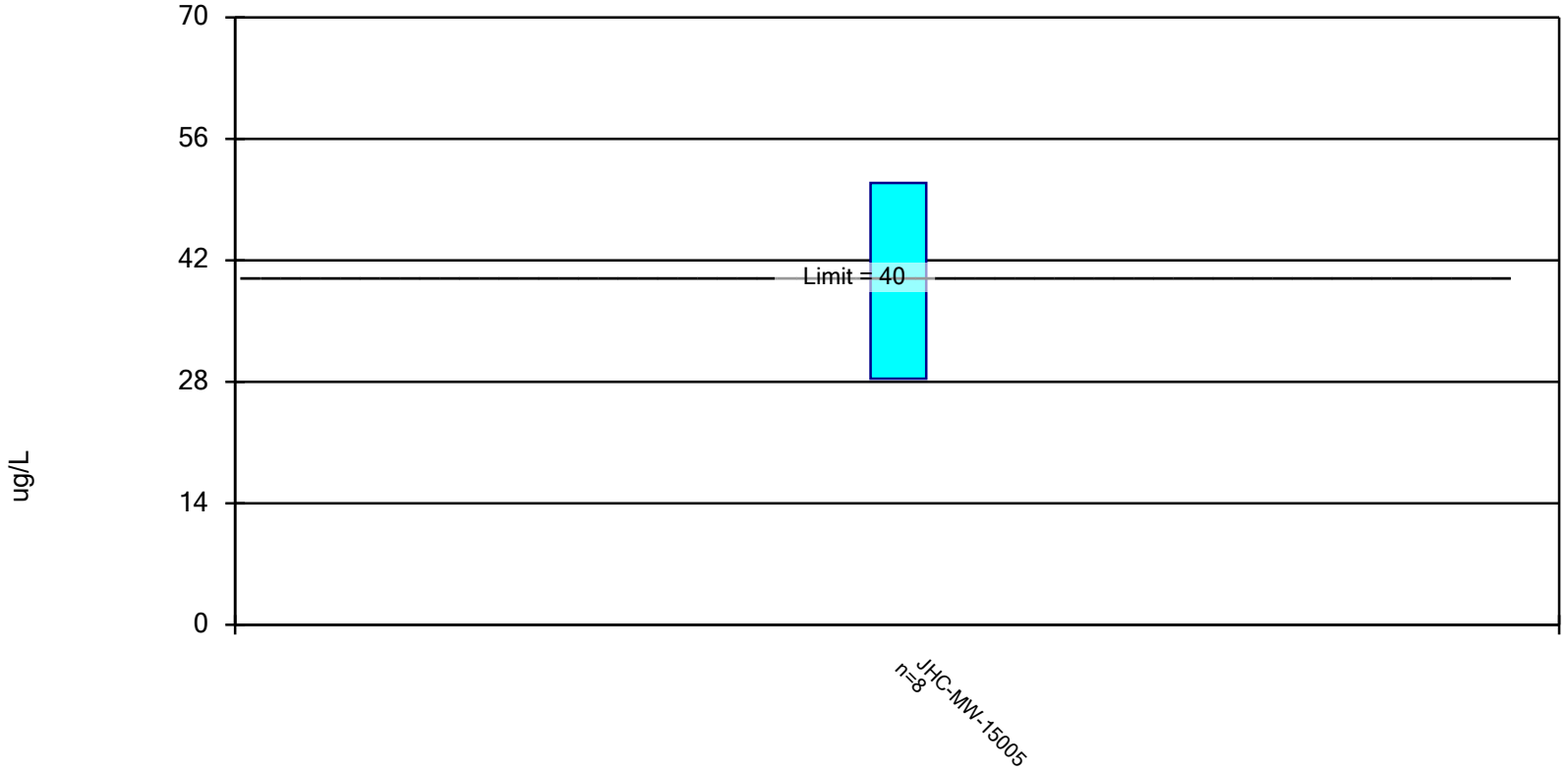
Constituent: Arsenic, Total (ug/L) Analysis Run 11/29/2018 10:29 AM

Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

	JHC-MW-15002	JHC-MW-15003	JHC-MW-15004
3/9/2016			9
6/22/2016	36	27	11
8/30/2016	34	27	8
11/15/2016	46	36	
11/16/2016			6
4/18/2017		26	4
4/20/2017	33		
6/20/2017	33.8 (D)		4.8
6/21/2017		20.4	
8/14/2017	45.15 (D)		
8/15/2017		23.7	5.7
4/25/2018	129.5 (D)	12.4	
4/26/2018			3.6
6/18/2018		14.2 (D)	
6/19/2018	127		
Mean	60.56	23.34	6.513
Std. Dev.	42.09	7.617	2.596
Upper Lim.	129.5	31.41	9.265
Lower Lim.	33	15.26	3.76

Parametric Confidence Interval

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



Constituent: Lithium, Total Analysis Run 11/27/2018 4:22 PM

Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

Confidence Interval

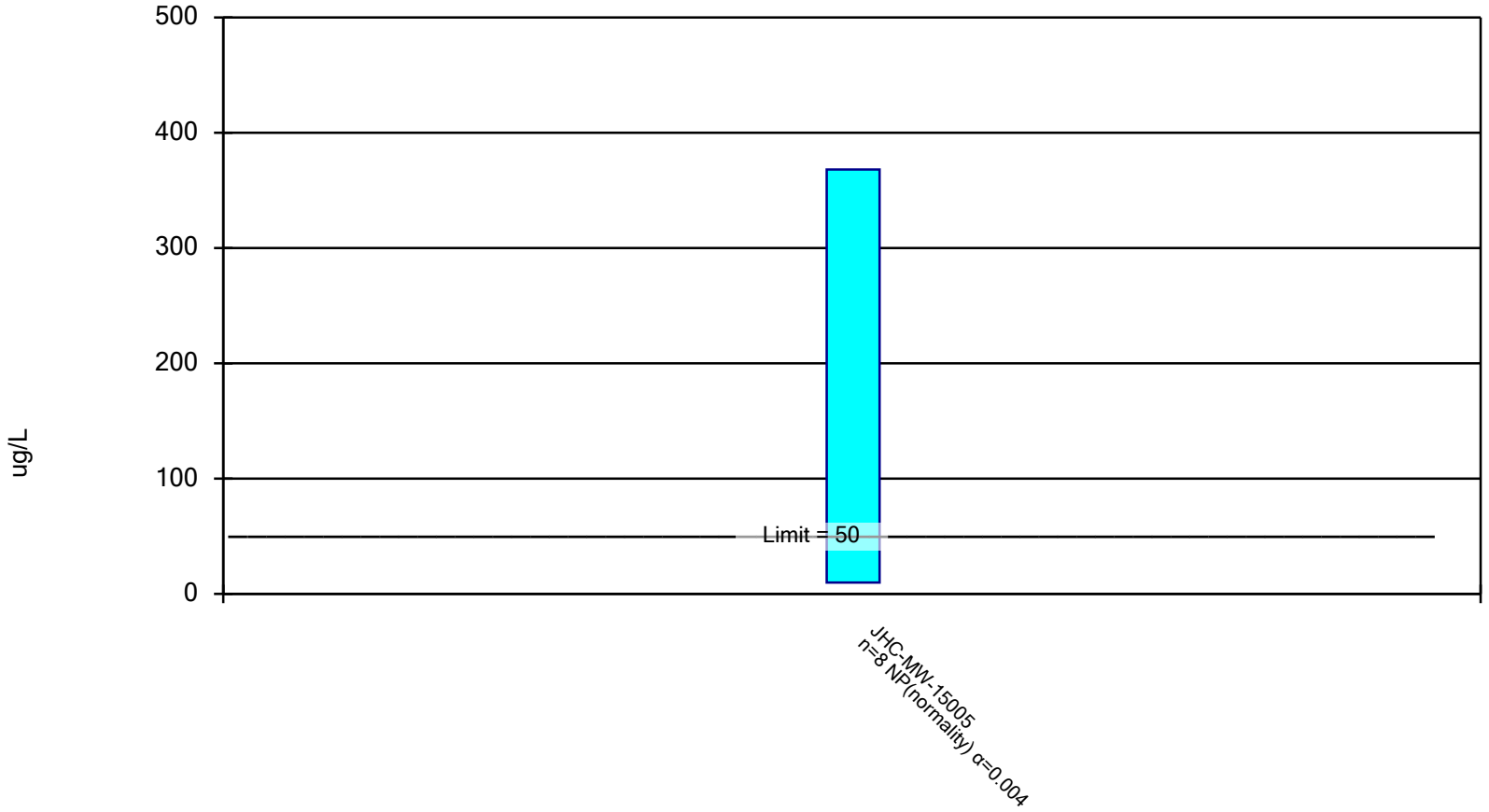
Constituent: Lithium, Total (ug/L) Analysis Run 11/27/2018 4:23 PM

Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

	JHC-MW-15005
6/22/2016	28
8/30/2016	31
11/16/2016	49
4/18/2017	38
6/21/2017	39
8/15/2017	36
4/26/2018	61
6/19/2018	35
Mean	39.63
Std. Dev.	10.64
Upper Lim.	50.9
Lower Lim.	28.35

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: Selenium, Total Analysis Run 11/27/2018 4:31 PM

Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

Confidence Interval

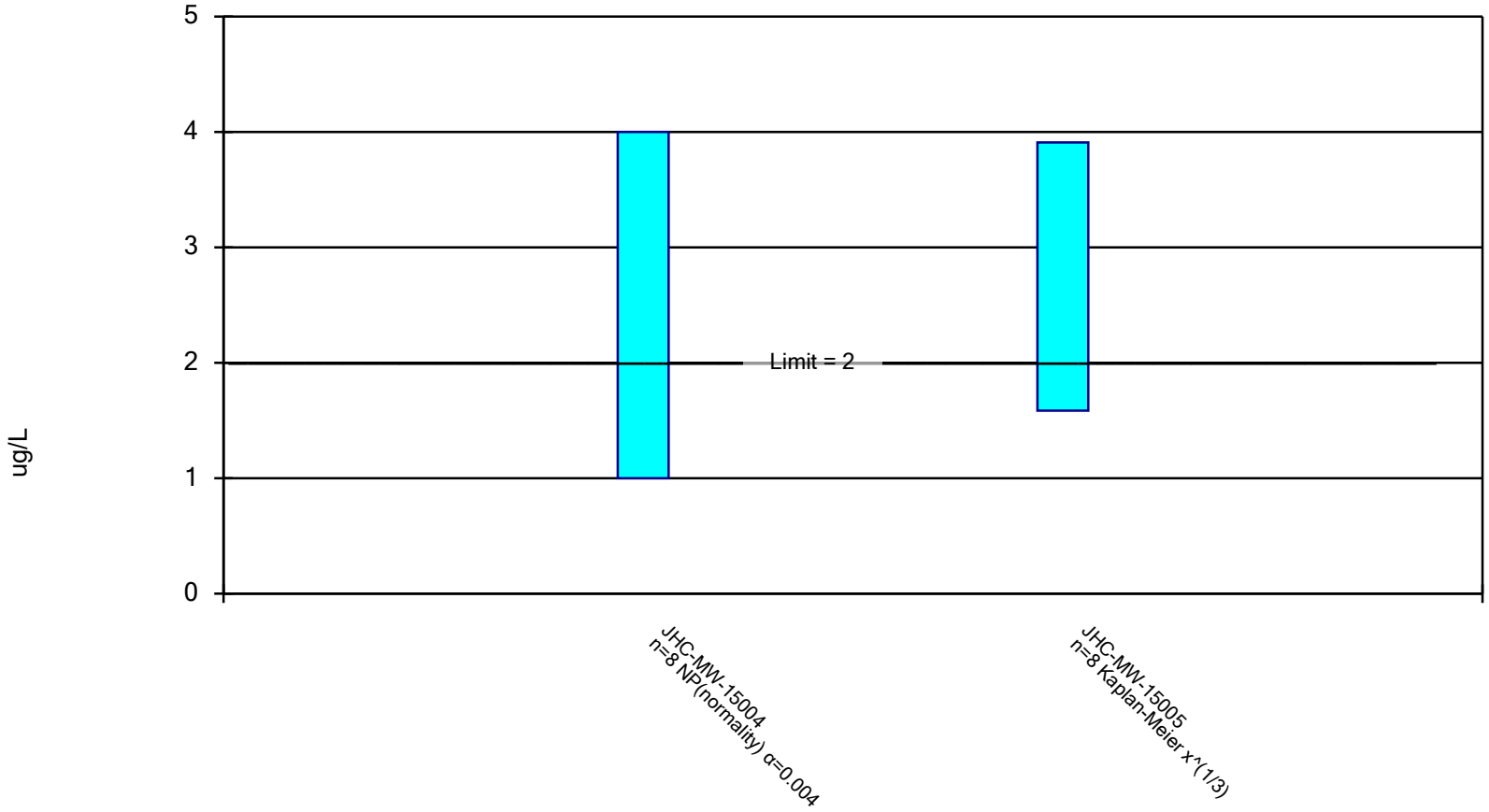
Constituent: Selenium, Total (ug/L) Analysis Run 11/27/2018 4:31 PM

Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

	JHC-MW-15005
6/22/2016	33
8/30/2016	18
11/16/2016	165
4/18/2017	10
6/21/2017	15.5
8/15/2017	15.7
4/26/2018	368
6/19/2018	14
Mean	79.9
Std. Dev.	127.5
Upper Lim.	368
Lower Lim.	10

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: Thallium, Total Analysis Run 11/27/2018 4:18 PM

Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

Confidence Interval

Constituent: Thallium, Total (ug/L) Analysis Run 11/27/2018 4:18 PM

Client: Consumers Energy Data: JHC_Unit_1_2_Sanitas

	JHC-MW-15004	JHC-MW-15005
3/9/2016	<2	
6/22/2016	2	2
8/30/2016	4	2
11/16/2016	3	4
4/18/2017	<2	<2
6/20/2017	<2	
6/21/2017		<2
8/15/2017	2.1	<2
4/26/2018	<2	5.8
6/19/2018		2.1
Mean	1.888	2.363
Std. Dev.	1.128	1.707
Upper Lim.	4	3.908
Lower Lim.	1	1.585

Appendix F
April 2019 Assessment Monitoring Statistical Evaluation

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Technical Memorandum

Date: June 12, 2019

To: Bethany Swanberg, Consumers Energy

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

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

Project No.: 322174.0000.0000 Phase 1 Task 3

Subject: Statistical Evaluation of April 2019 Assessment Monitoring Sampling Event, JH Campbell Bottom Ash Pond 1-2 North and 1-2 South CCR Unit, Consumers Energy Company, West Olive, Michigan

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During the statistical evaluation of the initial assessment monitoring event, arsenic was present in one or more downgradient monitoring wells at statistically significant levels exceeding the Groundwater Protection Standards (GWPSs). Therefore, Consumers Energy Company (Consumers Energy) initiated an Assessment of Corrective Measures (ACM) within 90 days from when the Appendix IV exceedance was determined. Currently, 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 1-2 North and 1-2 South (Pond 1-2). The first semiannual assessment monitoring event of 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 detailed 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 first semiannual assessment monitoring event for 2019 indicates that the following constituent is present at statistically significant levels exceeding the GWPS in downgradient monitoring wells at the Pond 1-2 CCR Unit:

Constituent	GWPS	# Downgradient Wells Observed
Arsenic	10 ug/L	1 of 4

These results are consistent with the results of the initial, and previous, assessment monitoring data statistical evaluation and Consumers Energy will continue the assessment of corrective measures per §257.95(g). Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Assessment Monitoring Statistical Evaluation

The compliance well network at the Pond 1-2 CCR Unit consists of four monitoring wells (JHC-MW-15001, JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005) located on the perimeter of the bottom ash ponds. Former downgradient monitoring well JHC-MW-15004 was decommissioned on June 14, 2018 during deconstruction of Pond 1-2; therefore, statistical analysis for JHC-MW-15004 terminates at the June 2018 monitoring event.

Following the first semiannual assessment monitoring sampling event, compliance well data for the JHC Pond 1-2 were evaluated in accordance with the Groundwater Statistical Evaluation Plan (Stats Plan) (TRC, October 2017). An assessment monitoring program was developed to evaluate concentrations of CCR constituents present in the uppermost aquifer relative to acceptable levels (i.e. GWPSs). To evaluate whether or not a GWPS exceedance is statistically significant, the difference in concentration observed at the downgradient wells during a given assessment monitoring event compared to the GWPS must be large enough, after accounting for variability in the sample data, that the result is unlikely to have occurred merely by chance. Consistent with the Unified Guidance [2], the preferred method for comparisons to a fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS. Based on the number of historical observations in the representative sample population, the population mean, the population standard deviation, and a selected confidence level (*i.e.* 99 percent), an upper and lower confidence limit is calculated. The true concentration, with 99 percent confidence, will fall between the lower and upper confidence limits.

The concentrations observed in the downgradient wells are deemed to be a statistically significant exceedance when the 99 percent lower confidence limit of the downgradient data exceeds the GWPS. If the confidence interval straddles the GWPS (i.e. the lower confidence level is below the GWPS but the upper confidence level is above), the statistical test result indicates that there is insufficient confidence that the measured concentrations are different from the GWPS and thus there is no

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

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 eight monitoring events (November 2016 through April 2019) were retained for further analysis. Arsenic in JHC-MW-15001 and JHC-MW-15003, arsenic and lithium in JHC-MW-15002, and lithium, molybdenum, selenium, and thallium in JHC-MW-15005 at Pond 1-2 had individual results exceeding the GWPS. Cobalt was detected in JHC-MW-15003 at a concentration of 23.6 ug/L in November 2018, which exceeds its GWPS. However, this is the only detection of cobalt in the Pond 1-2 wells during either baseline sampling or assessment monitoring, and it qualifies as an outlier. The well was sampled during the April 2019 assessment monitoring sampling event which confirmed that cobalt is not present in groundwater at that monitoring well. Per the Stats Plan and the Unified Guidance, cobalt is subject to the double quantification rule, where a detection above laboratory reporting limits must be observed for two consecutive events (e.g. initial sample and a resample) to confirm the initial detection and rule out a potential false positive result.

Groundwater data for the remaining parameter-well combinations with direct-comparison exceedances of a GWPS 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 the assessment monitoring results (April 2018 through April 2019) for these well-constituent pairs were observed visually for potential trends. Potential increasing trends were noted for lithium in JHC-MW-15002 and molybdenum in JHC-MW-15005 beginning in November 2018. Groundwater conditions are re-equilibrating following to CCR removal activities at the JHC Pond 1-2 recently completed in September 2018, 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 suspect lithium and molybdenum data from November 2018 and April 2019 have been kept in the assessment monitoring data set pending the collection of additional data. The suspect data will be tested for outliers once stabilized groundwater characteristics have been assessed. 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 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 tests were 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 data sets were found to be normally distributed, except the set for arsenic in JHC-MW-15002, which was first transformed as noted on the graph, and lithium in JHC-MW-15002 and molybdenum, selenium, and thallium in JHC-MW-15005 for which nonparametric confidence intervals were calculated. The confidence interval test compares the lower confidence limit to the GWPS. The statistical evaluation of the Appendix IV constituents shows exceedances for arsenic in JHC-MW-15002. These results are consistent with the results of the initial assessment monitoring data statistical evaluation and Consumers Energy will continue the assessment of corrective measures per §257.95(g). Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Attachments

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

Attachment 1 Sanitas™ Output

Table

Table A1

Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019

JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program

West Olive, Michigan

					Sample Location:	JHC-MW-15001												
					Sample Date:	12/7/2015	3/8/2016	6/21/2016	8/29/2016	11/15/2016	4/19/2017	6/20/2017	8/14/2017	9/25/2017	4/25/2018	6/18/2018	11/13/2018	4/25/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient												
Appendix III																		
Boron	ug/L	NC	NA	51	NA	396	235	195	271	309	149	368	238	287	--	339	146	78
Calcium	mg/L	NC	NA	46	NA	85.6	84.1	80.7	74.0	75.5	70.3	50.7	70.9	68	--	68.6	72.1	69
Chloride	mg/L	250*	NA	43	NA	12.3	48.4	152	98.5	105	7.1	51.8	94.8	73.6	--	109	2.7	< 2.0
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA	142	46.2	34.9	46.4	68.3	42.1	88	114	129	--	78.9	59.1	39
Total Dissolved Solids	mg/L	500*	NA	258	NA	630	190	570	550	560	440	340	562	563	--	596	310	280
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	6.6	6.4	6.2	6.0	6.4	6.3	6.2	6.3	6.2	7.2 (1)	6.3	6.3	6.0
Appendix IV																		
Antimony	ug/L	6	NA	2	6	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	**10**	6	3	3	4	3	4	1.8	2.2	--	< 1.0	1.8	**12.7**	5.8
Barium	ug/L	2,000	NA	35	2,000	160	148	164	148	141	172	106	142	--	71.4	183	84.9	58
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	NA	0.2	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100	1	2	2	2	3	2	1.0	1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	40	10	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	100	5	**100**	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	13.3	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.234	< 0.211	0.344	< 0.389	< 0.379	< 0.352	< 1.63	< 0.708	--	< 0.545	< 0.828	< 0.755	< 0.101
Radium-228	pCi/L	NC	NA	NA	NA	1.67	1.34	2.24	1.56	1.60	2.07	< 0.628	1.20	--	< 0.799	< 1.12	< 0.879	< 0.447
Radium-226/228	pCi/L	5	NA	1.93	5	1.90	1.53	2.58	1.77	1.89	2.13	< 2.26	1.61	--	< 1.34	< 1.95	< 1.63	< 0.447
Selenium	ug/L	50	NA	5	**50**	< 1	1	1	< 1	1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	**2**	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

NC - no criteria.

-- - not analyzed.

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

RSL - Regional Screening Level from 83 FR 36435.

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

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

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

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

All metals were analyzed as total unless otherwise specified.

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

(2) JHC-MW-15004 was decommissioned on June 14th, 2018.

(3) Outlier; single detection above reporting limit.

Table A1

Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019

JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program

West Olive, Michigan

					Sample Location:	JHC-MW-15002															
					Sample Date:	12/7/2015	3/8/2016	6/21/2016	8/30/2016	11/15/2016	4/19/2017	6/20/2017	6/20/2017	8/14/2017	8/14/2017	9/25/2017	9/25/2017	4/25/2018	4/25/2018	6/19/2018	11/15/2018	11/15/2018	4/25/2019
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	661	426	433	831	757	602	768	678	869	946	927	894	--	--	430	1,470	1,360	3,200
Calcium	mg/L	NC	NA	46	NA	21.9	35.8	36.4	36.1	18.9	28.0	24.6	25.1	25.7	25.3	30.5	30.6	--	--	75.3	41.9	41.1	85
Chloride	mg/L	250*	NA	43	NA	13.2	18.5	23.4	17.4	14.4	25.7	20.7	20.7	20.7	20.2	25.8	26.0	--	--	22.3	19.3	19.2	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
Sulfate	mg/L	250*	NA	14	NA	33.3	47.8	46.9	54.0	51.4	64.2	52.8	53.3	54.5	53.7	33.9	34.3	--	--	153	95.2	94.5	190
Total Dissolved Solids	mg/L	500*	NA	258	NA	150	160	180	190	140	190	160	130	236	174	144	148	--	--	356	222	274	410
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	8.8	8.7	8.5	8.6	8.8	8.8	9.2	--	9.2	--	9.6	--	10.2 (1)	--	8.3	8.0	--	6.9
Appendix IV																							
Antimony	ug/L	6	NA	2	6	< 1	< 1	4	3	1	< 1	3.3	2.9	1.9	2.1	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	**10**	**34**	**40**	**36**	**34**	**46**	**33**	**35.4**	**32.2**	**44.5**	**45.8**	--	--	**129**	**130**	**127**	**60.5**	**59.5**	**50**
Barium	ug/L	2,000	NA	35	2,000	10	9	8	8	8	8	7.2	6.3	7.8	7.7	--	--	30.4	30.4	19.8	18.4	18.1	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	< 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
Chromium	ug/L	100	NA	2	100	< 1	< 1	< 1	< 1	1	2	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	< 15.0	< 15.0	--	--	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 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
Lithium	ug/L	NC	40	10	**40**	12.1	10.1	< 10	< 10	11	< 10	< 10	< 10	11	< 10	--	--	28	28	19	**68**	**67**	**96**
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
Molybdenum	ug/L	NC	100	5	**100**	10	93	18	18	16	48	21.4	19.2	19.0	19.0	--	--	12.6	12.7	7.5	9.2	9.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	< 0.330	< 0.244	< 0.219	< 0.487	< 0.251	< 0.409	< 0.562	< 0.154	0.749	0.949	--	--	< 0.823	< 0.530	< 0.620	< 1.09	0.921	0.233
Radium-228	pCi/L	NC	NA	NA	NA	0.986	< 0.737	< 0.649	2.83	< 0.496	< 0.702	< 0.765	< 0.690	< 0.797	< 0.790	--	--	< 0.729	< 1.33	< 1.58	1.04	0.767	0.409
Radium-226/228	pCi/L	5	NA	1.93	5	1.09	< 0.737	< 0.649	2.9	< 0.496	< 0.702	< 1.33	< 0.844	< 1.43	< 1.26	--	--	< 1.55	< 1.86	< 2.20	< 1.70	1.69	0.642
Selenium	ug/L	50	NA	5	**50**	< 1	4	< 1	< 1	2	4	7.8	7.3	3.5	5.1	--	--	< 1.0	< 1.0	< 1.0	2.5	2.8	< 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

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) JHC-MW-15004 was decommissioned on June 14th, 2018.
(3) Outlier; single detection above reporting limit.

Table A1

Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019

JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program

West Olive, Michigan

						Sample Location:	JHC-MW-15003												
						Sample Date:	12/5/2015	3/8/2016	6/21/2016	8/29/2016	11/15/2016	4/18/2017	6/20/2017	8/14/2017	9/25/2017	4/25/2018	6/18/2018	6/18/2018	11/15/2018	4/29/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient													
Appendix III																		Field Dup		
Boron	ug/L	NC	NA	51	NA		439	455	426	882	1,670	1,280	1,240	1,150	1,120	--	1,170	1,320	1,120	1,700
Calcium	mg/L	NC	NA	46	NA		27.9	46.7	38.3	44.3	31.8	34.6	28.8	36.0	30.1	--	60.0	59.1	115	36
Chloride	mg/L	250*	NA	43	NA		21.7	25.7	28.5	20.1	30.8	27.9	24.0	22.0	19.3	--	37.5	36.6	16.3	18
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		41.3	52.7	48.1	45.8	63.0	71.8	61.8	61.9	51.9	--	81.9	82.7	294	75
Total Dissolved Solids	mg/L	500*	NA	258	NA		160	200	190	220	230	260	146	208	136	--	388	344	644	200
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		9.0	9.3	9.2	9.1	8.6	8.7	9.3	9.3	9.7	9.3	8.9	--	8.7	8.4
Appendix IV																				
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	2	1	< 1.0	1.3	--	1.5	1.9	1.8	2.0	2.2
Arsenic	ug/L	10	NA	1	**10**		**38**	**31**	**27**	**27**	**36**	**26**	**20.4**	**23.7**	--	**12.4**	**14.1**	**14.3**	8.1	10
Barium	ug/L	2,000	NA	35	2,000		21	16	15	19	18	16	18.0	18.0	--	42.3	55.7	52.5	113	42
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	1.7	0.41
Chromium	ug/L	100	NA	2	100		2	5	2	1	5	12	12.3	< 1.0	--	< 1.0	< 1.0	< 1.0	13.6	4.2
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 15.0	23.6 (3)	< 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	3.3	< 1.0
Lithium	ug/L	NC	40	10	**40**		11.1	< 10	< 10	< 10	11	< 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**		9	11	20	13	24	30	21.1	28.2	--	19.3	53.0	51.2	65.3	20
Radium-226	pCi/L	NC	NA	NA	NA		< 0.250	< 0.236	< 0.211	< 0.365	< 0.249	< 0.302	< 1.12	1.15	--	< 0.631	< 0.623	< 0.733	< 0.579	< 0.113
Radium-228	pCi/L	NC	NA	NA	NA		< 0.412	< 0.575	< 0.539	< 0.724	< 0.369	0.633	< 0.722	< 0.938	--	< 0.732	< 1.01	< 1.08	< 0.657	< 0.530
Radium-226/228	pCi/L	5	NA	1.93	5		< 0.412	< 0.575	< 0.539	< 0.724	< 0.369	0.769	< 1.84	1.81	--	< 1.36	< 1.63	< 1.81	< 1.24	< 0.530
Selenium	ug/L	50	NA	5	**50**		< 1	3	< 1	< 1	2	3	< 1.0	1.1	--	2.2	4.4	4.5	28.6	2.9
Thallium	ug/L	2	NA	2	**2**		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

NC - no criteria.

-- - not analyzed.

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

RSL - Regional Screening Level from 83 FR 36435.

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

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

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

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

All metals were analyzed as total unless otherwise specified.

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

(2) JHC-MW-15004 was decommissioned on June 14th, 2018.

(3) Outlier; single detection above reporting limit.

Table A1

Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019

JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program

West Olive, Michigan

					Sample Location:	**JHC-MW-15004(2)**										
					Sample Date:	12/5/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/18/2017	6/20/2017	8/14/2017	9/25/2017	4/25/2018	
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient										
Appendix III																
Boron	ug/L	NC	NA	51	NA	546	268	412	469	578	260	473	660	376	--	
Calcium	mg/L	NC	NA	46	NA	43.1	42.8	45.8	64.6	101	36.9	37.7	51.2	78.6	--	
Chloride	mg/L	250*	NA	43	NA	41.6	35.5	26.4	23.7	70.8	46.8	67.5	95.1	41.5	--	
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	
Sulfate	mg/L	250*	NA	14	NA	55.0	42.5	48.7	47.8	244	58.6	85.6	122	64.6	--	
Total Dissolved Solids	mg/L	500*	NA	258	NA	290	220	230	370	560	290	322	402	382	--	
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.6	7.3	7.1	6.8	7.3	7.6	7.4	7.6	7.1	7.3	
Appendix IV																
Antimony	ug/L	6	NA	2	6	< 1	< 1	1	1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	
Arsenic	ug/L	10	NA	1	**10**	**21**	9	**11**	8	6	4	4.8	5.7	--	3.6	
Barium	ug/L	2,000	NA	35	2,000	73	65	117	181	241	110	93.2	193	--	162	
Beryllium	ug/L	4	NA	1	4	< 1	< 1	< 1	< 1	< 1	< 1	< 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	
Chromium	ug/L	100	NA	2	100	1	1	1	1	1	3	6.9	< 1.0	--	< 1.0	
Cobalt	ug/L	NC	6	15	15	< 15	< 15	< 15	< 15	< 15	< 15	< 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	
Lead	ug/L	NC	15	1	15	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	
Lithium	ug/L	NC	40	10	**40**	< 10	< 10	< 10	12	12	< 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	
Molybdenum	ug/L	NC	100	5	**100**	9	8	10	5	10	6	10.1	11.2	--	< 5.0	
Radium-226	pCi/L	NC	NA	NA	NA	< 0.295	0.259	< 0.189	< 0.29	< 0.311	< 0.333	< 0.502	0.915	--	< 0.449	
Radium-228	pCi/L	NC	NA	NA	NA	0.422	0.452	0.605	1.62	0.856	0.366	< 0.685	< 0.920	--	< 0.787	
Radium-226/228	pCi/L	5	NA	1.93	5	0.702	0.711	0.633	1.85	1.12	0.497	< 1.19	1.66	--	< 1.24	
Selenium	ug/L	50	NA	5	**50**	8	2	2	7	1	2	< 1.0	< 1.0	--	5.5	
Thallium	ug/L	2	NA	2	**2**	**2.16**	< 2	2	**4**	**3**	< 2	< 2.0	**2.1**	--	< 2.0	

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

NC - no criteria.

-- - not analyzed.

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

RSL - Regional Screening Level from 83 FR 36435.

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

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

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

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

All metals were analyzed as total unless otherwise specified.

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

(2) JHC-MW-15004 was decommissioned on June 14th, 2018.

(3) Outlier; single detection above reporting limit.

Table A1

Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2019

JH Campbell Unit 1-2N/1-2S – RCRA CCR Monitoring Program

West Olive, Michigan

						Sample Location:	JHC-MW-15005											
						Sample Date:	12/5/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/18/2017	6/20/2017	8/14/2017	9/25/2017	4/25/2018	6/19/2018	11/15/2018	4/25/2019	4/25/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient													
Appendix III																				Field Dup
Boron	ug/L	NC	NA	51	NA		275	959	1,370	706	1,500	524	468	546	481	--	227	1,450	2,800	2,900
Calcium	mg/L	NC	NA	46	NA		55.0	60.2	55.1	51.6	73.4	56.8	53.6	48.0	40.3	--	61.8	61.9	170	180
Chloride	mg/L	250*	NA	43	NA		27.7	42.0	46.9	19.2	29.3	64.2	50.4	27.1	21.8	--	90.9	30.6	28	28
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	<1,000
Sulfate	mg/L	250*	NA	14	NA		51.2	53.0	57.9	46.5	61.8	58.3	66.0	64.9	61.9	--	74.3	133	240	320
Total Dissolved Solids	mg/L	500*	NA	258	NA		270	300	310	230	320	360	306	282	300	--	462	334	800	780
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.3	7.4	7.4	7.3	7.1	7.5	7.4	7.5	7.4	7.4	7.4	7.5	7.2	--
Appendix IV																				
Antimony	ug/L	6	NA	2	6		4	2	2	3	5	3	3.8	4.2	--	2.2	1.6	5.1	4.4	4.2
Arsenic	ug/L	10	NA	1	**10**		4	3	3	5	3	2	3.3	2.5	--	1.7	1.3	1.2	1.2	1.1
Barium	ug/L	2,000	NA	35	2,000		99	74	97	72	159	128	113	109	--	407	175	149	150	150
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		4	5	12	2	3	4	3.7	< 1.0	--	< 1.0	3.0	< 1.0	1.3	1.3
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
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**		**41.3**	25.5	28	31	**49**	38	39	36	--	**61**	35	28	38	38
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**		12	13	25	16	15	18	14.0	10	--	31.2	15.7	**222**	**900**	**870**
Radium-226	pCi/L	NC	NA	NA	NA		< 0.277	< 0.355	0.192	< 0.286	< 0.246	0.461	< 0.717	< 0.877	--	0.620	< 0.758	< 0.461	0.169	0.248
Radium-228	pCi/L	NC	NA	NA	NA		0.436	< 0.426	< 0.395	1.58	0.745	< 0.383	< 0.728	< 0.856	--	0.700	1.220	0.967	< 0.350	0.495
Radium-226/228	pCi/L	5	NA	1.93	5		0.564	< 0.426	< 0.395	1.78	0.974	0.841	< 1.45	< 1.73	--	1.32	1.91	1.41	< 0.350	0.743
Selenium	ug/L	50	NA	5	**50**		28	12	33	18	**165**	10	15.5	15.7	--	**368**	14	**158**	**140**	**130**
Thallium	ug/L	2	NA	2	**2**		**3.04**	< 2	2	2	**4**	< 2	< 2.0	< 2.0	--	**5.8**	**2.1**	< 2.0	2.0	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

NC - no criteria.

-- - not analyzed.

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

RSL - Regional Screening Level from 83 FR 36435.

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

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

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

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

All metals were analyzed as total unless otherwise specified.

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

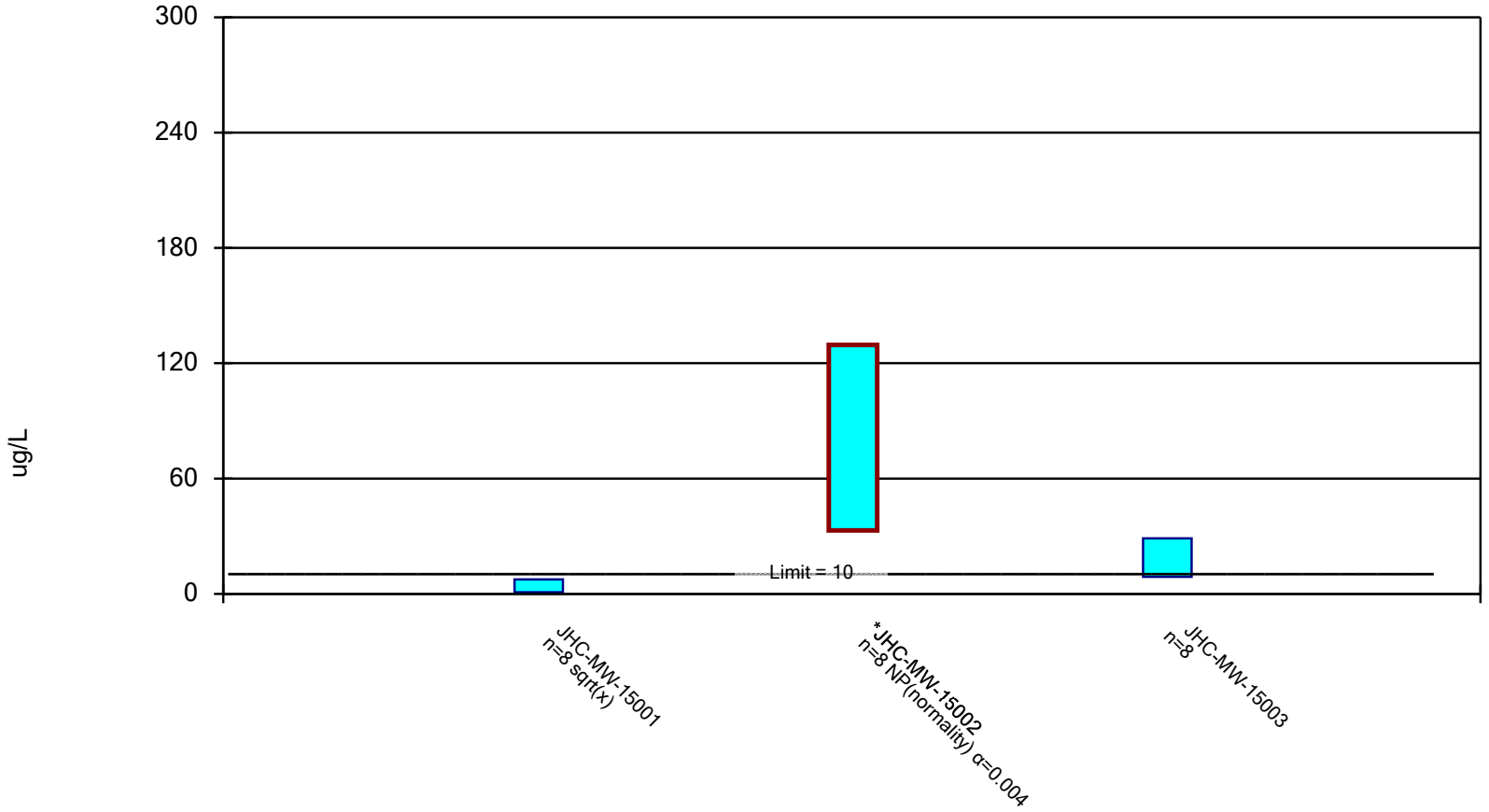
(2) JHC-MW-15004 was decommissioned on June 14th, 2018.

(3) Outlier; single detection above reporting limit.

Attachment 1
Sanitas™ Output

Parametric and Non-Parametric (NP) Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Arsenic, Total Analysis Run 6/10/2019 4:04 PM

Client: Consumers Energy Data: JHC_Sanitas_19.06.03

Confidence Interval

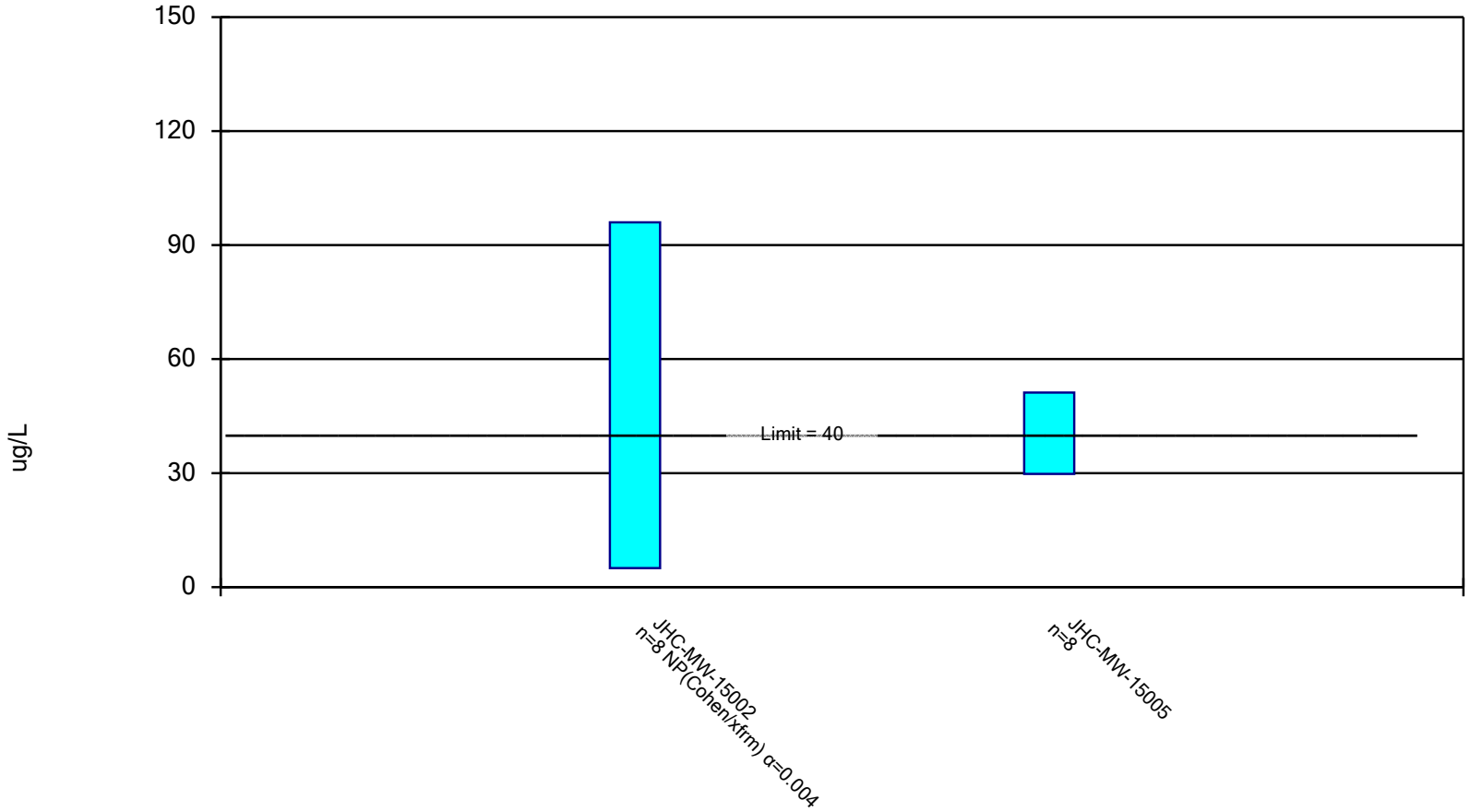
Constituent: Arsenic, Total (ug/L) Analysis Run 6/10/2019 4:05 PM

Client: Consumers Energy Data: JHC_Sanitas_19.06.03

	JHC-MW-15001	JHC-MW-15002	JHC-MW-15003
11/15/2016	3	46	36
4/18/2017			26
4/19/2017	4	33	
6/20/2017	1.8	33.8 (D)	20.4
8/14/2017	2.2	45.15 (D)	23.7
4/25/2018	<1	129.5 (D)	12.4
6/18/2018	1.8		14.2 (D)
6/19/2018		127	
11/13/2018	12.7		
11/15/2018		60 (D)	8.1
4/25/2019	5.8	50	
4/29/2019			10
Mean	3.975	65.56	18.85
Std. Dev.	3.875	39.65	9.474
Upper Lim.	7.502	129.5	28.89
Lower Lim.	0.8199	33	8.808

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: Lithium, Total Analysis Run 6/10/2019 4:05 PM

Client: Consumers Energy Data: JHC_Sanitas_19.06.03

Confidence Interval

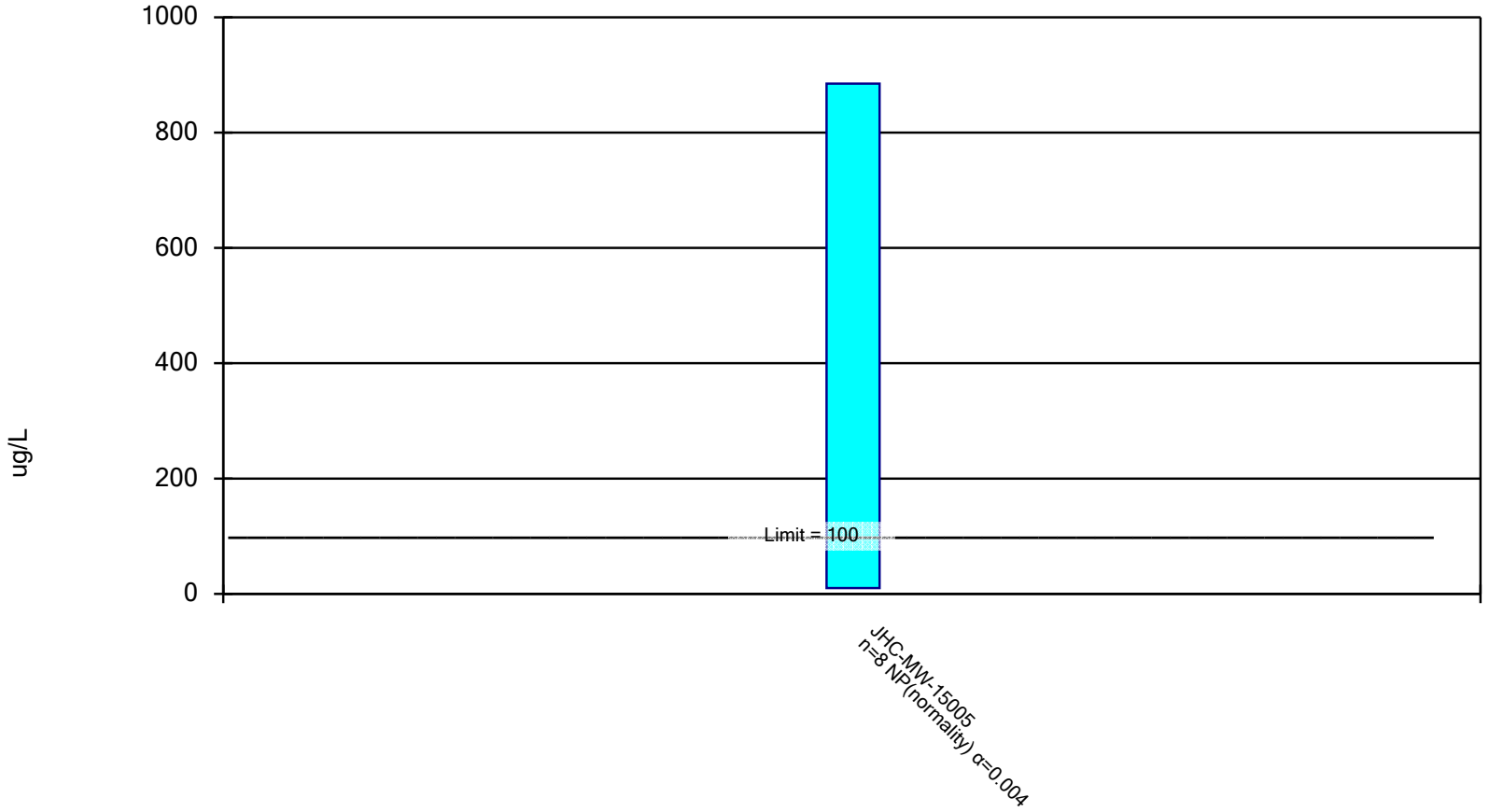
Constituent: Lithium, Total (ug/L) Analysis Run 6/10/2019 4:05 PM

Client: Consumers Energy Data: JHC_Sanitas_19.06.03

	JHC-MW-15002	JHC-MW-15005
11/15/2016	11	49
4/18/2017		38
4/19/2017	<10	
6/20/2017	<10 (D)	39
8/14/2017	10.5 (D)	36
4/25/2018	28 (D)	61
6/19/2018	19	35
11/15/2018	67.5 (D)	28
4/25/2019	96	38 (D)
Mean	30.25	40.5
Std. Dev.	33.55	10.1
Upper Lim.	96	51.2
Lower Lim.	5	29.8

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: Molybdenum, Total Analysis Run 6/10/2019 4:05 PM

Client: Consumers Energy Data: JHC_Sanitas_19.06.03

Confidence Interval

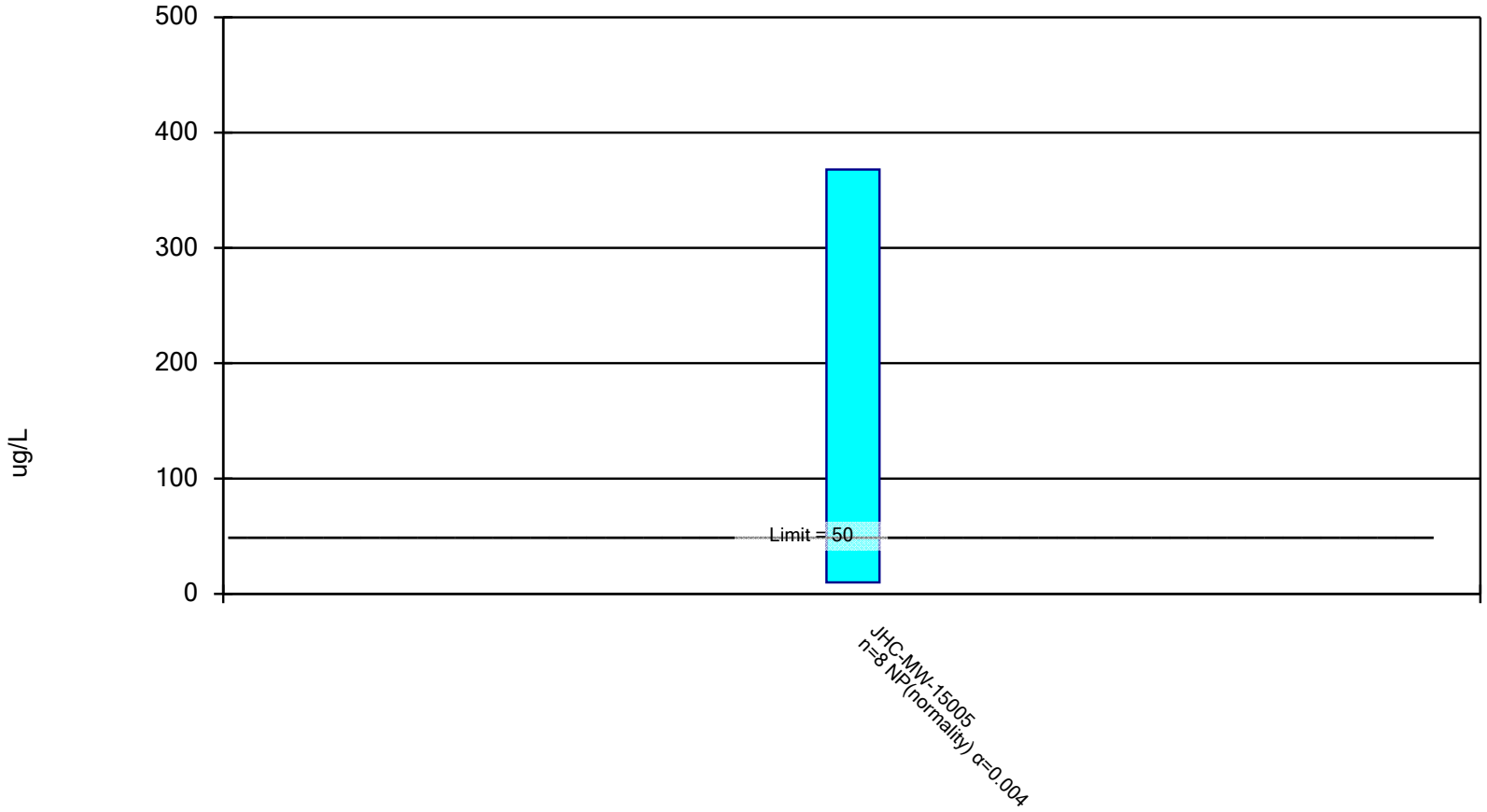
Constituent: Molybdenum, Total (ug/L) Analysis Run 6/10/2019 4:05 PM

Client: Consumers Energy Data: JHC_Sanitas_19.06.03

	JHC-MW-15005
11/15/2016	15
4/18/2017	18
6/20/2017	14
8/14/2017	10
4/25/2018	31.2
6/19/2018	15.7
11/15/2018	222
4/25/2019	885 (D)
Mean	151.4
Std. Dev.	305
Upper Lim.	885
Lower Lim.	10

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: Selenium, Total Analysis Run 6/10/2019 4:05 PM

Client: Consumers Energy Data: JHC_Sanitas_19.06.03

Confidence Interval

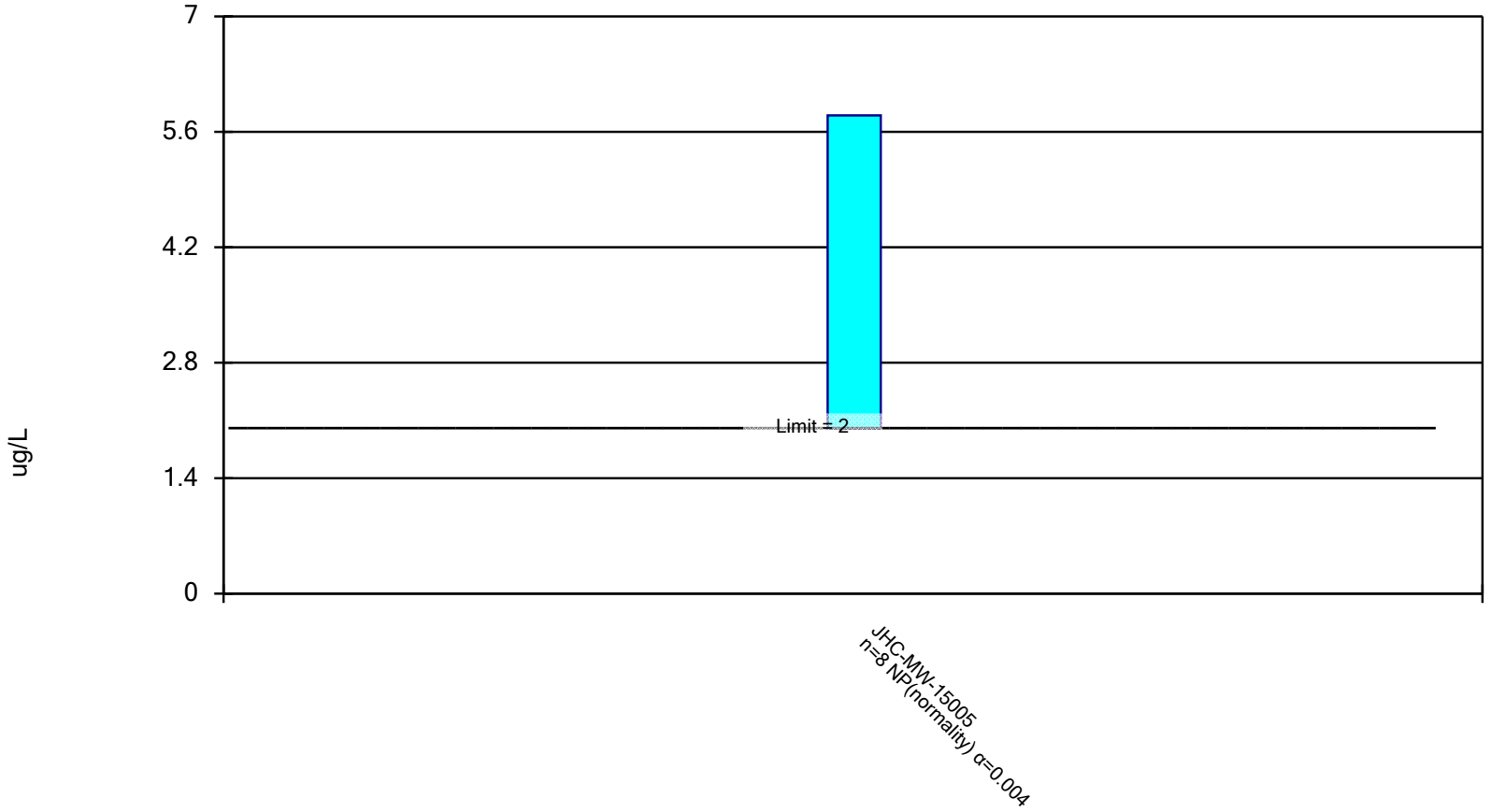
Constituent: Selenium, Total (ug/L) Analysis Run 6/10/2019 4:05 PM

Client: Consumers Energy Data: JHC_Sanitas_19.06.03

	JHC-MW-15005
11/15/2016	165
4/18/2017	10
6/20/2017	15.5
8/14/2017	15.7
4/25/2018	368
6/19/2018	14
11/15/2018	158
4/25/2019	135 (D)
Mean	110.2
Std. Dev.	125.1
Upper Lim.	368
Lower Lim.	10

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: Thallium, Total Analysis Run 6/10/2019 4:05 PM

Client: Consumers Energy Data: JHC_Sanitas_19.06.03

Confidence Interval

Constituent: Thallium, Total (ug/L) Analysis Run 6/10/2019 4:05 PM

Client: Consumers Energy Data: JHC_Sanitas_19.06.03

	JHC-MW-15005
11/15/2016	4
4/18/2017	<2
6/20/2017	<2
8/14/2017	<2
4/25/2018	5.8
6/19/2018	2.1
11/15/2018	<2
4/25/2019	2 (D)
Mean	2.738
Std. Dev.	1.419
Upper Lim.	5.8
Lower Lim.	2

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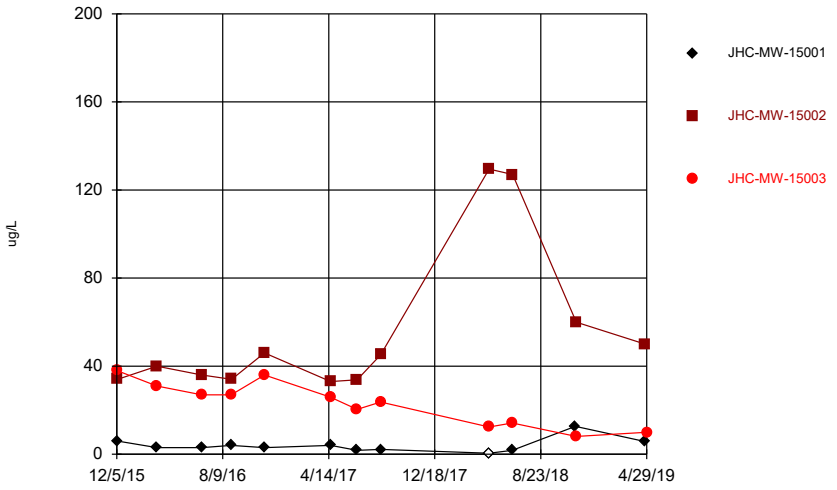
Hollow symbols indicate censored values.

Arsenic, Total



Time Series Analysis Run 6/10/2019 3:58 PM
Client: Consumers Energy Data: JHC_Sanitas_19.06.03

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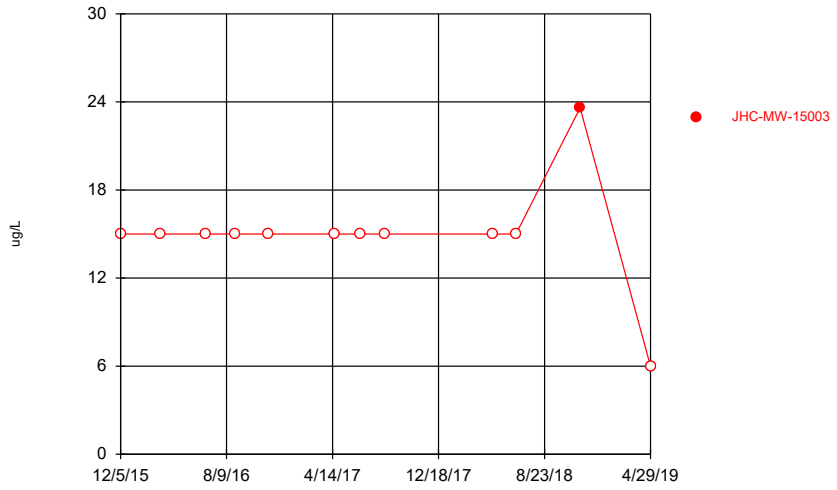
Hollow symbols indicate censored values.

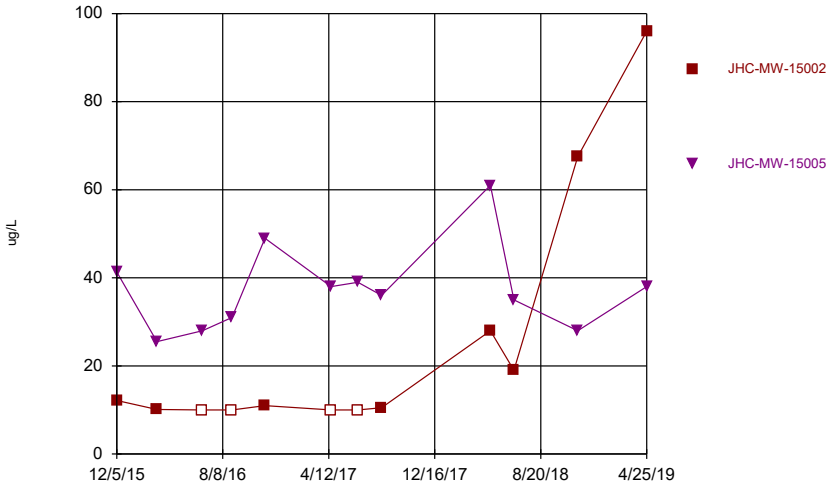
Cobalt, Total



Time Series Analysis Run 6/10/2019 3:58 PM
Client: Consumers Energy Data: JHC_Sanitas_19.06.03

Sanitas™ v.9.6.14 Sanitas software licensed to Consumers Energy. EPA
Hollow symbols indicate censored values.

Lithium, Total



Time Series Analysis Run 6/10/2019 3:58 PM
Client: Consumers Energy Data: JHC_Sanitas_19.06.03

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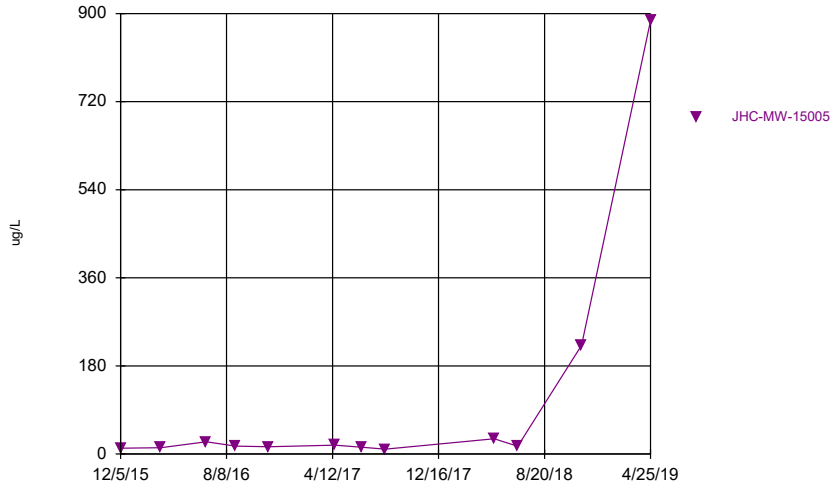
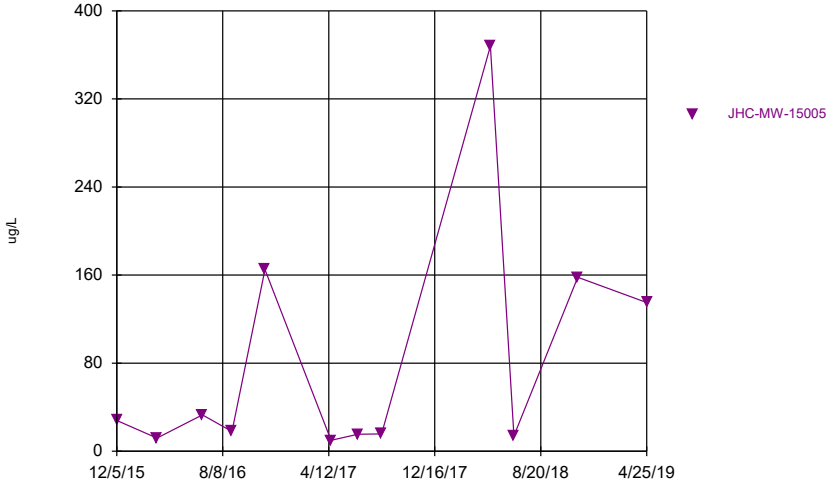
Molybdenum, Total



Time Series Analysis Run 6/10/2019 3:58 PM
Client: Consumers Energy Data: JHC_Sanitas_19.06.03

Selenium, Total



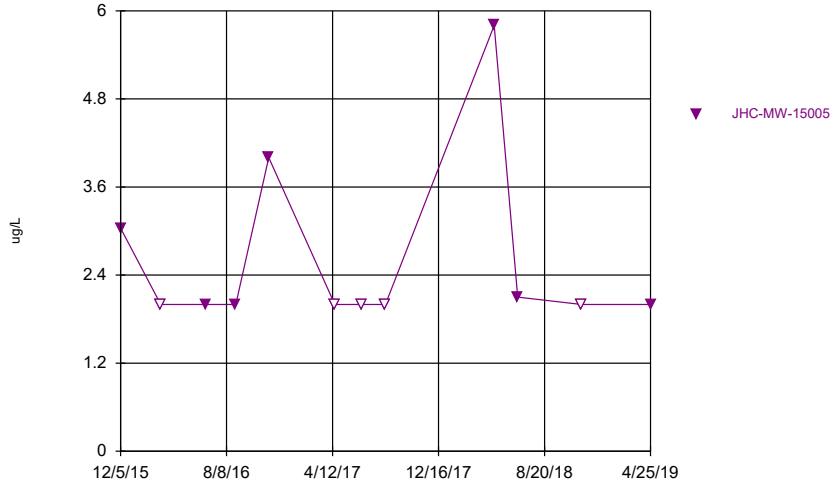
Time Series Analysis Run 6/10/2019 3:58 PM

Client: Consumers Energy Data: JHC_Sanitas_19.06.03

Sanitas™ v.9.6.14 Sanitas software licensed to Consumers Energy. EPA

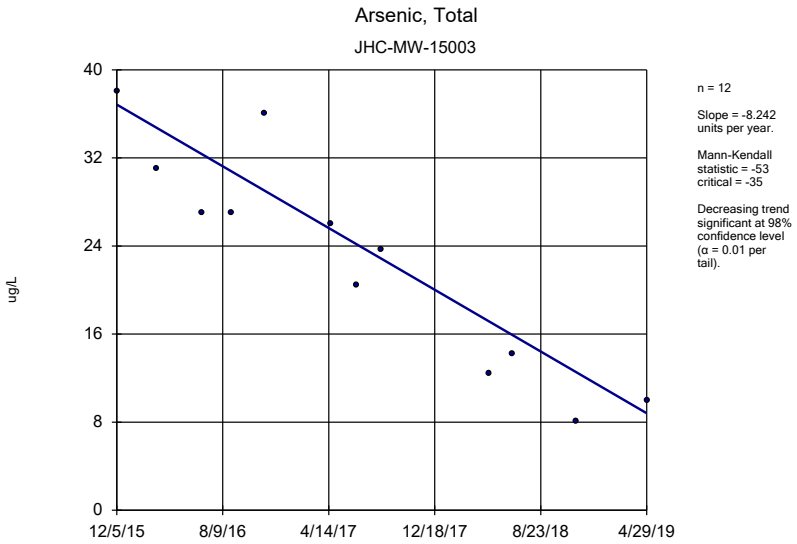
Hollow symbols indicate censored values.

Thallium, Total



Time Series Analysis Run 6/10/2019 3:58 PM

Client: Consumers Energy Data: JHC_Sanitas_19.06.03



Sen's Slope Estimator Analysis Run 6/10/2019 4:07 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 17, 2019

To: Bethany Swanberg, Consumers Energy

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

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

Project No.: 322174.0000.0000 Phase 1 Task 3

Subject: Statistical Evaluation of October 2019 Assessment Monitoring Sampling Event, JH Campbell Bottom Ash Ponds 1-2 North and 1-2 South CCR Unit, Consumers Energy Company, West Olive, Michigan

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During the statistical evaluation of the initial assessment monitoring event, arsenic was present in one or more downgradient monitoring wells at statistically significant levels exceeding the Groundwater Protection Standards (GWPSs). Therefore, Consumers Energy Company (Consumers Energy) initiated an Assessment of Corrective Measures (ACM) within 90 days from when the Appendix IV exceedance was determined. The ACM was completed on September 11, 2019.

Currently, 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 Ponds 1-2 North and 1-2 South (Ponds 1-2). The second semiannual assessment monitoring event of 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 detailed in the October 15, 2018 *Groundwater Protection Standards* technical memorandum, which was also included in the *2018 Annual Groundwater Monitoring Report* (2018

[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).

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 for 2019 indicates that the following constituent is present at statistically significant levels exceeding the GWPS in downgradient monitoring wells at the Ponds 1-2 CCR Unit:

Constituent	GWPS	# Downgradient Wells Observed
Arsenic	10 ug/L	1 of 6

These results are consistent with the results of the initial, and previous, assessment monitoring data statistical evaluation and Consumers Energy will continue to evaluate corrective measures per §257.96 and §257.97. Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Assessment Monitoring Statistical Evaluation

The compliance well network at the Ponds 1-2 CCR Unit consists of six monitoring wells. JHC-MW-15001, JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 are located on the perimeter of the bottom ash ponds. Former downgradient monitoring well JHC-MW-15004 was decommissioned on June 14, 2018, during deconstruction of Unit 1-2; therefore, statistical analysis for JHC-MW-15004 terminates at the June 2018 monitoring event. Due to the cessation of hydraulic loading to Ponds 1-2 and Bottom Ash Ponds 3 North and 3 South (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 two new downgradient wells (JHC-MW-18004 and JHC-MW-18005) on the south and southwest edge of former Ponds 1-2 from December 3 through December 5, 2018 to reassess groundwater flow and ensure sufficient wells were appropriately located to assess groundwater quality downgradient from the Ponds 1-2 CCR Units. 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 the Ponds 1-2 CCR Unit. Therefore, JHC-MW-18004 and JHC-MW-18005 have been added to the downgradient monitoring network for Ponds 1-2 and are included in the statistical evaluation.

Following the second semiannual assessment monitoring sampling event, compliance well data for the JHC Ponds 1-2 were evaluated in accordance with the Groundwater Statistical Evaluation Plan (Stats Plan) (TRC, October 2017). An assessment monitoring program was developed to evaluate concentrations of CCR constituents present in the uppermost aquifer relative to acceptable levels (i.e. GWPSs). To evaluate whether or not a GWPS exceedance is statistically significant, the difference in concentration observed at the downgradient wells during a given assessment monitoring event compared to the GWPS must be large enough, after accounting for variability in the sample data, that

the result is unlikely to have occurred merely by chance. Consistent with the Unified Guidance [2], the preferred method for comparisons to a fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS. Based on the number of historical observations in the representative sample population, the population mean, the population standard deviation, and a selected confidence level (*i.e.* 99 percent), an upper and lower confidence limit is calculated. The true concentration, with 99 percent confidence, will fall between the lower and upper confidence limits.

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

For each detected Appendix IV constituent, the concentrations 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 eight monitoring events (April 2017 through October 2019) for JHC-MW-15001, JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 and the past five events (December 2018 through October 2019) for JHC-MW-18004 and JHC-MW-18005 were retained for further analysis. Direct comparison GWPS exceedances included the following parameter-well combinations:

- Arsenic in JHC-MW-15001,
- Arsenic and lithium in JHC-MW-15002,
- Arsenic, cobalt, and molybdenum in JHC-MW-15003,
- Lithium, molybdenum, selenium, and thallium in JHC-MW-15005, and
- Arsenic and selenium in JHC-MW-18005 at Ponds 1-2.

Cobalt was detected in JHC-MW-15003 at a concentration of 23.6 ug/L in November 2018, which exceeds its GWPS but did not exceed its GWPS in April 2019. Cobalt again exceeded its GWPS in October 2019. These are the only detections of cobalt in the Ponds 1-2 wells during either baseline sampling or assessment monitoring, and it was also not detected in the site background monitoring

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

wells. However, to be conservative, the cobalt data have been retained in the assessment monitoring data set for this assessment monitoring data evaluation.

Groundwater data for the remaining parameter-well combinations with direct-comparison exceedances of a GWPS 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 the assessment monitoring results (April 2018 through October 2019) for these well-constituent pairs were observed visually for potential trends. Potential increasing trends were noted for lithium in JHC-MW-15002 and molybdenum in JHC-MW-15005 beginning in November 2018. Groundwater conditions are re-equilibrating following to CCR removal activities at the JHC Ponds 1-2 that were completed in September 2018, and the groundwater monitoring system is being re-assessed to account for post-deconstruction groundwater conditions. Hydrogeologic conditions are in the process of stabilizing and recent groundwater samples fromJHC-MW-15002 and JHC-MW-15005 may no longer represent groundwater passing beneath JHC Ponds 1-2. In order to be conservative, the suspect lithium and molybdenum data from November 2018 through October 2019 have been kept in the assessment monitoring data set pending the collection of additional data. The suspect data will be tested for outliers once stabilized groundwater characteristics have been assessed. 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 at the downgradient monitoring wells using the confidence interval method for the most recent eight sampling events (five events for JHC-MW-18005). 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 tests were 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. 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. Data distributions were as follows:

DISTRIBUTION	PARAMETER-WELL COMBINATIONS
Normal	Arsenic in JHC-MW-15003 and JHC-MW-18005 Lithium in JHC-MW-15005
Normalized by square root transformation	Arsenic in JHC-MW-15001 Lithium in JHC-MW-15002 Selenium in JHC-MW-15005 and JHC-MW-18005 Thallium in JHC-MW-15005 (Kaplan-Meier)
Normalized by natural log transformation	Arsenic in JHC-MW-15002 Molybdenum in JHC-MW-15003
Non-Parametric (not normalizable)	Cobalt in JHC-MW-15003 Molybdenum in JHC-MW-15005

The confidence interval test compares the lower confidence limit to the GWPS. The statistical evaluation of the Appendix IV constituents shows a statistically significance GWPS exceedances for arsenic in JHC-MW-15002. These results are consistent with the results of the initial assessment monitoring data statistical evaluation and Consumers Energy will continue to evaluate corrective measures per §257.96 and §257.97. Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Attachments

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

Attachment 1 Sanitas™ Output

Table

Table A1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to October 2019
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15001												
						Sample Date:	12/7/2015	3/8/2016	6/21/2016	8/29/2016	11/15/2016	4/19/2017	6/20/2017	8/14/2017	9/25/2017	4/25/2018	6/18/2018	11/13/2018	4/25/2019	10/9/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient													
Appendix III																				
Boron	ug/L	NC	NA	51	NA		396	235	195	271	309	149	368	238	287	--	339	146	78	150
Calcium	mg/L	NC	NA	46	NA		85.6	84.1	80.7	74.0	75.5	70.3	50.7	70.9	68	--	68.6	72.1	69	73
Chloride	mg/L	250*	NA	43	NA		12.3	48.4	152	98.5	105	7.1	51.8	94.8	73.6	--	109	2.7	< 2.0	< 2.0
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		142	46.2	34.9	46.4	68.3	42.1	88	114	129	--	78.9	59.1	39	21
Total Dissolved Solids	mg/L	500*	NA	258	NA		630	190	570	550	560	440	340	562	563	--	596	310	280	350
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		6.6	6.4	6.2	6.0	6.4	6.3	6.2	6.3	6.2	7.2 (1)	6.3	6.3	6.0	6.4
Appendix IV																				
Antimony	ug/L	6	NA	2	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	**10**		6	3	3	4	3	4	1.8	2.2	--	< 1.0	1.8	**12.7**	5.8	6.3
Barium	ug/L	2,000	NA	35	2,000		160	148	164	148	141	172	106	142	--	71.4	183	84.9	58	95
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	2	2	2	3	2	1.0	1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	1.2
Cobalt	ug/L	NC	6	15	**15**		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	< 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	0.25
Molybdenum	ug/L	NC	100	5	**100**		< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	< 5.0	--	< 5.0	< 5.0	13.3	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.234	< 0.211	0.344	< 0.389	< 0.379	< 0.352	< 1.63	< 0.708	--	< 0.545	< 0.828	< 0.755	< 0.101	< 0.162
Radium-228	pCi/L	NC	NA	NA	NA		1.67	1.34	2.24	1.56	1.60	2.07	< 0.628	1.20	--	< 0.799	< 1.12	< 0.879	< 0.447	< 0.516
Radium-226/228	pCi/L	5	NA	1.93	5		1.90	1.53	2.58	1.77	1.89	2.13	< 2.26	1.61	--	< 1.34	< 1.95	< 1.63	< 0.447	< 0.516
Selenium	ug/L	50	NA	5	**50**		< 1	1	1	< 1	1	< 1	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	NA	2	**2**		< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) JHC-MW-15004 was decommissioned on June 14th, 2018.
(3) 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 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15002																
						Sample Date:	12/7/2015	3/8/2016	6/21/2016	8/30/2016	11/15/2016	4/19/2017	6/20/2017	6/20/2017	8/14/2017	8/14/2017	9/25/2017	9/25/2017	4/25/2018	4/25/2018	6/19/2018	11/15/2018	11/15/2018	4/25/2019	10/9/2019
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		661	426	433	831	757	602	768	678	869	946	927	894	--	--	430	1,470	1,360	3,200	1,700
Calcium	mg/L	NC	NA	46	NA		21.9	35.8	36.4	36.1	18.9	28.0	24.6	25.1	25.7	25.3	30.5	30.6	--	--	75.3	41.9	41.1	85	99
Chloride	mg/L	250*	NA	43	NA		13.2	18.5	23.4	17.4	14.4	25.7	20.7	20.7	20.7	20.2	25.8	26.0	--	--	22.3	19.3	19.2	17	20
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		33.3	47.8	46.9	54.0	51.4	64.2	52.8	53.3	54.5	53.7	33.9	34.3	--	--	153	95.2	94.5	190	280
Total Dissolved Solids	mg/L	500*	NA	258	NA		150	160	180	190	140	190	160	130	236	174	144	148	--	--	356	222	274	410	480
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		8.8	8.7	8.5	8.6	8.8	8.8	9.2	--	9.2	--	9.6	--	10.2 (1)	--	8.3	8.0	--	6.9	6.5
Appendix IV																									
Antimony	ug/L	6	NA	2	6		< 1	< 1	4	3	1	< 1	3.3	2.9	1.9	2.1	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	**10**		**34**	**40**	**36**	**34**	**46**	**33**	**35.4**	**32.2**	**44.5**	**45.8**	--	--	**129**	**130**	**127**	**60.5**	**59.5**	**50**	**57**
Barium	ug/L	2,000	NA	35	2,000		10	9	8	8	8	8	7.2	6.3	7.8	7.7	--	--	30.4	30.4	19.8	18.4	18.1	49	150
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		< 1	< 1	< 1	< 1	1	2	< 1.0	< 1.0	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	6	15	**15**		< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	< 15.0	< 15.0	--	--	< 15.0	< 15.0	< 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	< 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**		12.1	10.1	< 10	< 10	11	< 10	< 10	< 10	11	< 10	--	--	28	28	19	**68**	**67**	**96**	**240**
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**		10	93	18	18	16	48	21.4	19.2	19.0	19.0	--	--	12.6	12.7	7.5	9.2	9.0	< 5.0	15
Radium-226	pCi/L	NC	NA	NA	NA		< 0.330	< 0.244	< 0.219	< 0.487	< 0.251	< 0.409	< 0.562	< 0.154	0.749	0.949	--	--	< 0.823	< 0.530	< 0.620	< 1.09	0.921	0.233	0.698
Radium-228	pCi/L	NC	NA	NA	NA		0.986	< 0.737	< 0.649	2.83	< 0.496	< 0.702	< 0.765	< 0.690	< 0.797	< 0.790	--	--	< 0.729	< 1.33	< 1.58	1.04	0.767	0.409	< 0.394
Radium-226/228	pCi/L	5	NA	1.93	5		1.09	< 0.737	< 0.649	2.9	< 0.496	< 0.702	< 1.33	< 0.844	< 1.43	< 1.26	--	--	< 1.55	< 1.86	< 2.20	< 1.70	1.69	0.642	1.04
Selenium	ug/L	50	NA	5	**50**		< 1	4	< 1	< 1	2	4	7.8	7.3	3.5	5.1	--	--	< 1.0	< 1.0	< 1.0	2.5	2.8	< 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) pH value potentially biased high due to groundwater quality meter malfunction.
(2) JHC-MW-15004 was decommissioned on June 14th, 2018.
(3) 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 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-15003													
					Sample Date:	12/5/2015	3/8/2016	6/21/2016	8/29/2016	11/15/2016	4/18/2017	6/20/2017	8/14/2017	9/25/2017	4/25/2018	6/18/2018	6/18/2018	11/15/2018	4/29/2019	10/9/2019	10/9/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient															
Appendix III																	Field Dup				Field Dup
Boron	ug/L	NC	NA	51	NA	439	455	426	882	1,670	1,280	1,240	1,150	1,120	--	1,170	1,320	1,120	1,700	3,500	3,300
Calcium	mg/L	NC	NA	46	NA	27.9	46.7	38.3	44.3	31.8	34.6	28.8	36.0	30.1	--	60.0	59.1	115	36	110	110
Chloride	mg/L	250*	NA	43	NA	21.7	25.7	28.5	20.1	30.8	27.9	24.0	22.0	19.3	--	37.5	36.6	16.3	18	47	47
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	41.3	52.7	48.1	45.8	63.0	71.8	61.8	61.9	51.9	--	81.9	82.7	294	75	210	220
Total Dissolved Solids	mg/L	500*	NA	258	NA	160	200	190	220	230	260	146	208	136	--	388	344	644	200	580	600
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	9.0	9.3	9.2	9.1	8.6	8.7	9.3	9.3	9.7	9.3	8.9	--	8.7	8.4	8.7	--
Appendix IV																					
Antimony	ug/L	6	NA	2	6	< 1	< 1	< 1	< 1	2	1	< 1.0	1.3	--	1.5	1.9	1.8	2.0	2.2	1.4	1.4
Arsenic	ug/L	10	NA	1	**10**	**38**	**31**	**27**	**27**	**36**	**26**	**20.4**	**23.7**	--	**12.4**	**14.1**	**14.3**	8.1	10	8.4	7.7
Barium	ug/L	2,000	NA	35	2,000	21	16	15	19	18	16	18.0	18.0	--	42.3	55.7	52.5	113	42	91	89
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	1.7	0.41	2.5	2.5
Chromium	ug/L	100	NA	2	100	2	5	2	1	5	12	12.3	< 1.0	--	< 1.0	< 1.0	< 1.0	13.6	4.2	11	10
Cobalt	ug/L	NC	6	15	**15**	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	< 15.0	< 15.0	< 15.0	**23.6**	< 6.0	**43**	**41**
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	3.3	< 1.0	3.2	3.2
Lithium	ug/L	NC	40	10	**40**	11.1	< 10	< 10	< 10	11	< 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**	9	11	20	13	24	30	21.1	28.2	--	19.3	53.0	51.2	65.3	20	**120**	**120**
Radium-226	pCi/L	NC	NA	NA	NA	< 0.250	< 0.236	< 0.211	< 0.365	< 0.249	< 0.302	< 1.12	1.15	--	< 0.631	< 0.623	< 0.733	< 0.579	< 0.113	0.301	0.430
Radium-228	pCi/L	NC	NA	NA	NA	< 0.412	< 0.575	< 0.539	< 0.724	< 0.369	0.633	< 0.722	< 0.938	--	< 0.732	< 1.01	< 1.08	< 0.657	< 0.530	0.421	< 0.361
Radium-226/228	pCi/L	5	NA	1.93	5	< 0.412	< 0.575	< 0.539	< 0.724	< 0.369	0.769	< 1.84	1.81	--	< 1.36	< 1.63	< 1.81	< 1.24	< 0.530	0.722	0.559
Selenium	ug/L	50	NA	5	**50**	< 1	3	< 1	< 1	2	3	< 1.0	1.1	--	2.2	4.4	4.5	28.6	2.9	18	19
Thallium	ug/L	2	NA	2	**2**	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) JHC-MW-15004 was decommissioned on June 14th, 2018.
(3) 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 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15004[2]								
						Sample Date:	12/5/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/18/2017	6/20/2017	8/14/2017	9/25/2017	4/25/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient									
Appendix III																
Boron	ug/L	NC	NA	51	NA		546	268	412	469	578	260	473	660	376	--
Calcium	mg/L	NC	NA	46	NA		43.1	42.8	45.8	64.6	101	36.9	37.7	51.2	78.6	--
Chloride	mg/L	250*	NA	43	NA		41.6	35.5	26.4	23.7	70.8	46.8	67.5	95.1	41.5	--
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
Sulfate	mg/L	250*	NA	14	NA		55.0	42.5	48.7	47.8	244	58.6	85.6	122	64.6	--
Total Dissolved Solids	mg/L	500*	NA	258	NA		290	220	230	370	560	290	322	402	382	--
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.6	7.3	7.1	6.8	7.3	7.6	7.4	7.6	7.1	7.3
Appendix IV																
Antimony	ug/L	6	NA	2	6		< 1	< 1	1	1	< 1	< 1	< 1.0	< 1.0	--	< 1.0
Arsenic	ug/L	10	NA	1	**10**		**21**	9	**11**	8	6	4	4.8	5.7	--	3.6
Barium	ug/L	2,000	NA	35	2,000		73	65	117	181	241	110	93.2	193	--	162
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 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
Chromium	ug/L	100	NA	2	100		1	1	1	1	1	3	6.9	< 1.0	--	< 1.0
Cobalt	ug/L	NC	6	15	**15**		< 15	< 15	< 15	< 15	< 15	< 15	< 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
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	< 1.0
Lithium	ug/L	NC	40	10	**40**		< 10	< 10	< 10	12	12	< 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
Molybdenum	ug/L	NC	100	5	**100**		9	8	10	5	10	6	10.1	11.2	--	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.295	0.259	< 0.189	< 0.29	< 0.311	< 0.333	< 0.502	0.915	--	< 0.449
Radium-228	pCi/L	NC	NA	NA	NA		0.422	0.452	0.605	1.62	0.856	0.366	< 0.685	< 0.920	--	< 0.787
Radium-226/228	pCi/L	5	NA	1.93	5		0.702	0.711	0.633	1.85	1.12	0.497	< 1.19	1.66	--	< 1.24
Selenium	ug/L	50	NA	5	**50**		8	2	2	7	1	2	< 1.0	< 1.0	--	5.5
Thallium	ug/L	2	NA	2	**2**		**2.16**	< 2	2	**4**	**3**	< 2	< 2.0	**2.1**	--	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) JHC-MW-15004 was decommissioned on June 14th, 2018.
(3) 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 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15005												
						Sample Date:	12/5/2015	3/8/2016	6/22/2016	8/30/2016	11/15/2016	4/18/2017	6/20/2017	8/14/2017	9/25/2017	4/25/2018	6/19/2018	11/15/2018	4/25/2019	4/25/2019	10/9/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient													Field Dup	
Appendix III																					
Boron	ug/L	NC	NA	51	NA		275	959	1,370	706	1,500	524	468	546	481	--	227	1,450	2,800	2,900	1,200
Calcium	mg/L	NC	NA	46	NA		55.0	60.2	55.1	51.6	73.4	56.8	53.6	48.0	40.3	--	61.8	61.9	170	180	110
Chloride	mg/L	250*	NA	43	NA		27.7	42.0	46.9	19.2	29.3	64.2	50.4	27.1	21.8	--	90.9	30.6	28	28	30
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		51.2	53.0	57.9	46.5	61.8	58.3	66.0	64.9	61.9	--	74.3	133	240	320	130
Total Dissolved Solids	mg/L	500*	NA	258	NA		270	300	310	230	320	360	306	282	300	--	462	334	800	780	360
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.3	7.4	7.4	7.3	7.1	7.5	7.4	7.5	7.4	7.4	7.4	7.5	7.2	--	7.3
Appendix IV																					
Antimony	ug/L	6	NA	2	6		4	2	2	3	5	3	3.8	4.2	--	2.2	1.6	5.1	4.4	4.2	3.3
Arsenic	ug/L	10	NA	1	**10**		4	3	3	5	3	2	3.3	2.5	--	1.7	1.3	1.2	1.2	1.1	1.4
Barium	ug/L	2,000	NA	35	2,000		99	74	97	72	159	128	113	109	--	407	175	149	150	150	190
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		4	5	12	2	3	4	3.7	< 1.0	--	< 1.0	3.0	< 1.0	1.3	1.3	1.3
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**		**41.3**	25.5	28	31	**49**	38	39	36	--	**61**	35	28	38	38	**50**
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**		12	13	25	16	15	18	14.0	10	--	31.2	15.7	**222**	**900**	**870**	**370**
Radium-226	pCi/L	NC	NA	NA	NA		< 0.277	< 0.355	0.192	< 0.286	< 0.246	0.461	< 0.717	< 0.877	--	0.620	< 0.758	< 0.461	0.169	0.248	0.592
Radium-228	pCi/L	NC	NA	NA	NA		0.436	< 0.426	< 0.395	1.58	0.745	< 0.383	< 0.728	< 0.856	--	0.700	1.220	0.967	< 0.350	0.495	0.427
Radium-226/228	pCi/L	5	NA	1.93	5		0.564	< 0.426	< 0.395	1.78	0.974	0.841	< 1.45	< 1.73	--	1.32	1.91	1.41	< 0.350	0.743	1.02
Selenium	ug/L	50	NA	5	**50**		28	12	33	18	**165**	10	15.5	15.7	--	**368**	14	**158**	**140**	**130**	**66**
Thallium	ug/L	2	NA	2	**2**		**3.04**	< 2	2	2	**4**	< 2	< 2.0	< 2.0	--	**5.8**	**2.1**	< 2.0	2.0	<2.0	**2.9**

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) JHC-MW-15004 was decommissioned on June 14th, 2018.
(3) 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 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-18004					JHC-MW-18005						
						Sample Date:	12/7/2018	2/28/2019	4/25/2019	8/13/2019	10/9/2019	12/7/2018	2/28/2019	2/28/2019	4/25/2019	8/13/2019	8/13/2019	10/9/2019
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient											
Appendix III														Field Dup			Field Dup	
Boron	ug/L	NC	NA	51	NA		970	900	920	1,200	620	641	660	720	650	750	780	660
Calcium	mg/L	NC	NA	46	NA		48.9	55	72	97	73	32.5	43	42	41	43	45	55
Chloride	mg/L	250*	NA	43	NA		25.7	50	34	35	40	29.8	27	26	25	27	27	18
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		109	69	100	110	120	90	89	85	66	95	95	110
Total Dissolved Solids	mg/L	500*	NA	258	NA		306	330	380	490	310	234	280	260	250	270	290	330
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.0	7.6 (3)	7.2	7.5	7.2	8.8	8.6 (3)	--	9.0	8.9	--	8.8
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	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	10	NA	1	**10**		1.0	< 1.0	1.1	1.2	1.1	9.5	10	**11**	8.8	7.4	7.3	7.1
Barium	ug/L	2,000	NA	35	2,000		92.6	170	220	680	270	58.1	72	73	73	120	120	150
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
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	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	NA	2	100		< 1.0	1.2	2.0	1.8	1.3	1.5	4.0	4.1	2.8	2.3	2.4	1.9
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
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		< 1.0	< 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
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
Molybdenum	ug/L	NC	100	5	**100**		7.4	7.4	8.2	9.0	10	18.6	14	15	14	15	15	66
Radium-226	pCi/L	NC	NA	NA	NA		< 0.695	< 0.0742	0.110	0.352	0.179	< 0.567	< 0.0795	<0.0779	< 0.0785	< 0.145	0.150	0.497
Radium-228	pCi/L	NC	NA	NA	NA		< 0.708	0.589	< 0.430	0.469	0.672	< 0.760	< 0.386	<0.337	< 0.357	< 0.400	< 0.374	0.456
Radium-226/228	pCi/L	5	NA	1.93	5		< 1.40	0.654	< 0.430	0.822	0.851	< 1.33	< 0.386	<0.337	< 0.357	< 0.400	< 0.374	0.953
Selenium	ug/L	50	NA	5	**50**		7.3	12	12	39	33	42.0	35	34	16	11	11	**140**
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

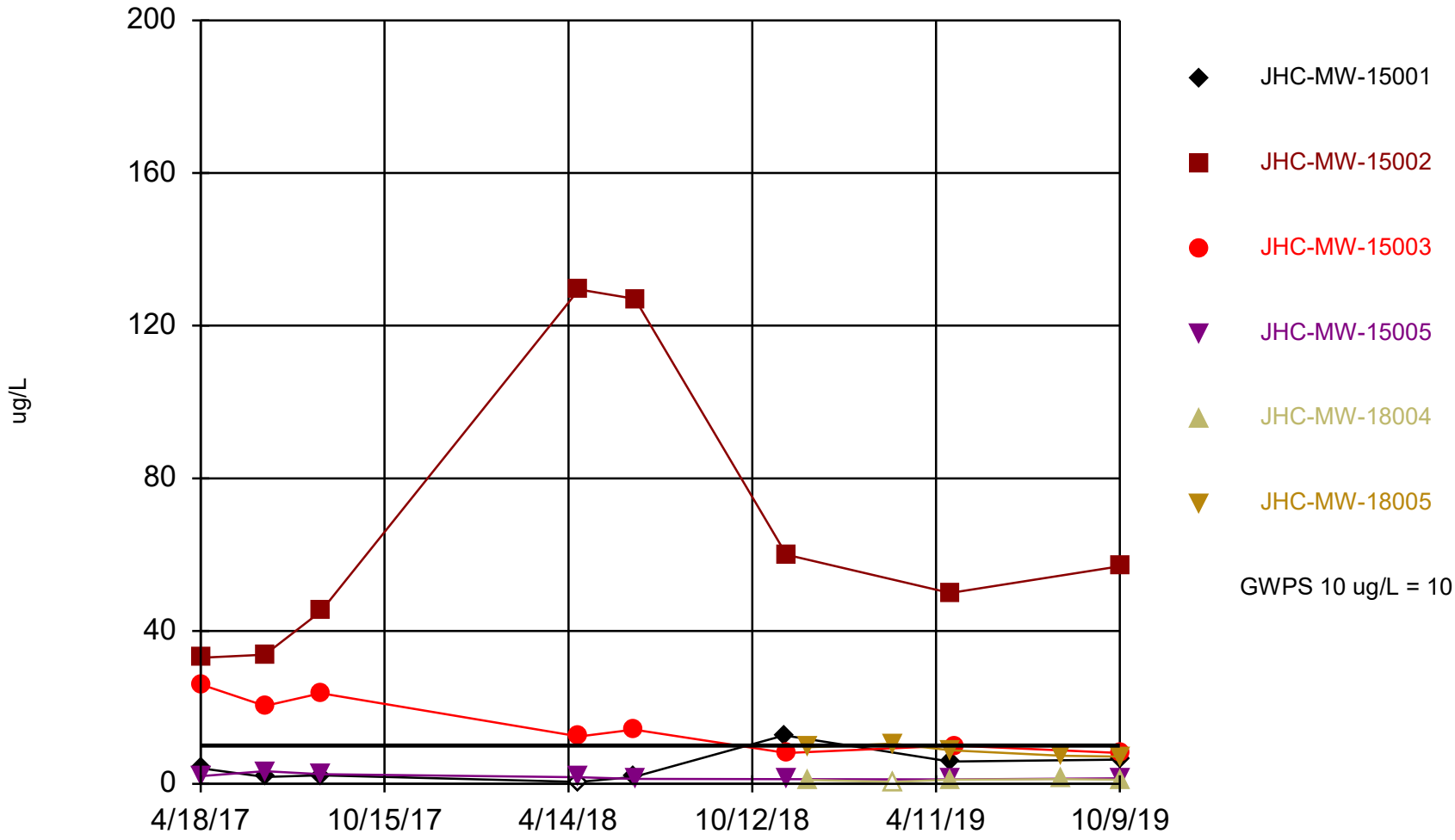
Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) pH value potentially biased high due to groundwater quality meter malfunction.
(2) JHC-MW-15004 was decommissioned on June 14th, 2018.
(3) 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

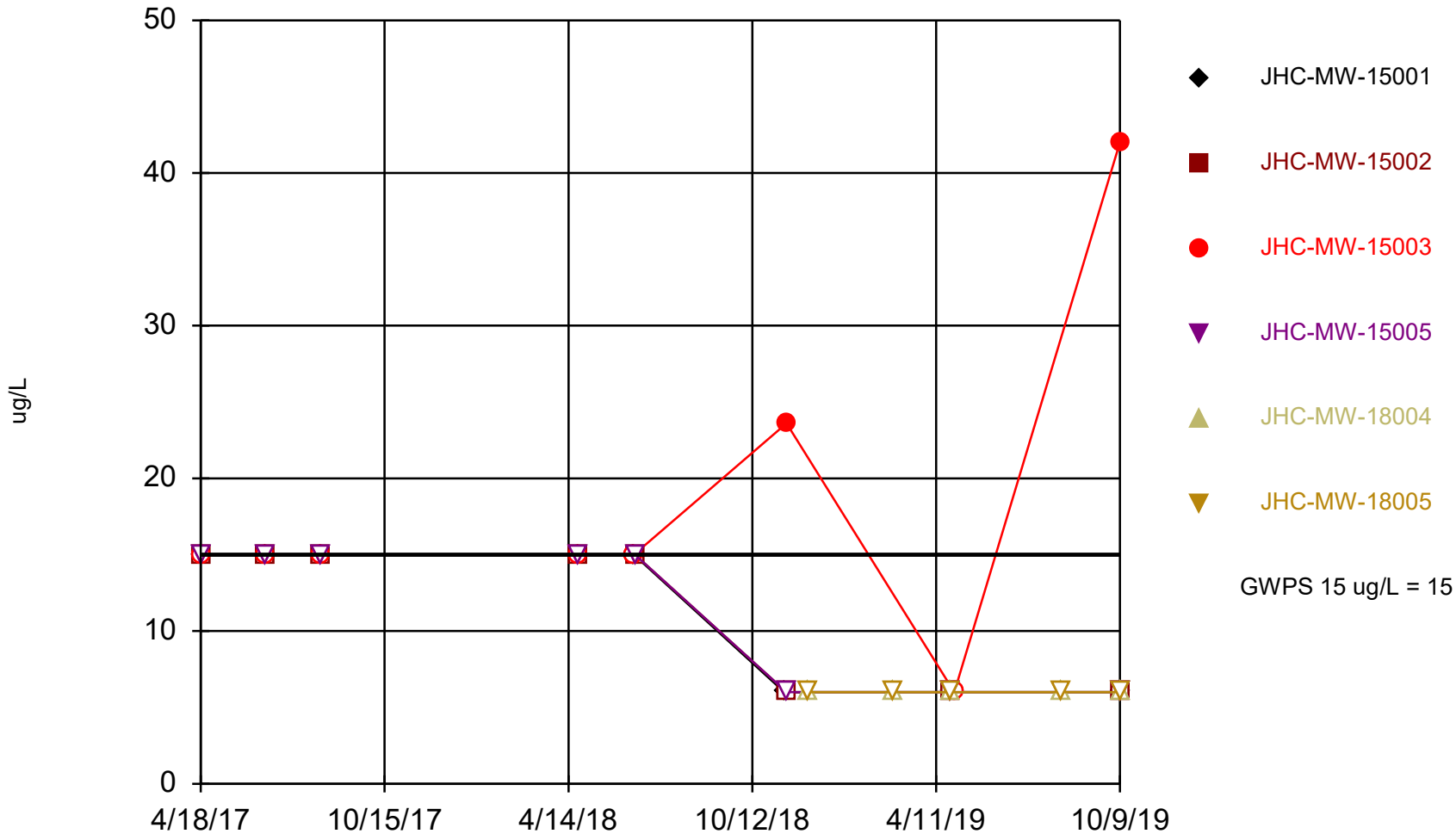


Constituent: Arsenic, Total Analysis Run 12/10/2019 6:47 AM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

Hollow symbols indicate censored values.

Time Series

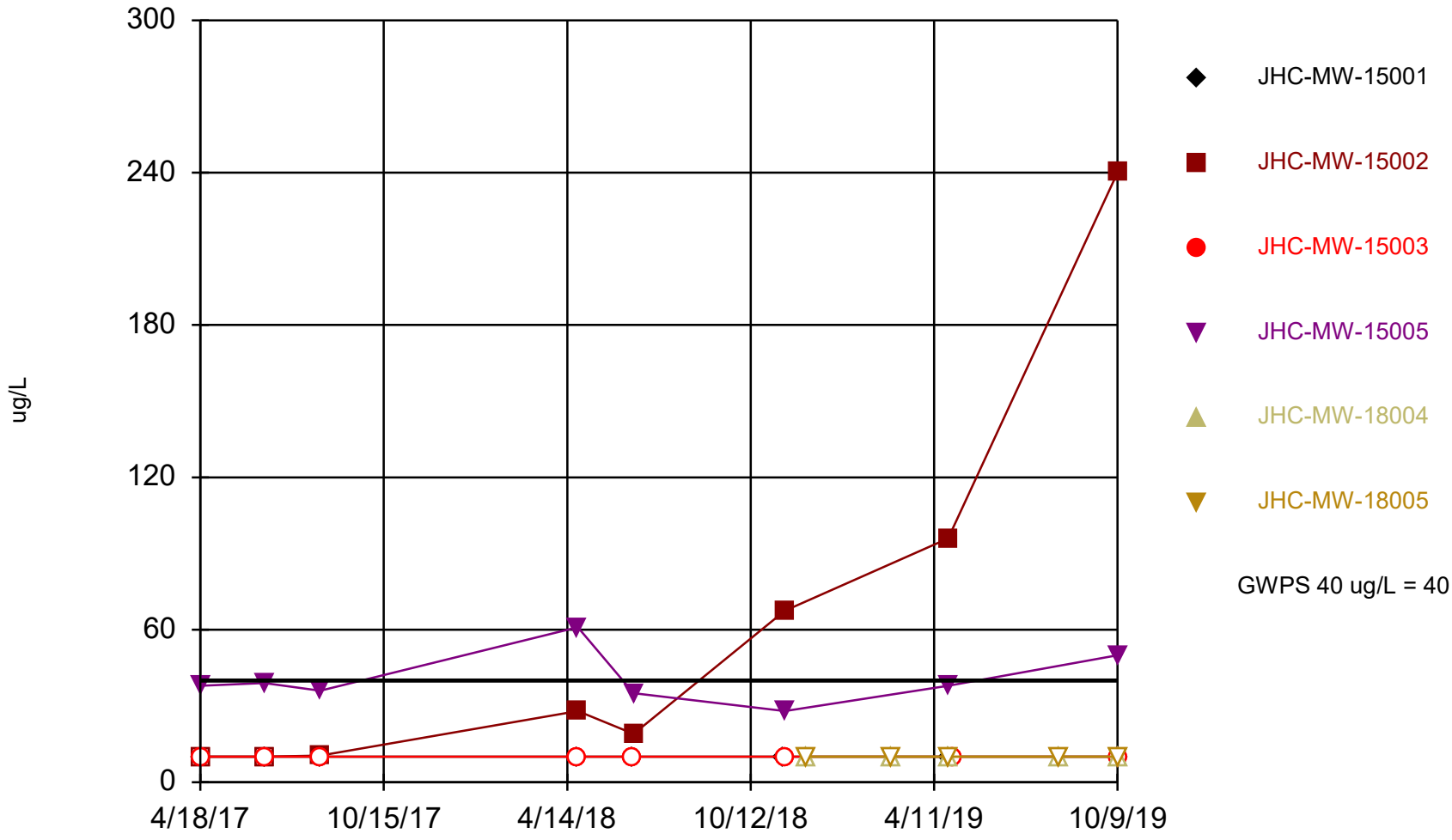


Constituent: Cobalt, Total Analysis Run 12/10/2019 6:48 AM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

Hollow symbols indicate censored values.

Time Series

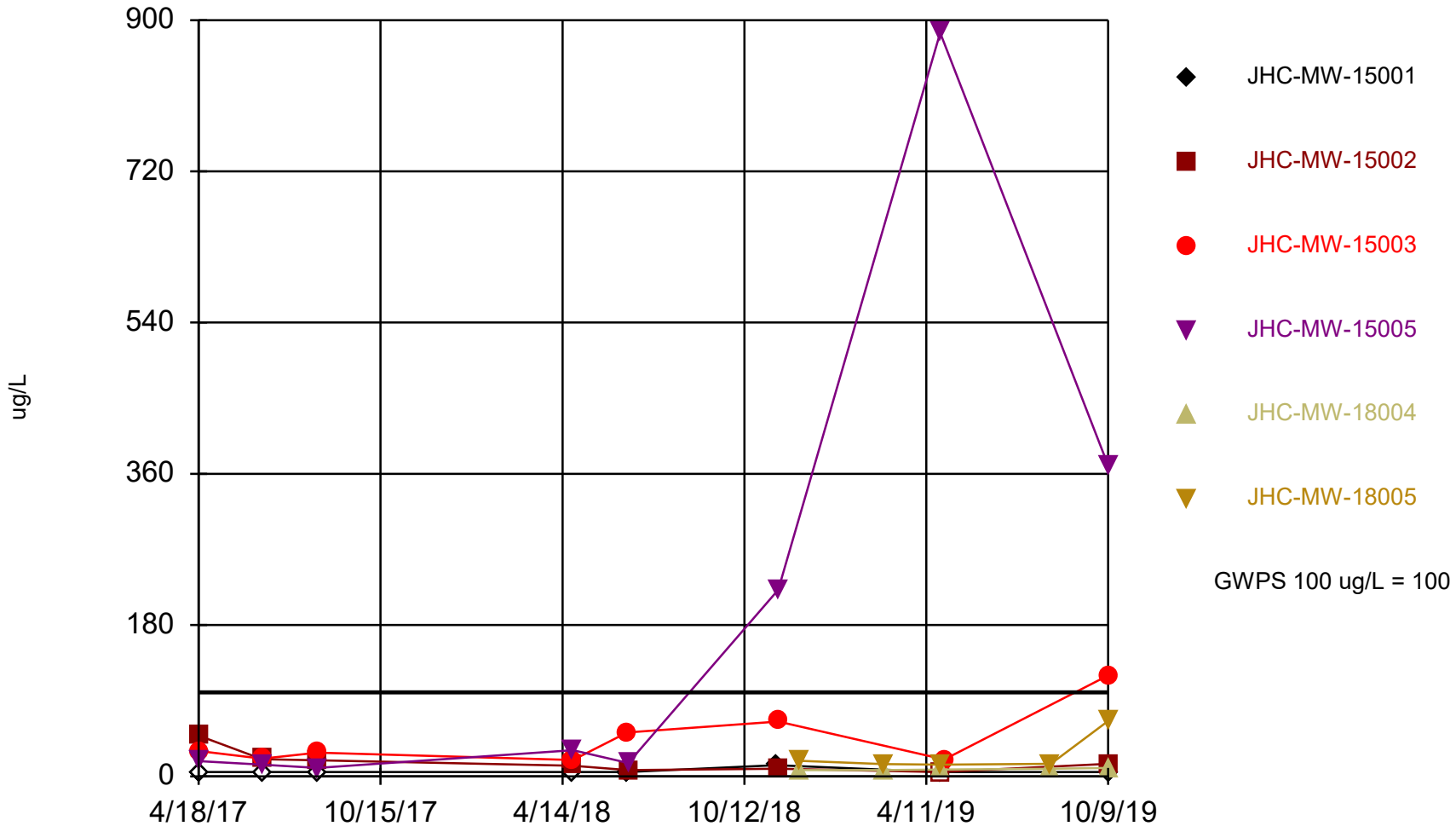


Constituent: Lithium, Total Analysis Run 12/10/2019 6:48 AM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

Hollow symbols indicate censored values.

Time Series

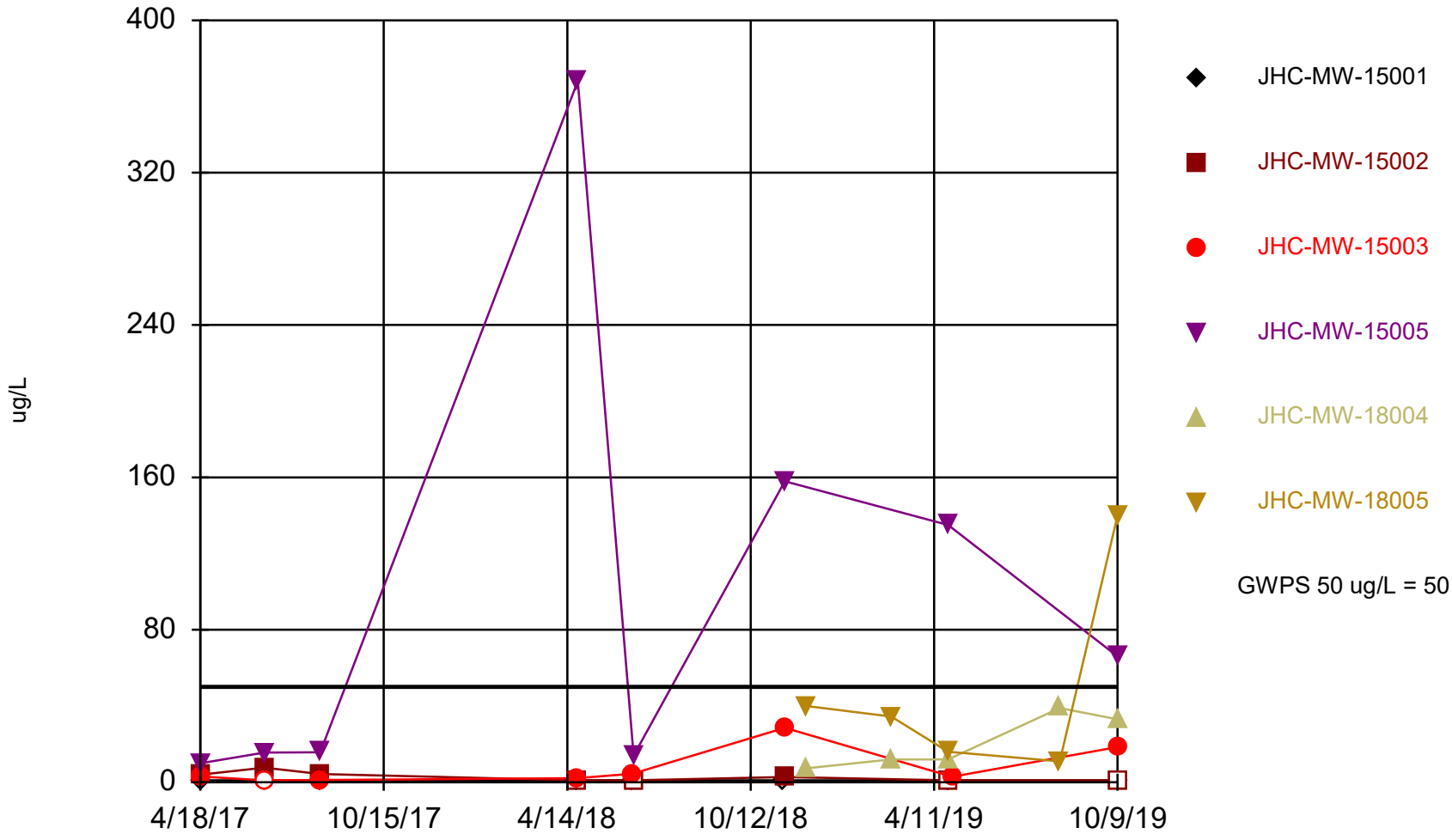


Constituent: Molybdenum, Total Analysis Run 12/10/2019 6:49 AM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

Hollow symbols indicate censored values.

Time Series

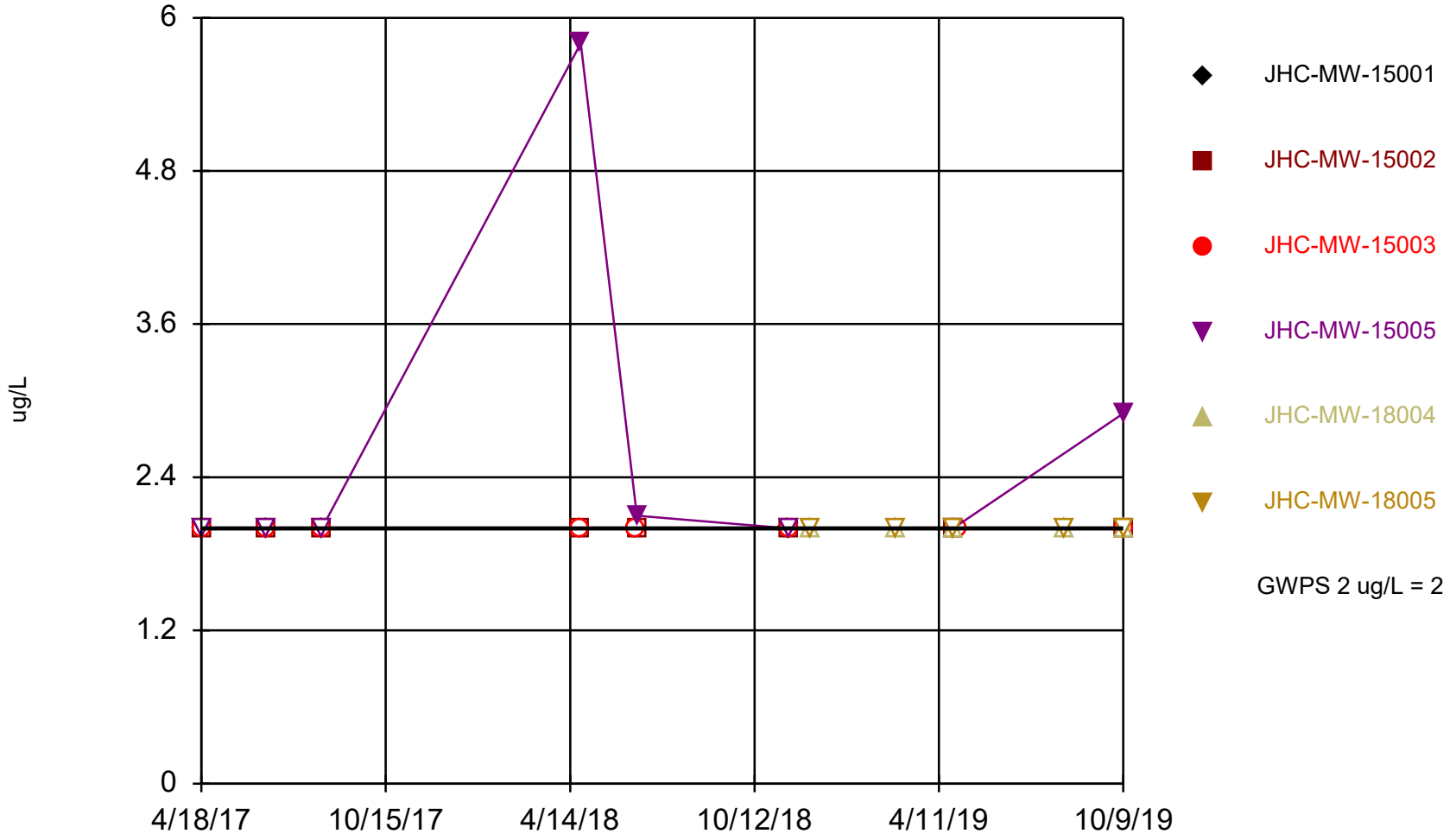


Constituent: Selenium, Total Analysis Run 12/10/2019 6:49 AM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

Hollow symbols indicate censored values.

Time Series



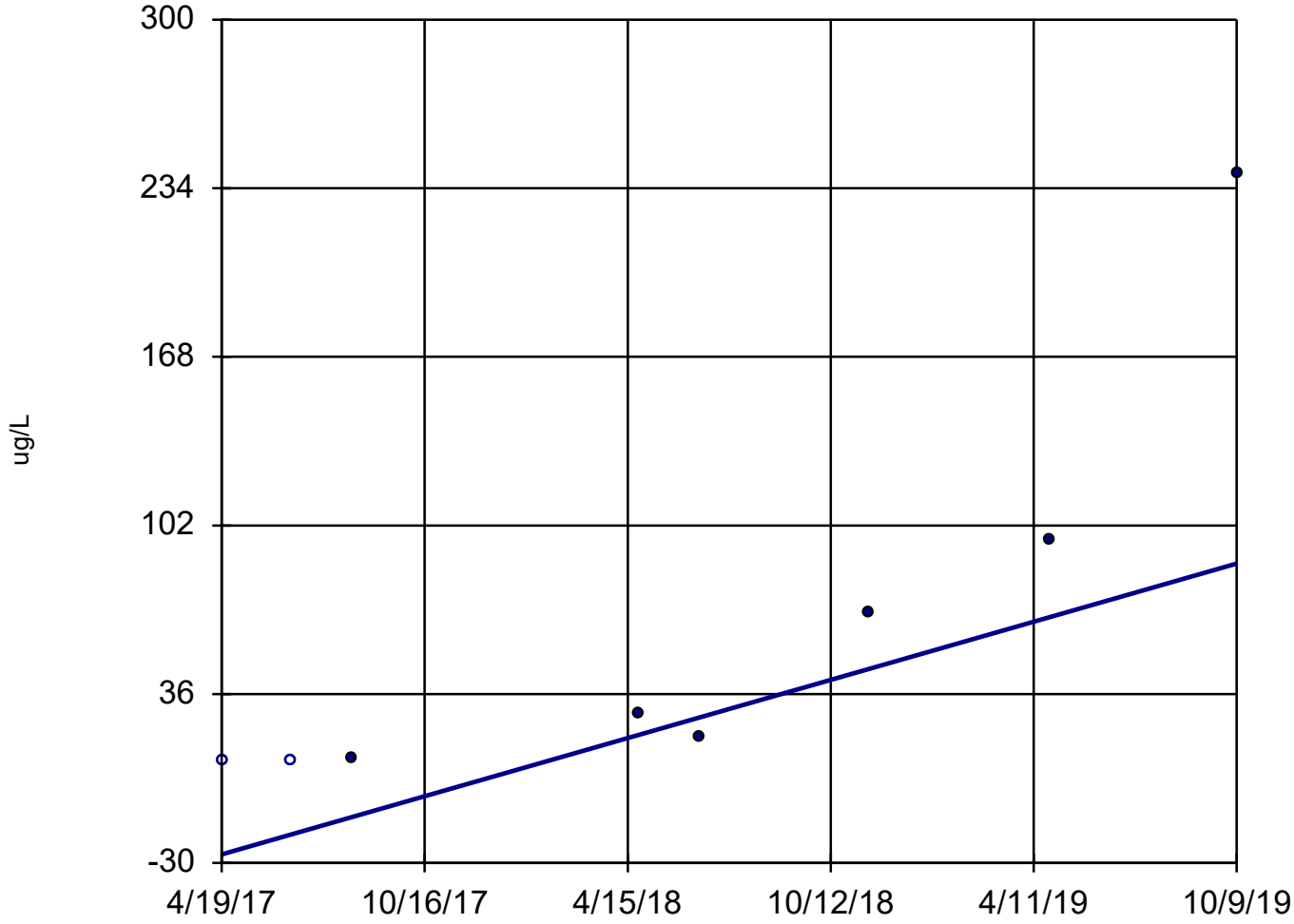
Constituent: Thallium, Total Analysis Run 12/10/2019 6:50 AM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

Hollow symbols indicate censored values.

Sen's Slope Estimator

JHC-MW-15002



n = 8

Slope = 46
units per year.

Mann-Kendall
statistic = 25
critical = 20

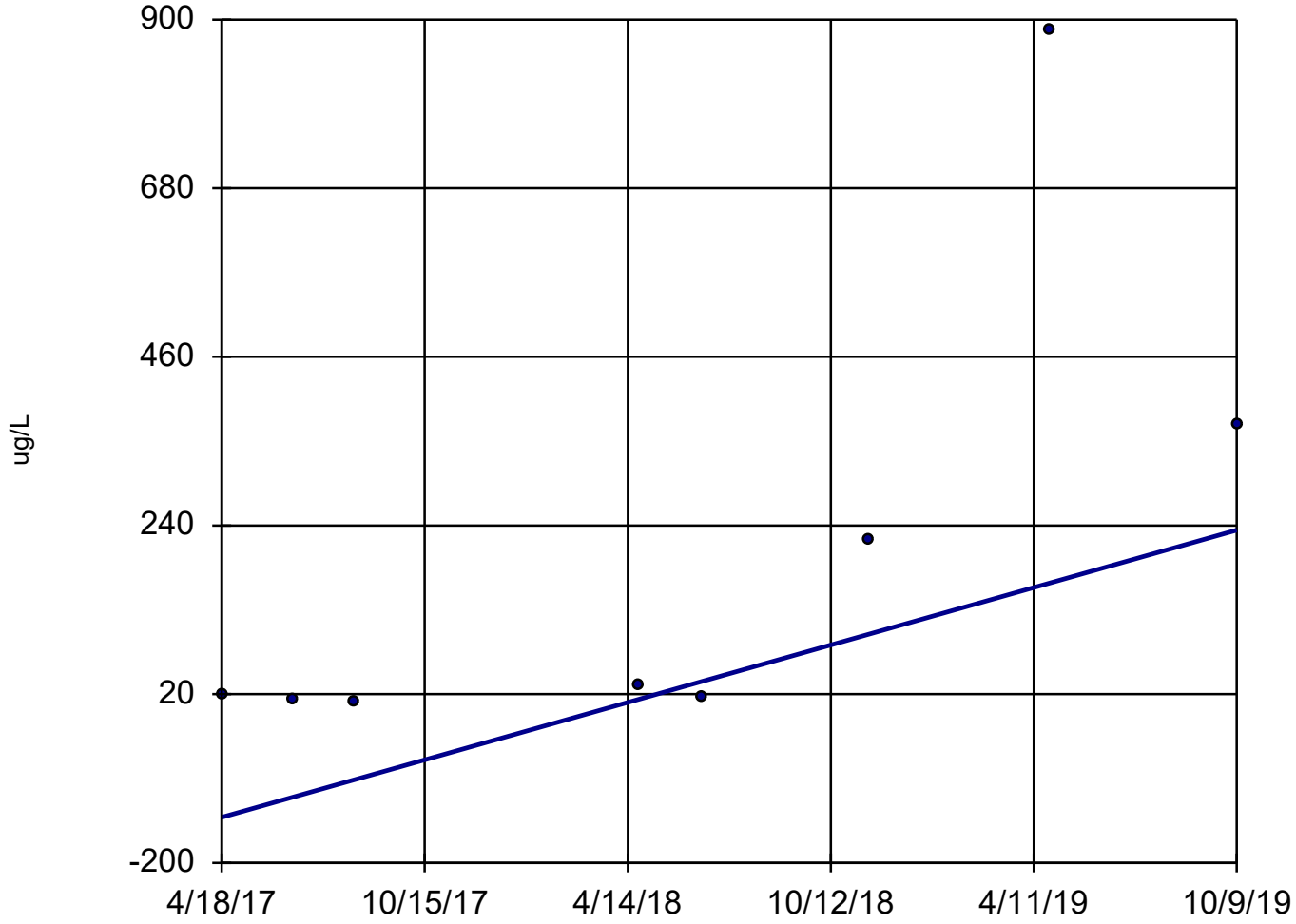
Increasing trend
significant at 98%
confidence level
(α = 0.01 per
tail).

Constituent: Lithium, Total Analysis Run 12/10/2019 6:50 AM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

Sen's Slope Estimator

JHC-MW-15005



n = 8

Slope = 151.2 units per year.

Mann-Kendall statistic = 16
critical = 20

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

Constituent: Molybdenum, Total Analysis Run 12/17/2019 8:18 AM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

Summary Report

Constituent: Arsenic, Total Analysis Run 12/10/2019 6:47 AM
Client: Consumers Energy Data: JHC_Sanitas_19.11.14

For observations made between 4/18/2017 and 10/9/2019, a summary of the selected data set:

Observations = 42
ND/Trace = 2
Wells = 6
Minimum Value = 1
Maximum Value = 129.5
Mean Value = 18.03
Median Value = 7.225
Standard Deviation = 29.55
Coefficient of Variation = 1.639
Skewness = 2.664

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	8	1	1	12.7	4.45	3.1	3.864	0.8683	1.272
JHC-MW-15002	8	0	33	129.5	66.93	53.5	39.06	0.5836	0.9476
JHC-MW-15003	8	0	8.05	26	15.36	13.3	7.103	0.4625	0.41
JHC-MW-15005	8	0	1.15	3.3	1.819	1.55	0.754	0.4146	1.005
JHC-MW-18004	5	1	1	1.2	1.08	1.1	0.08367	0.07747	0.3436
JHC-MW-18005	5	0	7.1	10.5	8.67	8.8	1.452	0.1675	0.06981

Summary Report

Constituent: Cobalt, Total Analysis Run 12/10/2019 6:47 AM
Client: Consumers Energy Data: JHC_Sanitas_19.11.14

For observations made between 4/18/2017 and 10/9/2019, a summary of the selected data set:

Observations = 42
ND/Trace = 40
Wells = 6
Minimum Value = 6
Maximum Value = 42
Mean Value = 11.56
Median Value = 15
Standard Deviation = 6.855
Coefficient of Variation = 0.5929
Skewness = 2.094

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	8	8	6	15	11.63	15	4.658	0.4007	-0.5164
JHC-MW-15002	8	8	6	15	11.63	15	4.658	0.4007	-0.5164
JHC-MW-15003	8	6	6	42	18.33	15	10.66	0.5817	1.432
JHC-MW-15005	8	8	6	15	11.63	15	4.658	0.4007	-0.5164
JHC-MW-18004	5	5	6	6	6	6	0	0	NaN
JHC-MW-18005	5	5	6	6	6	6	0	0	NaN

Summary Report

Constituent: Lithium, Total Analysis Run 12/10/2019 6:47 AM
Client: Consumers Energy Data: JHC_Sanitas_19.11.14

For observations made between 4/18/2017 and 10/9/2019, a summary of the selected data set:

Observations = 42
ND/Trace = 28
Wells = 6
Minimum Value = 10
Maximum Value = 240
Mean Value = 25.38
Median Value = 10
Standard Deviation = 38.98
Coefficient of Variation = 1.536
Skewness = 4.282

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	8	8	10	10	10	10	0	0	NaN
JHC-MW-15002	8	2	10	240	60.13	23.5	79.2	1.317	1.657
JHC-MW-15003	8	8	10	10	10	10	0	0	NaN
JHC-MW-15005	8	0	28	61	40.63	38	10.23	0.2517	0.9932
JHC-MW-18004	5	5	10	10	10	10	0	0	NaN
JHC-MW-18005	5	5	10	10	10	10	0	0	NaN

Summary Report

Constituent: Molybdenum, Total Analysis Run 12/10/2019 6:47 AM
Client: Consumers Energy Data: JHC_Sanitas_19.11.14

For observations made between 4/18/2017 and 10/9/2019, a summary of the selected data set:

Observations = 42
ND/Trace = 8
Wells = 6
Minimum Value = 5
Maximum Value = 885
Mean Value = 54.21
Median Value = 14.75
Standard Deviation = 146.7
Coefficient of Variation = 2.705
Skewness = 4.754

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	8	7	5	13.3	6.038	5	2.934	0.486	2.268
JHC-MW-15002	8	1	5	48	17.07	13.83	13.6	0.797	1.601
JHC-MW-15003	8	0	19.3	120	44.5	29.1	34.74	0.7807	1.416
JHC-MW-15005	8	0	10	885	195.7	24.6	308.2	1.574	1.589
JHC-MW-18004	5	0	7.4	10	8.4	8.2	1.114	0.1326	0.4664
JHC-MW-18005	5	0	14	66	25.59	15	22.66	0.8854	1.478

Summary Report

Constituent: Selenium, Total Analysis Run 12/10/2019 6:47 AM
Client: Consumers Energy Data: JHC_Sanitas_19.11.14

For observations made between 4/18/2017 and 10/9/2019, a summary of the selected data set:

Observations = 42
ND/Trace = 13
Wells = 6
Minimum Value = 1
Maximum Value = 368
Mean Value = 29.03
Median Value = 5.875
Standard Deviation = 65.4
Coefficient of Variation = 2.253
Skewness = 3.814

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	8	8	1	1	1	1	0	0	NaN
JHC-MW-15002	8	4	1	7.55	2.813	1.825	2.367	0.8418	1.007
JHC-MW-15003	8	1	1	28.6	7.719	2.95	10.2	1.321	1.346
JHC-MW-15005	8	0	10	368	97.78	40.85	123.8	1.266	1.417
JHC-MW-18004	5	0	7.3	39	20.66	12	14.29	0.6918	0.4178
JHC-MW-18005	5	0	11	140	48.29	34.5	52.69	1.091	1.305

Summary Report

Constituent: Thallium, Total Analysis Run 12/10/2019 6:47 AM
Client: Consumers Energy Data: JHC_Sanitas_19.11.14

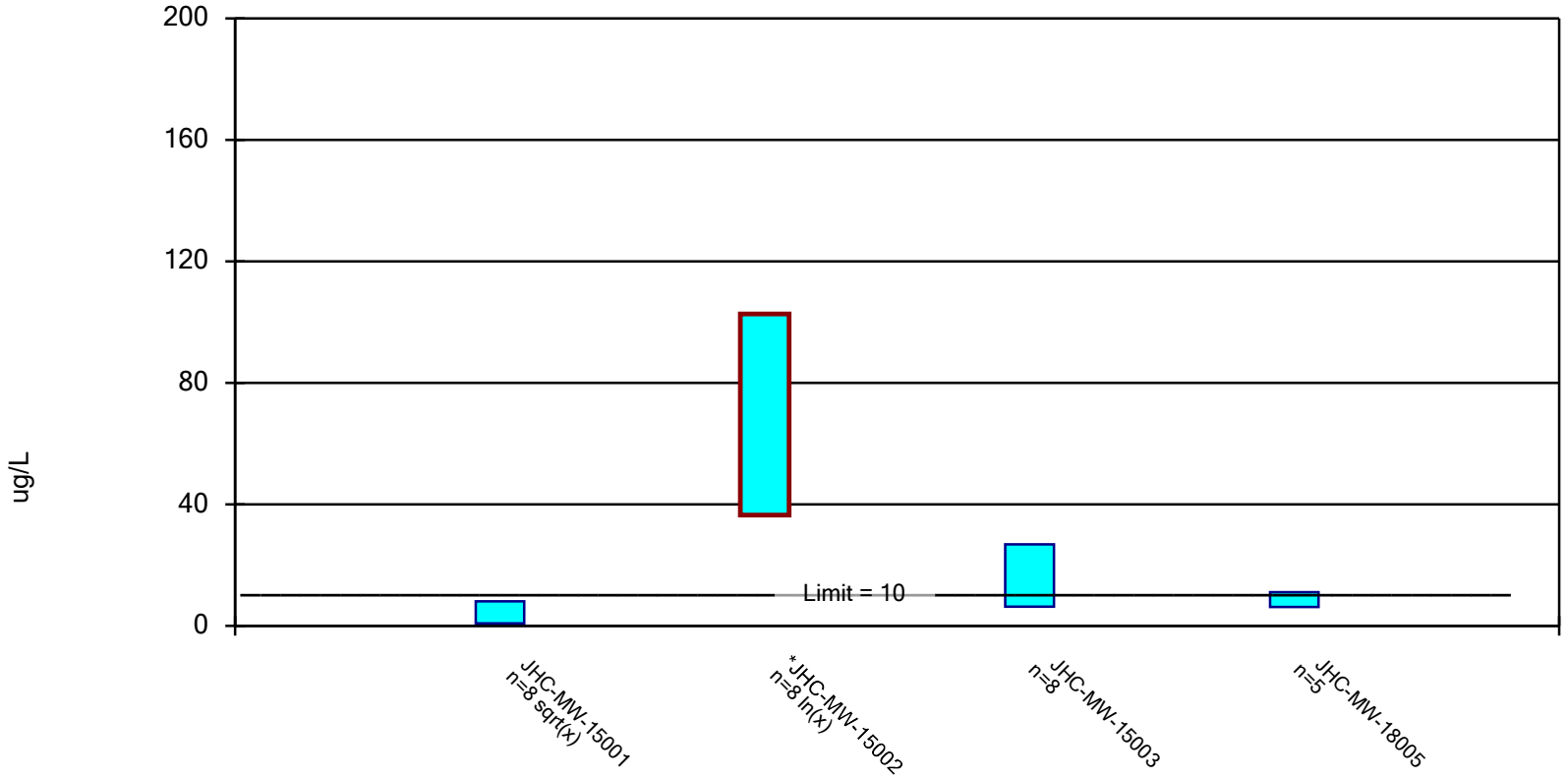
For observations made between 4/18/2017 and 10/9/2019, a summary of the selected data set:

Observations = 42
ND/Trace = 38
Wells = 6
Minimum Value = 2
Maximum Value = 5.8
Mean Value = 2.114
Median Value = 2
Standard Deviation = 0.599
Coefficient of Variation = 0.2833
Skewness = 5.8

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15001	8	8	2	2	2	2	0	0	NaN
JHC-MW-15002	8	8	2	2	2	2	0	0	NaN
JHC-MW-15003	8	8	2	2	2	2	0	0	NaN
JHC-MW-15005	8	4	2	5.8	2.6	2	1.33	0.5115	2.051
JHC-MW-18004	5	5	2	2	2	2	0	0	NaN
JHC-MW-18005	5	5	2	2	2	2	0	0	NaN

Parametric Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Arsenic, Total Analysis Run 12/10/2019 5:33 PM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

Confidence Interval

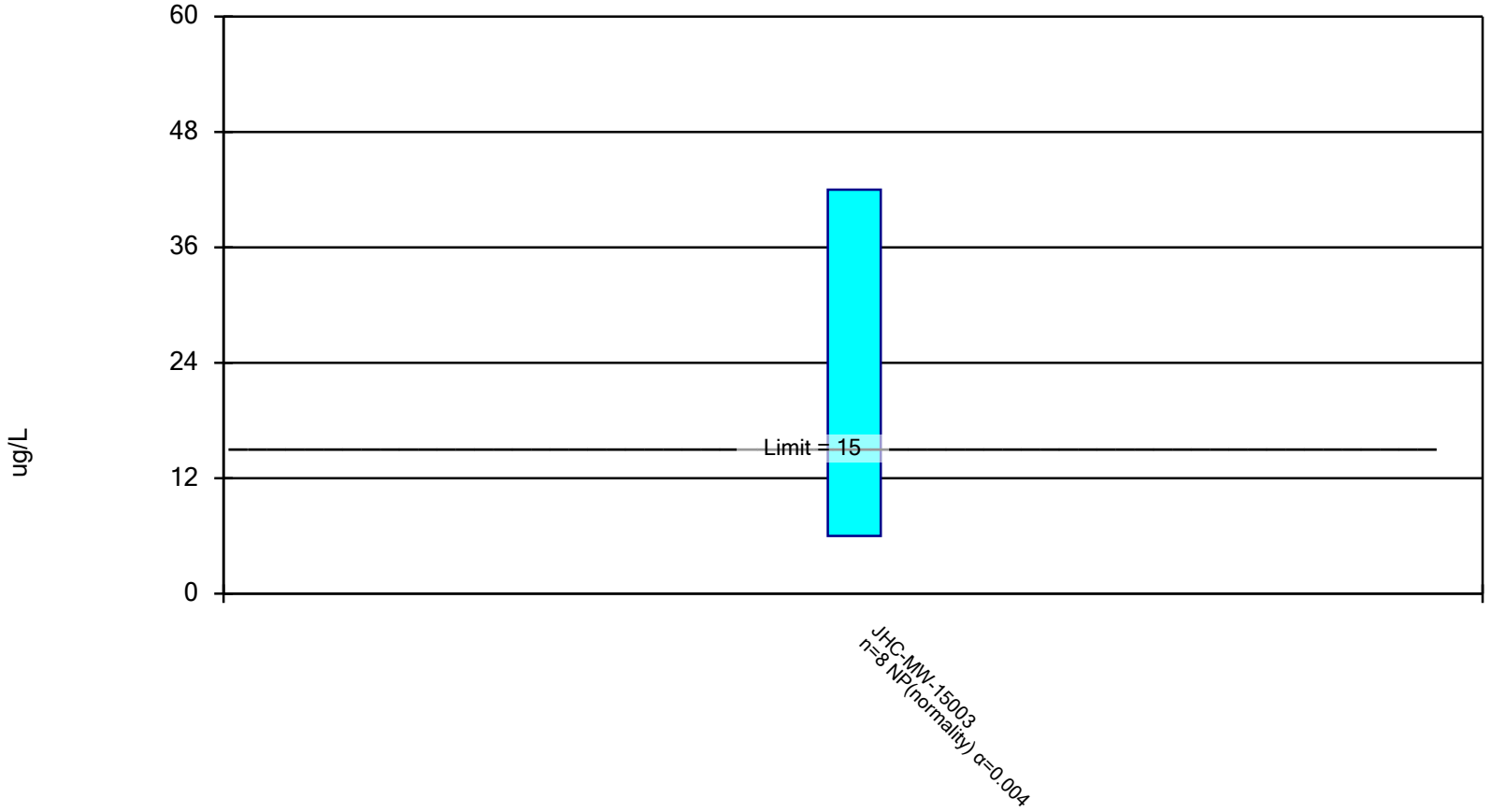
Constituent: Arsenic, Total (ug/L) Analysis Run 12/10/2019 5:35 PM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

	JHC-MW-15001	JHC-MW-15002	JHC-MW-15003	JHC-MW-18005
11/15/2016	3	46	36	
6/20/2017	1.8	33.8 (D)	20.4	
8/14/2017	2.2	45.15 (D)	23.7	
4/25/2018	<1	129.5 (D)	12.4	
6/18/2018	1.8		14.2 (D)	
6/19/2018		127		
11/13/2018	12.7			
11/15/2018		60 (D)	8.1	
12/7/2018				9.6 (D)
2/28/2019				10.5 (D)
4/25/2019	5.8	50		8.8
4/29/2019			10	
8/13/2019				7.35 (D)
10/9/2019	6.3	57	8.05 (D)	7.1
Mean	4.263	68.56	16.61	8.67
Std. Dev.	3.961	37.69	9.662	1.452
Upper Lim.	8.053	102.7	26.85	11.1
Lower Lim.	0.8725	36.5	6.365	6.236

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: Cobalt, Total Analysis Run 12/17/2019 8:24 AM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

Confidence Interval

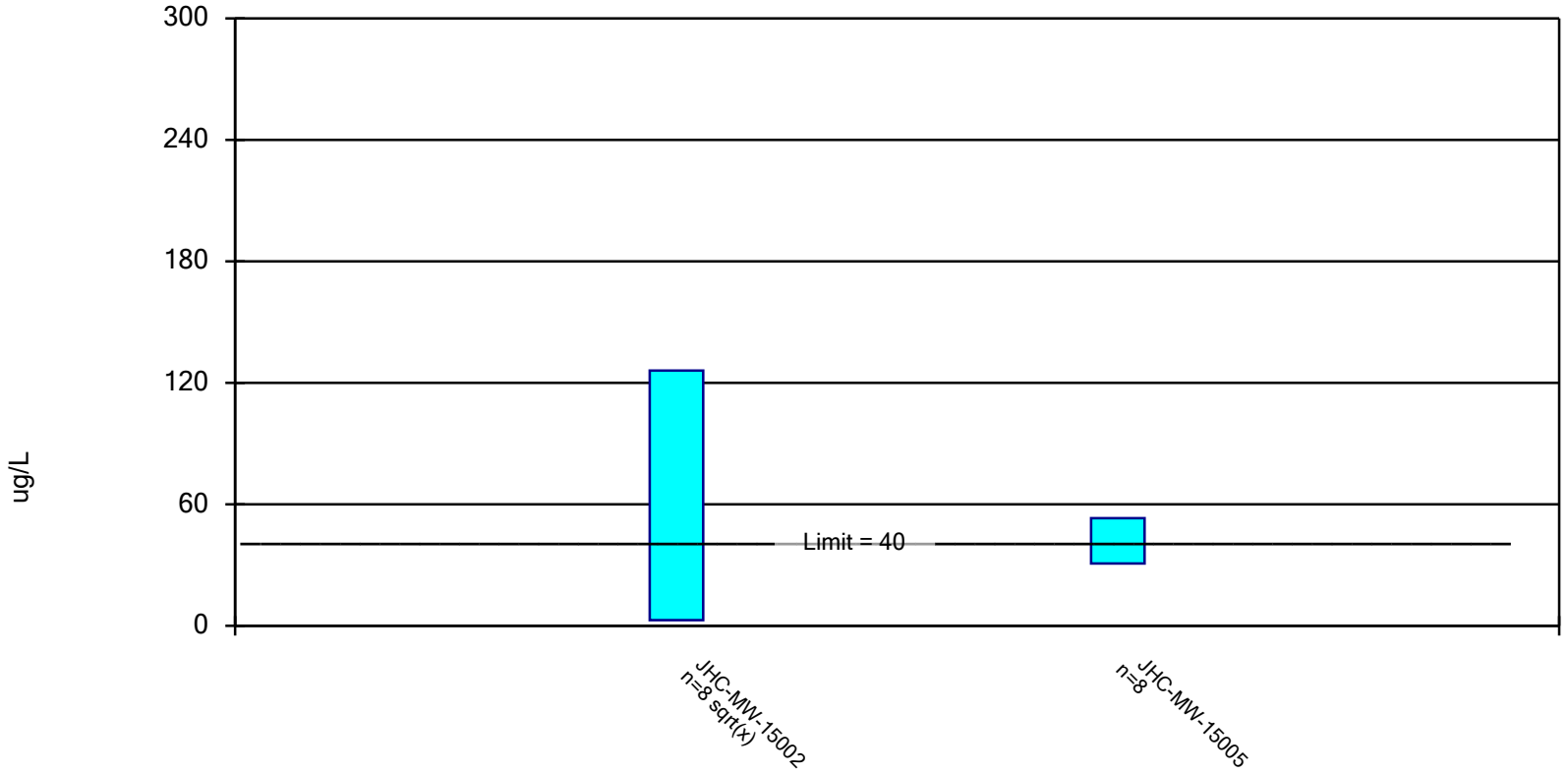
Constituent: Cobalt, Total (ug/L) Analysis Run 12/17/2019 8:25 AM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

	JHC-MW-15003
4/18/2017	<15
6/20/2017	<15
8/14/2017	<15
4/25/2018	<15
6/18/2018	<15 (D)
11/15/2018	23.6
4/29/2019	<6
10/9/2019	42 (D)
Mean	18.33
Std. Dev.	10.66
Upper Lim.	42
Lower Lim.	6

Parametric Confidence Interval

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



Constituent: Lithium, Total Analysis Run 12/10/2019 5:36 PM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

Confidence Interval

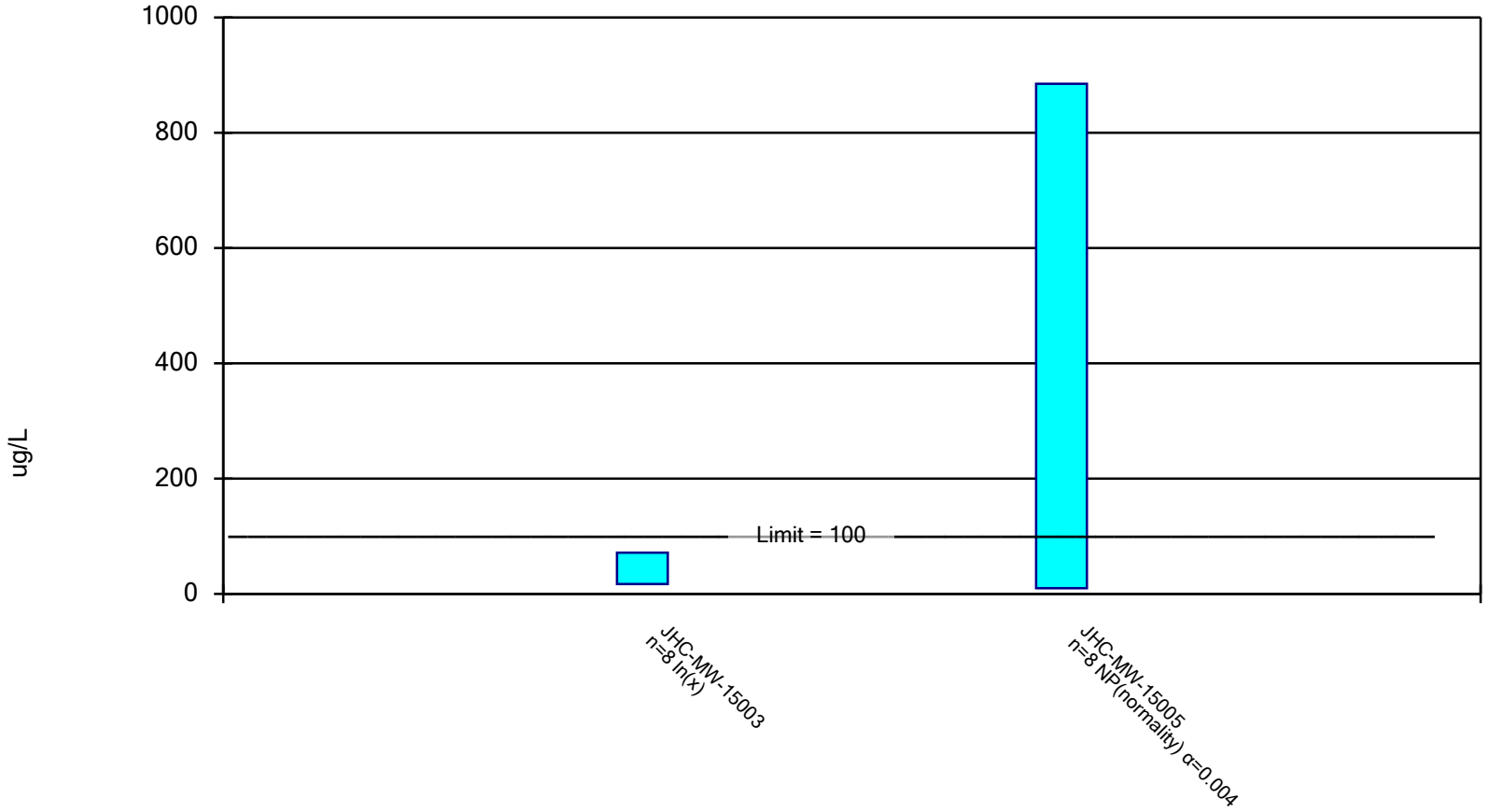
Constituent: Lithium, Total (ug/L) Analysis Run 12/10/2019 5:37 PM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

	JHC-MW-15002	JHC-MW-15005
11/15/2016	11	49
6/20/2017	<10 (D)	39
8/14/2017	8 (D)	36
4/25/2018	28 (D)	61
6/19/2018	19	35
11/15/2018	67.5 (D)	28
4/25/2019	96	38 (D)
10/9/2019	240	50
Mean	59.31	42
Std. Dev.	79.81	10.56
Upper Lim.	126	53.19
Lower Lim.	2.756	30.81

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 12/10/2019 5:37 PM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

Confidence Interval

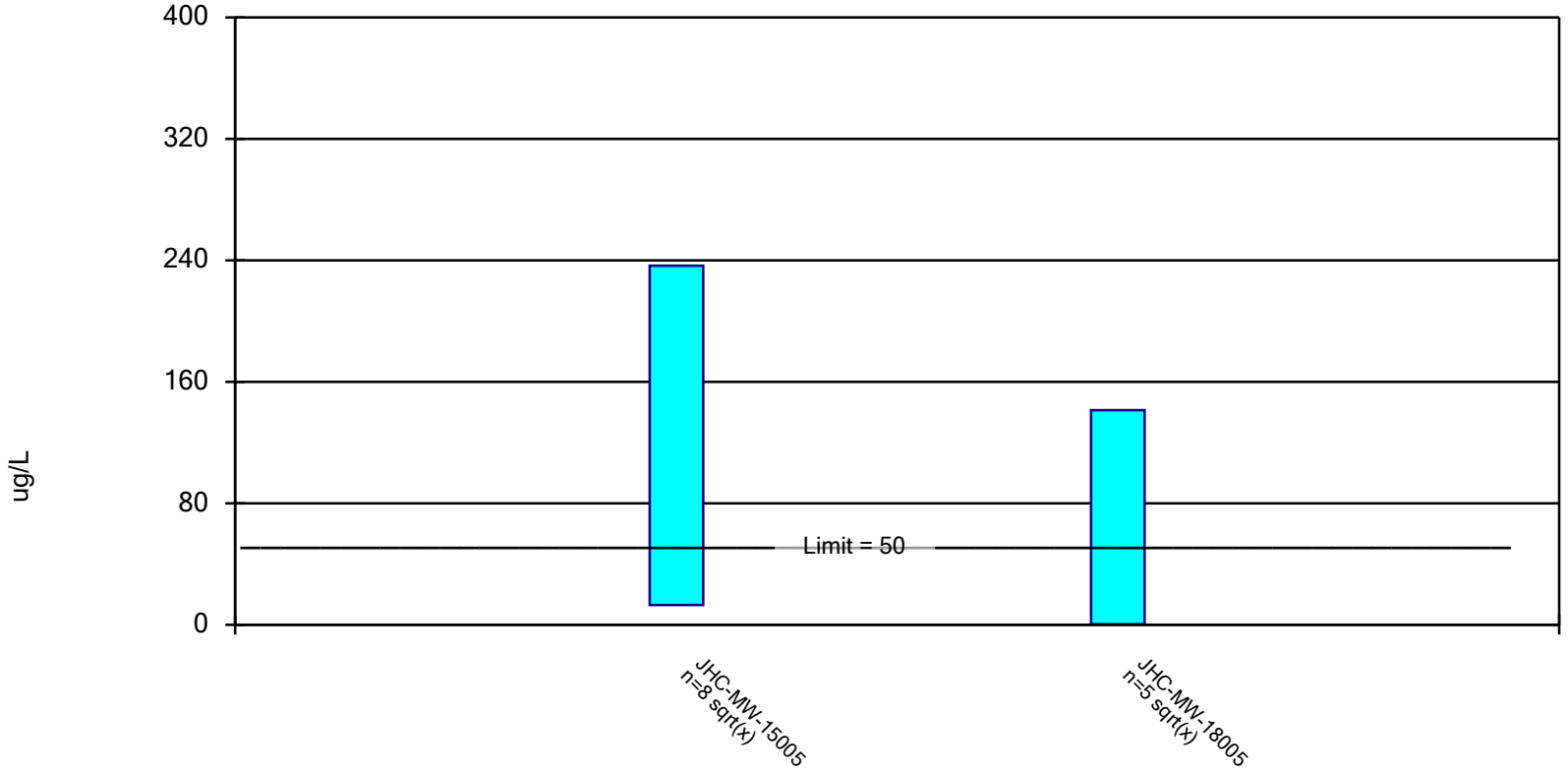
Constituent: Molybdenum, Total (ug/L) Analysis Run 12/10/2019 5:38 PM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

	JHC-MW-15003	JHC-MW-15005
11/15/2016	24	15
6/20/2017	21.1	14
8/14/2017	28.2	10
4/25/2018	19.3	31.2
6/18/2018	52.1 (D)	
6/19/2018		15.7
11/15/2018	65.3	222
4/25/2019		885 (D)
4/29/2019	20	
10/9/2019	120 (D)	370
Mean	43.75	195.4
Std. Dev.	35.16	308.4
Upper Lim.	71.48	885
Lower Lim.	17.13	10

Parametric Confidence Interval

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



Constituent: Selenium, Total Analysis Run 12/10/2019 5:39 PM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

Confidence Interval

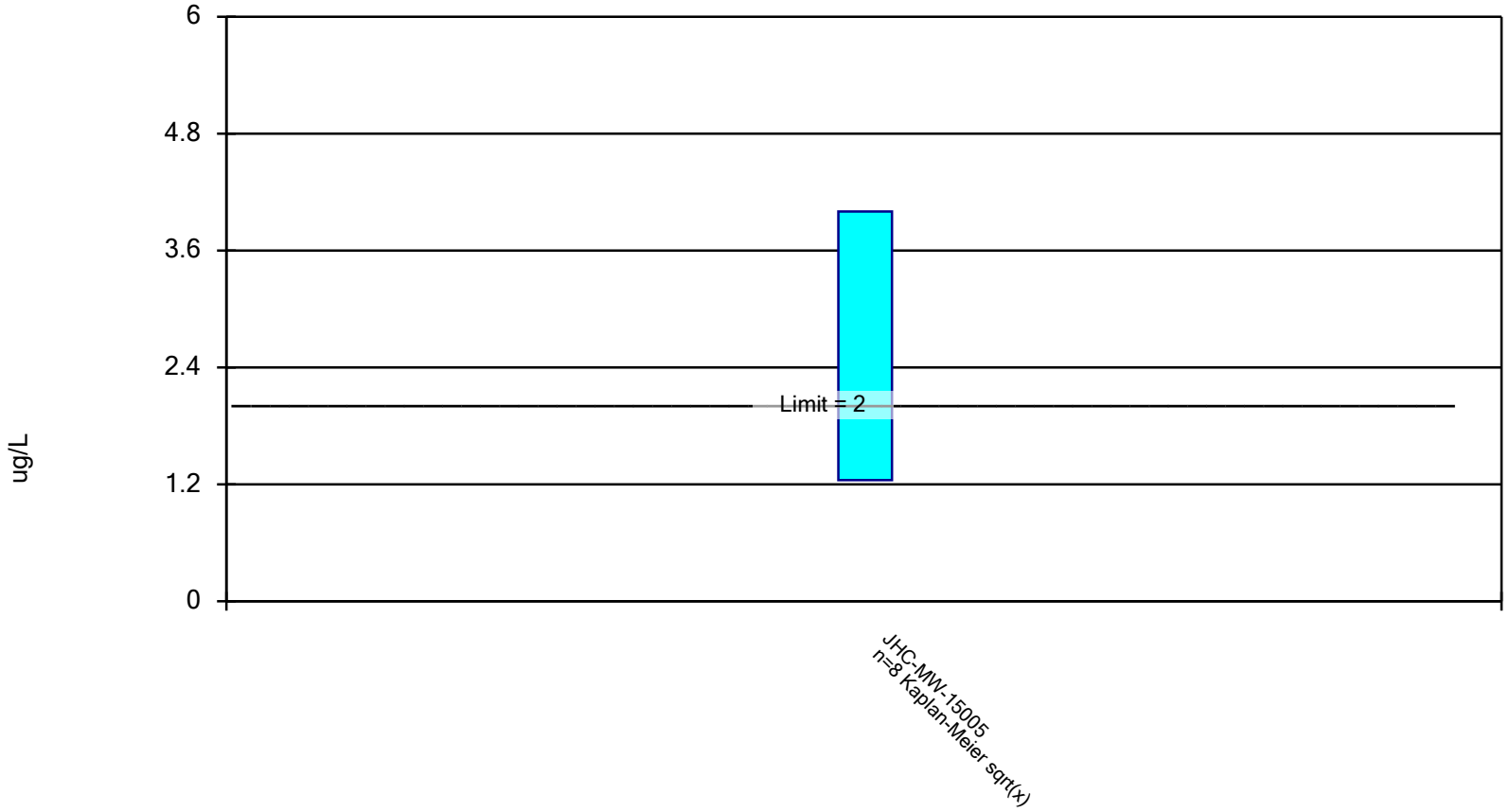
Constituent: Selenium, Total (ug/L) Analysis Run 12/10/2019 5:39 PM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

	JHC-MW-15005	JHC-MW-18005
11/15/2016	165	
6/20/2017	15.5	
8/14/2017	15.7	
4/25/2018	368	
6/19/2018	14	
11/15/2018	158	
12/7/2018		39.95 (D)
2/28/2019		34.5 (D)
4/25/2019	135 (D)	16
8/13/2019		11 (D)
10/9/2019	66	140
Mean	117.2	48.29
Std. Dev.	120.2	52.69
Upper Lim.	236.5	141.3
Lower Lim.	13.08	0.4224

Parametric Confidence Interval

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



Constituent: Thallium, Total Analysis Run 12/10/2019 5:45 PM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

Confidence Interval

Constituent: Thallium, Total (ug/L) Analysis Run 12/10/2019 5:45 PM

Client: Consumers Energy Data: JHC_Sanitas_19.11.14

	JHC-MW-15005
11/15/2016	4
6/20/2017	<2
8/14/2017	<2
4/25/2018	5.8
6/19/2018	2.1
11/15/2018	<2
4/25/2019	1.5 (D)
10/9/2019	2.9
Mean	2.413
Std. Dev.	1.738
Upper Lim.	4
Lower Lim.	1.243

Appendix H
ACM Extension Certification

Consumers Energy
Count on Us®

A CMS Energy Company

Date: July 12, 2019

To: Operating Record

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

RE: Demonstration for 60-Day Extension for Assessment of Corrective Measures
Professional Engineer Certification
JH Campbell Unit 1&2 Bottom Ash Pond and JH Campbell Pond A

Professional Engineer Certification Statement [§257.96(a)]

Consumers Energy has determined that the analysis of the effectiveness of potential corrective measures in meeting all of the requirements and objectives of a selected remedy described in §257.97 cannot be achieved within the 90-day timeline to complete the Assessment of Corrective Measures for JH Campbell Unit 1&2 Bottom Ash Pond and JH Campbell Pond A due to site-specific conditions that are changing based on initiating closure activities. Notification was made September 7, 2018 and September 17, 2018 for JH Campbell Unit 1&2 Bottom Ash Pond and JH Campbell Pond A, respectively, that closure activities had been initiated. Groundwater monitoring data collected to date indicates changing conditions that can influence factors that must be considered in the assessment, including source evaluation, plume delineation, groundwater assessment, and source control. The final published rule allows for a single 60 day extension based on site-specific conditions or circumstances.

I hereby attest that, having reviewed the detection and assessment monitoring documentation and being familiar with the provisions of Title 40 of the Code of Federal Regulations §257.96, that the demonstration justifying a 60-day time extension to the 90-day completion period of the Assessment of Corrective Measures is accurate for JH Campbell Unit 1&2 Bottom Ash Pond and JH Campbell Pond A in accordance with the requirements of §257.96(a). This will now set the deadline for completing the Assessment of Corrective Measures for September 11, 2019.

Harold D. Register, Jr.

Signature

STATE OF MICHIGAN
HAROLD D. REGISTER, JR.
ENGINEER
No. 6201056266
LICENSED PROFESSIONAL ENGINEER

July 12, 2019

Date of Certification

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

Name

07/12/2019

6201056266

Professional Engineer Certification Number

Appendix I
Semiannual Progress Report

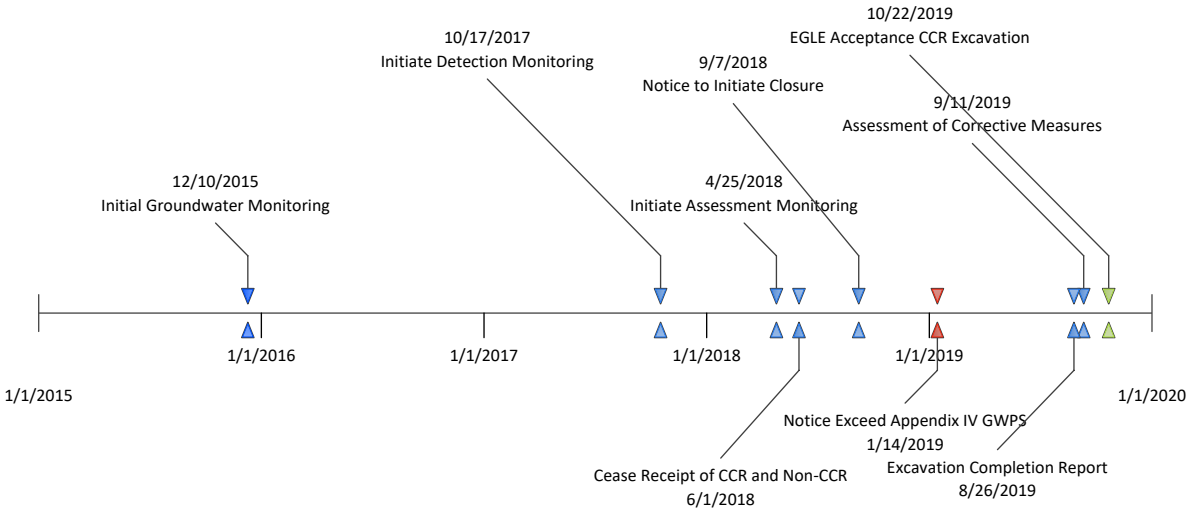
January 30th, 2020

Subject:
Initial Semiannual Progress Report - Selection of Final Remedy
JH Campbell Bottom Ash Ponds 1-2 CCR Unit
JH Campbell Pond A CCR Unit

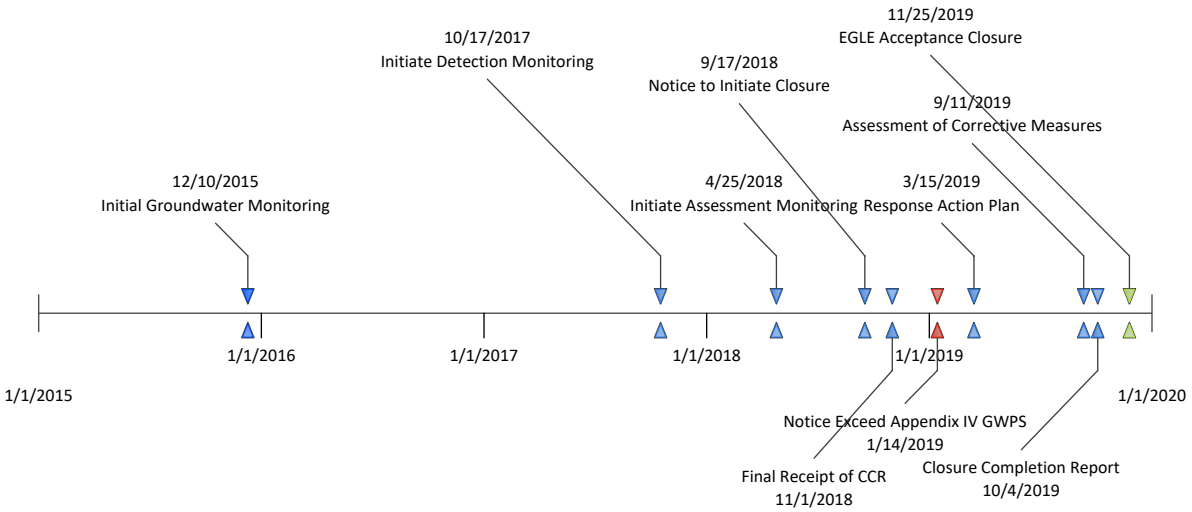
This Semiannual Progress Report, prepared as a requirement of §257.97(a) of the CCR Rule, describes progress toward selecting and designing the final remedy for two CCR units that triggered Assessment of Corrective Measures (ACM) under the CCR Rule at the JH Campbell Solid Waste Disposal Area: Bottom Ash Ponds 1-2 and Pond A. Based on the schedule of self-implementation prescribed in the CCR Rule, a progress report is required to be prepared semiannually upon completion of the Assessment of Corrective Measures Report until the final remedy is selected. It is noteworthy that assessment of corrective measures for the Bottom Ash Ponds 1-2 and Pond A prescribed by the CCR Rule is being undertaken in coordination with a Michigan Department of Environment, Great Lakes, and Energy (EGLE) Consent Agreement 115-01-2018, which was executed on December 28, 2018 to address sitewide corrective actions. Corrective actions for a portion of the ash management area were previously implemented under an Agreement for a Limited Site-Specific, Criteria Based Remedial Action Plan (RAP-LANDUSE-WHMD-2005-02) that was originally executed on July 31, 2005.

As presented in the key milestones timelines below, a groundwater monitoring system was installed for the CCR units and background monitoring commenced in December 2015 under the CCR Rule self-implementing requirements and schedule. The results from this groundwater monitoring program have been reviewed and coordinated with results from the groundwater monitoring program implemented under the existing state requirements for groundwater monitoring and corrective actions. Consumers Energy first reported the potential for statistically significant increases (SSIs) for Appendix IV constituents from the groundwater monitoring system certified under 257.91(reference)in the "*Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g)*" (Consumers Energy Company, January 2019). Subsequently, Assessment of Corrective Measures Reports (TRC, September 2019) were completed on September 11, 2019 for both units.

Consumers Energy
Environmental Services
1945 W Parnall Rd. Jackson, MI 49201



Key Milestones – Ponds 1-2



Key Milestones – Pond A

Results of 2019 Semi-Annual Sampling Events

Statistical analysis from semiannual groundwater monitoring verified that the only constituent of concern that triggered a statistically significant increase (SSI) and exceeds the established

Groundwater Protection Standard (GWPS) is arsenic. Groundwater monitoring results and statistical evaluations are presented in the appropriate annual groundwater monitoring reports to which this document has been appended.

Progress Towards Remedy Selection

Consumers Energy has not selected a remedy pursuant to §257.97 and R 444 of Part 115 for Ponds 1-2 or for Pond A. However, certain source control measures have been implemented, as detailed below:

Ponds 1-2

Consumers Energy has performed CCR removal at Ponds 1-2 as documented in the "*JH Campbell Generating Facility Bottom Ash Ponds 1-2 Closure Plan*," (Golder, January 2018). Ponds 1-2 is undergoing closure by removal of CCR in accordance with §257.102(c). Following the cessation of hydraulic loading and the cease of receipt of CCR and non-CCR waste streams, CCR removal activities were completed in October 2018 and Consumers Energy submitted final documentation of CCR removal to the EGLE in August 2019 (Golder, 2019). On October 22, 2019 EGLE provided written concurrence that all bottom ash had been removed from Ponds 1-2 based on multiple lines of evidence described in the approved closure work plan.

Pond A

Pursuant to §257.102, Consumers Energy prepared the "*JH Campbell Generating Facility Pond A Closure Plan, West Olive, Michigan*" (Golder, October 2016) and an updated closure plan detailing the final cover system that was submitted to EGLE in February 2019. Following the cessation of hydraulic loading and the cease of receipt of CCR and non-CCR waste streams, Pond A has undergone closure in place in accordance with the requirements for CCR landfills under RCRA (§257.102(d)) and a RCRA closure certification by the qualified professional engineer is in development. The state closure certification as required by Paragraph 4.2 of Consent Agreement WMRPD No. 115-01-2018 was approved by EGLE on November 25, 2019.

Source Control Impacts

It is expected that the cessation of hydraulic loading and other subsequent source control measures will change groundwater conditions with the potential to affect concentrations of Appendix III and Appendix IV constituents in the groundwater. Consumers Energy will continue to execute the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98, which includes semiannual assessment monitoring in accordance with §257.95 to monitor site groundwater conditions and inform remedy selection.

On March 18, 2019, Consumers Energy submitted the *Pond A Hydrogeological Monitoring Plan, JH Campbell Power Plant, West Olive, Michigan* (Pond A HMP) (TRC, March 2019; Revised July 2019), which includes the *Pond A Assessment Monitoring Plan* (Pond A AMP), to EGLE to comply with the requirements of Part 115, Rule 299.4905. The Pond A HMP and Pond A AMP were implemented during the fourth quarter of 2019. In addition, quarterly monitoring according to the site's EGLE-approved September 1996 *Hydrogeological Monitoring Plan (HMP) for JH Campbell Ash Storage Facility, Consumers Power Company, Solid Waste Disposal Area, Coal Ash, Type III* for the site continued to be implemented in the fourth quarter of 2019. State and federal monitoring and reporting requirements are being coordinated through the referenced documents.

State of Michigan Agreement

On December 21, 2018 Consumers Energy and the Michigan Department of Environmental Quality (now EGLE) signed WMRPD Agreement No. 115-01-2018 (Agreement). Per paragraph 4.5 of the Agreement, Consumers Energy agreed to submit a revised Remedial Action Plan (RAP) for the site by October 1, 2021. The revised RAP must address all existing-identified corrective actions related to the historic and ongoing management of CCR at the site in conformance with Michigan Part 115 Rules, the approved site Hydrogeological Monitoring Plan, and corrective actions in conformance with groundwater monitoring activities Consumers Energy is performing in accordance with the CCR Rule. The revised RAP is anticipated to comprehensively address groundwater monitoring and corrective action requirements in anticipation of documenting compliance with a state or federal permit program.

Remedy Selection Process

The ACM Report identified five technically feasible groundwater management alternatives to address residual arsenic. In conjunction with the work described in the ACM Report, Consumers Energy is developing a feasibility study to inform the development of the updated RAP for 2021. Additional data collected under the state and federal groundwater monitoring programs will be used to inform remedy selection and the creation of the updated RAP.

The final remedy for Ponds 1-2 and Pond A will be formally selected per §257.97 once the selected option is reviewed and commented on by EGLE and a public meeting is conducted at least 30-days prior to the final selection as required under §257.96(e).

References

Consumers Energy Company. January 14, 2019. Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g), JH Campbell Pond A CCR Unit.

Consumers Energy Company. January 14, 2019. Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g), JH Campbell Ponds 1-2 CCR Unit.

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

Golder Associates. October 2016. JH Campbell Generating Facility Pond A Closure Plan, West Olive, Michigan. Prepared for Consumers Energy Company.

Golder Associates. January 2018. JH Campbell Generating Facility Bottom Ash Ponds 1-2 Closure Plan, West Olive, Michigan. Prepared for Consumers Energy Company.

Golder Associates. August 9, 2019. JH Campbell Generating Facility Bottom Ash Ponds 1-2 N/S CCR Removal Documentation Report. Prepared for Consumers Energy Company.

TRC Environmental Corporation. September 2019. Assessment of Corrective Measures, Consumers Energy Company JH Campbell Ponds 1-2 North and 1-2 South and Pond A Coal Combustion Residual Units. Prepared for Consumers Energy Company.

TRC Environmental Corporation. March 2019; Revised July 2019. Pond A Hydrogeological Monitoring Plan, JH Campbell Power Plant, West Olive, Michigan. Prepared for Consumers Energy Company