2022 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 2023

Prepared For:

Consumers Energy Company

Prepared By:

TRC
1540 Eisenhower Place
Ann Arbor, Michigan 48108

Sarah B. Holmstrom, P.G.
Project Manager/Sr. Hydrogeologist

Graham Crockford, C.P.G.
Program Manager

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

Executive Summary

On behalf of Consumers Energy, TRC has prepared this report for the JH Campbell Ponds 1-2 Coal Combustion Residual (CCR) unit to cover the period of January 1, 2022 to December 31, 2022. 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 2022 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*. On April 25, 2018, Consumers Energy entered assessment monitoring upon determining that an Alternate Source Demonstration for the SSIs for Appendix III constituents was not successful. After subsequent sampling for Appendix IV constituents, Consumers Energy provided notification in the *Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g)* that arsenic was present at statistically significant levels above the federal groundwater protection standard (GWPS) established at 10 ug/L 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 14, 2019 and was certified and submitted to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) 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). 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. 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 statistical evaluations have confirmed that arsenic is the only Appendix IV constituent present at statistically significant levels above the GWPSs associated with the former Ponds 1-2 CCR Unit. However, those statistically significant levels of arsenic above the GWPS are limited to monitoring wells no longer downgradient from Ponds 1-2 that are influenced by the long operational history of ash management in this area of the site. All of the arsenic concentrations in groundwater during the 2022 monitoring period are below the GWPS within the current monitoring network (certified January 2023) and the nature and extent wells installed in the interior of the Ponds 1-2 footprint. 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.

Remedy selection for Ponds 1-2, prescribed by the CCR Rule, is being undertaken in coordination with the EGLE Consent Agreement WMRPD No. 115-01-2018, which was executed on December 28, 2018. The January 2023 semiannual progress report describing the progress in selecting and designing the remedy required pursuant to §257.97(a) is included in this report. CCR removal activities at Ponds 1-2 were completed in October 2018 and on

October 22, 2019, the 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.

The general decrease in arsenic concentrations downgradient of Ponds 1-2 suggest that source removal continues to have an observable impact on groundwater quality. Changing concentrations indicate that the system is establishing a new equilibrium following source removal and that an alternate source is impacting groundwater quality in the vicinity of Ponds 1-2, particularly along the east edge. The groundwater management remedy for 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, 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 2023.

1.0 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 (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 Ponds 1-2 to cover the period of January 1, 2022 to December 31, 2022. 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 2022 are presented in this report.

1.1 Program Summary

Consumers Energy first reported the potential for statistically significant increases (SSIs) for Appendix III constituents in the *Annual Groundwater Monitoring Report, JH Campbell Power Plant, Unit 1-2 North and 1-2 South CCR Unit* (2017 Annual Report) (TRC, January 2018). 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 entered assessment monitoring on April 25, 2018, 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 in the *Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g)* (Consumers Energy, January 2019) that arsenic was present at statistically significant levels above the federal groundwater protection standard (GWPS) established at 10 ug/L 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 14, 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.

The groundwater management remedy for 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, 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 JH Campbell solid waste disposal facility. The CCR surface impoundments located within the former wet ash pond area are Ponds 1-2, Pond 3 North and Pond 3 South Bottom Ash Pond (collectively Pond 3), and Pond A. Site features are shown on Figure 2.

The surface impoundments in the wet ash pond areas were decommissioned starting in 2017 and replaced with concrete bottom ash treatment tanks. Dry ash from all of the generating units is stored in silos until it is placed into the Dry Ash Landfill or is sold and shipped off site. This report focuses on the Ponds 1-2 CCR Unit.

1.3 Geology/Hydrogeology

The upgradient/background wells are located to the north-northwest of the Dry Ash Landfill. Groundwater is typically encountered at elevations ranging from 604 feet near the background wells to 590 feet along the southeast corner of the Dry Ash Landfill and south of the former Ponds 1-2 and Pond A CCR surface impoundments 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.

2.0 Groundwater Monitoring

2.1 Monitoring Well Network Updates

As documented in the *2020 Annual Groundwater Monitoring and Corrective Action Report for the JH Campbell Power Plant Units 1-2 North and 1-2 South CCR Unit* (2020 Annual Report) (TRC, January 2021), due to the cessation of hydraulic loading and decommissioning of Ponds 1-2, the groundwater flow direction changed significantly from the previous baseline and assessment monitoring events such that groundwater flow is generally toward the south at Ponds 1-2. As a result, the monitoring network was revisited and an updated monitoring well network certification was included in the 2020 Annual Report that consisted of three downgradient wells (JHC-MW-15005, JHC-MW-18004, and JHC-MW-18005) and two side gradient wells (JHC-MW-15002 and JH-MW-15003). JHC-MW-15001 was removed from the monitoring network post-pond decommissioning given the well is located upgradient relative to Ponds 1-2, dry conditions had been observed, and no Appendix IV constituents had been observed at statistically significant levels above groundwater protection standards at that location since monitoring began in 2015. Monitoring wells JHC-MW-15002 and JHC-MW-15003, although now located side gradient of Ponds 1-2, continued to be used to monitor post-decommissioning changes in groundwater quality since groundwater concentrations at those wells had contributed to the initiation of assessment monitoring.

As documented in the *Alternative Source Demonstration: Selenium at JHC-MW-15005* (October 2021 ASD) (TRC, October 2021), monitoring wells JHC-MW-15002 and JHC-MW-15003 are installed within the footprint of historic Ponds B-K (immediately east of the former Ponds 1-2 footprint) with historical CCR in place within the soil column immediately above each of the well screens. Data presented in the ASD not only confirmed the presence of CCRs at JHC-MW-15002 and JHC-MW-15003, but also established that groundwater chemistry and quality is being influenced by historical Ponds B-K at JHC-MW-15005 located immediately downgradient from JHC-MW-15002 and JHC-MW-15003. Semiannual monitoring data (Section 2.3) and data from newly installed nature and extent monitoring wells MW-22-14 and MW-22-15 (Section 4.1) collected in 2022 further confirm the influence of the alternate source at JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 and support the determination that these wells cannot reliably be used to assess groundwater quality associated with Ponds 1-2 and that they are not appropriate for use in assessment monitoring at Ponds 1-2. As a result, these wells are being removed from the certified compliance monitoring network for the Ponds 1-2 CCR Unit. They will continue to be monitored as nature and extent wells for the purpose of informing the ongoing remedy selection and risk mitigation evaluations.

In response to the determination that downgradient monitoring well JHC-MW-15005 on the eastern side of Ponds 1-2 is not appropriate to assess downgradient groundwater quality associated with Ponds 1-2, and to maintain a minimum of three downgradient monitoring wells, Consumers Energy installed a new monitoring well (JHC-MW-22001) on May 12, 2022 and collected additional data from this new well to confirm groundwater flow and further characterize groundwater quality downgradient from the former Ponds 1-2 footprint. Documentation of the well installation, including the soil boring log and well construction diagram, is included in

Appendix A. Sampling data collected in 2022 are included in the semiannual groundwater monitoring results presented in Section 2.3 and confirm that JHC-MW-22001 is appropriately positioned to assess downgradient groundwater quality associated with the Ponds 1-2 CCR Unit. As such, JHC-MW-22001 has been added to the downgradient monitoring network.

To document these changes, an updated groundwater monitoring network certification is included as Appendix B and reflected below in Section 2.2.

2.2 Monitoring Well Network

In accordance with 40 CFR 257.91, Consumers Energy has established a groundwater monitoring system for Ponds 1-2, which currently consists of 9 monitoring wells (6 background monitoring wells and 3 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 units (JHC-MW-15023 through JHC-MW-15028). Background groundwater quality data from these six background wells are additionally used for the CCR groundwater monitoring program at three other JH Campbell CCR units.

As detailed in Section 2.1, the certified monitoring network consists of the following:

- Background Monitoring Wells:
  - JHC-MW-15023 through JHC-MW-15028
- Downgradient Monitoring Wells:
  - JHC-MW-18004
  - JHC-MW-18005
  - JHC-MW-22001

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 at the JH Campbell CCR units and used to inform the site-wide groundwater contour map.

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 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 *Sample Analysis Plan* for JH Campbell Ponds 1-2 and Pond 3 (SAP) (TRC, January 2021).

2.3.1 Data Summary

The first semiannual groundwater assessment monitoring event for 2022 was performed on April 11 through 14, 2022 and the second semiannual groundwater assessment monitoring event for 2022 was performed on October 17 through 20, 2022. The first semiannual sampling at new monitoring well JHC-MW-22001 was completed on May 19, 2022. Both events were performed by Consumers Energy, and samples were analyzed by Consumers Energy Laboratory Services in Jackson, Michigan, with radium samples analyzed by Eurofins Environmental Testing in St Louis, Missouri, in accordance with the SAP. Static water elevation data were collected at all monitoring well locations. Groundwater samples were collected from the background monitoring wells and Ponds 1-2 monitoring wells for the Appendix III and Appendix IV constituents and field parameters.

A summary of the groundwater data collected during the April-May and October 2022 events 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).

2.3.2 Data Quality Review

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

2.3.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected site-wide during the 2022 semiannual assessment monitoring events were generally similar to data collected previously since the background sampling events commenced in December 2015. The data showed that groundwater within the uppermost aquifer generally flows to the south-southeast across the Site, with a southwesterly groundwater flow component on the western edge of the Site. Groundwater flow in the immediate vicinity of Ponds 1-2 is predominately toward the south, consistent with previous assessment monitoring events. The groundwater mounding previously observed in the immediate vicinity of Ponds 1-2 and Pond 3 early on in the program is no longer apparent subsequent to completing decommissioning activities at both units in September and October 2018, respectively.

Groundwater elevations measured across the Site during the April and October 2022 events are provided on Table 1. April 2022 and October 2022 groundwater elevations were used to construct the groundwater contour maps provided on Figure 3 and Figure 4, respectively. The average hydraulic gradient for each sampling event was calculated using the following well pairs: JHC-MW-15026/PZ-23S, JHC-MW-15017/PZ-24S, and JHC-MW-15024/JHC-MW-15031 (Figure 2). The average hydraulic gradient was 0.0035 ft/ft in April 2022 and 0.0035 ft/ft in October 2022. 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 0.54 ft/day or 200 ft/year for the April 2022 event, and approximately 0.55 ft/day or 200 ft/year for the

October 2022 event.

The general groundwater flow direction is similar to that identified in previous monitoring rounds post pond closure 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.

3.0 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 2022 groundwater data in accordance with the assessment monitoring program. The statistical evaluation details are provided in Appendix D (*Statistical Evaluation of April 2022 Assessment Monitoring Sampling Event*) and Appendix E (*Statistical Evaluation of October 2022 Assessment Monitoring Sampling Event*).

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 initial semiannual assessment monitoring event (June 2018). Therefore, Consumers Energy initiated the ACM. Assessment monitoring is ongoing.

Arsenic was identified at downgradient monitoring well JHC-MW-15002 and JHC-MW-15003 at statistically significant levels exceeding the GWPS during the initial assessment monitoring event conducted in June 2018. The April 2022 statistical evaluation included evaluation of JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 to support re-evaluation of the monitoring well network. Although arsenic concentrations have shown an overall decrease following removal of Ponds 1-2, arsenic continued to be present at statistically significant levels above the GWPS at JHC-MW-15002 in April 2022. However, as documented in the October 2021 ASD, due to the changes in groundwater flow direction subsequent to pond decommissioning, monitoring wells JHC-MW-15002 and JHC-MW-15003 are no longer downgradient of groundwater flow across the Ponds 1-2 area, and groundwater quality at JHC-MW-15002 and JHC-MW-15003 is being influenced by an adjacent alternate source (historical Ponds B-K).

Therefore, as discussed in Section 2.1, JHC-MW-15002 and JHC-MW-15003 have been removed from the certified assessment monitoring network along with JHC-MW-15005 located immediately downgradient from JHC-MW-15002 and JHC-MW-15003. As such, these wells were not included in the October 2022 statistical evaluation and are instead included in the

nature and extent sampling program discussed in Section 4.1.

Since entering assessment monitoring in 2018, the statistical evaluations at Ponds 1-2 have confirmed that arsenic is the only Appendix IV constituent present at statistically significant levels above the GWPSs not attributed to an alternative source. The locations of those statistically significant levels of arsenic above the GWPS have been limited to JHC-MW-15002 and JHC-MW-15003, which are no longer hydraulically downgradient from Ponds 1-2 and are also influenced by the long operational history of ash management in this area of the site. Arsenic concentrations in all of the other downgradient monitoring wells, including JHC-MW-15005, have remained below the GWPS since entering assessment monitoring in 2018.

The results of the October 2022 statistical evaluation show that no Appendix IV constituents are present at statistically significant levels above the GWPSs in the downgradient monitoring well network. A summary of the confidence intervals for April 2022 and October 2022 are provided in Table 5 and Table 6, respectively.

4.0 Corrective Action

Consumers Energy provided notification in January 2019 that arsenic was present at statistically significant levels above the federal GWPS established at 10 ug/L in two out of five monitoring wells that were at the time downgradient 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 ACM was initiated on April 14, 2019 and was certified and submitted to the 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 as shown on Figure 2. In addition to the supplemental downgradient wells, monitoring wells JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 are included as nature and extent monitoring wells. The soil boring logs and well construction diagrams for the downgradient step out monitoring wells utilized for the nature and extent groundwater sampling are included in the *2019 Annual Groundwater Monitoring Report for the JH Campbell Power Plant Unit 1-2 North and 1-2 South CCR Unit* (2019 Annual Report) (TRC, January 2020).

To further characterize groundwater quality within the Ponds 1-2 footprint, immediately upgradient of the Ponds 1-2 downgradient wells and side gradient from the identified alternate source on the eastern edge of Ponds 1-2, Consumers Energy installed two monitoring wells (MW-22-14 and MW-22-15) in the interior of the former Ponds 1-2 area in November 2022. The soil boring logs and well construction diagrams for the Ponds 1-2 interior wells are included in Appendix F.

A summary of the nature and extent groundwater data collected in 2022, including the new 2022 monitoring wells is provided on Table 7. The data from monitoring wells MW-22-14 and MW-22-15 show that groundwater quality directly beneath the former Ponds 1-2 footprint is well below the GWPSs for all of the Appendix IV constituents, which, along with the assessment monitoring results presented in Section 2.3, demonstrate that the CCR removal activities were effective in addressing arsenic concentrations associated with former Ponds 1-2 activities.

The data from MW-22-14 and MW-22-15 also provide additional supporting evidence that groundwater along the eastern edge of Ponds 1-2 (e.g. JHC-MW-15002, JHC-MW-15003 and JHC-MW-15005) is not representative of groundwater quality directly beneath Ponds 1-2 and is influenced by historical Ponds B-K. As detailed in the October 2021 ASD, historical Ponds B-K

have been identified as the primary source of Appendix IV GWPS exceedances that occurred at JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 subsequent to CCR removal from Ponds 1-2. Prior to closing Ponds 1-2, and prior to the shift in the groundwater flow regime across Ponds 1-2, arsenic was the only Appendix IV constituent that triggered corrective action. The statistical evaluations at Ponds 1-2 have confirmed that arsenic has been the only Appendix IV constituent observed at statistically significant levels above the GWPSs not attributed to an alternative source and there are no statistically significant Appendix IV exceedances above the GWPS within the current Ponds 1-2 well network (certified January 2023). The locations of those statistically significant levels of arsenic above the GWPS have been limited to JHC-MW-15002 and JHC-MW-15003, which are no longer hydraulically downgradient from Ponds 1-2. Monitoring wells MW-22-14 and MW-22-15 are located in the center and directly beneath the former Ponds 1-2 footprint and side gradient from JHC-MW-15002 and JHC-MW-15003 such that they are not in the direct flow path of groundwater influenced by surface infiltration and groundwater in contact with CCR material associated with historical Ponds B-K. As such, data from these two new wells is more representative of groundwater quality associated with Ponds 1-2 activities and provides clearer insight into the effectiveness of CCR removal from Ponds 1-2.

As discussed in the ACM, the nature and extent of contamination (i.e. 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 on-site 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.

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 is following 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.

4.3 Remedy Selection

Remedy selection for Ponds 1-2, prescribed by the CCR Rule, is being undertaken in coordination with EGLE Consent Agreement WMRPD No. 115-01-2018, which was executed on December 28, 2018. The January 2023 semiannual progress report describing the progress in selecting and designing the remedy required pursuant to §257.97(a) is included in Appendix G 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 has undergone 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. Results from monitoring wells MW-22-14 and MW-22-15 installed within the former Ponds 1-2 footprint are below the GWPS (Table 7), indicating that source removal was effective in reducing arsenic concentrations below the former pond area. Arsenic groundwater concentrations at monitoring wells JHC-MW-15002 and JHC-MW-15003 have generally decreased since 2018, after dewatering and removal of ash, as shown by the lower confidence limit of arsenic concentrations at JHC-MW-15003 that has remained below the GWPS since 2020 (Appendix D), further supporting reduced arsenic concentrations following Ponds 1-2 closure in comparison to when Ponds 1-2 were active.

Changes in groundwater chemistry continue to be evaluated following the completion of CCR removal at Ponds 1-2. The general decrease in arsenic concentrations before and after dewatering and removal of ash suggest that source removal continues to have an observable impact on groundwater quality despite the continued influence from historic Ponds B-K. Changing concentrations indicate that the system is establishing a new equilibrium following source removal and that the immediately adjacent closed CCR units are impacting groundwater quality along the east edge of Ponds 1-2.

5.0 Conclusions and Recommendations

Assessment monitoring is ongoing at the 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 associated with the former Ponds 1-2 CCR Unit. However, those statistically significant levels above the GWPS are limited to monitoring wells no longer downgradient from Ponds 1-2 that are influenced by the long operational history of ash management in this area of the site. All of the arsenic concentrations in groundwater are below the GWPS within the current monitoring network (certified January 2023) and the nature and extent wells installed in the interior of the Ponds 1-2 footprint.

The ACM also documents that groundwater nature and extent has been defined, as required in §257.95(g)(1). Further, 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.

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 following the completion of CCR removal at Ponds 1-2, particularly along the eastern edge, indicate that the system is establishing a new equilibrium following source removal and that the immediately adjacent closed CCR units are impacting groundwater quality in the vicinity of Ponds 1-2.

The groundwater management remedy for 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 2023.

6.0 References

ARCADIS. May 13, 2016. Summary of Monitoring Well Design, Installation, and Development – Bottom Ash Pond Unit 1-2N/1-2S. JH Campbell Electric Generation Facility – West Olive, Michigan. Prepared for Consumers Energy Company.

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

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

TRC. October 2017. Groundwater Statistical Evaluation Plan – JH Campbell Power Plant, Units 1-2 North and 1-2 South, West Olive, Michigan. Prepared for Consumers Energy Company.

TRC. January 2018. Annual Groundwater Monitoring Report, JH Campbell Power Plant, Unit 1-2 North and 1-2 South CCR Unit, West Olive, Michigan. Prepared for Consumers Energy Company.

TRC. October 15, 2018. Groundwater Protection Standards, Consumers Energy, JH Campbell Site, Bottom Ash Pond Units 1-2 North and 1-2 South CCR Unit, technical memorandum prepared for Consumers Energy Company.

TRC. January 2019. 2018 Annual Groundwater Monitoring Report, JH Campbell Power Plant, Unit 1-2 North and 1-2 South and Pond A Coal Combustion Residual Units, West Olive, Michigan. Prepared for Consumers Energy Company.

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

TRC. January 2020. 2019 Annual Groundwater Monitoring Report, JH Campbell Power Plant, Unit 1-2 North and 1-2 South CCR Unit, West Olive, Michigan. Prepared for Consumers Energy Company.

TRC. January 2021. 2020 Annual Groundwater Monitoring Report, JH Campbell Power Plant, Unit 1-2 North and 1-2 South CCR Unit, West Olive, Michigan. Prepared for Consumers Energy Company.

TRC. October 2021. Alternative Source Demonstration: Selenium at JHC-MW-15005. Prepared for Consumers Energy Company.

TRC. January 2021. Sample and Analysis Plan, JH Campbell Power Plant Ponds 1-2 and Pond 3, West Olive, Michigan. Prepared for Consumers Energy Company.

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

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

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

USEPA. April 2018. Barnes Johnson (Office of Resource Conservation and Recovery) to James Roewer (c/o Edison Electric Institute) and Douglas Green, Margaret Fawal (Venable LLP). Re: Coal Combustion Residuals Rule Groundwater Monitoring Requirements. April 30, 2018. United States Environmental Protection Agency, Washington, D.C. 20460. Office of Solid Waste and Emergency Response, now the Office of Land and Emergency Management.

Tables

Table 1
Summary of Groundwater Elevation Data - April - October 2022
JH Campbell – RCRA CCR Monitoring Program
West Olive, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Elevation (ft)			April 11, 2022		October 17, 2022	
							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	17.61	602.37	19.25	600.73
JHC-MW-15024	613.79	616.62	Sand	606.8	to	596.8	13.39	603.23	14.58	602.04
JHC-MW-15025	614.14	617.17	Sand	607.1	to	597.1	12.78	604.39	13.85	603.32
JHC-MW-15026	615.09	618.04	Sand	607.1	to	597.1	14.86	603.18	15.57	602.47
JHC-MW-15027	614.77	617.30	Sand	604.8	to	594.8	15.49	601.81	16.08	601.22
JHC-MW-15028	611.02	613.80	Sand	603.0	to	593.0	16.70	597.10	15.27	598.53
JHC-MW-15029	608.08	610.95	Sand	600.1	to	590.1	12.39	598.56	12.32	598.63
JHC-MW-15030	604.05	607.17	Sand	600.1	to	590.1	9.91	597.26	10.50	596.67
Pond 1N, 1S, 2N, 2S										
JHC-MW-15001	607.02	609.53	Sand	603.5	to	598.5	--		NM	
JHC-MW-15002	618.18	621.27	Sand	590.2	to	580.2	25.40	595.87	25.28	595.99
JHC-MW-15003	623.16	627.20	Sand	595.2	to	585.2	33.40	593.80	33.40	593.80
JHC-MW-15005	606.22	609.99	Sand	579.2	to	569.2	18.39	591.60	18.48	591.51
JHC-MW-18004	602.92	605.72	Sand	596.9	to	586.9	12.00	593.72	12.48	593.24
JHC-MW-18005	600.30	603.16	Sand	595.3	to	585.3	10.63	592.53	11.01	592.15
JHC-MW-22001	601.52	604.28	Sand	596.5	to	586.5			11.70	592.58
Pond 3N, 3S										
JHC-MW-15013	632.40	635.25	Sand	604.4	to	594.4	36.45	598.80	36.16	599.09
JHC-MW-15015	632.46	635.20	Sand	604.5	to	594.5	36.14	599.06	35.85	599.35
JHC-MW-15016	631.81	632.52	Sand	603.8	to	593.8	33.51	599.01	33.42	599.10
JHC-MW-18001	609.09	611.98	Sand	603.1	to	593.1	13.26	598.72	12.98	599.00
JHC-MW-18002	605.53	608.93	Sand	602.0	to	592.0	9.85	599.08	9.55	599.38
JHC-MW-18003	605.36	608.78	Sand	601.9	to	591.9	9.79	598.99	9.65	599.13
Landfill										
JHC-MW-15017	613.69	616.61	Sand	603.7	to	593.7	16.54	600.07	16.83	599.78
JHC-MW-15018	614.26	617.02	Sand	604.3	to	594.3	17.30	599.72	17.52	599.50
JHC-MW-15022	620.92	623.79	Sand	597.9	to	587.9	--		NM	
JHC-MW-15031	632.94	635.87	Sand	599.9	to	589.9	43.71	592.16	43.90	591.97
JHC-MW-15032	611.32	614.29	Sand	598.3	to	588.3	16.76	597.53	18.14	596.15
JHC-MW-15033	618.08	620.99	Sand	602.1	to	592.1	--		NM	
JHC-MW-15034	612.90	615.97	Sand	601.9	to	591.9	15.50	600.47	17.19	598.78
JHC-MW-15035	632.53	634.28	Sand	599.5	to	589.5	41.37	592.91	41.45	592.83
JHC-MW-15036	617.94	618.34	Sand	597.9	to	587.9	26.95	591.39	27.35	590.99
JHC-MW-15037	614.28	616.06	Sand	591.3	to	586.3	25.17	590.89	25.60	590.46
MW-B3	630.51	634.17	Sand	598.5	to	593.5	39.06	595.11	39.90	594.27
MW-B4	633.80	635.67	Sand	593.8	to	588.8	41.81	593.86	41.77	593.90
Pond A										
JHC-MW-15006	624.74	627.58	Sand	599.7	to	589.7	35.08	592.50	36.05	591.53
JHC-MW-15007R[(2)]	625.73	628.26	Sand	595.7	to	585.7	36.01	592.25	37.18	591.08
JHC-MW-15008R[(1)]	632.32	634.67	Sand	597.3	to	587.3	42.95	591.72	44.05	590.62
JHC-MW-15009R[(2)]	632.15	635.05	Sand	595.2	to	585.2	43.29	591.76	44.01	591.04
JHC-MW-15011R[(2)]	627.73	629.79	Sand	594.7	to	584.7	37.50	592.29	38.31	591.48
Downgradient Wells										
MW-13	593.40	595.37	Clayey Silt	587.9	to	585.4	DRY		NM	
MW-14S	587.36	590.98	Sand	582.9	to	577.9	10.32	580.66	10.51	580.47
PZ-23S	602.84	604.97	Sand	591.8	to	586.8	13.29	591.68	15.59	589.38
PZ-24S	586.56	590.15	Sand	584.6	to	579.6	7.17	582.98	8.90	581.25
PZ-40S	589.51	593.25	Sand	585.5	to	575.5	10.02	583.23	12.48	580.77
TW-19-05	603.44	606.36	Sand	592.8	to	587.8	15.41	590.95	17.15	589.21
TW-19-06A	599.61	602.54	Sand	592.3	to	587.3	12.52	590.02	14.21	588.33

Notes:
Survey conducted by Nederveld, November 2015, October 2018, December 2018, August 2019, and July 2021.
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.
--: Not measured
(1) JHC-MW-15008R installed in June 2019.
(2) JHC-MW-15007R, JHC-MW-15009R, and JHC-MW-15011R installed in July 2021.

Table 2

Summary of Field Parameters

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	4/12/2022	2.38	182.9	5.5	119	11.2	2.1
	10/18/2022	3.00	275.2	5.7	60	9.4	2.1
JHC-MW-15024	4/12/2022	1.47	100.2	7.4	418	10.7	2.6
	10/18/2022	0.52	207.4	7.8	372	10.0	3.7
JHC-MW-15025	4/11/2022	3.70	144.8	7.9	254	8.0	2.9
	10/18/2022	0.82	89.7	8.1	323	10.0	2.1
JHC-MW-15026	4/11/2022	2.56	172.0	5.9	43	10.2	2.2
	10/18/2022	2.33	283.7	5.9	41	12.2	3.0
JHC-MW-15027	4/11/2022	7.08	192.7	6.2	141	9.8	5.2
	10/18/2022	4.78	263.6	6.3	166	12.4	5.7
JHC-MW-15028	4/12/2022	4.64	107.9	8.5	153	12.8	1.8
	10/18/2022	3.90	132.0	8.5	155	12.2	3.2
Ponds 1-2N/1-2S							
JHC-MW-18004	4/13/2022	4.63	121.3	7.6	600	12.4	2.9
	10/20/2022	1.15	89.7	7.9	591	14.0	4.0
JHC-MW-18005	4/13/2022	3.20	94.3	8.6	419	11.9	1.5
	10/20/2022	1.63	92.4	8.5	505	14.4	8.4
JHC-MW-22001	5/19/2022	3.37	13.7	8.1	457	11.8	0.7
	10/20/2022	0.85	33.2	8.2	552	13.8	2.6

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

SU - Standard Units.

umhos/cm - Micromhos per centimeter.

°C - Degrees Celsius.

NTU - Nephelometric Turbidity Unit.

Table 3
Summary of Groundwater Sampling Results (Analytical) - April - October 2022
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:	4/12/2022	10/18/2022	4/12/2022	10/18/2022	4/11/2022	10/18/2022	4/11/2022	10/18/2022	4/11/2022	10/18/2022	4/12/2022	10/18/2022
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background											
Appendix III[(1)]																	
Boron	ug/L	NC	500	500	7,200	54	36	21	< 20	24	22	< 20	< 20	< 20	< 20	< 20	< 20
Calcium	mg/L	NC	NC	NC	500[EE]	15.3	7.88	42.9	37.7	27.4	25.9	4.65	3.48	16.6	21.6	20.3	20.2
Chloride	mg/L	250**	250[E]	250[E]	500[EE]	5.24	3.22	41.4	27.1	22.7	20.1	1.75	< 1.00	1.76	1.21	< 1.00	< 1.00
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[E]	250[E]	500[EE]	16.7	13.4	6.52	7.52	7.52	9.8	5.92	7.89	8.25	7.30	5.80	5.89
Total Dissolved Solids	mg/L	500**	500[E]	500[E]	500	88	76	233	226	145	187	31	44	83	131	80	110
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5[E]**	**6.5 - 8.5[E]**	**6.5 - 9.0**	**5.5**	**5.7**	7.4	7.8	7.9	8.1	**5.9**	**5.9**	**6.2**	**6.3**	8.5	8.5
Appendix IV[(1)]																	
Antimony	ug/L	6	6.0	6.0	130	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	10	10	10	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Barium	ug/L	2,000	2,000	2,000	820	49	27	26	22	7	8	12	8	28	20	8	8
Beryllium	ug/L	4	4.0	4.0	18	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5.0	5.0	3.5	0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	100	100	11	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1	< 1
Cobalt	ug/L	NC	40	100	100	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6
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	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
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[#]	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	73	210	3,200	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Radium-226	pCi/L	NC	NC	NC	NC	0.124	0.153	< 0.0963	< 0.124	< 0.0857	< 0.112	< 0.0921	< 0.106	< 0.103	< 0.127	< 0.0996	< 0.103
Radium-228	pCi/L	NC	NC	NC	NC	0.438	0.704	< 0.449	< 0.625	< 0.447	< 0.499	0.465	< 0.504	< 0.378	0.792	< 0.398	< 0.467
Radium-226/228	pCi/L	5	NC	NC	NC	0.562	0.857	< 0.449	< 0.625	< 0.447	< 0.499	0.552	< 0.504	< 0.378	0.822	< 0.398	0.534
Selenium	ug/L	50	50	50	5.0	1	< 1	2	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Thallium	ug/L	2	2.0	2.0	3.7	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2

Notes:

ug/L - micrograms per liter; mg/L - milligrams per liter.
pCi/L - picocuries per liter; SU - standard units; pH is a field parameter.
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 21, 2020.
** - 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.
E - Criterion is the aesthetic drinking water value per footnote {E}.
EE - Criterion is based on the total dissolved solids GSI value per footnote {EE}.
(1) 40 CFR Part 257 Appendix III Detection Monitoring Constituents and Appendix IV Assessment Monitoring Constituents.
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)
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-18004		JHC-MW-18005		JHC-MW-22001	
						Sample Date:	4/13/2022	10/20/2022	4/13/2022	10/20/2022	5/19/2022	10/20/2022
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^		downgradient					
Appendix III[(1)]												
Boron	ug/L	NC	500	500	7,200		346	437	347	340	365	353
Calcium	mg/L	NC	NC	NC	500[EE]		76.5	75.3	46.3	52.3	62.4	56.7
Chloride	mg/L	250**	250[E]	250[E]	500[EE]		2.22	8.85	7.55	8.41	5.79	8.05
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[E]	250[E]	500[EE]		100	66.0	55.4	45.2	60.8	56.5
Total Dissolved Solids	mg/L	500**	500[E]	500[E]	500		381	362	263	299	311	350
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5[E]**	**6.5 - 8.5[E]**	6.5 - 9.0		7.6	7.9	**8.6**	8.5	8.1	8.2
Appendix IV[(1)]												
Antimony	ug/L	6	6.0	6.0	130		< 1	1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	10	10	10		< 1	< 1	7	7	5	5
Barium	ug/L	2,000	2,000	2,000	820		302	286	258	316	216	248
Beryllium	ug/L	4	4.0	4.0	18		< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5.0	5.0	3.5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	100	100	11		< 1	< 1	1	1	< 1	1
Cobalt	ug/L	NC	40	100	100		< 6	< 6	< 6	< 6	< 6	< 6
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	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	170	350	440		< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	2.0	2.0	0.20#		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	73	210	3,200		< 5	< 5	6	9	8	7
Radium-226	pCi/L	NC	NC	NC	NC		0.228	0.223	0.206	0.228	0.256	0.171
Radium-228	pCi/L	NC	NC	NC	NC		0.354	0.930	< 0.350	0.653	< 0.532	< 0.514
Radium-226/228	pCi/L	5	NC	NC	NC		0.582	1.15	0.507	0.881	< 0.532	< 0.514
Selenium	ug/L	**50**	**50**	**50**	**5.0**		**27**	**44**	**64**	**24**	**32**	**45**
Thallium	ug/L	2	2.0	2.0	3.7		< 2	< 2	< 2	< 2	< 2	< 2

Notes:
ug/L - micrograms per liter; mg/L - milligrams per liter.
pCi/L - picocuries per liter; SU - standard units; pH is a field parameter.
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 21, 2020.
** - 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.
[E] - Criterion is the aesthetic drinking water value per footnote {E}.
[EE] - Criterion is based on the total dissolved solids GSI value per footnote {EE}.
(1) 40 CFR Part 257 Appendix III Detection Monitoring Constituents and Appendix IV Assessment Monitoring Constituents.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

Table 5

Summary of Groundwater Protection Standard Exceedances – April 2022
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

Constituent	Units	GWPS	JHC-MW-15002[1] (Side gradient)		JHC-MW-15003[1] (Side gradient)		JHC-MW-15005 (Downgradient)		JHC-MW-18005 (Downgradient)	
			LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL
Arsenic	ug/L	10	25[3]	57	7.8	20	--	--	--	--
Cobalt	ug/L	15	--	--	3.1	37	--	--	--	--
Lithium	ug/L	40	10	160	--	--	24	53	--	--
Molybdenum	ug/L	100	0.58	77	25	110	51	410	--	--
Selenium	ug/L	50	--	--	--	--	--[2]	--[2]	12	100
Thallium	ug/L	2	--	--	--	--	1.3	5.1	--	--

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 in downgradient monitoring well(s). An exceedance occurs when the LCL is greater than the GWPS.

(1) Monitoring wells JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes. These wells are no longer considered downgradient monitoring wells.

(2) The concentrations of selenium at JHC-MW-15005 are not a result of a release from the unit, as detailed in the Alternate Source Demonstration: Selenium at JHC-MW-15005 (TRC, October 2021); therefore, confidence intervals were not calculated.

(3) As detailed in the Alternate Source Demonstration: Selenium at JHC-MW-15005 (TRC, October 2021), groundwater concentrations at JHC-MW-15002 and JHC-MW-15003 are influenced by an alternate source. GWPS exceedances at these wells may not be the result of influence from CCR unit operations.

Table 6

Summary of Groundwater Protection Standard Exceedances – October 2022

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

West Olive, Michigan

Constituent	Units	GWPS	JHC-MW-18005	
			LCL	UCL
Selenium	ug/L	50	14	100

Notes:

ug/L - micrograms per Liter.

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

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

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

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

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

					Sample Location:	JHC-MW-15002[2]		JHC-MW-15003[2]		JHC-MW-15005		MW-14S			
					Sample Date:	4/13/2022	10/20/2022	4/13/2022	10/20/2022	4/13/2022	10/20/2022	2/23/2022	4/13/2022	7/14/2022	10/19/2022
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^										
Appendix III[1]															
Boron	ug/L	NC	**500**	**500**	7,200	**1,620**	**1,070**	**2,740**	**2,250**	**698**	**542**	31	24	23	30
Calcium	mg/L	NC	NC	NC	500[EE]	87.7	109	71.5	103	93.6	96.4	3.77	2.74	2.83	2.34
Chloride	mg/L	250**	250[E]	250[E]	500[EE]	21.3	32.4	17.9	15.2	9.28	5.14	4.05	2.39	1.54	1.34
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
Sulfate	mg/L	250**	250[E]	250[E]	500[EE]	187	241	125	214	176	135	3.12	8.15	10.3	12.5
Total Dissolved Solids	mg/L	**500****	**500[E]**	**500[E]**	**500**	420	**615**	389	**682**	457	**502**	26	24	45	37
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5[E]**	**6.5 - 8.5[E]**	**6.5 - 9.0**	6.7	6.8	7.6	7.7	7.2	7.7	**5.6**	**5.5**	**6.3**	**5.7**
Appendix IV[1]															
Antimony	ug/L	6	6.0	6.0	130	< 1	< 1	1	2	3	4	< 1	< 1	< 1	< 1
Arsenic	ug/L	**10**	**10**	**10**	**10**	**20**	**20**	**24**	**12**	2	2	< 1	< 1	< 1	< 1
Barium	ug/L	2,000	2,000	2,000	**820**	39	59	72	135	203	231	17	15	16	17
Beryllium	ug/L	4	4.0	4.0	18	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5.0	5.0	3.5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	100	100	11	1	< 1	3	8	1	< 1	< 1	< 1	< 1	< 1
Cobalt	ug/L	NC	40	100	100	< 6	< 6	< 6	22	< 6	< 6	< 6	< 6	< 6	< 6
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
Lead	ug/L	NC	4.0	4.0	39	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	170	350	440	14	10	< 10	11	23	38	< 10	< 10	< 10	< 10
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	**73**	210	3,200	**80**	72	41	**156**	61	52	< 5	< 5	< 5	< 5
Radium-226	pCi/L	NC	NC	NC	NC	0.407	0.186	0.123	0.337	0.324	0.377	--	< 0.0864	--	< 0.116
Radium-228	pCi/L	NC	NC	NC	NC	< 0.367	0.821	< 0.354	1.14	< 0.381	1.02	--	< 0.395	--	0.615
Radium-226/228	pCi/L	5	NC	NC	NC	0.745	1.01	< 0.354	1.48	< 0.381	1.40	--	< 0.395	--	0.701
Selenium	ug/L	**50**	**50**	**50**	**5.0**	**14**	**11**	**49**	**66**	**555**	**340**	< 1	< 1	< 1	< 1
Thallium	ug/L	**2**	**2.0**	**2.0**	**3.7**	< 2	< 2	< 2	< 2	**3**	**4**	< 2	< 2	< 2	< 2

Notes:

ug/L - micrograms per liter; mg/L - milligrams per liter.
pCi/L - picocuries per liter; SU - standard units; pH is a field parameter.
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 21, 2020.
** - 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.
[E] - Criterion is the aesthetic drinking water value per footnote {E}.
[EE] - Criterion is based on the total dissolved solids GSI value per footnote {EE}.
(1) 40 CFR Part 257 Appendix III Detection Monitoring Constituents and Appendix IV Assessment Monitoring Constituents.
(2) Monitoring wells JH-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes. These wells are no longer considered downgradient monitoring wells.
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)
JH Campbell Nature and Extent Wells – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	PZ-23S			PZ-24		PZ-24S			
						Sample Date:	2/22/2022	4/13/2022	7/15/2022	10/19/2022	4/13/2022	10/18/2022	2/23/2022	4/13/2022	7/14/2022	10/19/2022
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^											
Appendix III[(1)]																
Boron	ug/L	NC	**500**	**500**	7,200		26	< 20	< 20	< 20	157	140	22	< 20	< 20	< 20
Calcium	mg/L	NC	NC	NC	500[EE]		--	5.24	--	4.77	21.2	28.9	3.33	2.55	3.13	3.70
Chloride	mg/L	250**	250[E]	250[E]	500[EE]		--	< 1.00	--	< 1.00	4.89	2.88	2.71	1.79	1.10	1.28
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[E]	250[E]	500[EE]		--	2.42	--	2.28	9.47	59.8	4.92	7.70	8.03	8.96
Total Dissolved Solids	mg/L	**500****	**500[E]**	**500[E]**	**500**		--	30	--	32	113	186	40	40	52	44
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5[E]**	**6.5 - 8.5[E]**	**6.5 - 9.0**		6.9	6.7	7.5	7.1	6.7	6.8	**5.5**	**5.2**	**6.0**	**5.7**
Appendix IV[(1)]																
Antimony	ug/L	6	6.0	6.0	130		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	**10**	**10**	**10**	**10**		< 1	< 1	< 1	< 1	< 1	< 1	1	< 1	1	2
Barium	ug/L	2,000	2,000	2,000	**820**		--	< 5	--	< 5	16	21	67	74	28	20
Beryllium	ug/L	4	4.0	4.0	18		--	< 1	--	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5.0	5.0	3.5		--	< 0.2	--	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	100	100	11		< 1	< 1	< 1	< 1	1	< 1	2	2	1	1
Cobalt	ug/L	NC	40	100	100		--	< 6	--	< 6	< 6	< 6	< 6	< 6	< 6	< 6
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	--	< 1	< 1	< 1	1	< 1	< 1	< 1
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#		--	< 0.2	--	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	**73**	210	3,200		< 5	< 5	5	< 5	10	11	< 5	< 5	< 5	< 5
Radium-226	pCi/L	NC	NC	NC	NC		--	< 0.105	--	< 0.0996	< 0.132	< 0.152	--	0.145	--	< 0.159
Radium-228	pCi/L	NC	NC	NC	NC		--	< 0.406	--	< 0.595	< 0.561	< 0.680	--	< 0.403	--	< 0.610
Radium-226/228	pCi/L	5	NC	NC	NC		--	< 0.406	--	< 0.595	< 0.561	< 0.680	--	< 0.403	--	< 0.610
Selenium	ug/L	**50**	**50**	**50**	**5.0**		2	1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Thallium	ug/L	**2**	**2.0**	**2.0**	**3.7**		--	< 2	--	< 2	< 2	< 2	< 2	< 2	< 2	< 2

Notes:

ug/L - micrograms per liter; mg/L - milligrams per liter.
pCi/L - picocuries per liter; SU - standard units; pH is a field parameter.
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 21, 2020.
** - 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.
[E] - Criterion is the aesthetic drinking water value per footnote {E}.
[EE] - Criterion is based on the total dissolved solids GSI value per footnote {EE}.
(1) 40 CFR Part 257 Appendix III Detection Monitoring Constituents and Appendix IV Assessment Monitoring Constituents.
(2) Monitoring wells JH-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes. These wells are no longer considered downgradient monitoring wells.
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.

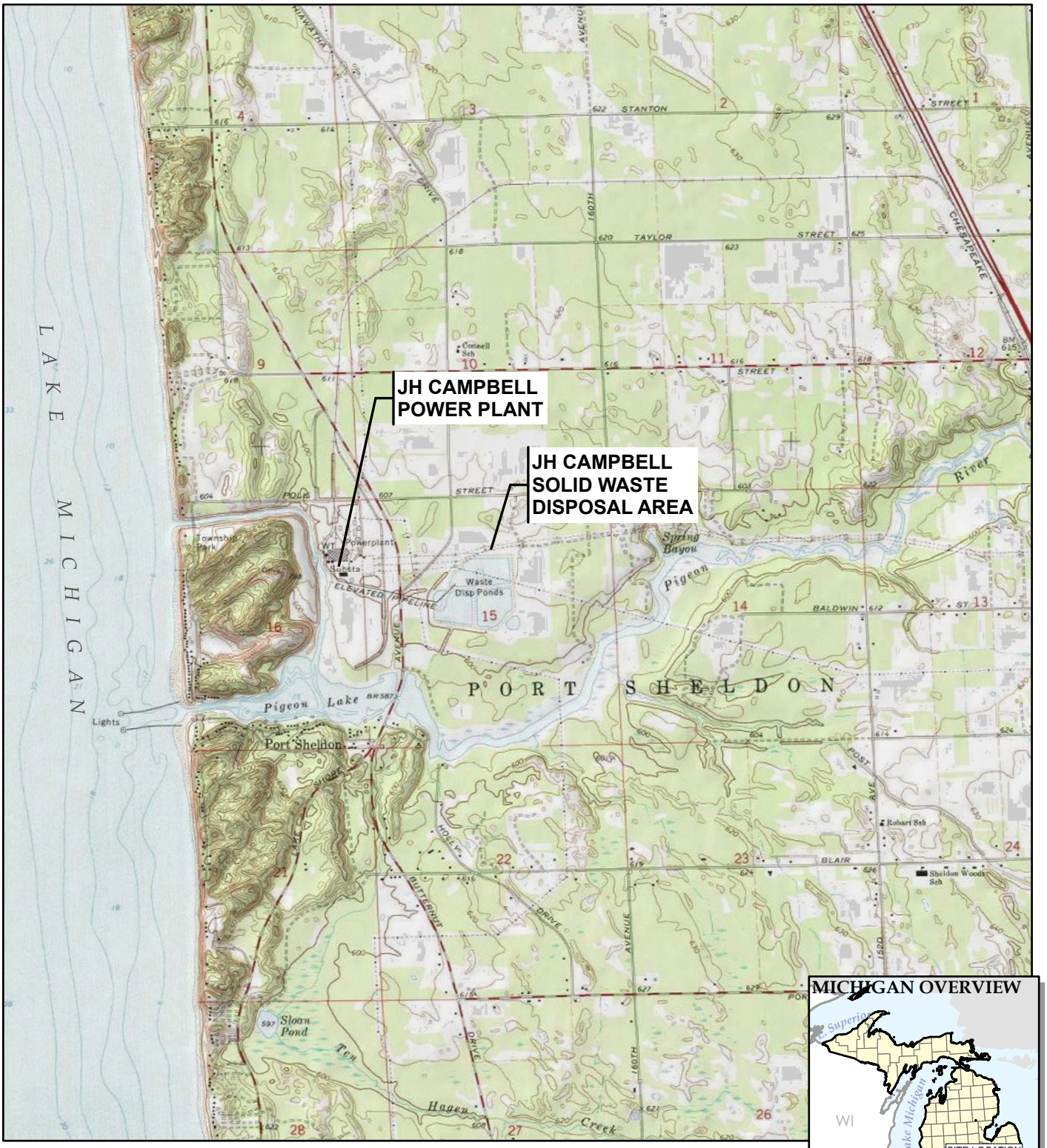
Table 7
Summary of Groundwater Sampling Results (Analytical)
JH Campbell Nature and Extent Wells – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	PZ-40		PZ-40S				MW-22-14	MW-22-15
					Sample Date:	4/12/2022	10/19/2022	2/23/2022	4/12/2022	7/14/2022	10/19/2022	11/23/2022	11/23/2022
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^								
Appendix III(1)													
Boron	ug/L	NC	**500**	**500**	7,200	275	161	64	39	29	64	247	240
Calcium	mg/L	NC	NC	NC	500EE	10.4	6.82	2.56	1.38	1.37	1.79	--	--
Chloride	mg/L	250**	250E	250E	500EE	6.75	2.62	3.10	1.26	1.72	2.42	--	--
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**	250E	250E	500EE	13.0	8.95	5.64	5.02	4.33	6.04	--	--
Total Dissolved Solids	mg/L	**500****	**500E**	**500E**	**500**	54	49	35	27	38	43	--	--
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5E**	**6.5 - 8.5E**	**6.5 - 9.0**	**6.1**	**6.1**	**5.1**	**5.1**	**5.8**	**5.2**	8.4	**8.6**
Appendix IV(1)													
Antimony	ug/L	6	6.0	6.0	130	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	**10**	**10**	**10**	**10**	< 1	< 1	< 1	< 1	< 1	< 1	1	1
Barium	ug/L	2,000	2,000	2,000	**820**	16	10	24	23	20	27	600	**1,060**
Beryllium	ug/L	4	4.0	4.0	18	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5.0	5.0	3.5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	100	100	11	< 1	< 1	1	1	< 1	1	1	1
Cobalt	ug/L	NC	40	100	100	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6
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	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	170	350	440	< 10	< 10	< 10	< 10	< 10	< 10	14	< 10
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	**73**	210	3,200	9	14	< 5	< 5	< 5	< 5	< 5	9
Radium-226	pCi/L	NC	NC	NC	NC	< 0.109	< 0.0979	--	< 0.0843	--	< 0.0911	--	--
Radium-228	pCi/L	NC	NC	NC	NC	< 0.438	0.823	--	< 0.386	--	0.723	--	--
Radium-226/228	pCi/L	5	NC	NC	NC	< 0.438	0.827	--	< 0.386	--	0.767	--	--
Selenium	ug/L	**50**	**50**	**50**	**5.0**	< 1	1	< 1	< 1	< 1	< 1	**19**	**33**
Thallium	ug/L	**2**	**2.0**	**2.0**	**3.7**	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2

Notes:

ug/L - micrograms per liter; mg/L - milligrams per liter.
pCi/L - picocuries per liter; SU - standard units; pH is a field parameter.
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 21, 2020.
** - 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.
E - Criterion is the aesthetic drinking water value per footnote {E}.
EE - Criterion is based on the total dissolved solids GSI value per footnote {EE}.
(1) 40 CFR Part 257 Appendix III Detection Monitoring Constituents and Appendix IV Assessment Monitoring Constituents.
(2) Monitoring wells JH-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes. These wells are no longer considered downgradient monitoring wells.
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

1:36,000
1:36,000

0 3,000 6,000 FEET

TRC

999 Fourier Drive
Suite 101
Madison, WI 53717
Phone: 608.826.3663

TRC - GIS

PROJECT:

CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:

SITE LOCATION MAP

DRAWN BY:	A. FOJTIK
CHECKED BY:	H. SCHNAIDT
APPROVED BY:	S. HOLMSTROM
DATE:	JANUARY 2023
PROJ. NO.:	464090.0001
FILE:	464090_JHC.mxd

FIGURE 1

-- Saved By: AFOJTIK on 1/11/2023, 16:01:20 PM

LEGEND

- BACKGROUND 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
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2018)
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2022)
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL (2018)
- NATURE AND EXTENT/DOWNGRADIENT MONITORING WELLS

NOTES:

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2021.
2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH JUNE 15, 2022.
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.
9. MONITORING WELLS DECOMMISSIONED MAY 25, 2021.
10. MONITORING WELLS DECOMMISSIONED AND REPLACED JULY 20-22, 2021.
11. JHC-MW-22001 MONITORING WELL INSTALLED MAY 12, 2022.
12. STATIC WATER ELEVATIONS IN NORTH AMERICAN VERTICAL DATUM 1988, NAVD 88.

N

1:8,400

1" = 700'

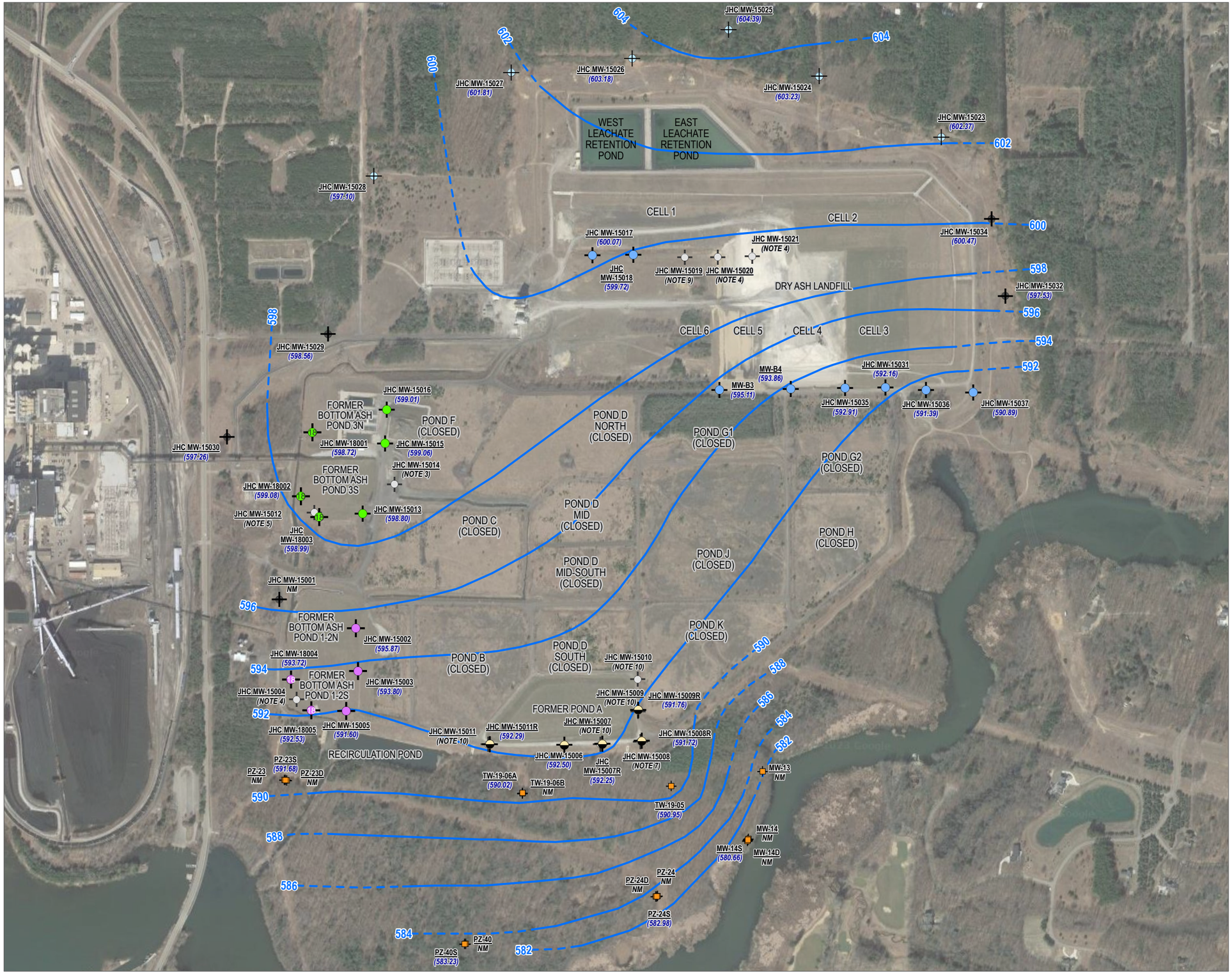
0 500 1,000 FEET

PROJECT:	CONSUMERS ENERGY COMPANY JH CAMPBELL POWER PLANT WEST OLIVE, MICHIGAN
TITLE:	SITE PLAN WITH CCR MONITORING WELL LOCATIONS
DRAWN BY: A. FOJTIK	PROJ. NO.: 464090.0001
CHECKED BY: H. SCHNAIDT	FIGURE 2
APPROVED BY: S. HOLMSTROM	
DATE: JANUARY 2023	

TRC
999 FOURIER DRIVE
SUITE 101
MADISON, WI 53717
PHONE: 608.826.3663

FILE: 464090_JHC.aprx

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl; Map Rotation: 0
Saved By: AFOJTIK on 1/23/2023, 1:24:09 PM; File Path: T:\1_PROJECTS\Consumers_Energy\464090_JHC\2-ARR\MXD\464090_JHC.aprx; Layout Name: JHC_fig2_Site_Plan



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
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2018)
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL (2018)
- NATURE AND EXTENT/DOWNGRADIENT MONITORING WELLS
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)

NOTES:

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2021.
2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH JUNE 15, 2022.
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.
9. MONITORING WELLS DECOMMISSIONED MAY 25, 2021.
10. MONITORING WELLS DECOMMISSIONED AND REPLACED JULY 20-22, 2021.

1:8,400
1" = 700'
0 500 1,000 FEET

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

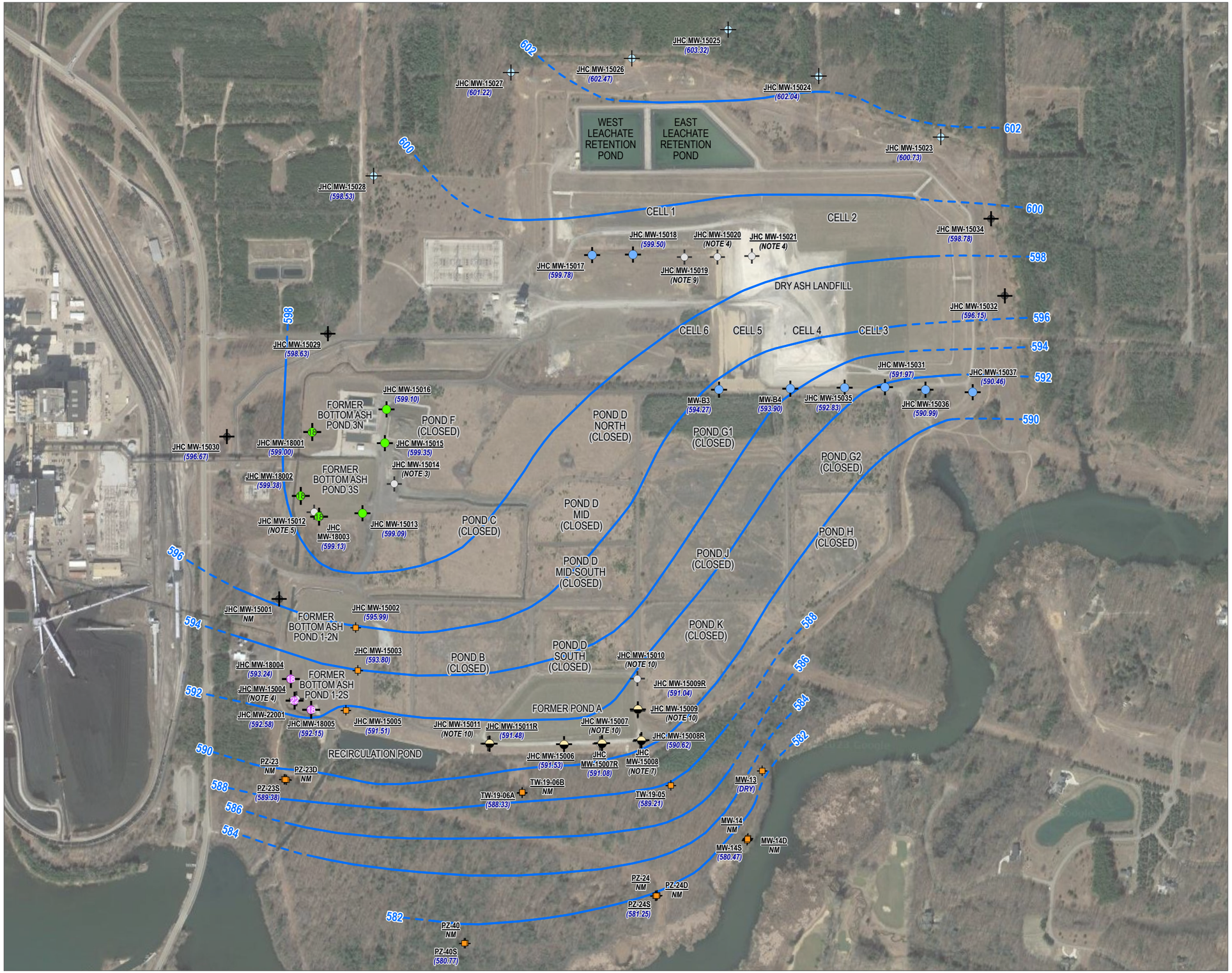
TITLE: GROUNDWATER CONTOUR MAP
APRIL 2022

DRAWN BY:	A. FOJTIK	PROJ. NO.:	464090.0001
CHECKED BY:	H. SCHNAIDT		
APPROVED BY:	S. HOLMSTROM		FIGURE 3
DATE:	JANUARY 2023		

TRC
999 FOURIER DRIVE
SUITE 101
MADISON, WI 53717
PHONE: 608.826.3663

FILE: 464090_JHC.aprx

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl - Map Rotation: 0
Saved By AFOJTIK on 1/23/2023 - 8:20:00 PM - File Path: T:\...PROJECTS\Consumers_Energy\464090_JHC\2-APRX\464090_JHC.aprx - Layout Name: JHC_GWEL_Apr2022



LEGEND

- BACKGROUND 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
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2018)
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2022)
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL (2018)
- NATURE AND EXTENT/DOWNGRADIENT MONITORING WELLS
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)

NOTES:

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2021.
2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH JUNE 15, 2022.
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.
9. MONITORING WELLS DECOMMISSIONED MAY 25, 2021.
10. MONITORING WELLS DECOMMISSIONED AND REPLACED JULY 20-22, 2021.
11. JHC-MW-22001 MONITORING WELL INSTALLED MAY 12, 2022.

1:8,400
1" = 700'
0 500 1,000 FEET

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

TITLE: GROUNDWATER CONTOUR MAP
OCTOBER 2022

DRAWN BY:	A. FOJTIK	PROJ. NO.:	464090.0001
CHECKED BY:	H. SCHNAIDT		
APPROVED BY:	S. HOLMSTROM		FIGURE 4
DATE:	JANUARY 2023		

TRC
999 FOURIER DRIVE
SUITE 101
MADISON, WI 53717
PHONE: 608.826.3663

FILE: 464090_JHC.aprx

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl; Map Rotation: 0
Saved By: AFOJTIK on 1/23/2023, 2:53:28 PM; File Path: T:\PROJECTS\Consumers_Energy\464090_JHC\2-APRX\464090_JHC.aprx; Layout Name: JHC_GWEL_Oct2022

Appendix A
JHC-MW-22001 Installation Documentation

1540 Eisenhower Pl.
Ann Arbor, MI 48108

T 734.971.7080
TRCcompanies.com

Technical Memorandum

Date:	July 22, 2022
To:	Beth Swanberg, Consumers Energy
From:	Sarah Holmstrom and Brian Yelen, TRC
Project No.:	464090.0001.0000
Subject:	**Monitoring Well JHC-MW-22001 Installation Summary, Consumers Energy JH Campbell Former Ponds 1-2, West Olive, Michigan**

TRC was retained by Consumers Energy to install an additional monitoring well, JHC-MW-22001, at the Consumers Energy JH Campbell former Ponds 1-2 bottom ash pond, located in West Olive, Michigan (site). This additional well was installed near the southwest corner of Ponds 1-2 (between JHC-MW-18004 and JHC-MW-18005) in order to further characterize groundwater quality downgradient from the former Ponds 1-2 footprint. The location of the newly installed monitoring well is illustrated on Figure 1. This memorandum provides a detailed summary of the monitoring well installation activities conducted at the site.

On May 12, 2022, TRC field staff mobilized to the site to install monitoring well JHC-MW-22001 at Ponds 1-2. Job Site Services of Bay City, Michigan was retained by TRC to provide the well drilling services. Monitoring well JHC-MW-22001 was installed using a Geoprobe 7822 direct push and hollow stem auger drill rig. Prior to well installation, the top five feet of the boring was hand cleared and soil samples were collected continuously to the remaining total depth for classification by TRC field staff using the Unified Soil Classification System and to verify the depth to groundwater. The soil boring log is provided in Attachment A.

The monitoring well is constructed using 2-inch inside diameter PVC casing with a 10-foot screen. The filter pack is comprised of medium washed silica sand and extends approximately 1 foot above the top of the screen. Following placement of the well screen, the well annulus was sealed with two feet of bentonite chips, and the remaining annulus sealed with concrete to ground surface (ft bgs). The well was finished with a 4-foot by 4-foot square, above-ground painted protective metal cover, which was set approximately 1-foot into the concrete surface seal. Well development was performed using pump and surge methods to remove any debris from within the well casing and establish communication with groundwater. The well was secured with three bollards surrounding the monitoring well, finished with a vented and locking well cap, and clearly labeled for identification. Soil cuttings were thin spread around the monitoring well and development water was managed onsite. Nederveld Inc. surveyors completed horizontal and vertical survey of the monitoring well on June 8, 2022. The survey data is included in the soil boring log and well construction diagram. The well construction and development details are documented in the diagram provided in Attachment A.

Attachments: Figure 1 – Site Layout and Monitoring Locations
Attachment A – Soil Boring Log and Well Construction Diagram

Figure

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
- PIEZOMETER 2021
- 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 1/2 N/S MONITORING WELL (2022)
- NEW DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL (2018)
- DOWNGRADIENT MONITORING WELLS
- STAFF GAUGE
- TEMPORARY WELL
- HMP WELL
- *(591.25)* GROUNDWATER ELEVATION (FEET ABOVE MSL)

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2021.
2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH 8/14/2019.
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.
9. MONITORING WELLS DECOMMISSIONED MAY 25, 2021.
10. MONITORING WELLS DECOMMISSIONED JULY 20-21, 2021.
11. STATIC WATER ELEVATIONS IN NORTH AMERICAN VERTICAL DATUM 1988, NAVD 88.
12. JHC-MW-22001 MONITORING WELL INSTALLED MAY 12, 2022.

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:	A. FOJTIK	PROJ NO.:	464090.0001
CHECKED BY:	B. YELEN		
APPROVED BY:	S. HOLMSTROM		**FIGURE 1**
DATE:	JULY 2022		

TRC

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

FILE NO.: 464090-001-002_fig1.mxd

TRC - GIS

Plot Date: 7/21/2022, 18:58:01 PM by AFOJTIK -- LAYOUT: ANSI B(11"x17")

Path: S:\1-PROJECTS\Consumers_Energy_Company\Michigan\CCR_GW\2017_269767\2_JHC\2Map\Production\464090-001-002_fig1.mxd

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

Attachment A

WELL CONSTRUCTION LOG

WELL NO. JHC MW-22001

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
Consumers Energy Company: JH Campbell	5/12/2022	5/12/2022	464090.0001

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Job Site Services	Direct Push / Hollow Stem Auger	601.5	604.28	15.0	2/9

Boring Location: Southwest of Ponds 1-2

State Plane N: 517850.0 E: 12633534.9

Personnel
Logged By - Brian Yelen
Driller - Dave Mockma

Drilling Equipment: Geoprobe 7822

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

Water Level Observations:
While Drilling: Date/Time 5/12/22 00:00 ▽ Depth (ft, bgs) 9
After Drilling: Date/Time 5/12/22 00:00 ▼ Depth (ft, bgs) 9

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
			0	**TOPSOIL**				
1 GP	75		2	**SAND** mostly fine to medium sand, brownish yellow (10 YR 6/6), no odor, moist, loose.	SW			
			4					
2 GP	75		6					
			8	▼ Change to wet at 9.0 feet below ground surface.				
3 GP	75		10	Change to trace to few coarse sand at 10.0 feet below ground surface.				
			12					
			14					
			15	End of boring at 15.0 feet below ground surface.				
			16					

SOIL BORING WELL CONSTRUCTION LOG 464090.0001_MW-22001.GPJ 7/21/22

Signature:

Firm: TRC
1540 Eisenhower Place Ann Arbor, Michigan

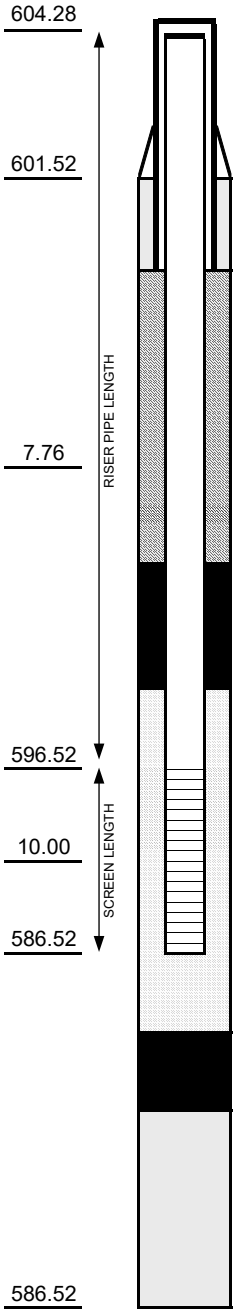
Phone 734-971-7080
Fax

Checked By: Andrew Whaley

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: Consumers Energy JH Campbell Ponds 1-2			WELL ID: **JHC-MW-22001**
PROJ. NO: 464090.0001	DATE INSTALLED: 5/12/2022	INSTALLED BY: Brian Yelen	CHECKED BY: A Whaley

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
604.28	2.76	TOP OF CASING
601.52	0.0	GROUND SURFACE
	2.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: NA
		GROUT/BACKFILL METHOD: NA
7.76		RISER PIPE LENGTH
	NA	GROUT
		BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	4.0	BENTONITE SEAL
596.52	5.0	TOP OF SCREEN
10.00		SCREEN LENGTH
		FILTER PACK MATERIAL: MEDIUM, WASHED SAND
586.52	15.0	BOTTOM OF SCREEN
	15.0	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NA
586.52	15.0	HOLE BOTTOM



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: 9 IN. FROM 0 TO 15 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: 90 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: Very turbid

COLOR BEFORE: Brown

CLARITY AFTER: Clear

COLOR AFTER: Clear

ODOR (IF PRESENT): None

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	18.10	T/PVC	5/12/2022	10:00
DTB AFTER DEVELOPING:	18.15	T/PVC	5/12/2022	10:45
SWL BEFORE DEVELOPING:	11.11	T/PVC	5/12/2022	10:00
SWL AFTER DEVELOPING:	10.92	T/PVC	5/12/2022	10:45
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: Consumers Energy Lock

Appendix B
Monitoring Well Network Certification

Consumers Energy
Count on Us®

A CMS Energy Company

Date: January 27, 2023

To: Operating Record

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

RE: Groundwater Monitoring System Certification, §257.91(f)
JH Campbell Power Plant, Ponds 1-2 North and 1-2 South CCR Unit

Introduction

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

Groundwater Monitoring System

A groundwater monitoring system has been developed for the former JH Campbell Ponds 1-2 North and 1-2 South CCR Unit, which established the following locations for determining background groundwater quality and detection monitoring. The downgradient monitoring network accurately represents the quality of groundwater passing the former waste boundary and ensures detection of groundwater contamination in the uppermost aquifer based on the groundwater flow regime and the limit of the practical length of the unit extending only 900 feet and acreage limited to approximately eleven acres, in addition to taking into consideration the presence of identified CCR sources influencing groundwater quality along the eastern boundary where groundwater cannot reliably be used to assess groundwater quality associated with the former Ponds 1-2 North and 1-2 South CCR Unit. The monitoring system consists of six background and three downgradient monitoring wells. The number and location of the downgradient wells is guided by the limited length of the former unit boundary in the downgradient direction that is outside of the direct flow path of groundwater influenced by historical Ponds B-K (approximately 600 feet).

Background:

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

Downgradient Monitoring Wells:
JHC-MW-18004
JHC-MW-18005
JHC-MW-22001

Provided herein, as required by §257.91(f), is certification from a qualified professional engineer that the groundwater monitoring system at Consumers Energy JH Campbell Ponds 1-2 North and 1-2 South CCR Unit meets the requirements of §257.91.

CERTIFICATION

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

I hereby certify that having reviewed the *2018 Annual Groundwater Monitoring Report*, *2019 Annual Groundwater Monitoring and Corrective Action Report*, *2020 Annual Groundwater Monitoring and Corrective Action Report, 2021 Annual Groundwater Monitoring and Corrective Action Report, and 2022 Annual Groundwater Monitoring and Corrective Action Report* for the JH Campbell Ponds 1-2 North and 1-2 South CCR Unit, and being familiar with the provisions of Title 40 of the Code of Federal Regulations §257.91 (40 CFR Part 257.91), I attest that this Groundwater Monitoring System has been designed and constructed to meet the requirements of 40 CFR 257.91. The report is accurate and has been prepared in accordance with good engineering practices, including the consideration of applicable industry standards, and with the requirements of 40 CFR Part 257.91.

Harold D. Register Jr.

Signature

January 27, 2023

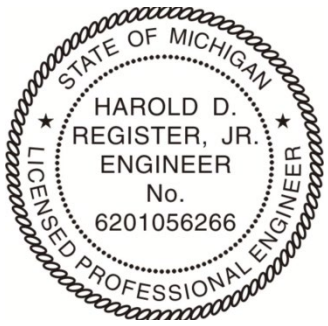
Date of Certification

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

Name

6201056266

Professional Engineer Certification Number



01/27/2023

Appendix C
Data Quality Reviews

Laboratory Data Quality Review
Groundwater Monitoring Event April 2022
CEC JH Campbell Background Wells

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the April 2022 sampling event. Samples were analyzed for total metals, anions, alkalinity, and total dissolved solids (TDS) by CE Laboratory Services in Jackson, Michigan. The radium analyses were subcontracted to Eurofins in St. Louis, Missouri (Eurofins - St. Louis). The laboratory analytical results were reported in laboratory sample delivery groups (SDGs) 22-0342R and 160-45244-1.

During the April 2022 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 (TDS)	SM 2540C
Total Metals	SW-846 6020B/7470A
Alkalinity	SM 2320B
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, 2020) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

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

- Data for laboratory control samples (LCSs) and laboratory control sample duplicates (LCSDs), when performed. The LCSs and/or LCSDs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- 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.

It should be noted that results for method blanks and laboratory control samples were not provided for review by the laboratory. Therefore, potential contamination arising from laboratory sample preparation and/or analytical procedures and the accuracy of the analytical method using a clean matrix could not be evaluated for the total metals, anions, alkalinity, and TDS analyses.

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 reviewed Appendix III and IV constituents as well as alkalinity, magnesium, potassium, and sodium 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 for radium. Radium was not detected in the method blanks.
- The LCS and LCSD recoveries and relative percent differences (RPDs) for radium were within QC limits.
- One equipment blank (EB-01) and one field blank (FB-01) were collected. Target analytes were not detected in these blank samples.

- MS and MSD analyses were performed on sample JHC-MW-15025 for mercury, total metals, and anions. The recoveries were within the acceptance limits. Relative percent differences (RPDs) were not provided by the laboratory and therefore were not evaluated; further, MS/MSD concentrations were not provided by the laboratory. However, since all recoveries were within the acceptance limits, there is no impact on data usability due to this issue.
- The field duplicate pair samples were DUP-01/JHC-MW-15023 for total metals, anions, alkalinity, TDS, and radium. All criteria were met.
- Carrier recoveries, where applicable, were within 40-110%.

Laboratory Data Quality Review
Groundwater Monitoring Event April 2022
Consumers Energy JH Campbell Ponds 1 and 2

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the April 2022 sampling event. Samples were analyzed for total metals, anions, total dissolved solids and alkalinity by CE Laboratory Services in Jackson, Michigan. The laboratory analytical results were reported in sample delivery group (SDG) 22-0343.

During the April 2022 sampling event, a groundwater sample was collected from each of the following wells:

- 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
Total Metals	SW-846 6020B, SW-846 7470A
Alkalinity	SM 2320B

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, 2020). 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;
- Field and equipment blanks are used to assess potential contamination arising from field procedures;
- 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;

- 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.

It should be noted that results for method blanks and LCSs were not provided for review by CE Laboratory Services. Therefore, potential contamination arising from laboratory sample preparation and/or analytical procedures and the accuracy of the analytical method using a clean matrix could not be evaluated for total metals, anions, alkalinity, and TDS analyses.

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

- One equipment blank (EB-02) and one field blank (FB-02) were collected. Target analytes were not detected in these blank samples.
- MS and MSD analyses were performed on sample JHC-MW-18004 for mercury, total metals and anions. The recoveries were within the acceptance limits. Relative percent differences (RPDs) were not provided by the laboratory and therefore were not evaluated; further, MS/MSD concentrations were not provided by the laboratory. However, since all recoveries were within the acceptance limits, there is no impact on data usability due to this issue.
- The field duplicate pair samples were DUP-02/JHC-MW-18005 for total metals, anions, TDS, and alkalinity. All criteria were met.

Laboratory Data Quality Review
Groundwater Monitoring Event April 2022
Consumers Energy JH Campbell Ponds 1 and 2

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the April 2022 sampling event. Samples were analyzed for radium by Eurofins in St. Louis, Missouri (Eurofins - St. Louis). The laboratory analytical results were reported in laboratory sample delivery group (SDG) 160-45247-1.

During the April 2022 sampling event, a groundwater sample was collected from each of the following wells:

- 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
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 Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

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

- The reviewed radium data will be used 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

- Radium was not detected in the method blanks.
- The LCS and LCSD recoveries and relative percent differences were within QC limits.
- One equipment blank (EB-02) and one field blank (FB-02) were collected. Target analytes were not detected in these blank samples.
- The field duplicate pair samples were DUP-02/JHC-MW-18005 for radium. All criteria were met.
- Carrier recoveries, where applicable, were within 40-110%.

Laboratory Data Quality Review
Groundwater Monitoring Event October 2022
CEC JH Campbell Background Wells

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the October 2022 sampling event. Samples were analyzed for total metals, anions, alkalinity, and total dissolved solids (TDS) by CE Laboratory Services in Jackson, Michigan. The radium analyses were subcontracted to Eurofins in St. Louis, Missouri (Eurofins - St. Louis). The laboratory analytical results were reported in laboratory sample delivery groups (SDGs) 22-1096 and 160-47680-1.

During the October 2022 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 (TDS)	SM 2540C
Total Metals	SW-846 6020B/7470A
Alkalinity	SM 2320B
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, 2020) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

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

- Data for laboratory control samples (LCSs) and laboratory control sample duplicates (LCSDs), when performed. The LCSs and/or LCSDs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- 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.

It should be noted that results for method blanks and LCSs were not provided for review by CE Laboratory Services. Therefore, potential contamination arising from laboratory sample preparation and/or analytical procedures and the accuracy of the analytical method using a clean matrix could not be evaluated for the total metals, anions, alkalinity, and TDS analyses.

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 reviewed Appendix III and IV constituents as well as alkalinity, magnesium, potassium, and sodium 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

- One equipment blank (EB-01) and one field blank (FB-01) were collected. Target analytes were not detected in these blank samples.
- A method blank was analyzed with each analytical batch for radium. Radium was not detected in the method blanks.
- The LCS recoveries for radium were within QC limits.
- MS and MSD analyses were performed on sample JHC-MW-15025 for total metals and anions. The recoveries were within the acceptance limits. Relative percent differences

(RPDs) were not provided by the laboratory and therefore were not evaluated; further, MS/MSD concentrations were not provided by the laboratory. However, since all recoveries were within the acceptance limits, there is no impact on data usability due to this issue.

- The field duplicate pair samples were DUP-01/JHC-MW-15023 for total metals, anions, alkalinity, TDS, and radium. All criteria were met.
- Carrier recoveries, where applicable, were within 40-110%.

Laboratory Data Quality Review
Groundwater Monitoring Event October 2022
Consumers Energy JH Campbell Ponds 1 and 2

Groundwater samples were collected by Consumers Energy (CE) Laboratory Services for the October 2022 sampling event. Samples were analyzed for total metals, anions, and total dissolved solids by CE Laboratory Services in Jackson, Michigan. The radium analyses were subcontracted to Eurofins in St. Louis, Missouri (Eurofins - St. Louis). The laboratory analytical results were reported in sample delivery groups (SDGs) 22-1097 and 160-47684-1.

During the October 2022 sampling event, a groundwater sample was collected from each of the following wells:

- JHC-MW-15002
- JHC-MW-15003
- JHC-MW-15005
- JHC-MW-18004
- JHC-MW-18005
- JHC-MW-22001

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Total Dissolved Solids (TDS)	SM 2540C
Total Metals	SW-846 6020B, SW-846 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, 2020) 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;
- Field and equipment blanks are used to assess potential contamination arising from field procedures;
- 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;

- 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.

It should be noted that results for method blanks and LCSs were not provided for review by CE Laboratory Services. Therefore, potential contamination arising from laboratory sample preparation and/or analytical procedures and the accuracy of the analytical method using a clean matrix could not be evaluated for total metals, anions, and TDS analyses.

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

- One equipment blank (EB-02) and one field blank (FB-02) were collected. Target analytes were not detected in these blank samples.
- A method blank was analyzed with each analytical batch for radium. Radium was not detected in the method blanks.
- The LCS percent recoveries (%Rs) for radium were within QC limits with the following exception.
  - The %R for radium 228 in LCS 160-588683/2-A was 147%. The detections of radium 228 in associated samples JHC-MW-15002, JHC-MW-15003, JHC-MW-15005, JHC-MW-18004, JHC-MW-18005, and DUP-02 should be considered estimated and are potentially uncertain, as summarized in Attachment A.
- MS and MSD analyses were performed on sample JHC-MW-18004 for mercury, total metals and anions. The recoveries were within the acceptance limits. Relative percent differences (RPDs) were not provided by the laboratory and therefore were not evaluated;

further, MS/MSD concentrations were not provided by the laboratory. However, since all recoveries were within the acceptance limits, there is no impact on data usability due to this issue.

- The field duplicate pair samples were DUP-02/JHC-MW-18005 for total metals, anions, TDS, and radium. All criteria were met.
- A laboratory duplicate analysis was performed on sample JHC-MW-15003 for radium 226 and 228. All criteria were met.
- Carrier recoveries, where applicable, were within 40-110%.

Attachment A

Summary of Data Non-Conformances

JH Campbell Pond 1 and 2 – RCRA CCR Monitoring Program

West Olive, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JHC-MW-15002	10/20/2022	Radium 228	Detected result is potentially uncertain due to high LCS recovery.
JHC-MW-15003	10/20/2022		
JHC-MW-15005	10/20/2022		
JHC-MW-18004	10/20/2022		
JHC-MW-18005	10/20/2022		
DUP-02	10/20/2022		

Appendix D
April 2022 Assessment Monitoring Statistical Evaluation

1540 Eisenhower Pl.
Ann Arbor, MI 48108

T 734.971.7080
TRCcompanies.com

Technical Memorandum

Date:	July 21, 2022
To:	Bethany Swanberg, Consumers Energy
From:	Sarah Holmstrom, TRC Kristin Lowery, TRC
Project No.:	464090.0001.0000 Phase 1 Task 2
Subject:	Statistical Evaluation of April 2022 Assessment Monitoring Sampling Event, JH Campbell Bottom Ash Ponds 1-2 North and 1-2 South CCR Unit, Consumers Energy Company, West Olive, Michigan

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 first semiannual assessment monitoring event of 2022 was conducted on April 11 through 14, 2022. In accordance with §257.95, the assessment monitoring data must be compared to Groundwater Protection Standards (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 Annual Report) (TRC, January 2019). The following narrative describes the methods that were employed for comparisons to the GWPSs. The results obtained and the Sanitas™ output files are included as an attachment.

The statistical evaluation of the first semiannual assessment monitoring event for 2022 indicates that there are no constituents present at statistically significant levels exceeding the GWPS in downgradient monitoring wells at the Ponds 1-2 CCR Unit:

Constituent	GWPS	# Downgradient Wells Observed

No constituents are present at statistically significant levels above the GWPSs.

These results are consistent with the results of the previous assessment monitoring data statistical evaluation, with no new statistically significant levels above the GWPSs. 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.

[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.

Assessment Monitoring Statistical Evaluation

The monitoring well network at the Ponds 1-2 CCR Unit boundary has recently consisted of five monitoring wells (three downgradient and two side gradient). Monitoring wells JHC-MW-15005 (east), JHC-MW-18004 (west), and JHC-MW-18005 (south) are located downgradient of Ponds 1-2 and monitoring wells JHC-MW-15002 and JHC-MW-15003 are located side gradient to the east of Ponds 1-2, as described in the January 22, 2021 Groundwater Monitoring System Certification.

The *Alternative Source Demonstration: Selenium at JHC-MW-15005* (TRC, October 2021) (October 2021 ASD) was prepared in response to the statistically significant level of selenium above the GWPS identified at JHC-MW-15005 in the April 2021 assessment monitoring event. The multiple lines of evidence presented in the ASD show that hydrogeological and geochemical changes post-CCR removal from Ponds 1-2 have resulted in observations of new increases in groundwater concentrations for selenium at JHC-MW-15005 that are unrelated to Ponds 1-2. The data presented in the October 2021 ASD also identified that monitoring wells JHC-MW-15002 and JHC-MW-15003 are installed within the footprint of historic Ponds B-K (immediately east of the former Ponds 1-2 footprint) with CCR in place within the soil column immediately above the each of the well screens. Data presented in the ASD not only confirmed the presence of CCRs at JHC-MW-15002 and JHC-MW-15003, but also established that groundwater chemistry is being influenced by historical Ponds B-K, which in turn is influencing groundwater quality at JHC-MW-15005 immediately downgradient from JHC-MW-15002 and JHC-MW-15003. As a result, Consumers Energy is in the process of re-evaluating the Ponds 1-2 well network given that groundwater quality at the three wells along the east boundary of Ponds 1-2 is influenced by an alternate source and are not entirely representative of groundwater quality associated with Ponds 1-2. However, these three wells continue to be sampled and evaluated as part of the assessment monitoring program and used to evaluate groundwater quality post-CCR removal while the use of these wells in the groundwater monitoring system is re-evaluated.

Following the first semiannual assessment monitoring sampling event for 2022, 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 is 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 sample mean, the sample standard deviation, and a selected confidence level (i.e. 99 percent), an upper and lower confidence limit is calculated. The actual mean concentration of the population, with 99 percent confidence, will fall between the lower and upper confidence limits.

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

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

For each detected Appendix IV constituent, the concentrations for each well were first compared directly to the GWPS, as shown on Table 1. Constituent-well combinations that included a direct exceedance of the GWPS within the past eight monitoring events (November 2018 through April 2022 for JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 and April 2019 through April 2022 for JHC-MW-18004 and JHC-MW-18005) were retained for further analysis (Attachment 1). Direct comparison GWPS exceedances included the following constituent-well combinations:

- Arsenic, lithium, and molybdenum in JHC-MW-15002 (side gradient),
- Arsenic, cobalt, and molybdenum in JHC-MW-15003 (side gradient),
- Lithium, molybdenum, selenium, and thallium in JHC-MW-15005, and
- Selenium in JHC-MW-18005.

As discussed above, an ASD was prepared in response to the presence of selenium above the GWPS in JHC-MW-15005 and showed that the concentrations of selenium are unrelated to Ponds 1-2. Therefore, comparison of selenium concentrations at JHC-MW-15005 to the GWPS is not appropriate and a confidence interval is not calculated. Groundwater data for the constituent-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 assessment monitoring results (November 2018 through April 2021) for these well-constituent pairs were observed visually for potential outliers and trends. No outliers were apparent. Visual trends were observed for arsenic in JHC-MW-15002 and JHC-MW-15003, lithium in JHC-MW-15002, molybdenum in JHC-MW-15002, and thallium in JHC-MW-15005 (time-series plots in Attachment 1); a statistically significant increasing trend at 98% confidence level was found for arsenic at JHC-MW-15003. However, no other statistically significant trends were found for the well-constituent pairs with visually observable trends.. As discussed in the October 2021 ASD, hydrogeological and geochemical changes post-CCR removal from Ponds 1-2 have resulted in observations of new increases in groundwater constituent concentrations for several Appendix III and Appendix IV parameters in the Ponds 1-2 monitoring network unrelated to Ponds 1-2 and are occurring as groundwater responds and re-equilibrates to the new geochemical conditions coupled with the constituent concentrations from upgradient historic CCR management sources. Because hydrogeologic conditions are in the process of stabilizing, temporary trending and sporadic outlier data are not unexpected, and all data collected during the re-equilibrating period will be kept in the assessment monitoring data set.

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 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 at JHC-MW-15002 Cobalt at JHC-MW-15003 (Kaplan-Meier) Lithium at JHC-MW-15002 and JHC-MW-15005 Molybdenum at JHC-MW-15002 and JHC-MW-15003 Selenium at JHC-MW-18005
Normalized by natural log transformation	Arsenic at JHC-MW-15003 Molybdenum at JHC-MW-15005

Distribution	Parameter-Well Combinations
Normalized by square root transformation	Thallium at 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 significant GWPS exceedance for arsenic in side gradient monitoring well JHC-MW-15002. These results are consistent with the results of previous assessment monitoring data statistical evaluations and, as detailed above, is representative of groundwater quality from the alternate source Ponds B-K. Consumers Energy continues 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 1 Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation

Attachment 1 Sanitas™ Output

Table

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15002[(1)]							
						Sample Date:	11/15/2018	11/15/2018	4/25/2019	10/9/2019	4/16/2020	10/22/2020	4/14/2021	10/21/2021	4/13/2022
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS										
Appendix III								Field Dup							
Boron	ug/L	NC	NA	51	NA		1,470	1,360	3,200	1,700	2,560	2,390	4,880	2,350	1,620
Calcium	mg/L	NC	NA	46	NA		41.9	41.1	85	99	122	80.1	103	112	87.7
Chloride	mg/L	250*	NA	43	NA		19.3	19.2	17	20	15.4	16.0	14.2	18.1	21.3
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		95.2	94.5	190	280	295	212	499	263	187
Total Dissolved Solids	mg/L	500*	NA	258	NA		222	274	410	480	567	396	583	570	420
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		8.0	--	6.9	6.5	6.1	5.7	5.3	6.5	6.72
Appendix IV															
Antimony	ug/L	6	NA	2	6		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	NA	1	**10**		**60.5**	**59.5**	**50**	**57**	**45**	**21**	**36**	**38**	**20**
Barium	ug/L	2,000	NA	35	2,000		18.4	18.1	49	150	128	85	49	47	39
Beryllium	ug/L	4	NA	1	4		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	NA	2	100		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	1	< 1	1
Cobalt	ug/L	NC	6	15	**15**		< 6.0	< 6.0	< 6.0	< 6.0	< 15	< 15	< 6	< 6	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	40	10	**40**		**68**	**67**	**96**	**240**	**125**	**76**	**48**	24	14
Mercury	ug/L	2	NA	0.2	2		< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**		9.2	9.0	< 5.0	15	49	43	12	**101**	80
Radium-226	pCi/L	NC	NA	NA	NA		< 1.09	0.921	0.233	0.698	0.378	0.468	0.302	0.332	0.407
Radium-228	pCi/L	NC	NA	NA	NA		1.04	0.767	0.409	< 0.394	< 0.408	< 0.250	0.524	0.823	< 0.367
Radium-226/228	pCi/L	5	NA	1.93	5		< 1.70	1.69	0.642	1.04	0.784	0.533	0.827	1.16	0.745
Selenium	ug/L	50	NA	5	**50**		2.5	2.8	< 1.0	< 1.0	1	< 1	1	1	14
Thallium	ug/L	2	NA	2	**2**		< 2.0	< 2.0	< 2.0	< 2.0	< 2	< 2	< 2	< 2	< 2

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) Monitoring wells JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15003[(1)]								
						Sample Date:	11/15/2018	4/29/2019	10/9/2019	10/9/2019	4/16/2020	10/22/2020	4/14/2021	10/20/2021	10/20/2021	4/13/2022
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS					Field Dup					Field Dup	
Appendix III																
Boron	ug/L	NC	NA	51	NA		1,120	1,700	3,500	3,300	3,880	2,370	674	1,060	1,020	2,740
Calcium	mg/L	NC	NA	46	NA		115	36	110	110	94.6	57.6	108	101	99.1	71.5
Chloride	mg/L	250*	NA	43	NA		16.3	18	47	47	17.3	22.3	24.2	16.6	16.6	17.9
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
Sulfate	mg/L	250*	NA	14	NA		294	75	210	220	194	89	207	172	173	125
Total Dissolved Solids	mg/L	500*	NA	258	NA		644	200	580	600	554	339	573	542	540	389
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		8.7	8.4	8.7	--	8.3	8.3	8.2	8.2	--	7.62
Appendix IV																
Antimony	ug/L	6	NA	2	6		2.0	2.2	1.4	1.4	1	< 1	1	< 1	< 1	1
Arsenic	ug/L	10	NA	1	**10**		8.1	10	8.4	7.7	9	**12**	**15**	**24**	**24**	**24**
Barium	ug/L	2,000	NA	35	2,000		113	42	91	89	103	68	75	75	76	72
Beryllium	ug/L	4	NA	1	4		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5		1.7	0.41	2.5	2.5	1.0	< 0.2	< 0.2	0.3	0.3	< 0.2
Chromium	ug/L	100	NA	2	100		13.6	4.2	11	10	7	7	3	9	9	3
Cobalt	ug/L	NC	6	15	**15**		**23.6**	< 6.0	**43**	**41**	**47**	< 15	< 6	**22**	**23**	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		3.3	< 1.0	3.2	3.2	5	2	< 1	1	1	< 1
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		< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**		65.3	20	**120**	**120**	**125**	59	38	52	52	41
Radium-226	pCi/L	NC	NA	NA	NA		< 0.579	< 0.113	0.301	0.430	0.272	< 0.322	0.170	0.358	0.357	0.123
Radium-228	pCi/L	NC	NA	NA	NA		< 0.657	< 0.530	0.421	< 0.361	0.541	< 0.282	< 0.423	< 0.517	< 0.344	< 0.354
Radium-226/228	pCi/L	5	NA	1.93	5		< 1.24	< 0.530	0.722	0.559	0.813	< 0.322	< 0.423	< 0.517	0.604	< 0.354
Selenium	ug/L	50	NA	5	**50**		28.6	2.9	18	19	27	1	25	38	37	49
Thallium	ug/L	2	NA	2	**2**		< 2.0	< 2.0	< 2.0	< 2.0	< 2	< 2	< 2	< 2	< 2	< 2

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) Monitoring wells JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-15005								
						Sample Date:	11/15/2018	4/25/2019	4/25/2019	10/9/2019	4/16/2020	10/22/2020	4/13/2021	4/13/2021	10/21/2021	4/13/2022
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS				Field Dup					Field Dup		
Appendix III																
Boron	ug/L	NC	NA	51	NA		1,450	2,800	2,900	1,200	1,020	1,340	616	623	661	698
Calcium	mg/L	NC	NA	46	NA		61.9	170	180	110	97.1	131	99.7	94.7	86.1	93.6
Chloride	mg/L	250*	NA	43	NA		30.6	28	28	30	15.6	57.1	6.19	5.24	14.1	9.28
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
Sulfate	mg/L	250*	NA	14	NA		133	240	320	130	133	207	88.8	85.4	138	176
Total Dissolved Solids	mg/L	500*	NA	258	NA		334	800	780	360	487	735	470	455	489	457
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		7.5	7.2	--	7.3	7.1	7.2	7.4	--	7.5	7.17
Appendix IV																
Antimony	ug/L	6	NA	2	6		5.1	4.4	4.2	3.3	2	2	2	2	3	3
Arsenic	ug/L	10	NA	1	**10**		1.2	1.2	1.1	1.4	1	2	3	2	2	2
Barium	ug/L	2,000	NA	35	2,000		149	150	150	190	270	354	208	211	229	203
Beryllium	ug/L	4	NA	1	4		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.20	< 0.20	< 0.20	< 0.20	0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	NA	2	100		< 1.0	1.3	1.3	1.3	1	< 1	1	1	< 1	1
Cobalt	ug/L	NC	6	15	**15**		< 6.0	< 6.0	< 6.0	< 6.0	< 15	< 15	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	40	10	**40**		28	38	38	**50**	**59**	**42**	20	21	**46**	23
Mercury	ug/L	2	NA	0.2	2		< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**		**222**	**900**	**870**	**370**	91	**110**	88	90	50	61
Radium-226	pCi/L	NC	NA	NA	NA		< 0.461	0.169	0.248	0.592	0.448	0.691	0.264	0.284	0.570	0.324
Radium-228	pCi/L	NC	NA	NA	NA		0.967	< 0.350	0.495	0.427	0.566	0.791	< 0.360	0.471	0.553	< 0.381
Radium-226/228	pCi/L	5	NA	1.93	5		1.41	< 0.350	0.743	1.02	1.01	1.48	0.510	0.755	1.12	< 0.381
Selenium	ug/L	50	NA	5	**50**		**158**	**140**	**130**	**66**	**282**	**260**	**165**	**171**	**98**	**555**
Thallium	ug/L	2	NA	2	**2**		< 2.0	2.0	<2.0	**2.9**	**3**	**7**	**3**	**3**	**4**	**3**

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) Monitoring wells JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

					Sample Location:	JHC-MW-18004							
					Sample Date:	4/25/2019	8/13/2019	10/9/2019	4/16/2020	10/22/2020	4/13/2021	10/22/2021	4/13/2022
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS								
Appendix III													
Boron	ug/L	NC	NA	51	NA	920	1,200	620	524	638	444	456	346
Calcium	mg/L	NC	NA	46	NA	72	97	73	117	98.4	88.9	73.1	76.5
Chloride	mg/L	250*	NA	43	NA	34	35	40	14.2	12.5	5.17	10.8	2.22
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
Sulfate	mg/L	250*	NA	14	NA	100	110	120	249	127	64.4	69.3	100
Total Dissolved Solids	mg/L	500*	NA	258	NA	380	490	310	604	515	418	407	381
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA	7.2	7.5	7.2	6.9	7.4	7.7	7.7	7.64
Appendix IV													
Antimony	ug/L	6	NA	2	6	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	NA	1	**10**	1.1	1.2	1.1	< 1	1	< 1	1	< 1
Barium	ug/L	2,000	NA	35	2,000	220	680	270	210	323	325	361	302
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	NA	2	100	2.0	1.8	1.3	< 1	< 1	< 1	< 1	< 1
Cobalt	ug/L	NC	6	15	**15**	< 6.0	< 6.0	< 6.0	< 15	< 15	< 6	< 6	< 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
Lead	ug/L	NC	15	1	15	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	40	10	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**	8.2	9.0	10	7	10	7	7	< 5
Radium-226	pCi/L	NC	NA	NA	NA	0.110	0.352	0.179	< 0.131	0.367	0.243	0.583	0.228
Radium-228	pCi/L	NC	NA	NA	NA	< 0.430	0.469	0.672	0.889	0.454	0.642	< 0.355	0.354
Radium-226/228	pCi/L	5	NA	1.93	5	< 0.430	0.822	0.851	0.952	0.821	0.885	0.745	0.582
Selenium	ug/L	50	NA	5	**50**	12	39	33	34	18	39	34	27
Thallium	ug/L	2	NA	2	**2**	< 2.0	< 2.0	< 2.0	< 2	< 2	< 2	< 2	< 2

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) Monitoring wells JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

						Sample Location:	JHC-MW-18005									
						Sample Date:	4/25/2019	8/13/2019	8/13/2019	10/9/2019	4/16/2020	10/22/2020	10/22/2020	4/13/2021	10/22/2021	4/13/2022	4/13/2022
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS				Field Dup				Field Dup				Field Dup
Appendix III																	
Boron	ug/L	NC	NA	51	NA		650	750	780	660	534	486	499	382	408	347	343
Calcium	mg/L	NC	NA	46	NA		41	43	45	55	42.6	58.7	60.1	45.5	55.7	46.3	45.1
Chloride	mg/L	250*	NA	43	NA		25	27	27	18	19.6	16.4	16.8	16.6	8.25	7.55	6.78
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	14	NA		66	95	95	110	74.5	105	108	75.3	79.9	55.4	52.6
Total Dissolved Solids	mg/L	500*	NA	258	NA		250	270	290	330	262	339	317	287	337	263	282
pH, Field	SU	6.5 - 8.5*	NA	4.8 - 9.2	NA		9.0	8.9	--	8.8	8.5	8.4	--	8.7	8.4	8.6	--
Appendix IV																	
Antimony	ug/L	6	NA	2	6		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	NA	1	**10**		8.8	7.4	7.3	7.1	8	8	8	8	8	7	7
Barium	ug/L	2,000	NA	35	2,000		73	120	120	150	144	207	206	201	310	258	256
Beryllium	ug/L	4	NA	1	4		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	NA	2	100		2.8	2.3	2.4	1.9	< 1	1	1	< 1	< 1	1	1
Cobalt	ug/L	NC	6	15	**15**		< 6.0	< 6.0	< 6.0	< 6.0	< 15	< 15	< 15	< 6	< 6	< 6	< 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
Lead	ug/L	NC	15	1	15		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1
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		< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	5	**100**		14	15	15	66	9	7	7	7	< 5	6	7
Radium-226	pCi/L	NC	NA	NA	NA		< 0.0785	< 0.145	0.150	0.497	0.150	< 0.205	< 0.182	0.225	0.316	0.206	0.145
Radium-228	pCi/L	NC	NA	NA	NA		< 0.357	< 0.400	< 0.374	0.456	< 0.455	< 0.141	0.131	< 0.395	< 0.498	< 0.350	0.620
Radium-226/228	pCi/L	5	NA	1.93	5		< 0.357	< 0.400	< 0.374	0.953	< 0.455	< 0.205	0.185	< 0.395	0.507	0.507	0.765
Selenium	ug/L	50	NA	5	**50**		16	11	11	**140**	46	**99**	**103**	**58**	31	**64**	**62**
Thallium	ug/L	2	NA	2	**2**		< 2.0	< 2.0	< 2.0	< 2.0	< 2	< 2	< 2	< 2	< 2	< 2	< 2

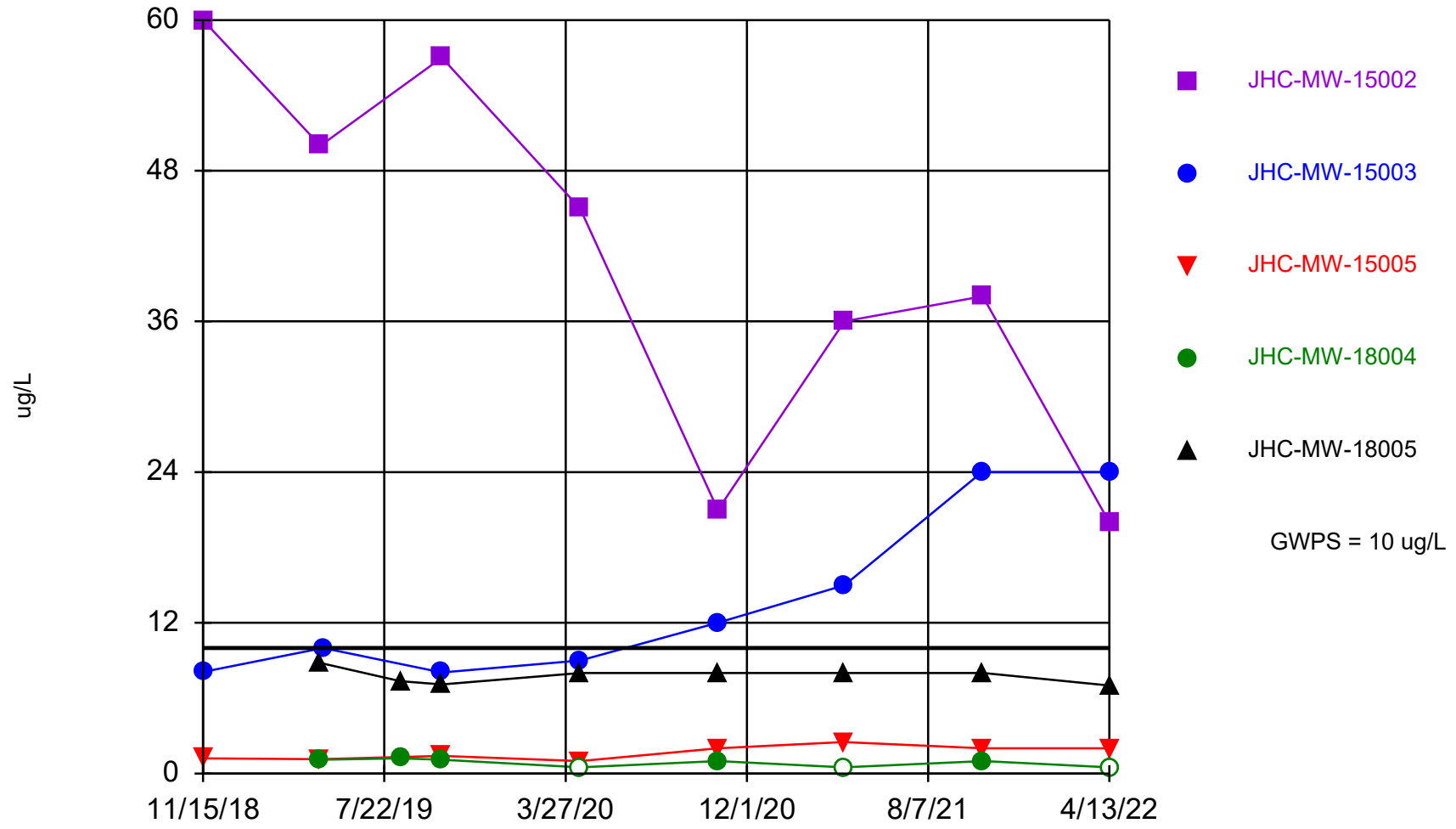
Notes:

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) Monitoring wells JHC-MW-15002 and JHC-MW-15003 have been side gradient of Ponds 1-2 since 2018 due to post-pond decommissioning groundwater flow direction changes and are no longer considered downgradient monitoring wells.

Attachment 1
Sanitas™ Output

Hollow symbols indicate censored values.

Arsenic Comparison to GWPS

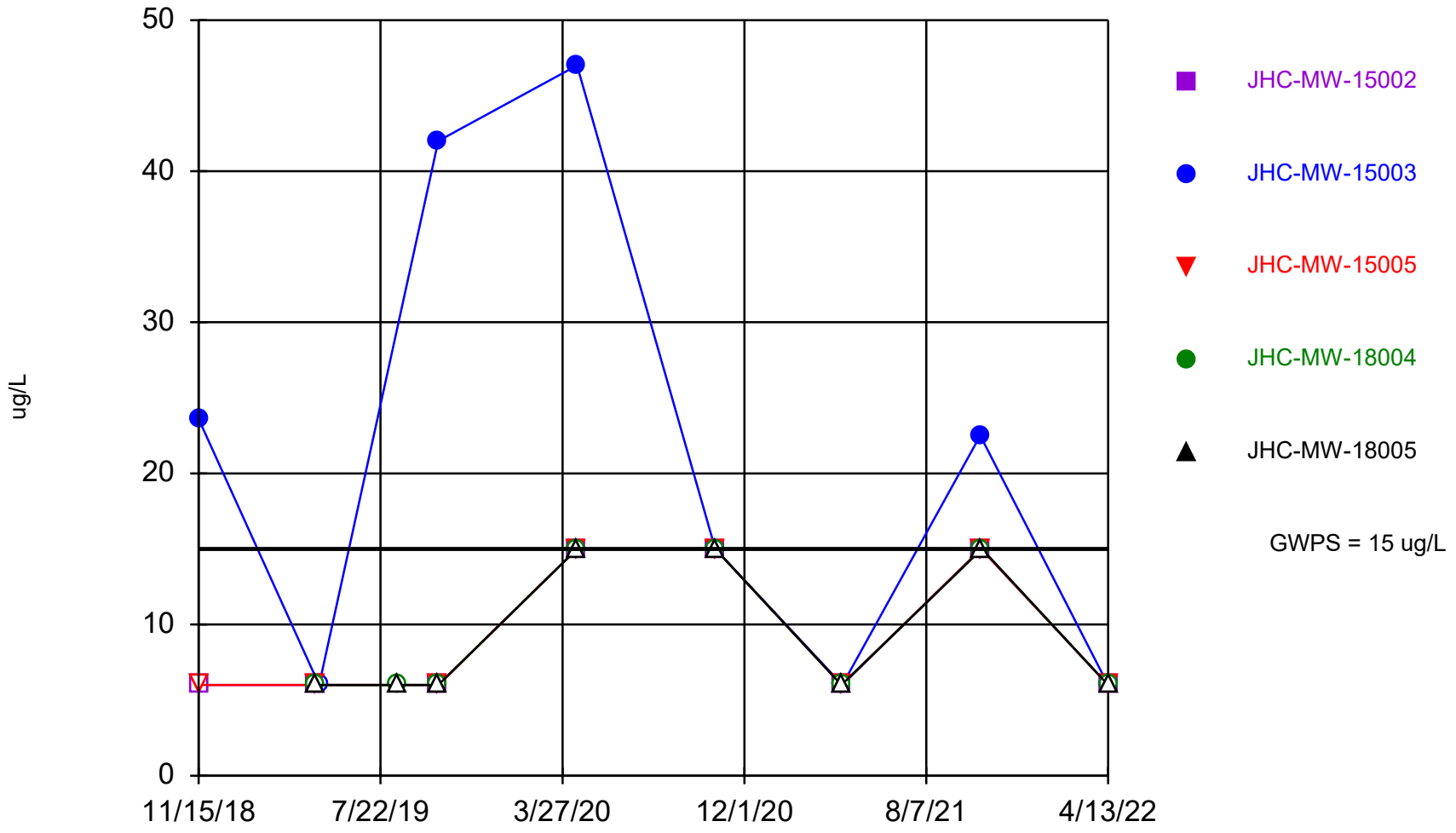


Time Series Analysis Run 6/17/2022 1:08 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_

Hollow symbols indicate censored values.

Cobalt Comparison to GWPS

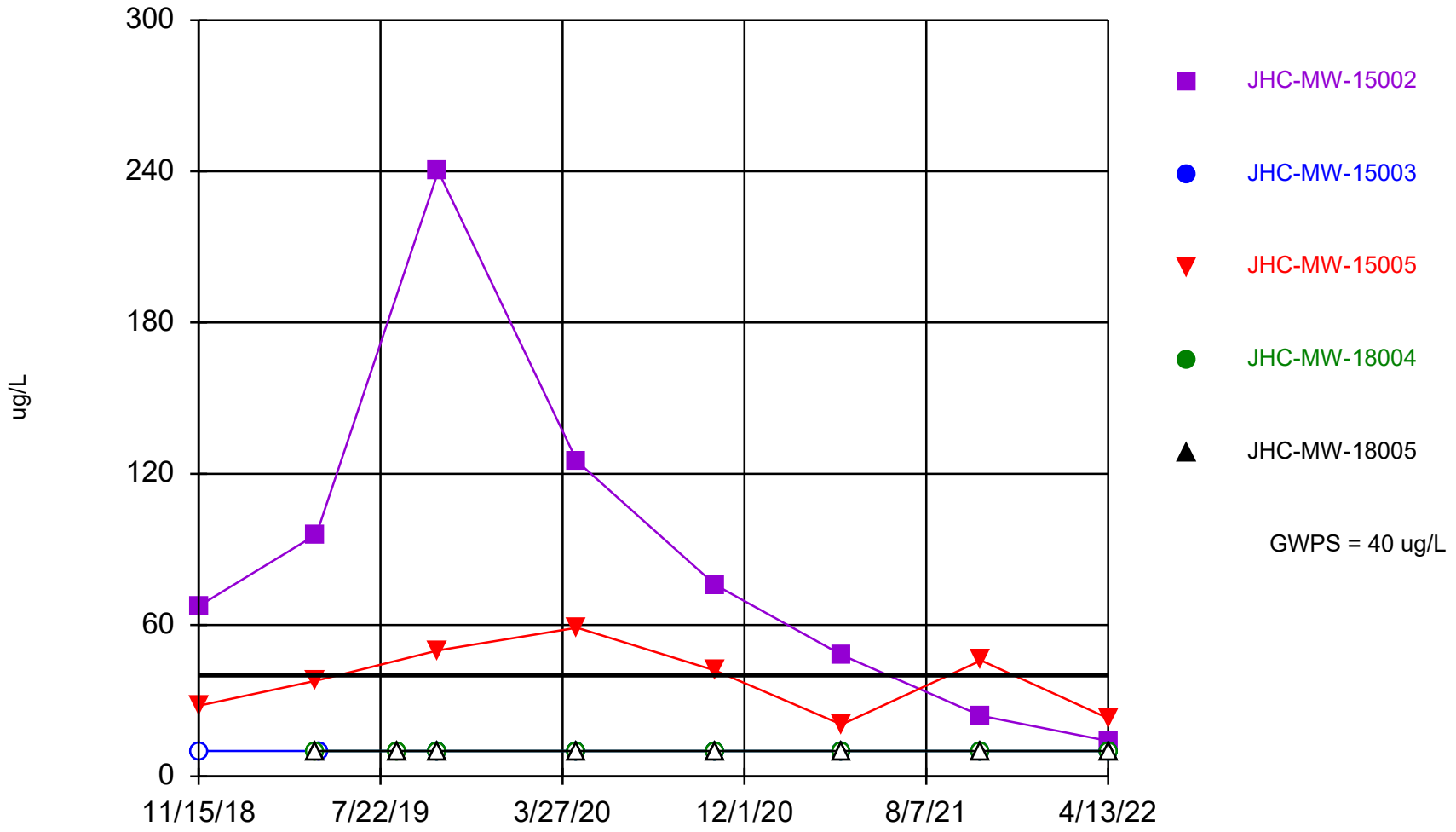


Time Series Analysis Run 6/17/2022 1:09 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_

Hollow symbols indicate censored values.

Lithium Comparison to GWPS

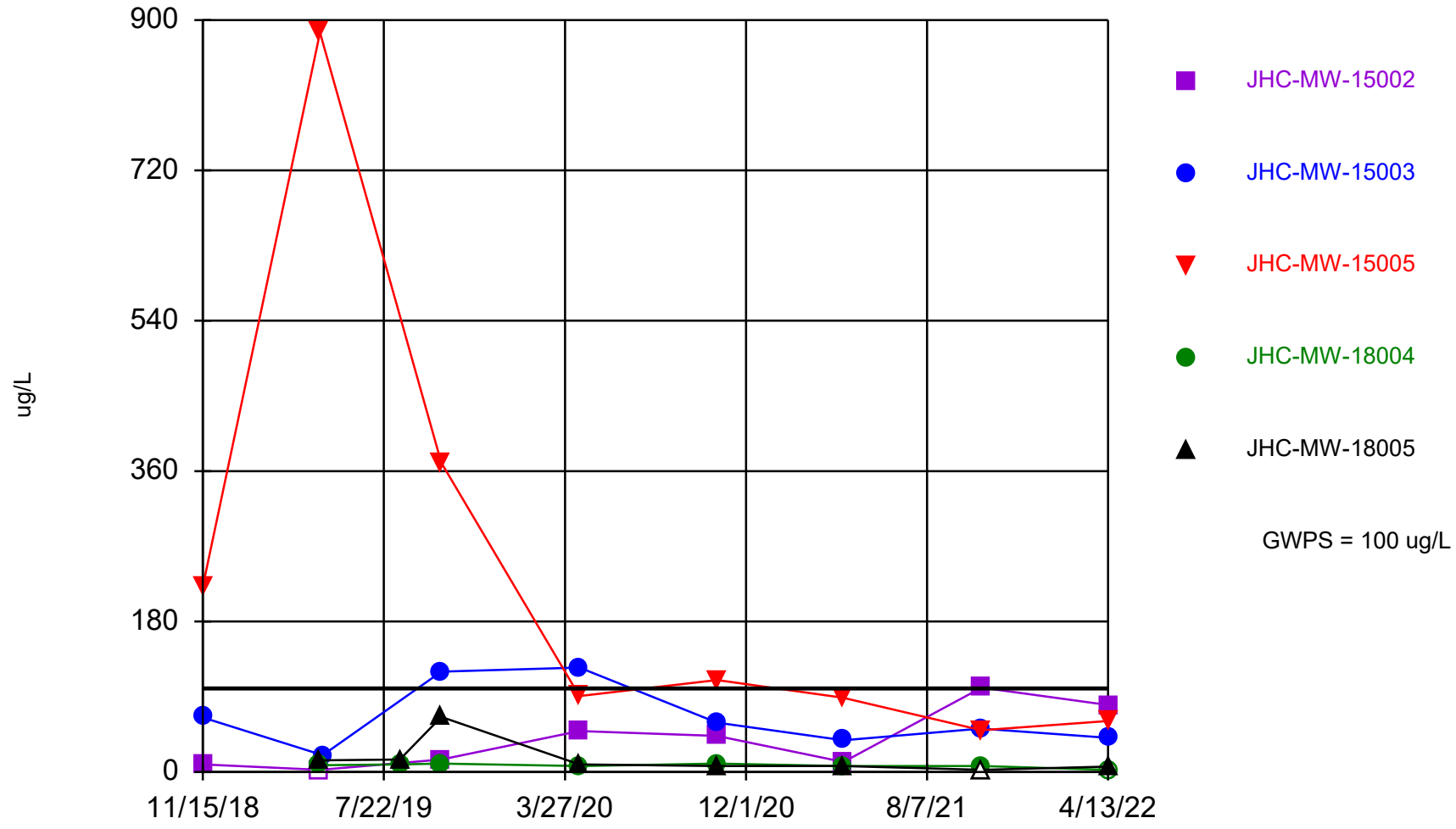


Time Series Analysis Run 6/17/2022 1:10 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_

Hollow symbols indicate censored values.

Molybdenum Comparison to GWPS

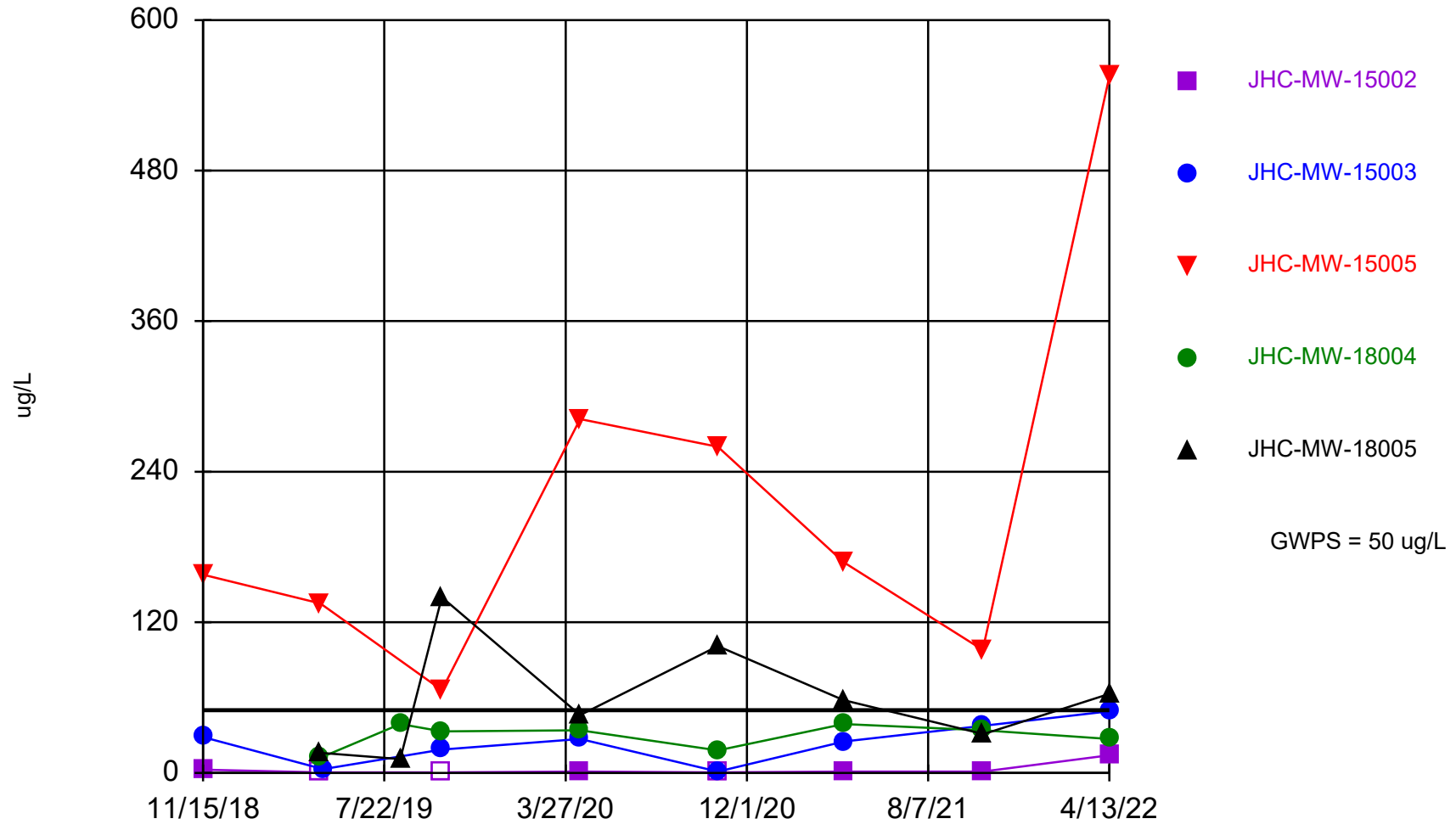


Time Series Analysis Run 6/17/2022 1:11 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_

Hollow symbols indicate censored values.

Selenium Comparison to GWPS

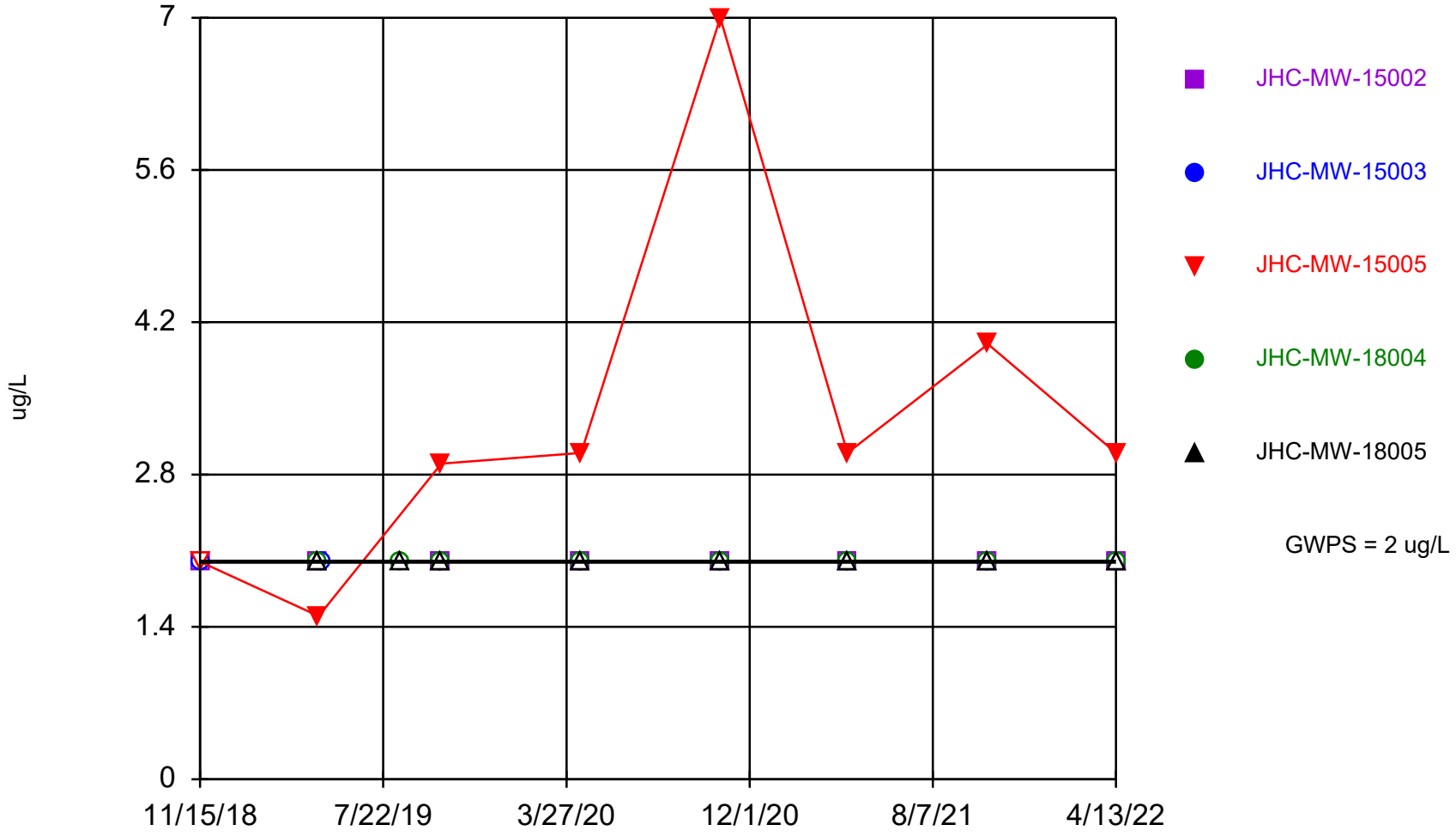


Time Series Analysis Run 6/17/2022 1:12 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_

Hollow symbols indicate censored values.

Thallium Comparison to GWPS



Time Series Analysis Run 6/17/2022 1:14 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_

Summary Report

Constituent: Arsenic, Total Analysis Run 6/9/2022 4:19 PM
Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22

For observations made between 11/15/2018 and 4/13/2022, a summary of the selected data set:

Observations = 40
ND/Trace = 3
Wells = 5
Minimum Value = 0.5
Maximum Value = 60
Mean Value = 12.99
Median Value = 8
Standard Deviation = 16.45
Coefficient of Variation = 1.267
Skewness = 1.612

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15002	8	0	20	60	40.88	41.5	15.07	0.3686	-0.2264
JHC-MW-15003	8	0	8.05	24	13.77	11	6.717	0.4878	0.8101
JHC-MW-15005	8	0	1	2.5	1.656	1.7	0.5381	0.3249	0.1944
JHC-MW-18004	8	3	0.5	1.2	0.8625	1	0.3068	0.3557	-0.3834
JHC-MW-18005	8	0	7	8.8	7.781	8	0.5964	0.07664	0.1627

Summary Report

Constituent: Cobalt, Total Analysis Run 6/9/2022 4:19 PM
Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22

For observations made between 11/15/2018 and 4/13/2022, a summary of the selected data set:

Observations = 40
ND/Trace = 36
Wells = 5
Minimum Value = 6
Maximum Value = 47
Mean Value = 11.7
Median Value = 6
Standard Deviation = 9.214
Coefficient of Variation = 0.7874
Skewness = 2.354

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15002	8	8	6	15	9.375	6	4.658	0.4968	0.5164
JHC-MW-15003	8	4	6	47	21.01	18.75	16.2	0.771	0.5909
JHC-MW-15005	8	8	6	15	9.375	6	4.658	0.4968	0.5164
JHC-MW-18004	8	8	6	15	9.375	6	4.658	0.4968	0.5164
JHC-MW-18005	8	8	6	15	9.375	6	4.658	0.4968	0.5164

Summary Report

Constituent: Lithium, Total Analysis Run 6/9/2022 4:18 PM
Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22

For observations made between 11/15/2018 and 4/13/2022, a summary of the selected data set:

Observations = 40
ND/Trace = 24
Wells = 5
Minimum Value = 10
Maximum Value = 240
Mean Value = 30.93
Median Value = 10
Standard Deviation = 43.27
Coefficient of Variation = 1.399
Skewness = 3.269

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15002	8	0	14	240	86.31	71.75	71.96	0.8337	1.231
JHC-MW-15003	8	8	10	10	10	10	0	0	NaN
JHC-MW-15005	8	0	20.5	59	38.31	40	13.6	0.3551	0.03736
JHC-MW-18004	8	8	10	10	10	10	0	0	NaN
JHC-MW-18005	8	8	10	10	10	10	0	0	NaN

Summary Report

Constituent: Molybdenum, Total Analysis Run 6/9/2022 4:17 PM
Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22

For observations made between 11/15/2018 and 4/13/2022, a summary of the selected data set:

Observations = 40
ND/Trace = 3
Wells = 5
Minimum Value = 2.5
Maximum Value = 885
Mean Value = 72.44
Median Value = 29
Standard Deviation = 148.9
Coefficient of Variation = 2.056
Skewness = 4.413

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15002	8	1	2.5	101	38.95	29	36.2	0.9294	0.6466
JHC-MW-15003	8	0	20	125	65.04	55.5	38.1	0.5858	0.702
JHC-MW-15005	8	0	50	885	234.8	100.5	283.6	1.208	1.726
JHC-MW-18004	8	1	2.5	10	7.588	7.6	2.418	0.3187	-1.093
JHC-MW-18005	8	1	2.5	66	15.88	8	20.66	1.302	2.095

Summary Report

Constituent: Selenium, Total Analysis Run 6/9/2022 4:16 PM
Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22

For observations made between 11/15/2018 and 4/13/2022, a summary of the selected data set:

Observations = 40
ND/Trace = 3
Wells = 5
Minimum Value = 0.5
Maximum Value = 555
Mean Value = 65.87
Median Value = 32
Standard Deviation = 104
Coefficient of Variation = 1.579
Skewness = 3.081

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15002	8	3	0.5	14	2.644	1	4.642	1.756	2.17
JHC-MW-15003	8	0	1	49	23.69	26	16.22	0.6848	-0.06402
JHC-MW-15005	8	0	66	555	215.3	163	155.8	0.7237	1.368
JHC-MW-18004	8	0	12	39	29.5	33.5	9.842	0.3336	-0.794
JHC-MW-18005	8	0	11	140	58.25	52	43.82	0.7523	0.765

Summary Report

Constituent: Thallium, Total Analysis Run 6/9/2022 4:16 PM
Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22

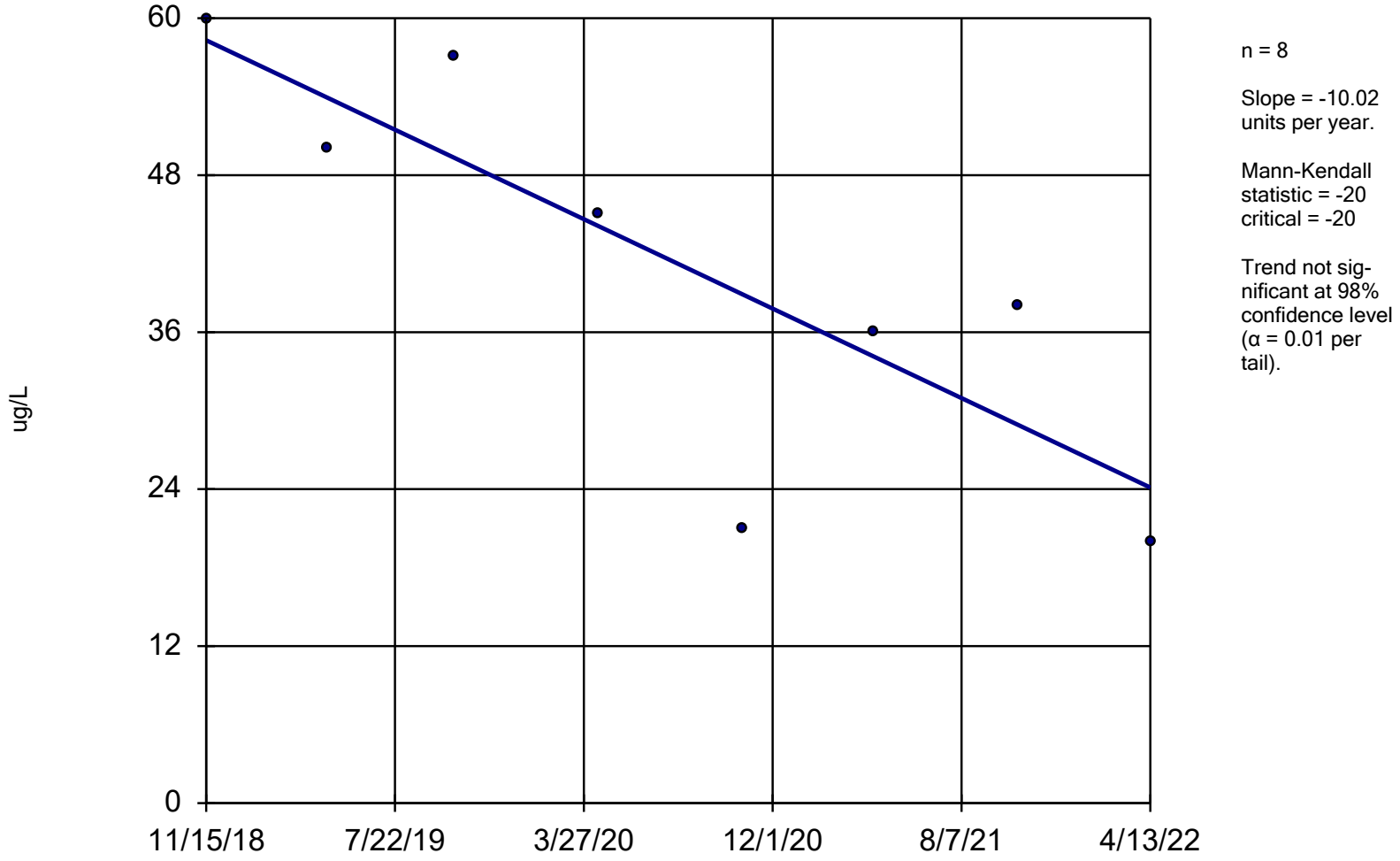
For observations made between 11/15/2018 and 4/13/2022, a summary of the selected data set:

Observations = 40
ND/Trace = 33
Wells = 5
Minimum Value = 1.5
Maximum Value = 7
Mean Value = 2.26
Median Value = 2
Standard Deviation = 0.8822
Coefficient of Variation = 0.3904
Skewness = 4.244

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
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	1	1.5	7	3.3	3	1.671	0.5063	1.402
JHC-MW-18004	8	8	2	2	2	2	0	0	NaN
JHC-MW-18005	8	8	2	2	2	2	0	0	NaN

Arsenic, Total

JHC-MW-15002



n = 8

Slope = -10.02 units per year.

Mann-Kendall statistic = -20
critical = -20

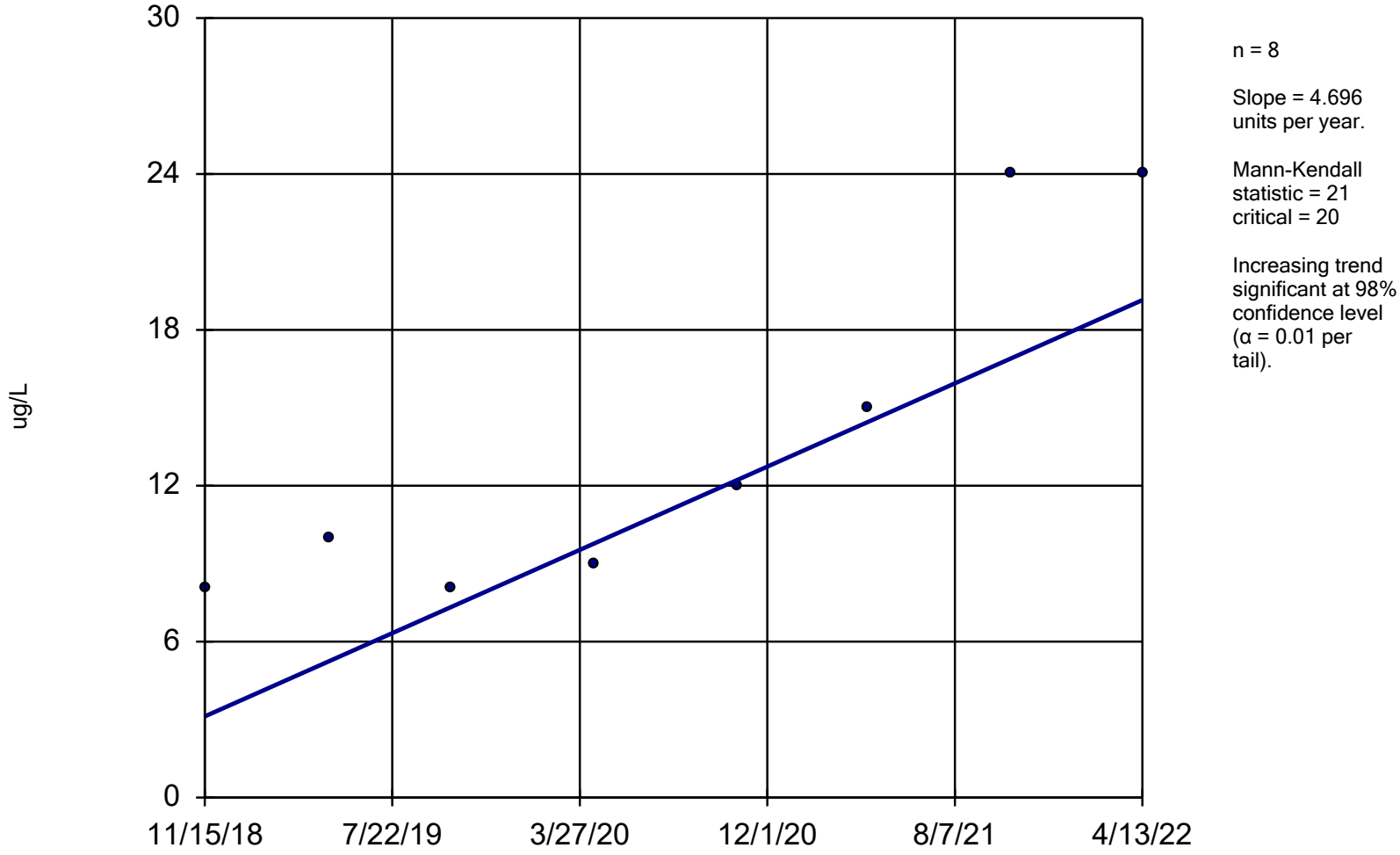
Trend not significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 6/10/2022 10:06 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_backup

Arsenic, Total

JHC-MW-15003



n = 8

Slope = 4.696 units per year.

Mann-Kendall statistic = 21
critical = 20

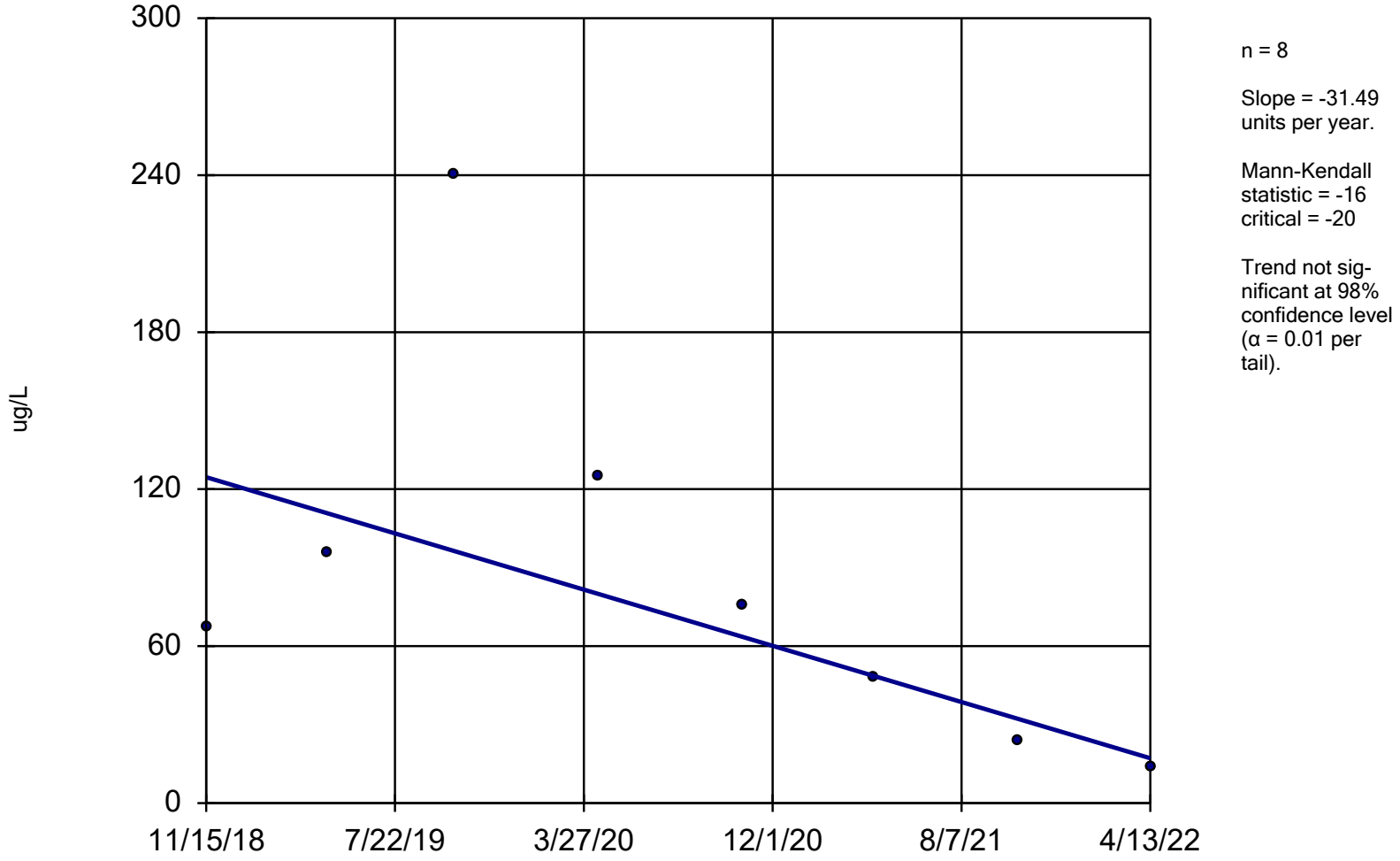
Increasing trend significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 6/10/2022 10:07 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_backup

Lithium, Total

JHC-MW-15002



n = 8

Slope = -31.49 units per year.

Mann-Kendall statistic = -16
critical = -20

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

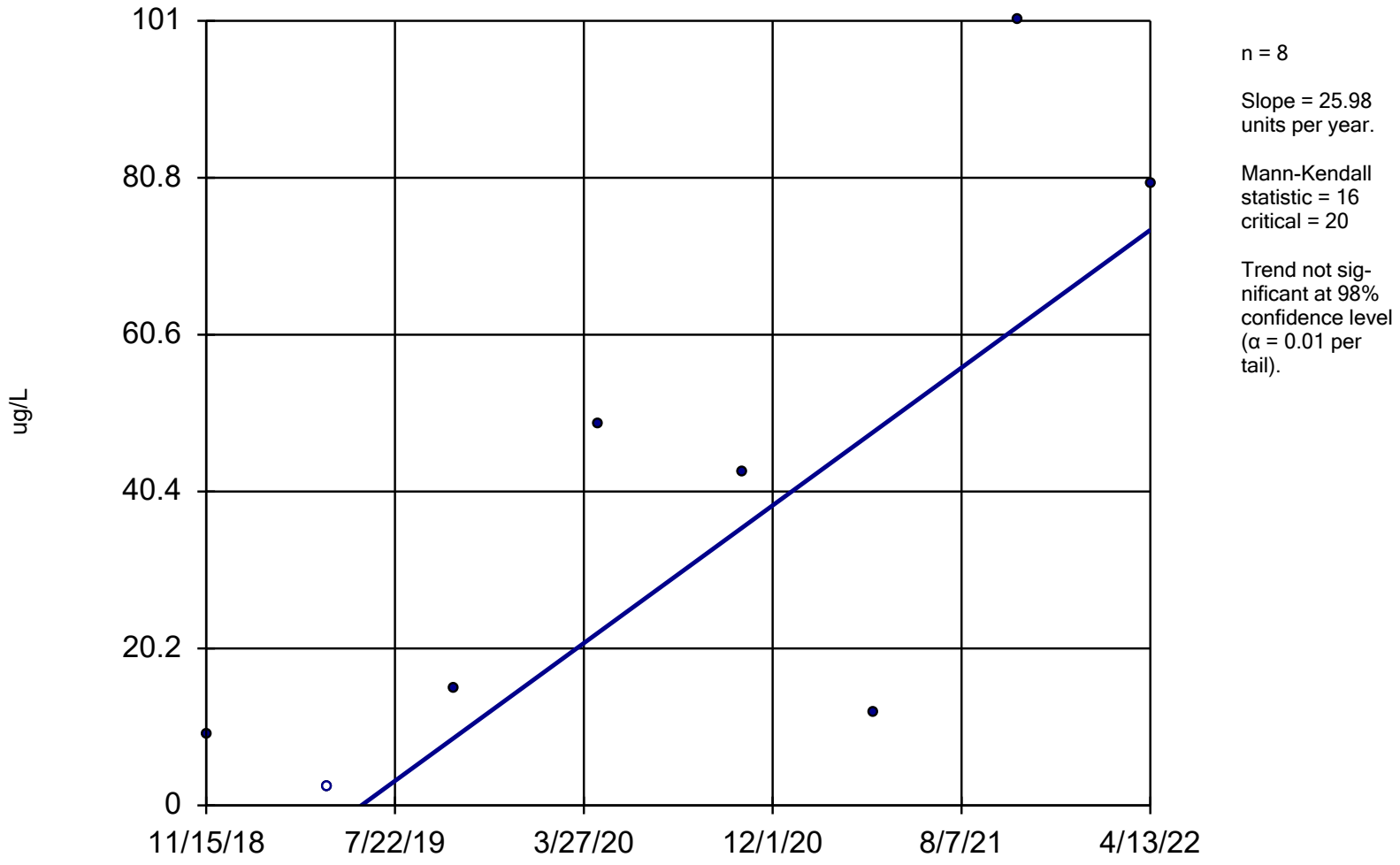
Sen's Slope Estimator Analysis Run 6/10/2022 10:08 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_backup

Hollow symbols indicate censored values.

Molybdenum, Total

JHC-MW-15002



n = 8

Slope = 25.98 units per year.

Mann-Kendall statistic = 16
critical = 20

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

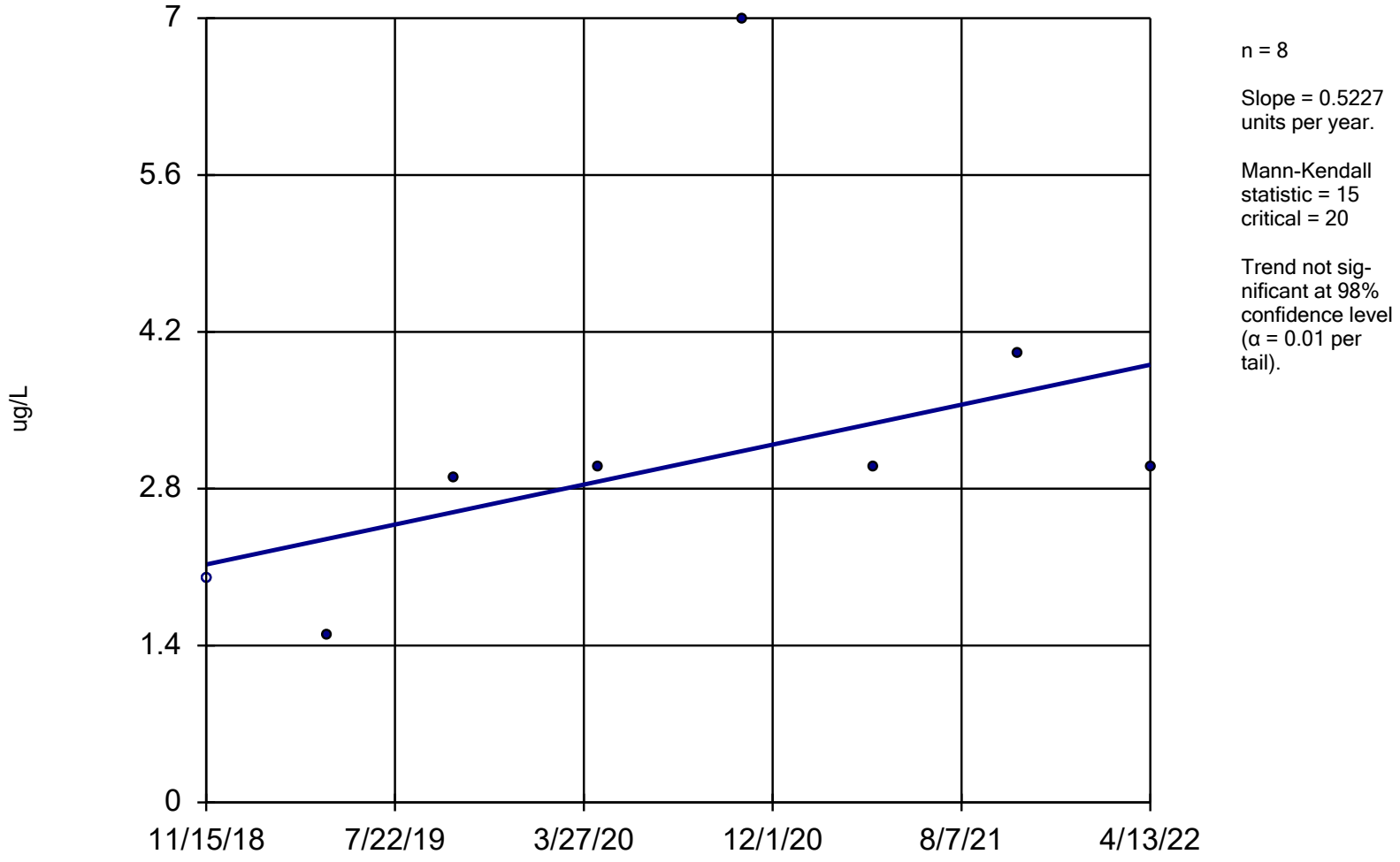
Sen's Slope Estimator Analysis Run 6/10/2022 10:09 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_backup

Hollow symbols indicate censored values.

Thallium, Total

JHC-MW-15005



n = 8

Slope = 0.5227 units per year.

Mann-Kendall statistic = 15
critical = 20

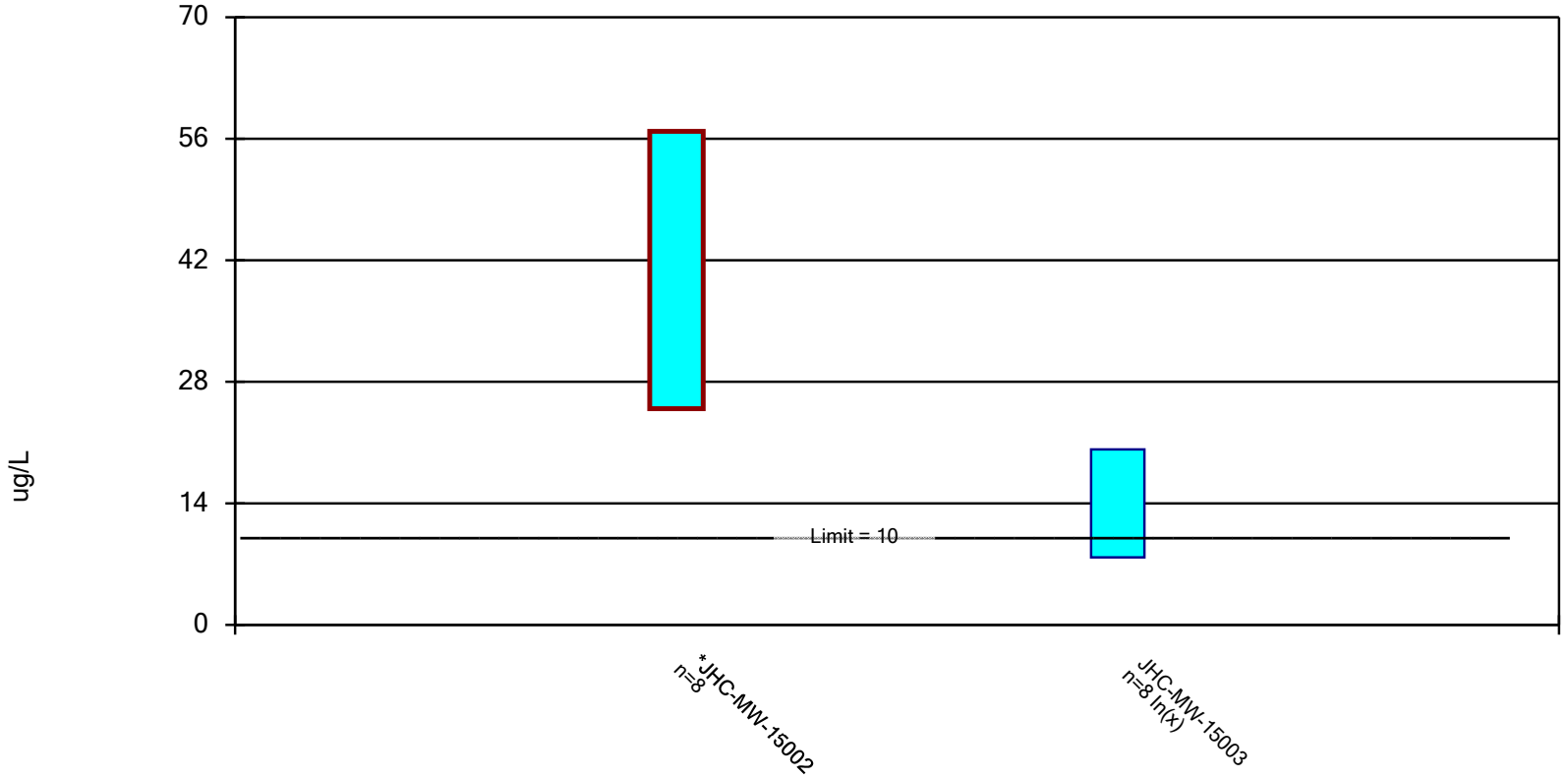
Trend not significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 6/10/2022 10:10 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_backup

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 6/10/2022 8:27 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_backup

Confidence Interval

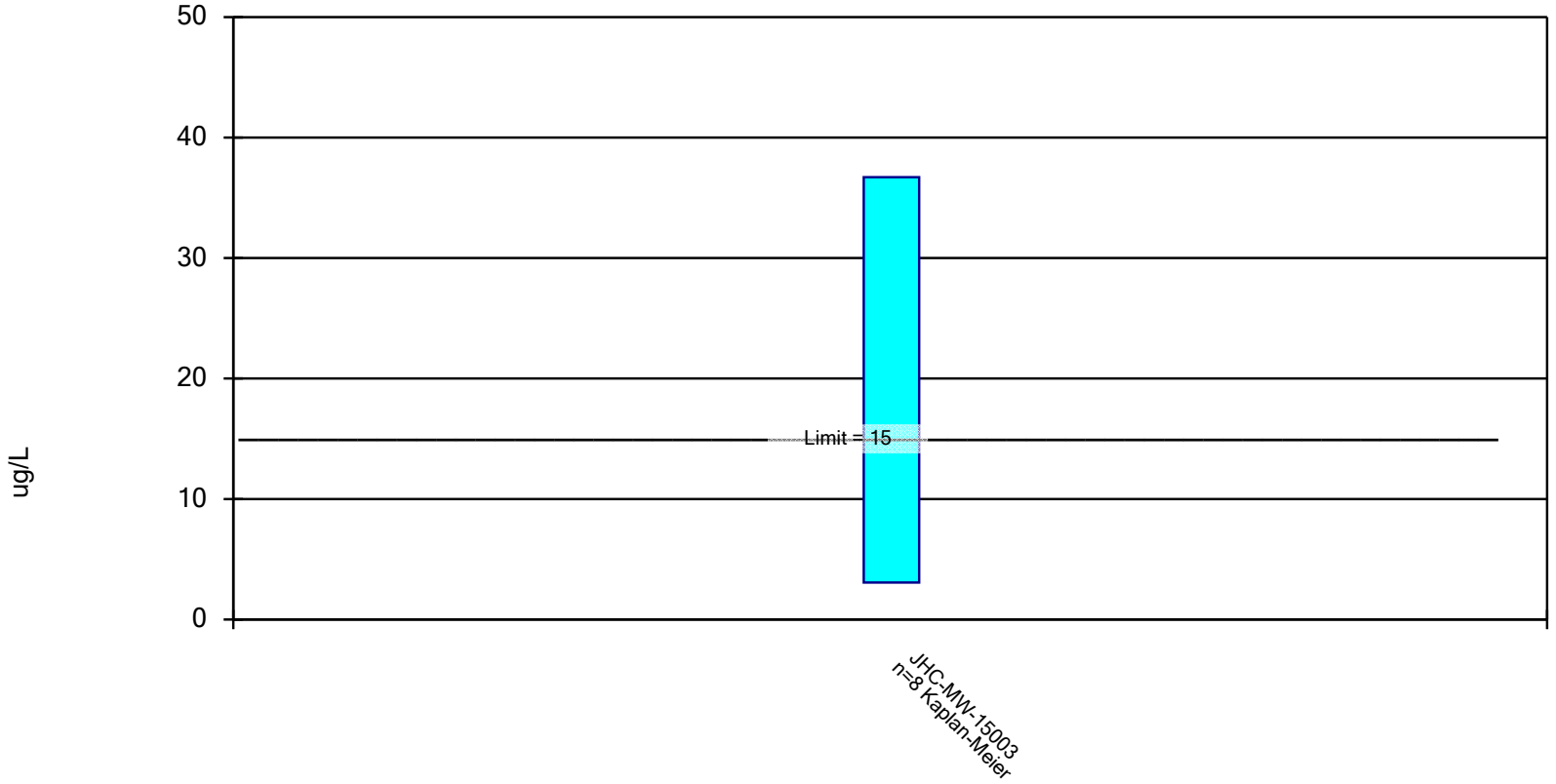
Constituent: Arsenic, Total (ug/L) Analysis Run 6/15/2022 12:49 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_

	JHC-MW-15002	JHC-MW-15003
11/15/2018	60 (D)	8.1
4/25/2019	50	
4/29/2019		10
10/9/2019	57	8.05 (D)
4/16/2020	45	9
10/22/2020	21	12
4/14/2021	36	15
10/20/2021		24 (D)
10/21/2021	38	
4/13/2022	20	24
Mean	40.88	13.77
Std. Dev.	15.07	6.717
Upper Lim.	56.84	20.22
Lower Lim.	24.91	7.768

Parametric Confidence Interval

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



Constituent: Cobalt, Total Analysis Run 6/10/2022 8:28 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_backup

Confidence Interval

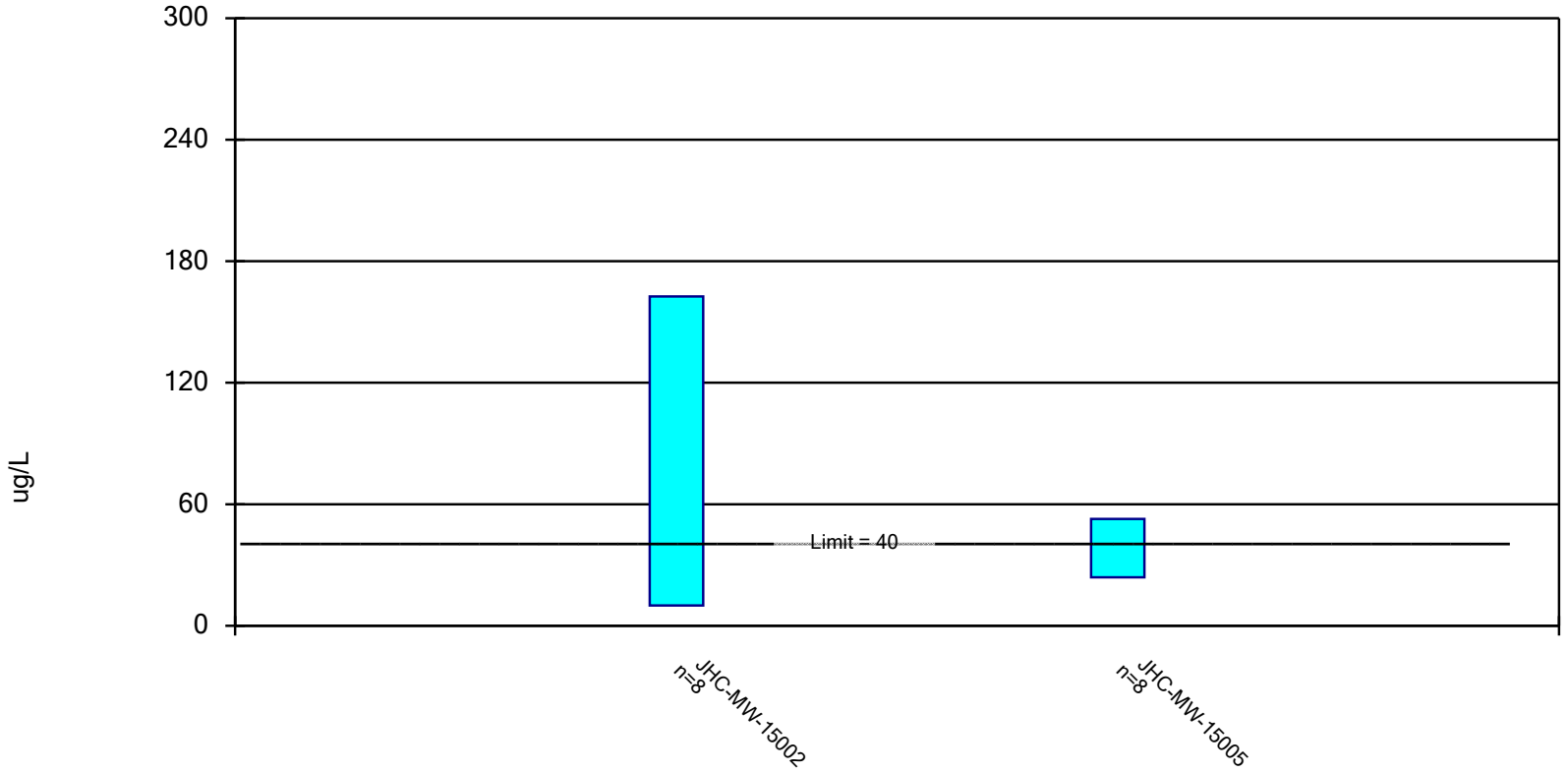
Constituent: Cobalt, Total (ug/L) Analysis Run 6/15/2022 12:53 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_

	JHC-MW-15003
11/15/2018	23.6
4/29/2019	<6
10/9/2019	42 (D)
4/16/2020	47
10/22/2020	<15
4/14/2021	<6
10/20/2021	22.5 (D)
4/13/2022	<6
Mean	21.01
Std. Dev.	16.2
Upper Lim.	36.71
Lower Lim.	3.061

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 6/10/2022 8:35 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_backup

Confidence Interval

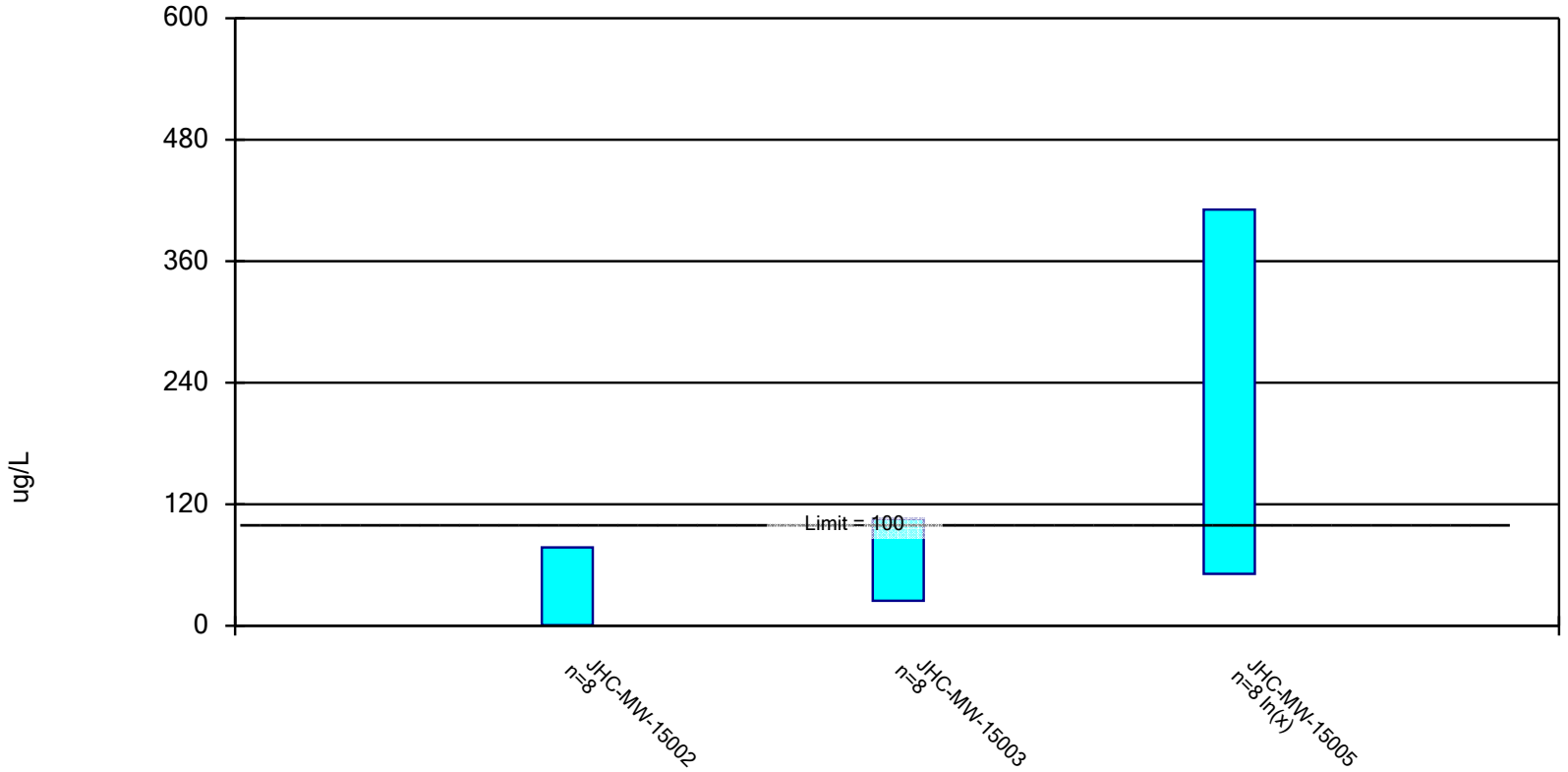
Constituent: Lithium, Total (ug/L) Analysis Run 6/15/2022 12:55 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_

	JHC-MW-15002	JHC-MW-15005
11/15/2018	67.5 (D)	28
4/25/2019	96	38 (D)
10/9/2019	240	50
4/16/2020	125	59
10/22/2020	76	42
4/13/2021		20.5 (D)
4/14/2021	48	
10/21/2021	24	46
4/13/2022	14	23
Mean	86.31	38.31
Std. Dev.	71.96	13.6
Upper Lim.	162.6	52.73
Lower Lim.	10.04	23.89

Parametric Confidence Interval

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



Constituent: Molybdenum, Total Analysis Run 6/10/2022 8:38 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_backup

Confidence Interval

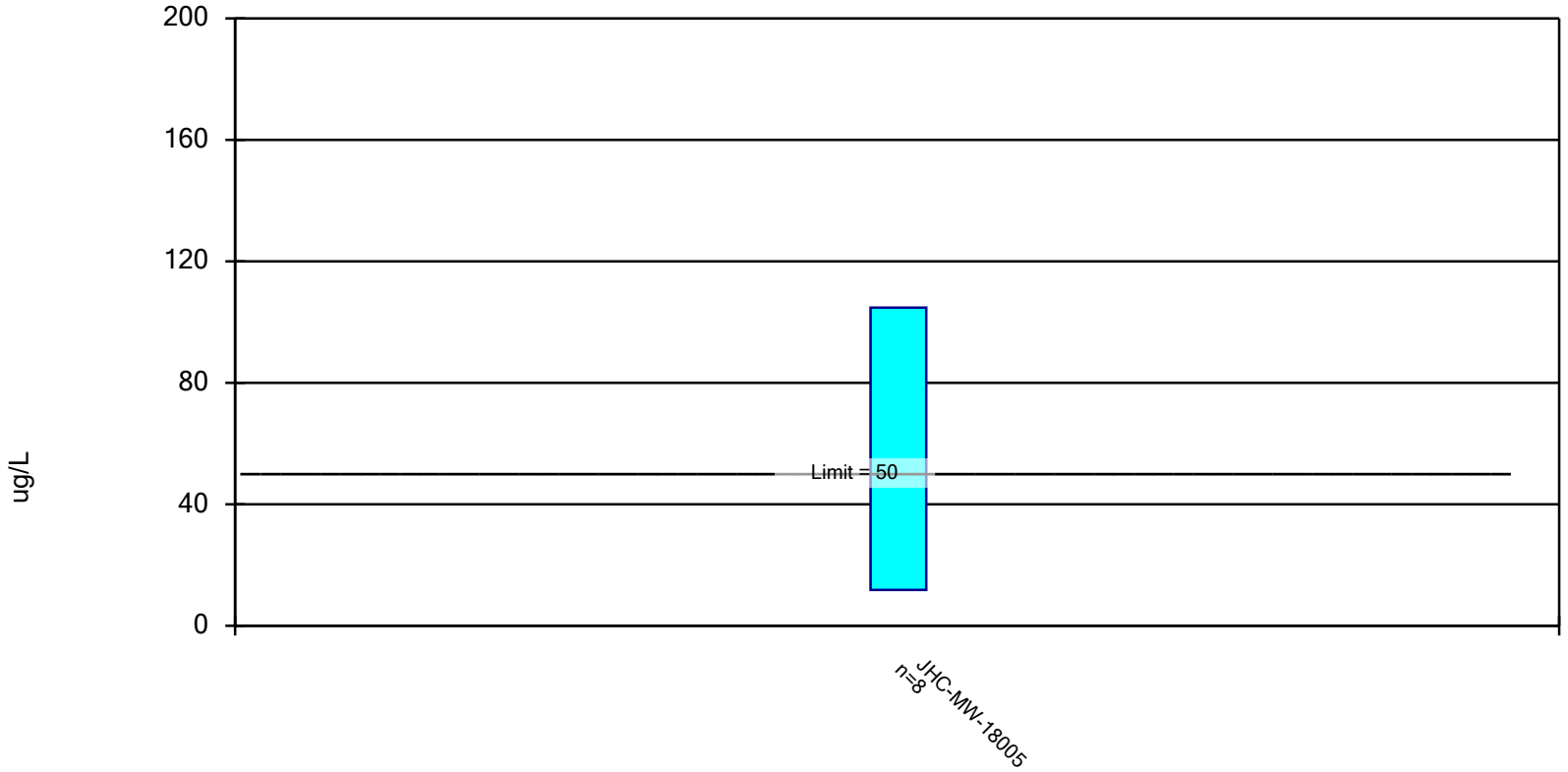
Constituent: Molybdenum, Total (ug/L) Analysis Run 6/15/2022 12:58 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_

	JHC-MW-15002	JHC-MW-15003	JHC-MW-15005
11/15/2018	9.1 (D)	65.3	222
4/25/2019	<5		885 (D)
4/29/2019		20	
10/9/2019	15	120 (D)	370
4/16/2020	49	125	91
10/22/2020	43	59	110
4/13/2021			89 (D)
4/14/2021	12	38	
10/20/2021		52 (D)	
10/21/2021	101		50
4/13/2022	80	41	61
Mean	38.95	65.04	234.8
Std. Dev.	36.2	38.1	283.6
Upper Lim.	77.32	105.4	411
Lower Lim.	0.582	24.66	51.29

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 6/17/2022 1:45 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_

Confidence Interval

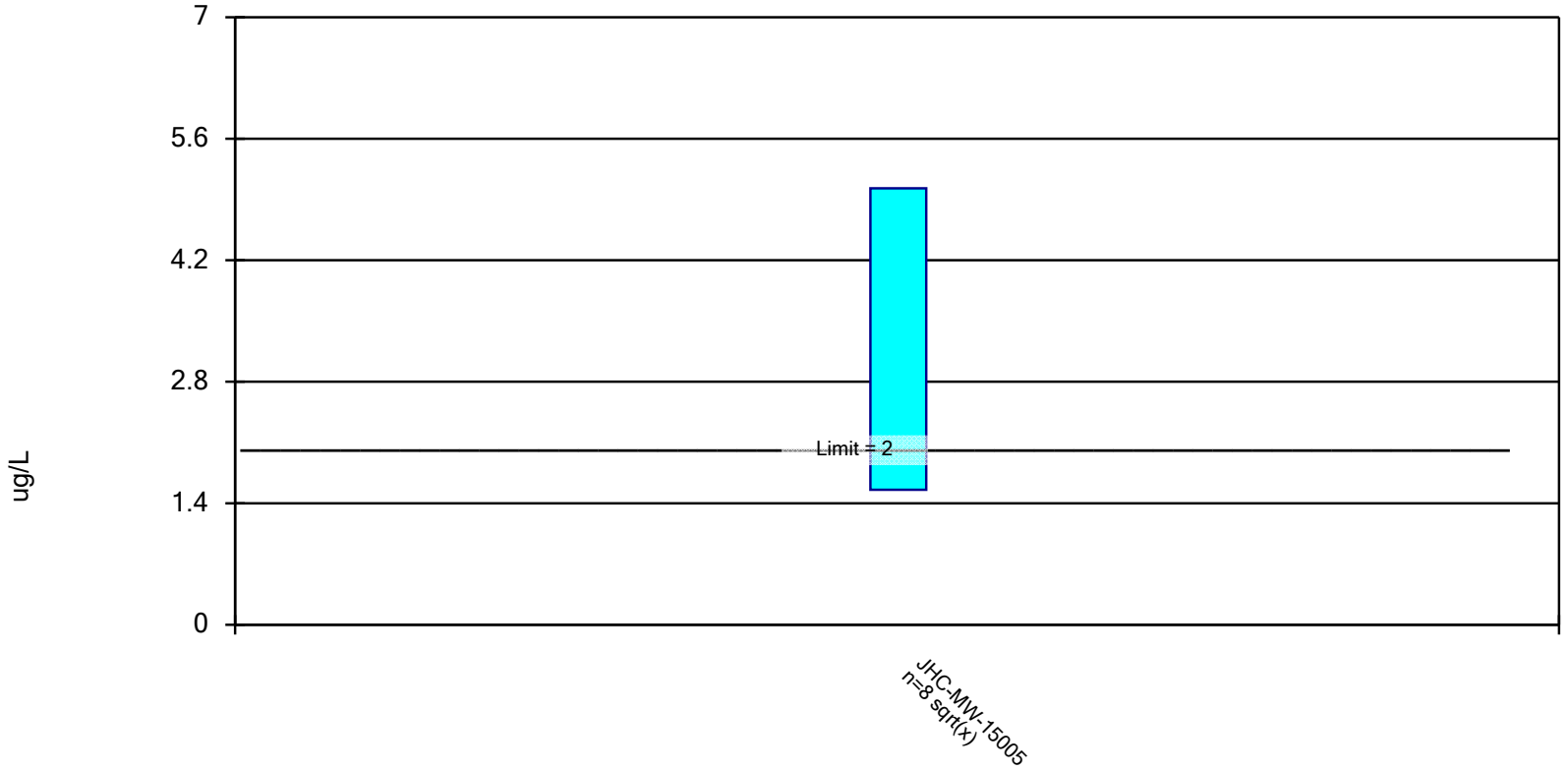
Constituent: Selenium, Total (ug/L) Analysis Run 6/17/2022 1:46 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_

	JHC-MW-18005
4/25/2019	16
8/13/2019	11 (D)
10/9/2019	140
4/16/2020	46
10/22/2020	101 (D)
4/13/2021	58
10/22/2021	31
4/13/2022	63 (D)
Mean	58.25
Std. Dev.	43.82
Upper Lim.	104.7
Lower Lim.	11.8

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 6/10/2022 9:03 AM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_backup

Confidence Interval

Constituent: Thallium, Total (ug/L) Analysis Run 6/15/2022 1:00 PM

Client: Consumers Energy Data: JHC CCR_Sanitas Data_2Q22_

	JHC-MW-15005
11/15/2018	<2
4/25/2019	1.5 (D)
10/9/2019	2.9
4/16/2020	3
10/22/2020	7
4/13/2021	3 (D)
10/21/2021	4
4/13/2022	3
Mean	3.175
Std. Dev.	1.813
Upper Lim.	5.097
Lower Lim.	1.253

Appendix E
October 2022 Assessment Monitoring Statistical Evaluation

1540 Eisenhower Pl.
Ann Arbor, MI 48108

T 734.971.7080
TRCcompanies.com

Technical Memorandum

Date:	January 31, 2023
To:	Bethany Swanberg, Consumers Energy
From:	Sarah Holmstrom, TRC Kristin Lowery, TRC Henry Schnaidt, TRC
Project No.:	464090.0001.0000 Phase 1 Task 2
Subject:	Statistical Evaluation of October 2022 Assessment Monitoring Sampling Event, JH Campbell Bottom Ash Ponds 1-2 North and 1-2 South CCR Unit, Consumers Energy Company, West Olive, Michigan

Consumers Energy is continuing semiannual assessment monitoring in accordance with §257.95 of the CCR Rule[1] at the JH Campbell Power Plant Bottom Ash Ponds 1-2 North and 1-2 South (Ponds 1-2). The second semiannual assessment monitoring event of 2022 was conducted on October 17 through 20, 2022. In accordance with §257.95, the assessment monitoring data must be compared to Groundwater Protection Standards (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 Annual Report) (TRC, January 2019). The following narrative describes the methods that were employed for comparisons to the GWPSs. The results obtained and the Sanitas™ output files are included as an attachment.

The statistical evaluation of the second semiannual assessment monitoring event for 2022 indicates that there are no constituents present at statistically significant levels exceeding the GWPS in the downgradient monitoring well network at the Ponds 1-2 CCR Unit:

Constituent	GWPS	# Downgradient Wells Observed

No constituents are present at statistically significant levels above the GWPSs.

These results are consistent with the results of the previous assessment monitoring data statistical evaluation, with no new statistically significant levels above the GWPSs. Consumers Energy will continue to evaluate corrective measures per §257.96 and §257.97 and will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

[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.

Assessment Monitoring Statistical Evaluation

The current downgradient monitoring well network at the Ponds 1-2 CCR Unit boundary is made up of three monitoring wells: Monitoring wells JHC-MW-18004 (west), JHC-MW-18005 (south), and JHC-MW-22001(south), as described in the January 27, 2023 Groundwater Monitoring System Certification.

In response to the influence of an alternate source at JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005, a new monitoring well, JHC-MW-22001, was installed south of Ponds 1-2 in order to provide an additional downgradient well to assess groundwater quality downgradient from the former Ponds 1-2 footprint.

Following the second semiannual assessment monitoring sampling event for 2022, Ponds 1-2 groundwater data from the certified monitoring network were evaluated in accordance with the Groundwater Statistical Evaluation Plan (Stats Plan) (TRC, October 2017). The assessment monitoring program was developed to evaluate concentrations of CCR constituents associated with Ponds 1-2 that are 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 compliance 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 is 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 sample mean, the sample standard deviation, and a selected confidence level (i.e. 99 percent), an upper and lower confidence limit is calculated. The actual mean concentration of the population, 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 1. Constituent-well combinations that included a direct exceedance of the GWPS within the past eight monitoring events (April 2019 through October 2022 for JHC-MW-18004 and JHC-MW-18005) were retained for further analysis (Attachment 1). 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.

well JHC-MW-22001 has not accumulated an adequate number of data points to perform the statistical analysis, however, direct comparison of the results to GWPS was still performed as shown on Table 1. Direct comparison GWPS exceedances included the following constituent-well combinations:

- Selenium in JHC-MW-18005.

Groundwater data for the constituent-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 or 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 and the results obtained. 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. The statistical evaluation was completed for monitoring wells JHC-MW-18004, JHC-MW-18005, and JHC-MW-22001.

Initially, the results for these well-constituent pairs were observed visually for potential outliers and trends. No outliers were apparent. No statistically significant trends were found.

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 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:

JHC-MW-18005

Distribution	Parameter-Well Combinations
Normal	Selenium at JHC-MW-18005

The confidence interval test compares the lower confidence limit to the GWPS. The statistical evaluation of the Appendix IV constituents shows no statistically significant levels above the GWPSs within the Ponds 1-2 monitoring network. Consumers Energy continues 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 1 Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation

Attachment 1 Sanitas™ Output

Table

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

		Sample Location:	JHC-MW-18004							
		Sample Date:	8/13/2019	10/9/2019	4/16/2020	10/22/2020	4/13/2021	10/22/2021	4/13/2022	10/20/2022
Constituent	Unit	GWPS								
Appendix III										
Boron	ug/L	NA	1,200	620	524	638	444	456	346	437
Calcium	mg/L	NA	97	73	117	98.4	88.9	73.1	76.5	75.3
Chloride	mg/L	NA	35	40	14.2	12.5	5.17	10.8	2.22	8.85
Fluoride	ug/L	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	NA	110	120	249	127	64.4	69.3	100	66.0
Total Dissolved Solids	mg/L	NA	490	310	604	515	418	407	381	362
pH, Field	SU	NA	7.5	7.2	6.9	7.4	7.7	7.7	7.6	7.9
Appendix IV										
Antimony	ug/L	6	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	1
Arsenic	ug/L	**10**	1.2	1.1	< 1	1	< 1	1	< 1	< 1
Barium	ug/L	2,000	680	270	210	323	325	361	302	286
Beryllium	ug/L	4	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	1.8	1.3	< 1	< 1	< 1	< 1	< 1	< 1
Cobalt	ug/L	**15**	< 6.0	< 6.0	< 15	< 15	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	15	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	**100**	9.0	10	7	10	7	7	< 5	< 5
Radium-226/228	pCi/L	5	0.822	0.851	0.952	0.821	0.885	0.745	0.582	1.15
Selenium	ug/L	**50**	39	33	34	18	39	34	27	44
Thallium	ug/L	**2**	< 2.0	< 2.0	< 2	< 2	< 2	< 2	< 2	< 2

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.
-- - not analyzed.
GWPS - Groundwater Protection Standard. GWPS is the higher of the Maximum Contaminant Level/Regional Screening Level and Upper Tolerance Limit as established in TRC's Technical Memorandum dated October 15, 2018.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards for Statistical Evaluation
JH Campbell Ponds 1-2N/1-2S – RCRA CCR Monitoring Program
West Olive, Michigan

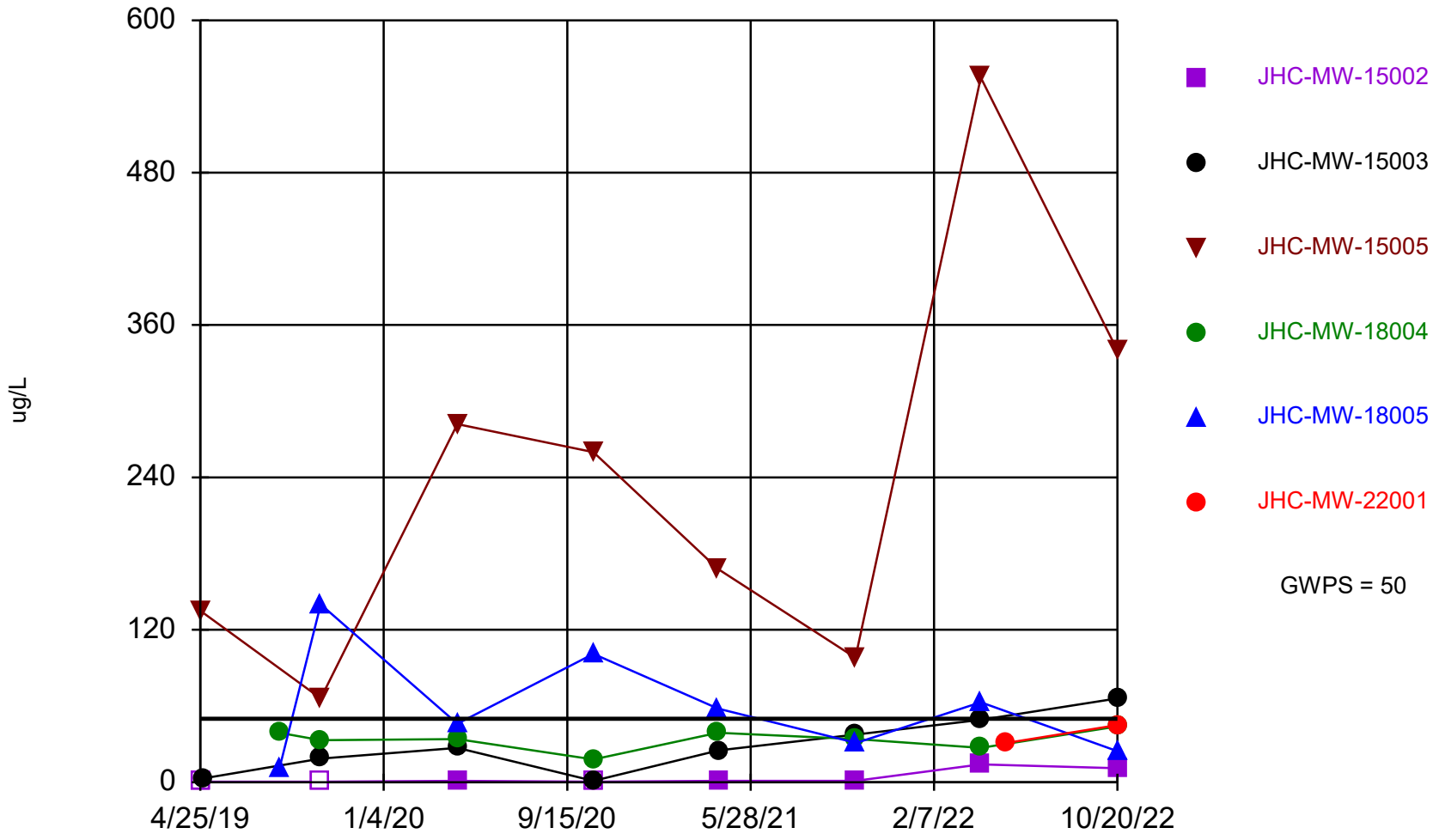
		Sample Location:	JHC-MW-18005												JHC-MW-22001		
		Sample Date:	8/13/2019	8/13/2019	10/9/2019	4/16/2020	10/22/2020	10/22/2020	4/13/2021	10/22/2021	4/13/2022	4/13/2022	10/20/2022	10/20/2022	5/19/2022	5/19/2022	10/20/2022
Constituent	Unit	GWPS															
Appendix III				Field Dup				Field Dup				Field Dup		Field Dup		Field Dup	
Boron	ug/L	NA	750	780	660	534	486	499	382	408	347	343	340	326	365	376	353
Calcium	mg/L	NA	43	45	55	42.6	58.7	60.1	45.5	55.7	46.3	45.1	52.3	52.0	62.4	60.2	56.7
Chloride	mg/L	NA	27	27	18	19.6	16.4	16.8	16.6	8.25	7.55	6.78	8.41	8.90	5.79	5.60	8.05
Fluoride	ug/L	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	NA	95	95	110	74.5	105	108	75.3	79.9	55.4	52.6	45.2	46.2	60.8	60.8	56.5
Total Dissolved Solids	mg/L	NA	270	290	330	262	339	317	287	337	263	282	299	341	311	309	350
pH, Field	SU	NA	8.9	--	8.8	8.5	8.4	--	8.7	8.4	8.6	--	8.5	--	8.1	--	8.2
Appendix IV																	
Antimony	ug/L	6	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	**10**	7.4	7.3	7.1	8	8	8	8	8	7	7	7	7	5	5	5
Barium	ug/L	2,000	120	120	150	144	207	206	201	310	258	256	316	324	216	217	248
Beryllium	ug/L	4	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	2.3	2.4	1.9	< 1	1	1	< 1	< 1	1	1	1	1	< 1	< 1	1
Cobalt	ug/L	**15**	< 6.0	< 6.0	< 6.0	< 15	< 15	< 15	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6
Fluoride	ug/L	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	15	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	**40**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	ug/L	2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	**100**	15	15	66	9	7	7	7	< 5	6	7	9	9	8	8	7
Radium-226/228	pCi/L	5	< 0.400	< 0.374	0.953	< 0.455	< 0.205	0.185	< 0.395	0.507	0.507	0.765	0.881	1.17	< 0.532	< 0.465	< 0.514
Selenium	ug/L	**50**	11	11	**140**	46	**99**	**103**	**58**	31	**64**	**62**	24	25	32	30	45
Thallium	ug/L	**2**	< 2.0	< 2.0	< 2.0	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2

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.
-- - not analyzed.
GWPS - Groundwater Protection Standard. GWPS is the higher of the Maximum Contaminant Level/Regional Screening Level and Upper Tolerance Limit as established in TRC's Technical Memorandum dated October 15, 2018.
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.

Attachment 1
Sanitas™ Output

Hollow symbols indicate censored values.

Selenium Comparison to GWPS



Time Series Analysis Run 11/18/2022 3:36 PM

Client: Consumers Energy Data: JHC_CCR Sanitas_4Q22

Summary Report

Constituent: Selenium, Total Analysis Run 11/18/2022 3:37 PM
Client: Consumers Energy Data: JHC_CCR Sanitas_4Q22

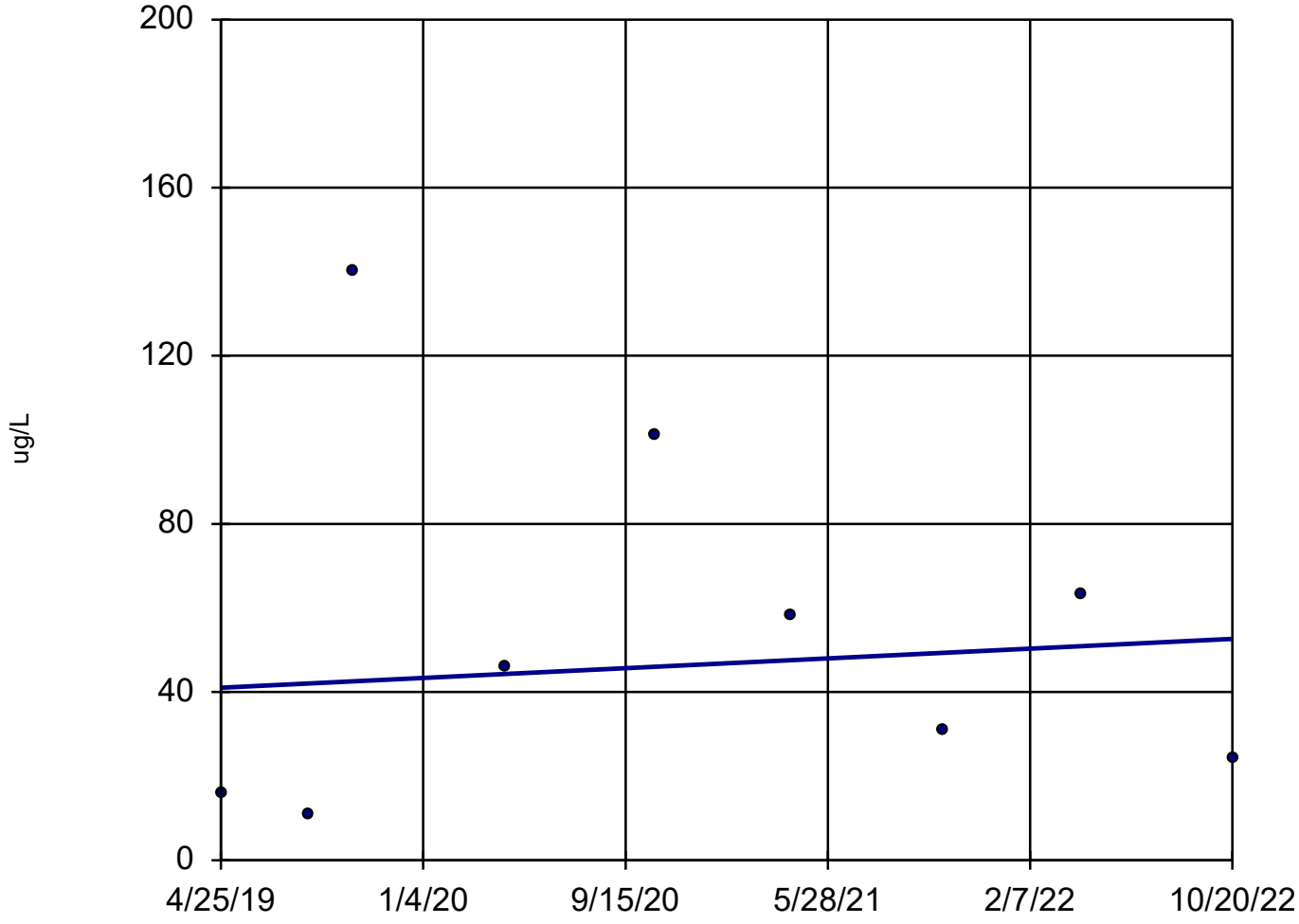
For observations made between 4/25/2019 and 10/20/2022, a summary of the selected data set:

Observations = 42
ND/Trace = 3
Wells = 6
Minimum Value = 0.5
Maximum Value = 555
Mean Value = 70.93
Median Value = 34
Standard Deviation = 108.6
Coefficient of Variation = 1.531
Skewness = 2.818

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JHC-MW-15002	8	3	0.5	14	3.688	1	5.503	1.492	1.221
JHC-MW-15003	8	0	1	66	28.36	26	22.15	0.7809	0.3497
JHC-MW-15005	8	0	66	555	238	214	159.5	0.67	0.8942
JHC-MW-18004	8	0	18	44	33.5	34	8.053	0.2404	-0.7333
JHC-MW-18005	8	0	11	140	59.31	52	42.74	0.7206	0.8171
JHC-MW-22001	2	0	31	45	38	38	9.899	0.2605	0

Selenium, Total

JHC-MW-18005



n = 9

Slope = 3.334 units per year.

Mann-Kendall statistic = 2
critical = 23

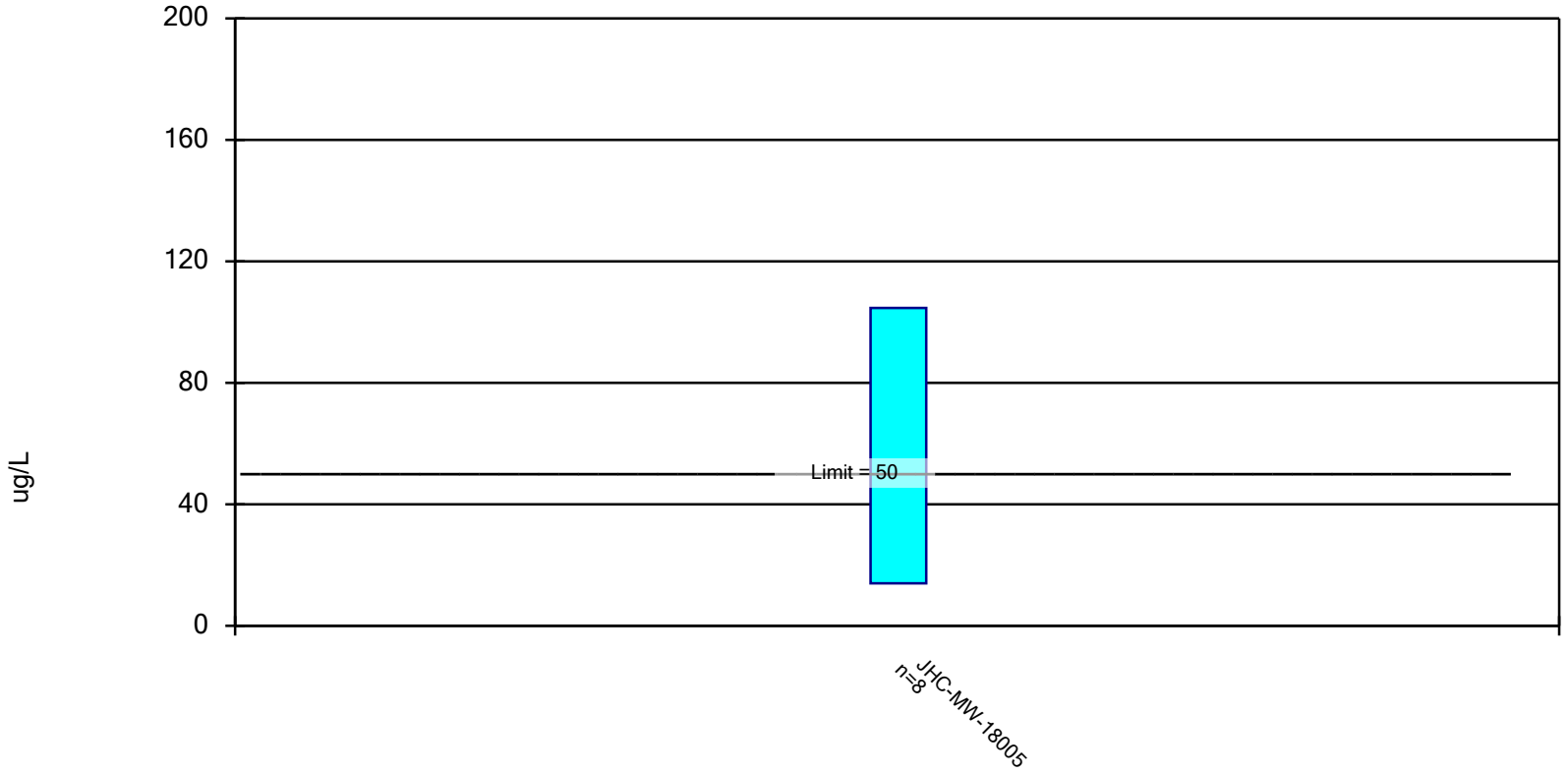
Trend not significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 11/18/2022 3:41 PM

Client: Consumers Energy Data: JHC_CCR Sanitas_4Q22

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 11/18/2022 3:41 PM

Client: Consumers Energy Data: JHC_CCR Sanitas_4Q22

Confidence Interval

Constituent: Selenium, Total (ug/L) Analysis Run 11/18/2022 3:41 PM

Client: Consumers Energy Data: JHC_CCR Sanitas_4Q22

	JHC-MW-18005
8/13/2019	11 (D)
10/9/2019	140
4/16/2020	46
10/22/2020	101 (D)
4/13/2021	58
10/22/2021	31
4/13/2022	63 (D)
10/20/2022	24.5 (D)
Mean	59.31
Std. Dev.	42.74
Upper Lim.	104.6
Lower Lim.	14.01

Appendix F
Nature and Extent Well Installation Documentation

Barr Engineering Co.
3005 Boardwalk St, Suite 100
Ann Arbor, MI 48108
Telephone: 734-922-4400

LOG OF BORING MW-22-14

Project:	Consumers J.H. Campbell Monitoring Well Installation	Surface Elevation:	601.8 ft
Project No.:	22/70-1071.02	Drilling Method:	Hand Auger/Hollow Stem Auger
Location:	West Olive, MI	Sampling Method:	Split Spoon
Coordinates:	N 518,007.4 ft E 12,633,724.0 ft	Completion Depth:	14.0 ft
Datum:	MISP-S NAD83 (2011) Int. Ft.		

Depth, feet	Sample No.	Blows/6in.	ENVIRONMENTAL DATA	USCS	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0.0					TOPSOIL: sand with silt; fine grained; dark brown; dry; roots.	Stick-up protective cover installed	
			PID:0.0 **D/O/S:**None/ None/ None		POORLY GRADED SAND (SP): fine to medium grained; tan; dry; trace silt.		
			PID:0.0 **D/O/S:**None/ None/ None			Bentonite grout 0-3.8'	600.0
2.5			**PID:**0.0 **D/O/S:**None/ None/ None				
			PID:0.0 **D/O/S:**None/ None/ None				597.5
5.0	1	2-2-7-9.			At 5', moist. From 5.33-7.66', increased silt content.	Bentonite seal 3.8-6'	
			PID:0.0 **D/O/S:**None/ None/ None				
	2	3-5-5-4.		SP			595.0
7.5					At 7.66', saturated, color changes to orange to tan. From 7.66-14', medium grained sand with some fine grained.	Filter sand 6-14'	
			PID:0.0 **D/O/S:**None/ None/ None				
	3	1-2-2-2.					592.5
			PID:0.0 **D/O/S:**None/ None/ None				
10.0					From 10.33-11', black discoloration.		
	4	2-2-1-2.			From 11-14', tan.		
			PID:0.0 **D/O/S:**Black/ None/ None			10-slot PVC Screen set 9-14'	590.0
12.5							
	5	0.5-0.5-0.5-0.5.	**PID:**0.0 **D/O/S:**None/ None/ None				
			PID:0.0 **D/O/S:**None/ None/ None		End of boring 14.0 feet		587.5
15.0							

Date Boring Started:	11/7/22
Date Boring Completed:	11/7/22
Logged By:	NAV
Drilling Contractor:	Stearns Drilling Company
Drill Rig:	CME-55-LCX

Remarks: Hand-augered to 5'; split-spoon sampling beginning at approximately 4' bgs due to sloughing in hand-augered boring.
Water level 11/7/2022 8.0'.

PID = Headspace; D/O/S = Discoloration/Odor/Sheen; FID/MC = FID/Methane Corrected; G/S/F = Gravel/Sand/Fines

C:\USERS\BPK\DESKTOP\DELIVERABLES\JH CAMPBELL\2022 LOGS\22701071 2022 WELL INSTALLATION.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Barr Engineering Co.
3005 Boardwalk St, Suite 100
Ann Arbor, MI 48108
Telephone: 734-922-4400

LOG OF BORING MW-22-15

Project:	Consumers J.H. Campbell Monitoring Well Installation	Surface Elevation:	603.5 ft
Project No.:	22/70-1071.02	Drilling Method:	Hand Auger/Hollow Stem Auger
Location:	West Olive, MI	Sampling Method:	Split Spoon
Coordinates:	N 518,194.6 ft E 12,633,688.8 ft	Completion Depth:	14.0 ft
Datum:	MISP-S NAD83 (2011) Int. Ft.		

Depth, feet	Sample No.	Blows/6in.	ENVIRONMENTAL DATA	USCS	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0.0					TOPSOIL: sand with silt; fine grained; dark brown; dry; roots.	Stick-up protective cover installed	
			PID:0.0 **D/O/S:**None/ None/ None		POORLY GRADED SAND (SP): fine to medium grained; tan; dry; trace silt. From 0.33-2', trace cobble-size non-native material present.		602.5
2.5			**PID:**0.0 **D/O/S:**None/ None/ None			Bentonite grout 0-3.7'	
			PID:0.0 **D/O/S:**Dark gray/ None/ None		From 3.5-4', orange to tan, moist. From 4-5', dark gray discoloration.		600.0
5.0	1	1-4-4-5.	**PID:**0.0 **D/O/S:**None/ None/ None			Bentonite seal 3.7-6'	
			PID:0.0 **D/O/S:**None/ None/ None				597.5
	2	3-3-4-4.		SP			
7.5 ▼			**PID:**0.0 **D/O/S:**None/ None/ None		At 7.5', tan, saturated, medium grained sand with some fine, trace silt.	Filter sand 6-14'	595.0
	3	2-2-2-3.					
			PID:0.0 **D/O/S:**None/ None/ None				
10.0					From 10.5-14', medium grained sand, trace silt and gravel.		592.5
	4	1-2-2-3.					
			PID:0.0 **D/O/S:**None/ None/ None			10-slot PVC Screen set 9-14'	
12.5							
	5	3-1-1-3.					
			PID:0.0 **D/O/S:**None/ None/ None				590.0
			PID:0.0 **D/O/S:**None/ None/ None		End of boring 14.0 feet		
15.0							

Date Boring Started:	11/7/22
Date Boring Completed:	11/7/22
Logged By:	NAV
Drilling Contractor:	Stearns Drilling Company
Drill Rig:	CME-55-LCX

Remarks: Hand-augered to 5'; split-spoon sampling beginning at approximately 4' bgs due to sloughing in hand-augered boring.
Water level 11/7/2022 7.8'.

PID = Headspace; D/O/S = Discoloration/Odor/Sheen; FID/MC = FID/Methane Corrected; G/S/F = Gravel/Sand/Fines

C:\USERS\BPK\DESKTOP\DELIVERABLES\JH CAMPBELL\2022 LOGS\22701071 2022 WELL INSTALLATION.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Appendix G
Semiannual Progress Report

January 31, 2023

Subject:
Semiannual Progress Report - Selection of Remedy
JH Campbell Ponds 1-2 North and 1-2 South CCR Unit
JH Campbell Pond A CCR Unit

This Semiannual Progress Report, prepared as a requirement of §257.97(a) of 40 CFR Parts 257 and 261, Disposal of Coal Combustion Residuals from Electric Utilities, under subtitle D of the Resource Conservation and Recovery Act (RCRA), also known as the Coal Combustion Residuals (CCR) Rule, describes progress toward selecting and designing remedies for two CCR units that triggered Assessment of Corrective Measures (ACM) under the CCR Rule at the JH Campbell Solid Waste Disposal Area: 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 remedy is selected. It is noteworthy that remedy selection for the 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.

Consumers Energy (CE) reported statistically significant exceedances above the groundwater protection standard (GWPS) for a single Appendix IV constituent, arsenic, in the "*Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g)*" (Consumers Energy Company, January 2019).

Unit with GWPS Exceedance	Constituent	# of Downgradient Wells Observed
Pond A	Arsenic	1 of 6
Ponds 1-2	Arsenic	2 of 5

Subsequently, the Assessment of Corrective Measures Report (TRC, September 2019) was completed on September 11, 2019 for Ponds 1-2 and Pond A. Five remedial approaches were evaluated and presented based on source control by removing CCRs in Ponds 1-2 or by construction of a final cover and certifying the closure in place for Pond A.

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

Semi-annual progress reports have been completed by placing the document in the operating record and making it available on the CE public-facing website starting with the 2019 Annual Groundwater Monitoring and Corrective Action Report for Ponds 1-2 (TRC, January 2020) and the 2019 Annual Groundwater Monitoring and Corrective Action Report and Fourth Quarter 2019 Hydrogeological Monitoring Report for Pond A (TRC, January 2020).

Assessment Activities

Ponds 1-2

CE 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). Following the permanent cessation of hydraulic loading, CCR removal activities were completed in October 2018. 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.

To further characterize groundwater quality within the Ponds 1-2 footprint, Consumers Energy installed two monitoring wells (MW-22-14 and MW-22-15) in the interior of the former Ponds 1-2 area in November 2022. The wells are located within the center and directly beneath the former Ponds 1-2 footprint. The data from monitoring wells MW-22-14 and MW-22-15 show that groundwater quality directly beneath the former Ponds 1-2 footprint is well below the GWPSs for all of the Appendix IV constituents, which, along with the assessment monitoring results presented in the "*2022 Annual Groundwater Monitoring and Corrective Action Report, JH Campbell Power Plant, Ponds 1-2 North and 1-2 South CCR Unit*"(TRC, January 2023), demonstrate that the CCR removal activities were effective in addressing arsenic concentrations associated with former Ponds 1-2 activities.

As documented in the "*Alternative Source Demonstration: Selenium at JHC-MW-15005*" (October 2021 ASD) (TRC, October 2021), groundwater chemistry and quality is being influenced by historical Ponds B-K at JHC-MW-15005 located immediately downgradient from JHC-MW-15002 and JHC-MW-15003. Data presented in the ASD also established that monitoring wells JHC-MW-15002 and JHC-MW-15003 are installed within the footprint of historic Ponds B-K, and historical CCR is in place within the soil column immediately above each of the well screens.

The ASD completed for JHC-MW-15005 and data collected in 2022 demonstrate the influence of immediately adjacent, closed, pre-existing units not regulated by the CCR Rule on wells JHC-JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005. This supports the determination that these wells cannot reliably be used to assess groundwater quality associated with Ponds 1-2 and that

they are not appropriate for use in assessment monitoring at Ponds 1-2. As a result, these wells are being removed from the certified compliance monitoring network for the Ponds 1-2 CCR Unit. They will continue to be monitored as nature and extent wells for the purpose of informing the ongoing remedy selection and risk mitigation evaluations.

Pond A

CE closed Pond A according to 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 was submitted to EGLE in February 2019. 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.

Increases in Appendix III constituents (e.g. boron) and direct exceedances of the selenium GWPS in JHC-MW-15011, JHC-MW-15010, JHC-MW-15009, and JHC-MW-15008R that have not yet resulted in a statistically significant exceedance suggest a detectable influence from the immediately adjacent, upgradient, closed, pre-existing CCR units on-site. The closed, pre-existing units are not regulated under the RCRA CCR Rule, but remedial action is being taken under Consent Agreement WMRPD No. 115-01-2018. A RAP for these units was submitted to EGLE on September 30, 2021. In a letter sent June 10, 2022, CE committed to revising elements of the RAP based on comments received and ongoing discussion with EGLE.

Conclusions

Ponds 1-2

Changing constituent concentrations indicate that the system is establishing a new hydraulic and chemical equilibrium following source removal. Nature and extent sampling results suggest that the GWPS exceedances do not pose an immediate threat to human health or the environment.

Sampling data from wells within the center and directly beneath the Ponds 1-2 footprint and the three downgradient wells in the assessment monitoring network support there are no exceedances of the GWPS within the current (certified January 2023) monitoring well network.

Pond A

Arsenic at JHC-MW-15011/R continues to demonstrate attenuation in visual downward concentration trends. Nature and extent sampling data indicate that arsenic is not detected above the GWPS immediately downgradient from Pond A.

Groundwater monitoring data since the installation of the final cover indicates an observable influence from immediately adjacent, upgradient, closed, pre-existing units. Remedial action for the upgradient units is being taken under Consent Agreement WMRPD No. 115-01-2018.

Remedy Selection Process

The ACM Report identified source removal and final cover as primary corrective actions for Ponds 1-2 and Pond A, respectively, but also considered five technically feasible groundwater management alternatives to address the potential for residual arsenic. The first alternative was to monitor post-source control groundwater concentration improvements (e.g. no additional measures required once source control was completed), but four other alternatives were retained in the event GWPS could not be achieved for all constituents in all monitoring wells in the groundwater monitoring system.

The 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.

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.

TRC. January 2023. 2022 Annual Groundwater Monitoring and Corrective Action Report, JH Campbell Power Plant, Ponds 1-2 North and 1-2 South CCR Unit. Prepared for Consumers Energy Company.

TRC. October 2021. Alternative Source Demonstration: Selenium at JHC-MW-15005. Prepared for Consumers Energy Company.

TRC. January 2020. 2019 Annual Groundwater Monitoring and Corrective Action Report, JH Campbell Power Plant, Ponds 1-2 North and 1-2 South CCR Unit. Prepared for Consumers Energy Company.

TRC. January 2020. 2019 Annual Groundwater Monitoring and Corrective Action Report and Fourth Quarter 2019 Hydrogeological Monitoring Report, JH Campbell Power Plant, Pond A CCR Unit. Prepared for Consumers Energy Company. TRC. 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.