January 29, 2021 ***TRANSMITTAL VIA EMAIL 01/29/2021***

Ms. Lori Babcock
Michigan Department of Environment, Great Lakes, and Energy
Materials Management Division
Saginaw Bay District Office
401 Ketchum St, Suite B
Bay City, Michigan 48708

SUBJECT: 2020 Annual Groundwater Monitoring and Corrective Action Report
JC Weadock Bottom Ash Pond and Landfill Coal Combustion Residuals (CCR) Units

Dear Ms. Babcock,

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) Bottom Ash Pond and Landfill CCR Units at the JC Weadock Power Plant Site. 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). This *2020 Annual Groundwater Monitoring and Corrective Action* report documents activities from July 2020 through December 2020 and incorporates by reference the *Semiannual Progress Report* (Consumers Energy, July 2020) that documents activities completed from January 2020 through June 2020. The *Semiannual Progress Report* was prepared, submitted to the EGLE, and posted on Consumers Energy's CCR Rule Compliance Data and Information website on July 30, 2020. Collectively, the two reports cover the period of January 1, 2020 to December 31, 2020.

Consumers Energy prepared and submitted to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) a closure work plan for the Weadock Bottom Ash Pond (Weadock Bottom Ash Pond Work Plan) and a Response Action Plan developed for the Weadock Bottom Ash Pond and Weadock Landfill in accordance with Part 115 dated November 30, 2018 and March 15, 2019, respectively. These plans were developed in anticipation of supporting the Assessment of Corrective Measures that would be necessary for evaluating and selecting a remedy for the Weadock Bottom Ash Pond and Weadock Landfill. Consumers Energy provided notification on January 14, 2019 of exceeding a Groundwater Protection Standard (GWPS) per §257.95(g), which documented beryllium and lithium were present at statistically significant levels above the GWPS in one downgradient well at the Weadock Bottom Ash Pond and arsenic was present at one downgradient monitoring well in the original Weadock Landfill groundwater monitoring system. The Weadock Bottom Ash Pond and Weadock Landfill were both in assessment monitoring at the beginning and at the end of the period covered by this report. Consumers

Energy will continue to evaluate corrective measures per §257.96 and §257.97 and is continuing semiannual assessment monitoring in accordance with §257.95.

WEADOCK BOTTOM ASH POND

Response Action and Assessment Activities

EGLE approved the Weadock Bottom Ash Pond Work Plan on December 20, 2018 based on expectation that a report documenting the removal activities and certifying solid waste has been removed in accordance with the work plan would be submitted at the completion of activities. Subsequently, EGLE approved the Response Action Plan on May 14, 2019, which identified interim response activities taken or to be taken to control possible sources of contamination and noted that constituents with identified exceedances will be further evaluated as part of the forthcoming nature and extent analysis and Assessment of Corrective Measures. Consumers Energy submitted for review and approval, *J.C. Weadock Generating Facility Bottom Ash Pond CCR Removal Documentation Report* (Weadock Bottom Ash Pond Closure Report) on August 26, 2020 to satisfy requirements for completing the removal of solid waste which rendered the need for a solid waste operating license unnecessary. EGLE approved the documentation removal report satisfying state requirements to close on December 1, 2020.

This report, prepared as a requirement of §257.90(e) and §257.97(a) of the Federal Coal Combustion Residual (CCR) Rule, describes progress towards selecting and implementing any remedy in addition to the CCR source material management and removal activities completed and certified in order to close the Weadock Bottom Ash Pond by removal. *Assessment of Corrective Measures, JC Weadock Bottom Ash Pond and Landfill Coal Combustion Residual Units*, dated September 11, 2019 (JC Weadock ACM) (TRC, 2019) outlined alternatives considered to be technically feasible following source removal activities that could potentially address the residual beryllium and lithium under known groundwater conditions. Groundwater management alternatives identified and discussed in the report are: 1) Post-remedy monitoring, 2) Groundwater capture/control, 3) Impermeable barrier, 4) Active geochemical sequestration, and 5) Passive geochemical sequestration.

Based on completing the source removal activities, Consumers Energy continues to implement the Response Action Plan which has completed the following objectives:

- The source of contamination identified in the Response Action Plan has been removed to health-based criteria and certified through a robust quality assurance program. This certification was approved by EGLE on December 1, 2020.
- The potential for future migration from infiltration within the excavated footprint has been minimized by restoring the excavation footprint with placement of a compacted clay soil graded to facilitate stormwater runoff to perimeter stormwater ditches and outfalls.
- The Nature and Extent of contamination from the Weadock Bottom Ash Pond developed in the Response Action Pan and refined in the Assessment of Corrective Measures continues to be validated through the assessment monitoring program and the Weadock Landfill Groundwater

Surface Water Interface (GSI) Compliance Monitoring Program approved in Hydrogeological Monitoring Plan, Rev. 2. JC Weadock Solid Waste Disposal Area (Consumers, 2015). There are no adverse effects on human health or the environment from either surface water or groundwater due to CCR management at the Weadock Bottom Ash Pond.

- The potentiometric "high" from the Weadock Bottom Ash Pond pool elevation has been reduced by at several feet and the potentiometric surface around the previous pool continues to flatten based on observations of the average hydraulic gradient evaluated over time.
- The groundwater monitoring system that identified beryllium and lithium at statistically significant concentrations above the §257.95(h) GWPS criteria continues to validate that no other constituents have exceeded the GWPS at statistical significance indicating that further releases from the unit are being mitigated effectively through the source removal.
- The groundwater monitoring well that identified beryllium and lithium at statistically significant concentrations above the §257.95(h) GWPS criteria has reported both constituents at concentrations below the GWPS for the past 3 semi-annual sampling events indicating cessation of receiving CCR and process water and removing the source has yielded positive results in water quality for Monitoring Well JCW-MW-15009.

Results of October 2020 Sampling Event

Statistical analysis from the October 2020 assessment groundwater monitoring event verified that the that there were no constituents of concern present at statistically significant levels above the established Groundwater Protection Standard (GWPS) within the Weadock Bottom Ash Pond groundwater monitoring system. Results are presented in the enclosed *October 2020 Assessment Monitoring Data Summary and Statistical Evaluation, Consumers Energy, JC Weadock Site, Bottom Ash Pond and Landfill CCR Unit,* (October 2020 Event Summary) (TRC, 2021). Additionally, monitoring performed under the Weadock GSI Compliance Program demonstrates protection of human health and the environment with criteria determined to be protective at the point of exposure. These results are depicted in Figure 4 of the October 2020 Event Summary.

Significant observations from the event summary are as follows:

- Beryllium and lithium are no longer present at statistically significant levels above their respective GWPSs in the Weadock Bottom Ash Pond groundwater monitoring system,
- No additional Appendix IV constituents have been observed at statistically significant levels above GWPSs for the Weadock Bottom Ash Pond groundwater monitoring systems;

WEADOCK LANDFILL

Weadock Landfill Assessment Activities

The Weadock Landfill was also evaluated under the Response Action Plan and Assessment of Corrective Measures outlined alternatives focusing on materials management with an emphasis on improving source control through the closure plan. Once the final closure of the landfill is complete, groundwater management alternatives identified and discussed in the Assessment of Corrective Measures will be further evaluated: 1) Post-remedy monitoring, 2) Groundwater capture/control, 3) Impermeable barrier, 4) Active geochemical sequestration, and 5) Passive geochemical sequestration. Consumers Energy continues to implement the Response Action Plan which has completed the following objectives:

- The Nature and Extent of contamination from the Weadock Landfill developed in the Response Action Pan and refined in the Assessment of Corrective Measures continues to be validated through the assessment monitoring program and the Weadock Landfill Groundwater Surface Water Interface (GSI) Compliance Monitoring Program approved in Hydrogeological Monitoring Plan, Rev. 2. JC Weadock Solid Waste Disposal Area (Consumers, 2017). There are no adverse effects on human health or the environment from either surface water or groundwater due to CCR management at the Weadock Bottom Ash Pond.

- Consumers Energy completed construction of a soil-bentonite slurry wall (Weadock Slurry Wall) that enclosed the landfill with the exception of a 1,600 ft venting feature (NTH Consultants, Ltd., 2009). Later, construction of the Weadock Slurry Wall was extended to include the previous vent (Golder, 2018). EGLE approved the construction certification reports on June 24, 2009 and December 19, 2018, respectively.

- Consumers Energy submitted a revised closure plan that to update the final cover design to close at minimum grades in anticipation of the DE Karn Units 1&2 coal-fired electrical generating units scheduled to cease operations in mid-2023. This design provides improvements by providing a minimum of 2% grades for overland drainage, grading perimeter stormwater drainage ditching to at least 1% slope and coordinating ditching with stormwater stilling basin structures located along perimeter embankment, and limiting stormwater drainage ditching inside the landfill at 1% grade to a total of 6,000 linear feet. The comment period for the design and variances needed to revise this closure plan and final cover design are under review with final Department action scheduled for March 12, 2021.

Results of October 2020 Sampling Event

Statistical analysis from the October 2020 assessment groundwater monitoring event verified that arsenic is present at a statistically significant levels above the GWPS of 21 ug/L at JCW-MW-18006 within the Weadock Landfill groundwater monitoring system. Results are presented in the enclosed October 2020 Event Summary. Additionally, monitoring performed under the Weadock GSI Compliance Program demonstrates protection of human health and the environment with criteria determined to be protective at the point of exposure. These results are depicted in Figure 4 of the October 2020 Event Summary.

Significant observations from the event summary are as follows:

- Arsenic is present at a statistically significant levels above the GWPS at JCW-MW-18006; however, this well is located adjacent to dewatering and excavation work for the Weadock Bottom Ash Pond and groundwater quality is expected to improve now that the source removal work is completed;
- Arsenic and molybdenum concentrations at monitoring well MW-55 have been reviewed through an Alternate Source Demonstration provided in Appendix G of the *2020 Annual Groundwater Monitoring and Corrective Action Report* (TRC, January 2020) indicating elevated levels of constituents at that location are not related to materials management of the Weadock Landfill; and
- No additional Appendix IV constituents have been observed at statistically significant levels above GWPS for Weadock Landfill groundwater monitoring system;

CONCLUSIONS

Source removal activities for the Weadock Bottom Ash Pond have been completed and documented in the Weadock Bottom Ash Pond Closure Report and approved by EGLE on December 1, 2020. Observations from the October 2020 sampling event demonstrate that source removal has resulted in groundwater improvements based on reductions in potentiometric surface elevation and average groundwater flow gradient in combination with concentrations of beryllium and lithium in Monitoring Well JCW-MW-15009 being observed at less than GWPS for three consecutive events. Observations of ongoing changes in groundwater potentiometric surface that likely influence groundwater flow characteristics and/or alter groundwater redox conditions at monitoring locations that could influence observed trends in constituent concentrations still require further evaluation before a final remedy determination can be made for the Weadock Bottom Ash Pond. Containment measures for the Weadock Landfill, including the completion of the fully enclosed soil-bentonite slurry wall and revisions to the final cover design, will inform any further measures that may be necessary once fully constructed.

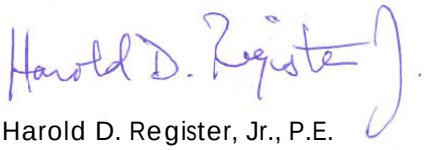
Subsequent sampling events will inform the on-going improvements and retention of monitoring-only, passive, or active remedial options following the source removal for the Weadock Bottom Ash Pond, or final cover construction for the Weadock Landfill. As conditions continue to be evaluated post-source removal or final cover construction, protection of the drinking water and GSI pathway are demonstrated through quarterly monitoring performed under the Michigan-approved hydrogeological monitoring plan that includes a GSI Compliance Monitoring Program. A revised Hydrogeological Monitoring Plan was submitted to the EGLE for review on January 15, 2021, which incorporates requirements of both state and federal CCR programs.

The final remedy for the Weadock Bottom Ash Pond and Weadock Landfill will be formally selected per §257.97 and Michigan Solid Waste requirements 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).

The next semiannual progress report will be submitted in six months by July 30, 2021. Please feel free to contact me with any questions or clarifications.

Sincerely,



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Mr. Caleb Batts, Consumers Energy
Ms. Darby Litz, TRC
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Enclosure: *October 2020 Assessment Monitoring Data Summary and Statistical Evaluation, Consumers Energy, JC Weadock Site, Landfill and Bottom Ash Pond CCR Units*. (TRC, January 29, 2021).

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January 29, 2021

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VIA email: Harold.RegisterJR@cmsenergy.com

Subject: October 2020 Assessment Monitoring Data Summary and Statistical Evaluation, Consumers Energy, JC Weadock Site, Bottom Ash Pond and Landfill CCR Units

Dear Mr. Register:

Consumers Energy is continuing assessment monitoring in accordance with §257.95 of the CCR Rule[1] for the JC Weadock (Weadock) site in Essexville, Michigan (Figure 1). Statistical evaluation from the May 2018 assessment monitoring event data determined that beryllium and lithium were present at statistically significant levels above the federal Groundwater Protection Standard (GWPS) in one downgradient monitoring well within the Weadock Bottom Ash Pond groundwater monitoring system and arsenic was present at a statistically significant levels above the federal GWPS in one downgradient monitoring well within the Weadock Landfill groundwater monitoring system. This letter report has been prepared to provide the summary of the October 2020 assessment groundwater monitoring results, data quality review, and statistical data evaluation for the Weadock Landfill and Weadock Bottom Ash Pond groundwater monitoring systems.

Assessment Monitoring Sampling Summary

TRC conducted the second semiannual assessment monitoring event of 2020 for Appendix III and IV constituents at the Weadock Landfill and Bottom Ash Pond CCR Units in accordance with the *JC Weadock Monitoring Program Sample Analysis Plan* (TRC, 2018) (SAP). The semiannual assessment monitoring event was performed on October 5 through October 14, 2020. The Landfill downgradient monitoring well network (JCW-MW-18001, JCW-MW-18004, JCW-MW-18005, JCW-MW-18006, OW-57R Out, MW-50, MW-51, MW-52, MW-53, MW-54R, and MW-55), Bottom Ash Pond downgradient monitoring well network (JCW-MW-15007, JCW-MW-15009, JCW-MW-15010, and JCW-MW-15028), and background monitoring wells (MW-15002, MW-15008, MW-15016, and MW-15019) were sampled during the semiannual assessment monitoring event. The locations of the monitoring wells are depicted on Figure 2. There were no changes to the groundwater monitoring system during the time period covered by this report. There were no monitoring wells that were installed or decommissioned.

The October 2020 sampling event consisted of collecting static water level measurements from the Weadock Landfill and Weadock Bottom Ash Pond groundwater monitoring system, respectively. Static water elevation data are summarized in Table 1 and groundwater elevation data are shown on

[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.

Figure 3. Monitoring wells were purged with peristaltic pumps utilizing low-flow sampling methodology. Field parameters were stabilized at each monitoring well prior to collecting groundwater samples. Stabilized field parameters for each monitoring well are summarized in Table 2.

Eurofins TestAmerica Inc. (TestAmerica) provided the radiological analysis of the groundwater samples. The remaining Appendix III and IV constituents were analyzed by Consumers Energy Laboratory Services in Jackson, Michigan in accordance with the SAP. The analytical results for the background monitoring wells are summarized in Table 3. The analytical results for the Landfill and Bottom Ash Pond downgradient monitoring wells are summarized in Tables 4 and 5 respectively

Groundwater Flow Rate and Direction

Groundwater elevation data collected during the October 2020 assessment monitoring event are provided in Table 1, as well as additional groundwater elevation data collected from August 2020 (two months prior to the assessment monitoring event). These data were used to construct the groundwater contour map (Figure 3).

Groundwater elevations at the Weadock site are generally within the range of 581 to 594 feet above mean sea level (ft NAVD88) and groundwater is typically encountered at a similar or slightly higher elevation relative to the surrounding surface water features measured by the NOAA gauging station data.

The static water level elevations inside of the Weadock Landfill perimeter slurry wall are generally significantly different (>1 ft) than static water levels outside of the slurry wall, which demonstrates the presence of a low permeability feature between the well pairings inside and outside of the constructed slurry wall. The groundwater monitoring system is structured such that there are eleven (11) monitoring well pairs used to evaluate the hydraulic gradient and potential for water flux across the slurry wall. As such, the water level elevations indicate that the slurry wall is performing as designed. The general flow direction observed within the confinement of the slurry wall is similar to that identified in previous monitoring rounds. Due to the potential for radial flow, the downgradient wells are appropriately positioned to detect the presence of Appendix IV parameters that could potentially migrate from the Weadock Landfill.

Figure 3 shows that groundwater near the Weadock Bottom Ash Pond continues to flow to the north toward the discharge channel and to the west near the Saginaw River. The average hydraulic gradient throughout the bottom ash pond area during the October 2020 event is estimated at 0.0017 ft/ft. The gradient was calculated using the monitoring well pairs JCW-MW-15028/JCW-MW-15009, JCW-MW-15007/JCW-MW-15010, and MW-15016/MW-15002. Using the mean hydraulic conductivity of 16 ft/day (ARCADIS, 2016) and an assumed effective porosity of 0.3, the estimated average seepage velocity ranged from approximately 0.087 ft/day or 32 ft/year, which is consistent with the estimated seepage velocity observed in May 2020 (0.086 ft/day or 32 ft/year). The general flow direction is similar to that identified in previous monitoring rounds and continues to demonstrate that the downgradient monitoring wells are appropriately positioned to detect the presence of Appendix III/IV constituents that could potentially migrate from the Weadock Bottom Ash Pond.

Data Quality

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

Assessment Monitoring Statistical Evaluation

Based on the results from the October 2020 assessment monitoring event, both the Weadock Bottom Ash Pond and Weadock Landfill will remain in assessment monitoring in accordance with §257.95. The following section summarizes the statistical approach applied to assess the October 2020 groundwater data in accordance with the assessment monitoring program.

Establishing Groundwater Protection Standards

The 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. In accordance with §257.95(h) and the unit-specific Stats Plans[2,3], GWPSs were established for the Appendix IV constituents following the preliminary assessment monitoring event using nine rounds of data collected from the background monitoring wells MW-15002, MW-15008, MW-15016, and MW-15019 (December 2015 through April 2018). The calculation of the GWPSs is documented in the Groundwater Protection Standards technical memorandum included as Appendix C of the *2018 Annual Groundwater Monitoring Report* (TRC, 2019). The GWPS is established as the higher value of the EPA Maximum Contaminant Level (MCL) or statistically derived background level for constituents with MCLs and the higher of the EPA Regional Screening Levels (RSLs) or background level for constituents without an established MCL.

Data Comparison to Groundwater Protection Standards

The compliance well groundwater concentrations for Appendix IV constituents were compared to the GWPSs to determine if a statistically significant exceedance had occurred in accordance with §257.95. Consistent with the *Unified Guidance*[4], 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 monitoring well data exceeds the GWPS for any Appendix IV constituent. As documented in the January 14, 2019 Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g), beryllium and lithium were present at statistically significant levels above the federal GWPS in one downgradient monitoring well within the Weadock Bottom Ash Pond groundwater monitoring system and arsenic was present at one downgradient monitoring well within the original

[2] TRC. 2017. *Groundwater Statistical Evaluation Plan* – JC Weadock Power Plant, Bottom Ash Pond, Essexville, Michigan. October.
[3] TRC. 2018. *Groundwater Statistical Evaluation Plan Rev. 1* – JC Weadock Power Plant, Landfill, Essexville, Michigan. December.
[4] USEPA. 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance.* Office of Conservation and Recovery. EPA 530/R-09-007.

Weadock Landfill groundwater monitoring system. Completion of closing the slurry wall vent in 2018 necessitated modifications to the groundwater monitoring system to adequately monitor for releases of Appendix III/Appendix IV constituents along potential groundwater flow pathways[5].

Confidence intervals were established per the statistical methods detailed in the *Statistical Evaluation of October 2020 Assessment Monitoring Sampling Event* technical memorandum provided in Attachment B. For each Appendix IV constituent, the concentrations were first compared directly to the respective GWPSs. Constituent-well combinations that included a direct exceedance of the GWPSs were retained for further statistical analysis using confidence limits.

Weadock Bottom Ash Pond

Overall, the assessment monitoring statistical evaluations have confirmed that beryllium, and lithium are the only Appendix IV constituents that have been present at statistically significant levels above the GWPS. The statistical evaluation of this semiannual assessment monitoring event data indicate that no appendix IV constituents are present at statistically significant levels exceeding the GWPS in downgradient monitoring wells at the Weadock Bottom Ash Pond:

Constituent	GWPS	#Downgradient Wells Observed

No constituents are present at statistically significant levels exceeding the GWPS

Previously, beryllium and lithium were present in downgradient well JCW-MW-15009 at a statistically significant levels; however, the May and October 2020 statistical evaluations show that the lower confidence limit for beryllium and lithium are remaining below their respective GWPSs. Source removal of CCR has been completed, as reported in the Weadock Bottom Ash Pond Removal Documentation Report (Golder, August 2020) and approved by the Michigan Department of Environment, Great Lakes, and Energy on December 18, 2020. For units that are closed by removal, two consecutive rounds of data below the GWPS are needed to demonstrate closure. Lithium and beryllium concentrations have been below the GWPS at JCW-MW-15009 for the past three semi-annual sampling events. Arsenic and barium at JCW-MW-15007 were detected in October 2020 at concentrations above the GWPS, although not at statistically significant levels. There are no constituents triggering additional corrective action but given there are still individual exceedances of the GWPSs, assessment monitoring will continue while Consumers Energy continues to evaluate corrective measures per §257.96 and §257.97. A summary of the confidence intervals for October 2020 is provided in Table 6.

[5] TRC. 2018. *Revised Groundwater Monitoring System Summary Report – Consumers Energy, JC Weadock Landfill.* December 19.

Weadock Landfill

Overall, the assessment monitoring statistical evaluations have confirmed that arsenic is the only Appendix IV constituent that has been present at statistically significant levels above the GWPS. The statistical evaluation of this semiannual assessment monitoring event data indicates that arsenic is present at statistically significant levels above the GWPSs in one downgradient monitoring well at the JCW Landfill.

Constituent	GWPS	#Downgradient Wells Observed
Arsenic	21 ug/L	1 of 12

Arsenic concentrations at JCW-MW-18006 are considered statistically significant since the lower confidence limit (22 µg/L) slightly exceeds the GWPS (21 ug/L); however arsenic concentrations appear to be decreasing as of the two most recent events (Attachment C). The results of the statistical analysis for other wells/constituents are consistent with previous evaluations using the modified well network. A summary of the confidence intervals for October 2020 is provided in Table 6.

Nature and Extent of Affected Groundwater

Since beryllium and lithium have been detected at the Weadock Bottom Ash Pond and arsenic has been detected at the Weadock Landfill at statistically significant levels above the GWPSs, the nature and extent of the releases were characterized in accordance with the requirements of §257.95(g)(1) and characterized in the *Assessment of Corrective Measures, JC Weadock Bottom Ash Pond and Landfill Coal Combustion Residual Unit* (Weadock ACM) (TRC, 2019). The nature and extent characterization of groundwater was performed using data collected from site monitoring wells not included in the groundwater monitoring system. Additionally, site hydrogeological investigations have demonstrated that a shallow water-bearing unit is not present towards the southern portion of the property. Although arsenic, beryllium, and lithium concentrations exceed the GWPS within the groundwater monitoring system wells, these COCs are delineated within the limits of the property owned by Consumers Energy and there are currently no adverse effects on human health or the environment from either surface water or groundwater due to CCR management at the Weadock Bottom Ash Pond or Weadock Landfill. The property is owned and operated by Consumers Energy and groundwater is not used for drinking water. There are no on-site drinking water wells and there are no surface water potable water intakes within 3 miles of the site, so the drinking water pathway is not complete. A shallow water-bearing unit is not observed to the south of the landfill, which prevents offsite migration of Appendix III and Appendix IV constituents.

The distribution of arsenic, beryllium, and lithium relative to the Weadock Landfill and Weadock Bottom Ash Pond, respectively, in the shallow water-bearing unit as compared to the GWPS is presented in Figure 4. Three categories were assigned to groundwater data collected from November 2018 to October 2020, as follows:

- White – No Exceedances: all concentrations were below the GWPS

- Yellow – Two or More Exceedances: individual observations above the GWPS[6]
- Orange – Statistically Significant GWPS Exceedances[7]

As shown on Figure 4, the following is a summary of the RCRA CCR comparison results organized by constituent:

Arsenic

Although during the statistical evaluation of the October 2020 semi-annual data the lower confidence limits of arsenic did not exceed the GWPS of 21 ug/L at the Weadock Bottom Ash Pond, the observed upper confidence limit is above the GWPS at one well near the Weadock Bottom Ash Pond (JCW-MW-15007). During the statistical evaluation of the May 2020 semi-annual event monitoring well JCW-MW-15010 also exhibited an upper confidence limit at or above the GWPS for arsenic; however, since sluicing to the Weadock Bottom Ash Pond ceased in April 2016, concentrations of arsenic in JCW-MW-15010 appear to exhibit a downward trend. The statistical evaluation of the October 2020 assessment monitoring data shows the upper confidence limit for arsenic in JCW-MW-15010 is now below the GWPS of 21 ug/L. The influence of the source removal combined with changes in redox geochemistry impacted by the cessation of sluice water loading to the Weadock Bottom Ash Pond is still being evaluated as additional data collection events are completed.

Additionally, arsenic concentrations have at times exceeded the GWPS in four groundwater monitoring wells located along the Weadock Landfill perimeter (MW-51, MW-53R, MW-55, and JCW-MW-18006). These areas of elevated arsenic concentrations are limited in extent and are dependent upon geochemical conditions, which are changing either due to lake levels rising or in the case of JCW-MW-18006, activities related to the Weadock Bottom Ash Pond closure. Also, an Alternate Source Demonstration (ASD) for arsenic at MW-55 was included in Appendix G of the 2019 *Annual Groundwater Monitoring and Corrective Action Report for the Weadock Landfill* (TRC, January 2020). The basis for this ASD is summarized below and updated time series plots in support of this ASD are included in Attachment D.

Data collected from the 2018 investigation as well as data collected during routine sampling events for Part 115 and Federal CCR groundwater compliance show the following:

- **Distinct Chemistry from Leachate** – The leachate chemistry from a monitoring well screened at the base of the ash fill (LH-104) is distinctly different from the groundwater chemistry near MW- 55 and the temporary monitoring wells installed by TRC in the investigation area, as illustrated Appendix G of the 2020 Annual Groundwater Monitoring and Corrective Action Report (TRC, January 2020). The groundwater samples collected during the Q4 groundwater sampling event will be analyzed for additional parameters in

[6] Although an exceedance is defined as a single detection above the GWPS, confidence intervals will be used to determine compliance per the CCR Rule. Once corrective action is triggered (i.e., the lower confidence limit is above the GWPS), the upper confidence limit must be below the GWPS to demonstrate achievement of the GWPS for units that were not closed by removal. For units that are closed by removal, two consecutive rounds of data below the GWPS are needed to demonstrate closure.
[7] Lower confidence limit is above the GWPS based upon most recent assessment monitoring statistical evaluation.

support of preparing an updated piper diagram, which will be presented with the next sampling event report.

- **Conservative Tracer** – Boron is a metalloid known to be present in coal ash and can be used as a conservative tracer in groundwater to indicate whether elevated concentrations of constituents (i.e. arsenic) are consistent with coal ash. Concentrations of boron in Leachate Headwell LH-104 are significantly higher than concentrations observed at any of the other location sampled as a part of this ASD. Additionally, boron concentrations at MW-55 have decreased since 2010, as evidenced by the time series plots in Attachment C. A downward trend in concentration for boron is strong evidence that the water quality at MW-55 is not directly affected by groundwater migrating from the landfill.
- **Reducing Conditions and Groundwater Head Levels** – Water levels for MW-55, as shown in Attachment C, are trending upwards and have increased over 4-ft since 2010. The oxidation-reduction potential (ORP) at MW-55 is generally lower (i.e., more reducing) than other wells along the southern and eastern portion of the landfill perimeter Table 5). The lowering of ORP over time as a result of increased water levels has changed the geochemical conditions in the vicinity of MW-55 and has resulted in an increased solubility of arsenic and molybdenum.

Beryllium and Lithium

Beryllium and lithium were present at statistically significant levels above their respective GWPSs at JCW-MW-15009 at the Weadock Bottom Ash Pond when the groundwater monitoring program started in December 2015. Since sluicing to the Weadock Bottom Ash Pond ceased in April 2016, concentrations of beryllium and lithium appear to exhibit a downward trend. The influence of the bottom ash sluice water loading or changes in redox geochemistry impacted by the cessation of sluice water loading to the Weadock Bottom Ash Pond is still being evaluated as additional data collection events are completed after the source removal activity was completed and certified in August 2020. Lithium and beryllium concentrations have remained below the GWPS at other monitoring wells in the groundwater monitoring system and concentrations in JCW-MW-15009 have been below the GWPS for the past three semi-annual sampling events.

Next Steps

Consumers Energy will continue assessment monitoring and evaluate corrective measures in accordance with §257.96 and §257.97 as outlined in the Weadock ACM. The groundwater management remedy for the Weadock Bottom Ash Pond and Weadock Landfill will be selected as soon as feasible to meet the federal standards of §257.96(b) of the CCR Rule and state standards in R299.4444(2) of PA 640. Consumers Energy will continue the assessment of corrective measures, per §257.95(g), and execute the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Sincerely,

TRC

Darby Litz
Hydrogeologist/Project Manager

Jacob Krenz
Staff Geologist

Attachments:

Table 1	Summary of Groundwater Elevation Data
Table 2	Summary of Field Parameter Results
Table 3	Summary of Background Well Groundwater Sampling Results (Analytical)
Table 4	Summary of Groundwater Sampling Results (Analytical) – JCW Bottom Ash Pond – October 2020
Table 5	Summary of Groundwater Sampling Results (Analytical) – JCW Landfill – October 2020
Table 6	Summary of Groundwater Protection Standard Exceedances – October 2020
Figure 1	Site Location Map
Figure 2	Karn and Weadock Complex Map
Figure 3	Shallow Groundwater Contour Map – October 2020
Figure 4	Nature and Extent Summary GWPS Exceedances
Attachment A	Data Quality Reviews
Attachment B	Weadock Bottom Ash Pond: Statistical Evaluation of October 2020 Assessment Monitoring Sampling Event
Attachment C	Weadock Landfill: Statistical Evaluation of October 2020 Assessment Monitoring Sampling Event
Attachment D	Alternate Source Demonstration for MW-55: Time-Series Plots

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Tables

Table 1
Summary of Groundwater Elevation Data: August & October 2020
DE Karn and JC Weadock – RCRA CCR Monitoring Program
Essexville, Michigan

Well Location	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Elevation (ft)	August 10, 2020		October 5, 2020	
				Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background							
MW-15002	587.71	Sand	580.9 to 570.9	5.45	582.26	5.75	581.96
MW-15008	585.36	Sand with clay	578.7 to 568.7	2.85	582.51	3.29	582.07
MW-15016	586.49	Sand	581.2 to 578.2	5.20	581.29	3.94	582.55
MW-15019	586.17	Sand and Sand/Clay	579.5 to 569.5	3.87	582.3	4.25	581.92
JCW Bottom Ash Pond							
JCW-MW-15007	587.40	Sand	582.7 to 579.2	6.08	581.32	6.13	581.27
JCW-MW-15009	589.64	Sand	581.9 to 576.9	7.57	582.07	7.50	582.14
JCW-MW-15010	597.76	Sand	579.7 to 578.2	15.78	581.98	15.55	582.21
JCW-MW-15028	589.64	Sand	567.7 to 564.7	7.65	581.99	7.00	582.64
JCW Landfill							
JCW-MW-18001	596.73	Sand and Sandy Clay	578.3 to 573.3	14.49	582.24	14.88	581.85
JCW-MW-18004	593.04	Sandy Clay	583.9 to 578.9	10.52	582.52	10.93	582.11
JCW-MW-18005	590.89	Sand and Sandy Clay	580.0 to 575.0	9.20	581.69	9.89	581.00
JCW-MW-18006	600.72	Fly Ash and Sandy Clay	582.8 to 577.8	13.80	586.92	15.60	585.12
MW-50	593.36	Sand	577.8 to 574.8	11.15	582.21	11.50	581.86
MW-51	594.29	Sand and Clay	577.8 to 574.8	12.08	582.21	11.30	582.99
MW-52	594.90	Sand	579.3 to 576.3	12.62	582.28	12.95	581.95
MW-53	593.68	Sand and Clay	579.1 to 576.1	11.50	582.18	11.85	581.83
MW-53R	594.25	Sand and Clay	580.4 to 575.4	11.97	582.28	12.33	581.92
MW-54R	593.89	Clay and Sand	581.3 to 576.3	11.57	582.32	11.95	581.94
MW-55	593.82	Sand	581.5 to 578.5	11.60	582.22	12.00	581.82
OW-57ROUT	591.00	Sandy Clay	577.0 to 572.0	10.55	580.45	10.30	580.70

Notes:
Survey data from: Rowe Professional Services Company (Nov. 2015) and Consumers Energy Company drawings: SG-21733, Sheet 1, Rev. G (Karn, 11/27/18); and SG-21733, Sheet 2, Rev. C (Weadock, 11/27/18).
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.
NR: Not Recorded

Table 1
Summary of Groundwater Elevation Data: August & October 2020
DE Karn and JC Weadock – RCRA CCR Monitoring Program
Essexville, Michigan

Well Location	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Elevation (ft)	August 10, 2020		October 5, 2020	
				Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
JCW Static Water Level Only							
JCW-OW-18001	595.84	Fly Ash and Sand	581.1 to 576.1	6.36	589.48	6.80	589.04
JCW-OW-18002	593.63	Sand	578.9 to 573.9	11.20	582.43	11.55	582.08
JCW-OW-18003	593.99	Sand and Clay	580.5 to 575.5	9.30	584.69	10.78	583.21
JCW-OW-18004	594.19	Sandy Clay	584.6 to 579.6	9.95	584.24	9.78	584.41
JCW-OW-18006	600.61	Fly Ash and Clay with Sand	582.9 to 577.9	11.65	588.96	12.54	588.07
MW-20	592.73	NR	~581.1 to ~578.1	8.88	583.85	7.47	585.26
MW-58 (MW-15027)	586.26	Sand	578.2 to 568.2	3.80	582.46	4.28	581.98
OW-51	593.62	Clay and Sand	578.9 to 575.9	14.20	579.42	14.61	579.01
OW-53	593.64	Clay and Sand	579.0 to 576.0	6.93	586.71	7.50	586.14
OW-54	594.10	Clay and Sand	580.0 to 577.0	8.72	585.38	8.49	585.61
OW-55	594.67	Clay (or Sand and Clay)	580.9 to 577.9	6.78	587.89	6.31	588.36
OW-56R	592.02	Ash and Sand	577.5 to 572.5	9.61	582.41	9.59	582.43
OW-57R IN	590.86	Sandy Clay	575.7 to 570.7	7.85	583.01	17.76	573.10
OW-61	612.37	Ash and Sand	588.0 to 585.0	22.65	589.72	22.55	589.82
OW-63	612.53	Ash and Sand	594.2 to 591.2	26.55	585.98	22.35	590.18
JCW Leachate Headwells							
LH-103	603.49	Fly Ash	30.2 to 33.2	17.74	585.75	17.63	585.86
LH-104	596.56	Fly Ash	8.0 to 11.0	9.88	586.68	8.60	587.96

Notes:
Survey data from: Rowe Professional Services Company (Nov. 2015) and Consumers Energy Company drawings: SG-21733, Sheet 1, Rev. G (Karn, 11/27/18); and SG-21733, Sheet 2, Rev. C (Weadock, 11/27/18).
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.
NR: Not Recorded

Table 2
Summary of Field Parameters: October 2020
JC Weadock Landfill and Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Background							
MW-15002	10/13/2020	1.09	-148.0	7.6	888	16.6	0.5
MW-15008	10/13/2020	1.12	-118.9	7.1	1,638	14.5	9.3
MW-15016	10/13/2020	2.00	36.0	7.3	1,620	15.9	1.0
MW-15019	10/13/2020	1.27	-105.8	7.0	2,269	14.2	1.2
Bottom Ash Pond							
JCW-MW-15007	10/13/2020	1.17	-134.9	7.3	20,455	14.9	0.5
JCW-MW-15009	10/13/2020	1.16	-93.0	6.6	2,331	15.5	1.4
JCW-MW-15010	10/13/2020	1.49	-158.5	7.1	1,595	12.8	0.5
JCW-MW-15028	10/13/2020	1.29	-177.9	7.9	3,749	12.5	1.3
Landfill							
JCW-MW-18001	10/13/2020	1.14	-129.1	7.1	2,123	15.8	1.3
JCW-MW-18004	10/14/2020	1.35	71.0	6.9	2,235	15.5	0.7
JCW-MW-18005	10/14/2020	1.56	-59.3	7.0	1,550	13.3	3.0
JCW-MW-18006	10/14/2020	1.49	-93.2	7.1	1,522	11.9	0.9
MW-50	10/13/2020	1.29	-110.0	7.1	2,775	17.2	0.9
MW-51	10/14/2020	1.43	-104.1	6.8	2,169	13.3	0.7
MW-52	10/14/2020	1.55	-103.7	7.0	2,175	12.8	1.0
MW-53	10/14/2020	1.38	-105.8	7.2	1,569	14.2	0.9
MW-53R	10/14/2020	1.35	-82.5	7.0	1,753	14.4	1.5
MW-54R	10/14/2020	1.48	-39.1	7.1	1,290	14.5	0.3
MW-55	10/14/2020	1.39	-154.0	7.2	1,449	15.7	3.0
OW-57ROUT	10/14/2020	1.79	36.5	7.1	1,403	14.2	5.0

Notes:
mg/L - Milligrams per Liter.
mV - Millivolts.
SU - Standard units.
umhos/cm - Micromhos per centimeter.
°C - Degrees Celcius
NTU - Nephelometric Turbidity Unit.

Table 3
Summary of Groundwater Sampling Results (Analytical): October 2020
DE Karn & JC Weadock Background – RCRA CCR Monitoring Program
Essexville, Michigan

					Sample Location:	**MW-15002**	**MW-15008**	**MW-15016**	**MW-15019**
					Sample Date:	10/13/2020	10/13/2020	10/13/2020	10/13/2020
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	Background			
Appendix III									
Boron	ug/L	NC	**500**	**500**	4,000	28	148	**510**	288
Calcium	mg/L	NC	NC	NC	500[EE]	62.7	115	259	158
Chloride	mg/L	**250****	**250[E]**	**250[E]**	**50**	**74.8**	**246**	**63.3**	**355**
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	**250****	**250[E]**	**250[E]**	**500[EE]**	8.86	2.55	**521**	35
Total Dissolved Solids	mg/L	**500****	**500[E]**	**500[E]**	**500**	466	**871**	**1,150**	**1,180**
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5[E]	6.5 - 8.5[E]	6.5 - 9.0	7.6	7.1	7.3	7.0
Appendix IV									
Antimony	ug/L	6	6	6	2	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	10	10	10	3	< 1	2	< 1
Barium	ug/L	2,000	2,000	2,000	1,200	51	65	55	290
Beryllium	ug/L	4	4	4	33	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5	5	2.5	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	100	100	11	< 1	1	< 1	< 1
Cobalt	ug/L	NC	40	100	100	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4	4	14	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	170	350	440	< 10	17	84	13
Mercury	ug/L	2	2	2	0.20#	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	73	210	120	< 5	< 5	6	< 5
Radium-226	pCi/L	NC	NC	NC	NC	< 0.295	0.593	< 0.423	0.545
Radium-228	pCi/L	NC	NC	NC	NC	< 0.409	< 0.488	< 0.537	0.65
Radium-226/228	pCi/L	5	NC	NC	NC	< 0.409	0.806	< 0.537	1.19
Selenium	ug/L	50	50	50	5	< 1	< 1	2	< 1
Thallium	ug/L	2	2	2	2	< 2	< 2	< 2	< 2
MI Part 115 Parameters									
Iron	ug/L	**300****	**300[E]**	**300[E]**	500,000[EE]	**2,720**	**11,700**	139	**14,700**
Copper	ug/L	1,000**	1,000[E]	1,000[E]	20	< 1	< 1	4	< 1
Nickel	ug/L	NC	100	100	120	2	2	7	4
Silver	ug/L	100**	34	98	0.2	< 0.2	< 0.2	< 0.2	< 0.2
Vanadium	ug/L	NC	**4.5**	62	27	< 2	**6**	< 2	< 2
Zinc	ug/L	5,000**	2,400	5,000[E]	260	< 10	< 10	< 10	< 10

Notes:

ug/L - micrograms per liter. mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using hardness of 258 mg CaCO3/L (average of SW-01 [Lake Huron] and SW-02 [Saginaw River] collected in April 2018) per footnote {G} of Michigan Part 201 criteria tables. Chromium GSI criterion based on hexavalent chromium per footnote {H}. GSI criterion is protective for surface water used as a drinking water source as described in footnote {X}. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters per footnote {FF}

- If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.

[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}.

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): October 2020
JC Weadock Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

						Sample Location:	JCW-MW-15007	JCW-MW-15009	JCW-MW-15010	JCW-MW-15028
						Sample Date:	10/13/2020	10/13/2020	10/13/2020	10/13/2020
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^		Downgradient			
Appendix III										
Boron	ug/L	NC	**500**	**500**	4,000		329	263	**2,000**	**644**
Calcium	mg/L	NC	NC	NC	**500EE**		413	**560**	218	221
Chloride	mg/L	**250****	**250E**	**250E**	**50**		**5,810**	5.96	**105**	**811**
Fluoride	ug/L	4,000	NC	NC	NC		1,160	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	**250****	**250E**	**250E**	**500EE**		4.47	**1,060**	**254**	99.8
Total Dissolved Solids	mg/L	**500****	**500E**	**500E**	**500**		**11,200**	**1,910**	**982**	**2,070**
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5E	6.5 - 8.5E	6.5 - 9.0		7.3	6.6	7.1	7.9
Appendix IV										
Antimony	ug/L	6	6	6	2		< 1	< 1	< 1	< 1
Arsenic	ug/L	**10**	**10**	**10**	**10**		**61**	1	4	< 1
Barium	ug/L	**2,000**	**2,000**	**2,000**	**1,200**		**2,400**	51	220	332
Beryllium	ug/L	4	4	4	33		< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5	5	2.5		< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	100	100	11		1	< 1	< 1	< 1
Cobalt	ug/L	NC	40	100	100		< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	NC	NC	NC		1,160	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4	4	14		< 1	< 1	< 1	2
Lithium	ug/L	NC	170	350	440		94	53	96	53
Mercury	ug/L	2	2	2	0.20#		< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	73	210	120		< 5	9	< 5	< 5
Radium-226	pCi/L	NC	NC	NC	NC		1.71	< 0.352	< 0.442	0.697
Radium-228	pCi/L	NC	NC	NC	NC		1.67	< 0.495	< 0.493	< 0.468
Radium-226/228	pCi/L	5	NC	NC	NC		3.38	< 0.495	< 0.493	1.15
Selenium	ug/L	50	50	50	5		< 1	< 1	< 1	< 1
Thallium	ug/L	2	2	2	2		< 2	< 2	< 2	< 2
MI Part 115 Parameters										
Iron	ug/L	**300****	**300E**	**300E**	500,000EE		**3,820**	**4,090**	**485**	**340**
Copper	ug/L	1,000**	1,000E	1,000E	20		2	3	1	1
Nickel	ug/L	NC	100	100	120		10	12	5	5
Silver	ug/L	100**	34	98	0.2		< 0.2	< 0.2	< 0.2	< 0.2
Vanadium	ug/L	NC	**4.5**	62	27		**20**	< 2	2	4
Zinc	ug/L	5,000**	2,400	5,000E	260		< 10	< 10	< 10	< 10

Notes:

ug/L - micrograms per liter. mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using hardness of 258 mg CaCO3/L (average of SW-01 [Lake Huron] and SW-02 [Saginaw River] collected in April 2018) per footnote {G} of Michigan Part 201 criteria tables. Chromium GSI criterion based on hexavalent chromium per footnote {H}. GSI criterion is protective for surface water used as a drinking water source as described in footnote {X}. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters per footnote {FF}

- If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.

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}.

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 Sampling Results (Analytical): October 2020
JC Weadock Landfill – RCRA CCR Monitoring Program
Essexville, Michigan

						Sample Location:	JCW-MW-18001	JCW-MW-18004	JCW-MW-18005	JCW-MW-18006	MW-50
						Sample Date:	10/13/2020	10/14/2020	10/14/2020	10/14/2020	10/13/2020
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^		downgradient				
Appendix III											
Boron	ug/L	NC	**500**	**500**	4,000		**1,370**	410	**1,090**	**2,610**	**1,470**
Calcium	mg/L	NC	NC	NC	500		282	323	195	167	368
Chloride	mg/L	250**	250[E]	250[E]	**50**		**73.8**	22.6	**66.5**	**72.2**	**77.5**
Fluoride	ug/L	4,000	NC	NC	NC		< 1,000	< 1,000	1,640	< 1,000	< 1,000
Sulfate	mg/L	**250****	**250[E]**	**250[E]**	**500**		**435**	**756**	185	50.1	**990**
Total Dissolved Solids	mg/L	**500****	**500[E]**	**500[E]**	**500**		**1,370**	**1,690**	**986**	**861**	**1,950**
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5[E]	6.5 - 8.5[E]	6.5 - 9.0		7.1	6.9	7.0	7.1	7.1
Appendix IV											
Antimony	ug/L	6	6	6	2		< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	**10**	**10**	**10**	**10**		3	< 1	8	**22**	3
Barium	ug/L	2,000	2,000	2,000	1,200		273	34	98	489	147
Beryllium	ug/L	4	4	4	33		< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5	5	2.5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	100	100	11		< 1	< 1	< 1	< 1	< 1
Cobalt	ug/L	NC	40	100	100		< 6	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	NC	NC	NC		< 1,000	< 1,000	1,640	< 1,000	< 1,000
Lead	ug/L	NC	4	4	14		< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	170	350	440		66	37	33	59	100
Mercury	ug/L	2	2	2	0.20#		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	**73**	210	**120**		< 5	< 5	< 5	< 5	7
Radium-226	pci/L	NC	**NC**	NC	**NC**		< 0.423	< 0.424	1.07	0.716	< 0.537
Radium-228	pci/L	NC	**NC**	NC	**NC**		0.616	1.04	0.54	0.853	0.613
Radium-226/228	pci/L	5	**NC**	NC	**NC**		1.03	0.922	1.61	1.57	1.01
Selenium	ug/L	50	50	50	5		< 1	< 1	< 1	< 1	1
Thallium	ug/L	2	2	2	2		< 2	< 2	< 2	< 2	< 2
MI Part 115 Parameters											
Iron	ug/L	**300****	**300[E]**	**300[E]**	500,000		182	< 20	**3,550**	**5,760**	**2,990**
Copper	ug/L	1,000**	1,000[E]	1,000[E]	20		1	3	1	< 1	3
Nickel	ug/L	NC	100	100	120		2	4	11	< 2	< 2
Silver	ug/L	100**	34	98	0.2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Vanadium	ug/L	NC	**4.5**	62	27		< 2	< 2	< 2	3	< 2
Zinc	ug/L	5,000**	2,400	5,000[E]	260		< 10	< 10	< 10	< 10	< 10

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

-- - not analyzed.

* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using hardness of 258 mg CaCO3/L (average of SW-01 [Lake Huron] and SW-02 [Saginaw River] collected in April 2018) per footnote {G} of Michigan Part 201 criteria tables. Chromium GSI criterion based on hexavalent chromium per footnote {H}. GSI criterion is protective for surface water used as a drinking water source as described in footnote {X}. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters per footnote {FF}

- If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.

[E] - Criterion is the aesthetic drinking water value per footnote {E}.

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 Sampling Results (Analytical): October 2020
JC Weadock Landfill – RCRA CCR Monitoring Program
Essexville, Michigan

					Sample Location:	**MW-51**	**MW-52**	**MW-53**	**MW-53R**	**MW-54R**	**MW-55**	**OW-57ROUT**
					Sample Date:	10/14/2020	10/14/2020	10/14/2020	10/14/2020	10/14/2020	10/14/2020	10/14/2020
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient			Nature and Extent	downgradient		
Appendix III												
Boron	ug/L	NC	**500**	**500**	4,000	**739**	**1,110**	**2,720**	**1,780**	**1,660**	**705**	**1,730**
Calcium	mg/L	NC	NC	NC	500	330	256	192	246	174	170	144
Chloride	mg/L	250**	250[E]	250[E]	**50**	**74.2**	**73.3**	38.6	31.8	23.9	18	49.4
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	1,140	1,020	< 1,000	1,800	1,220	1,830
Sulfate	mg/L	**250****	**250[E]**	**250[E]**	**500**	**522**	**572**	**269**	196	100	84	109
Total Dissolved Solids	mg/L	**500****	**500[E]**	**500[E]**	**500**	**1,550**	**1,540**	**1,030**	**1,100**	**743**	**826**	**782**
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5[E]	6.5 - 8.5[E]	6.5 - 9.0	6.8	7.0	7.2	7.0	7.1	7.2	7.1
Appendix IV												
Antimony	ug/L	6	6	6	2	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	ug/L	**10**	**10**	**10**	**10**	**17**	< 1	2	**40**	3	**123**	< 1
Barium	ug/L	2,000	2,000	2,000	1,200	147	139	131	242	103	223	73
Beryllium	ug/L	4	4	4	33	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5	5	2.5	< 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
Cobalt	ug/L	NC	40	100	100	< 6	< 6	< 6	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	1,140	1,020	< 1,000	1,800	1,220	1,830
Lead	ug/L	NC	4	4	14	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	170	350	440	51	33	49	66	57	33	24
Mercury	ug/L	2	2	2	0.20#	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	**73**	210	**120**	< 5	< 5	< 5	< 5	5	**179**	8
Radium-226	pci/L	NC	**NC**	NC	**NC**	1.35	0.744	< 0.531	0.616	< 0.334	< 0.447	< 0.324
Radium-228	pci/L	NC	**NC**	NC	**NC**	< 0.588	0.636	0.503	1.2	< 0.504	0.566	< 0.463
Radium-226/228	pci/L	5	**NC**	NC	**NC**	1.43	1.38	0.823	1.82	0.546	0.798	0.499
Selenium	ug/L	50	50	50	5	< 1	1	< 1	1	< 1	1	< 1
Thallium	ug/L	2	2	2	2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
MI Part 115 Parameters												
Iron	ug/L	**300****	**300[E]**	**300[E]**	500,000	**5,400**	**4,770**	**1,560**	**2,140**	**1,030**	**21,800**	92
Copper	ug/L	1,000**	1,000[E]	1,000[E]	20	2	2	2	1	1	< 1	2
Nickel	ug/L	NC	100	100	120	< 2	< 2	< 2	< 2	4	< 2	14
Silver	ug/L	100**	34	98	0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Vanadium	ug/L	NC	**4.5**	62	27	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Zinc	ug/L	5,000**	2,400	5,000[E]	260	< 10	< 10	< 10	< 10	< 10	< 10	16

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
-- - not analyzed.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using hardness of 258 mg CaCO3/L (average of SW-01 [Lake Huron] and SW-02 [Saginaw River] collected in April 2018) per footnote {G} of Michigar Part 201 criteria tables. Chromium GSI criterion based on hexavalent chromium per footnote {H}. GSI criterion is protective for surface water used as a drinking water source as described in footnote {X}. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters per footnote {FF}
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE policy and procedure 09-014 dated June 20, 2012.
[E] - Criterion is the aesthetic drinking water value per footnote {E}.
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 6

Summary of Groundwater Protection Standard Exceedances – October 2020

JC Weadock – RCRA CCR Monitoring Program

Essexville, Michigan

JC Weadock Bottom Ash Pond								
Constituent	Units	GWPS	JCW-MW-15007		JCW-MW-15009		JCW-MW-15010	
			LCL	UCL	LCL	UCL	LCL	UCL
Arsenic	ug/L	21	5.6	48	--	--	5.0	18
Barium	ug/L	2,000	0.50	2,400	--	--	--	--
Beryllium	ug/L	4	--	--	1.0	7.4	--	--
Lithium	ug/L	180	--	--	57	250	--	--

JC Weadock Landfill						
Constituent	Units	GWPS	JCW-MW-18006		MW-51	
			LCL	UCL	LCL	UCL
Arsenic	ug/L	21	22	40	11	23

Notes:

ug/L - micrograms per Liter

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

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

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

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

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

Figures

BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

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

0 3,000 6,000 FEET

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

PROJECT:

CONSUMERS ENERGY COMPANY
DE KARN AND JC WEADOCK POWER PLANTS
ESSEXVILLE, MICHIGAN

TITLE:

SITE LOCATION MAP

DRAWN BY:	S. MAJOR
CHECKED BY:	J. KRENZ
APPROVED BY:	D. LITZ
DATE:	JANUARY 2021
PROJ. NO.:	367389.0001
FILE:	367388-001-004.mxd

FIGURE 1

S:\1-PROJECTS\Consumers_Energy_Company\Michigan\CCR_GW\2017_269767\367388-001-004.mxd -- Saved By: SMAJOR on 7/15/2020, 14:00:57 PM

LEGEND

- BACKGROUND MONITORING WELL
- DEK BOTTOM ASH POND & LINED IMPOUNDMENT MONITORING WELL
- DEK BOTTOM ASH POND MONITORING WELL
- DEK LINED IMPOUNDMENT MONITORING WELL
- DECOMMISSIONED MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
- JCW LANDFILL CCR WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- LEACHATE HEADWELL
- SURFACE WATER GAUGING STATION
- NATURE AND EXTENT WELL
- SLURRY WALL (APPROXIMATE)
- LINED IMPOUNDMENT (COVENANT BOUNDARY)

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).
4. A SINGLE WELL SYMBOL IS SHOWN FOR WELL PAIRS MW-01/MW-02, MW-03/MW-04, OW-02/MW-22, AND OW-07/MW-23 AS THE WELLS ARE LOCATED WITHIN 15-FT OF EACH OTHER.

N

0 1,000 2,000 Feet

1 " = 1,000 '

1:12,000

PROJECT:

CONSUMERS ENERGY COMPANY
DE KARN AND JC WEADOCK POWER PLANTS
ESSEXVILLE, MICHIGAN

TITLE:

KARN AND WEADOCK COMPLEX AREA

DRAWN BY:	S. MAJOR	PROJ NO.:	367388-001
CHECKED BY:	J. KRENZ		
APPROVED BY:	D. LITZ		**FIGURE 2**
DATE:	JANUARY 2021		

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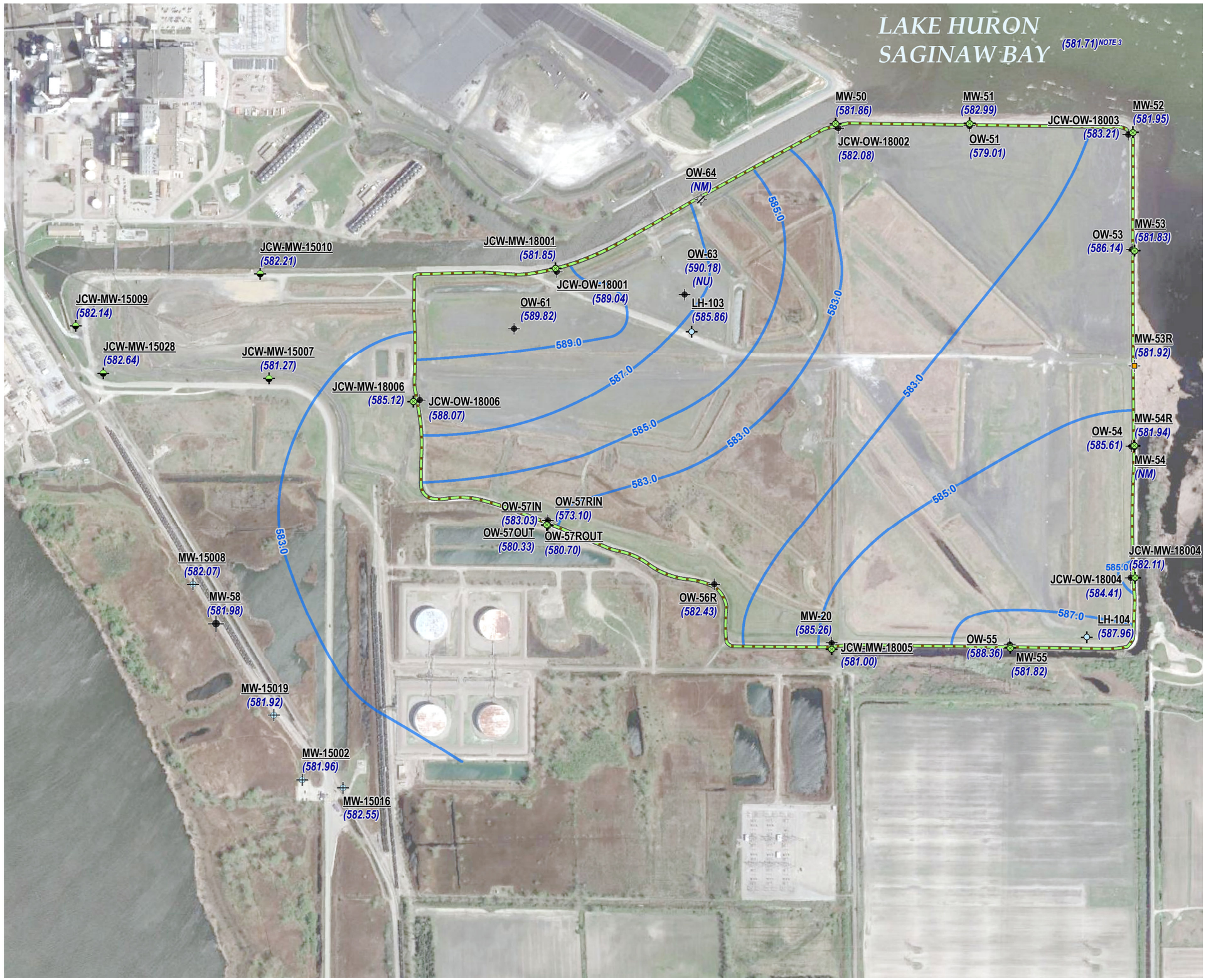
FILE NO.: 367388-001-005.mxd

TRC - GIS
Plot Date: 1/26/2021, 12:36:22 PM by SMAJOR -- LAYOUT: ANSI B (11"x17")
Path: S:\1-PROJECTS\Consumers Energy Company\Michigan\CCR GW\2017 269767\367388-0\Map Rotation: 0
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)



LEGEND

- BACKGROUND MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
- JCW LANDFILL CCR WELL
- LEACHATE HEADWELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- NATURE AND EXTENT WELL
- DECOMMISSIONED MONITORING WELL
- SLURRY WALL (APPROXIMATE)
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- (580.85) GROUNDWATER ELEVATION (FEET)
- (NU) NOT USED TO DEVELOP CONTOURS

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
2. MONITORING WELL AND SLURRY WALL LOCATIONS PROVIDED BY CEC; SG21733SHT2 REVB.DWG DATED 11/21/2018.
3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).
4. GROUNDWATER ELEVATIONS DISPLAYED IN FEET RELATIVE TO THE NORTH AMERICAN VERTICAL DATUM OF 1988.

N

0 600 1,200 Feet

1 " = 600 '

1:7,200

PROJECT:

CONSUMERS ENERGY COMPANY
JC WEADOCK POWER PLANT
ESSEXVILLE, MICHIGAN

TITLE:

POTENTIOMETRIC SURFACE MAP OCTOBER 2020

DRAWN BY:	S. MAJOR	PROJ NO.:	367389-001
CHECKED BY:	J. KRENZ		
APPROVED BY:	D. LITZ		**FIGURE 3**
DATE:	JANUARY 2021		

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FILE NO.: 367389-001-009.mxd

Plot Date: 1/28/2021, 17:13:50 PM by SMAJOR -- LAYOUT: ANSI B (11"x17")
Path: S:\11-PROJECTS\Consumers Energy Company\Michigan\CCR GW\2017 269767\367389-001-009.mxd
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0
TRC - GIS

LEGEND

- BACKGROUND MONITORING WELL
- JCW LANDFILL MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- LEACHATE HEADWELL
- NATURE AND EXTENT WELL
- NO EXCEEDANCES
- TWO OR MORE EXCEEDANCES (NOTES 4 & 5)
- STATISTICALLY SIGNIFICANT GWPS EXCEEDANCE (NOTE 6)
- SLURRY WALL (APPROXIMATE)
- APPROXIMATE WATER-BEARING UNIT BOUNDARY

WELL ID
CONSTITUENT(S) EXCEEDING GWPS

* EXCEEDANCE TRIGGERING ASSESSMENT OF CORRECTIVE MEASURES PURSUANT TO §257.96

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
2. MONITORING WELL AND SLURRY WALL LOCATIONS PROVIDED BY CEC; SG21733SHT2 REVB.DWG DATED 11/21/2018
3. GWPS (GROUNDWATER PROTECTION STANDARD) IS THE HIGHER OF THE MAXIMUM CONTAMINANT LEVEL (MCL)/REGIONAL SCREENING LEVEL FROM 83 FR 36435 (RSL) AND UPPER TOLERANCE LIMIT (UTL) AS ESTABLISHED IN TRC'S TECHNICAL MEMORANDUM DATED OCTOBER 15, 2018.
4. GROUNDWATER DATA FROM NOVEMBER 2018 TO OCTOBER 2020 ARE SCREENED AGAINST THE GWPS FOR EVALUATION PURPOSES ONLY. AN EXCEEDANCE IS DEFINED AS A SINGLE DETECTION ABOVE THE GWPS, HOWEVER, CONFIDENCE INTERVALS WILL BE USED TO DETERMINE COMPLIANCE PER THE CCR RULES.
5. AN EXCEEDANCE OF THE GWPS DOES NOT INDICATE UNACCEPTABLE RISK FROM GROUNDWATER EXPOSURE; THE DRINKING WATER PATHWAY IS NOT COMPLETE ON THE PROPERTY. GROUNDWATER CONDITIONS CONTINUE TO BE MONITORED TO INFORM THE JCW BOTTOM ASH POND AND LANDFILL REMEDY SELECTION.
6. LOWER CONFIDENCE LIMIT IS ABOVE GWPS.
7. ALTERNATE SOURCE DEMONSTRATION INCLUDED IN 2019 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT (TRC, JANUARY 2020).

Constituent	GWPS
Antimony	6 ug/L
Arsenic	21 ug/L
Barium	2,000 ug/L
Beryllium	4 ug/L
Cadmium	5 ug/L
Chromium	100 ug/L
Cobalt	15 ug/L
Fluoride	4,000 ug/L
Lead	15 ug/L
Lithium	180 ug/L
Mercury	2 ug/L
Molybdenum	100 ug/L
Radium-226/228	5 pCi/L
Selenium	50 ug/L
Thallium	2 ug/L

0 600 1,200 Feet

1 " = 600 '

1:7,200

PROJECT:
CONSUMERS ENERGY COMPANY
JC WEADOCK POWER PLANT
ESSEXVILLE, MICHIGAN

TITLE:
NATURE AND EXTENT SUMMARY GWPS EXCEEDANCES

DRAWN BY:	S. MAJOR	PROJ NO.:	367389.0001
CHECKED BY:	J. KRENZ		
APPROVED BY:	D. LITZ		**FIGURE 4**
DATE:	JANUARY 2021		

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FILE NO.: 367389-ExceedancesNE_ACM.mxd

Attachment A
Data Quality Reviews

Laboratory Data Quality Review
Groundwater Monitoring Event October 2020
JC Weadock/ DE Karn Background

Groundwater samples were collected by TRC for the October 2020 sampling event. Samples were analyzed for total metals, anions, and total dissolved solids by Consumers Energy (CE) Laboratory Services in Jackson, Michigan. The radium analyses were subcontracted to Eurofins-TestAmerica in St. Louis, Missouri (Eurofins TA – St. Louis). The laboratory analytical results were reported in laboratory sample delivery groups (SDGs) 20-1105 and 240-138442-1.

During the October 2020 sampling event, a groundwater sample was collected from each of the following wells:

- MW-15002
- MW-15008
- MW-15016
- MW-15019

Each sample was analyzed for one or more of 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
Radium (Ra-226, Ra-228, Combined Ra-226 & Ra-228)	EPA 903.0, EPA 904.0

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

Data Usability Review Procedure

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

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

- The reviewed Appendix III, IV, and additional Part 115 constituents will be utilized for the purposes of a detection or assessment monitoring program.
- Data are usable for the purposes of the detection or assessment monitoring program.
- When the data are evaluated through a detection or assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- A method blank was analyzed for the radium 226 analysis only and radium 226 was not detected in the method blank. The laboratory inadvertently did not analyze a method blank for radium 228; therefore, potential contamination arising from laboratory sample preparation and/or analytical procedures could not be evaluated for radium 228.
- One field blank (FB-04) sample was collected. Target analytes were not detected in the field blank.
- An equipment blank was not collected in this data set.
- MS and MSD analyses were not performed on a sample from this data set.
- An LCS and LCSD were analyzed with each analytical batch for radium; the following issues were noted:

  - The recoveries of radium 228 in the LCS 160-488925/1-A (74%) and LCSD 160-488925/2-A (70%) were below the lower control limit (75%); the positive and non-detect results for radium 228 for all samples are potentially biased low, as summarized in the attached Table 1.
- The field duplicate pair samples were DUP-04 and MW-15008; relative percent differences (RPDs) between the parent and duplicate sample were within the QC limits.
- Laboratory duplicate analyses were not performed on a sample from this data set.
- Carrier recoveries, where applicable, were within 40-110%.

Table 1

Summary of Data Non-Conformances for Groundwater Analytical Data

JC Weadock/DE Karn Background – RCRA CCR Monitoring Program

Essexville, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
MW-15002	10/13/2020	Radium 228	LCS/LCSD recoveries below acceptance limit (75%). Positive and non-detect results are potentially biased low.
MW-15008	10/13/2020		
MW-15016	10/13/2020		
MW-15019	10/13/2020		
DUP-04	10/13/2020		

Laboratory Data Quality Review
Groundwater Monitoring Event October 2020
JC Weadock Bottom Ash Pond

Groundwater samples were collected by TRC for the October 2020 sampling event. Samples were analyzed for metals, anions, and total dissolved solids by Consumers Energy (CE) Laboratory Services in Jackson, Michigan. The radium analyses were subcontracted to Eurofins-TestAmerica in St. Louis, Missouri (Eurofins TA – St. Louis). The laboratory analytical results were reported in laboratory sample delivery groups (SDGs) 20-1106 and 240-138443-1.

During the October 2020 sampling event, a groundwater sample was collected from each of the following wells:

- JCW-MW-15007
- JCW-MW-15009
- JCW-MW-15010
- JCW-MW-15028

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

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

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

Data Usability Review Procedure

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

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

- The reviewed Appendix III and IV constituents as well as iron, copper, nickel, silver, vanadium, and zinc 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:

- Method blanks were analyzed for the radium analyses. Target analytes were not detected in the method blanks.
- One field blank (FB-02) sample and two equipment blanks (EB-02 and EB-03) were collected. Target analytes were not detected in the field blank and equipment blanks.
- An LCS and LCSD were analyzed with each analytical batch for radium; the LCS and LCSD recoveries were within QC limits.
- MS and MSD analyses were performed on sample JCW-MW-15009 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-02 and JCW-MW-15010; relative percent differences (RPDs) between the parent and duplicate sample were within the QC limits.
- Laboratory duplicate analyses were not performed on a sample from this data set.
- Carrier recoveries, where applicable, were within 40-110%.

Laboratory Data Quality Review
Groundwater Monitoring Event October 2020
JC Weadock Landfill

Groundwater samples were collected by TRC for the October 2020 sampling event. Samples were analyzed for total metals, anions, total dissolved solids, alkalinity, and total phosphorus by Consumers Energy (CE) Laboratory Services in Jackson, Michigan. The radium analyses were subcontracted to Eurofins-TestAmerica in St. Louis, Missouri (Eurofins TA – St. Louis). The laboratory analytical results were reported in laboratory sample delivery groups (SDGs) 20-1111 and 240-138441-1.

During the October 2020 sampling event, a groundwater or pore water sample was collected from each of the following wells:

- JCW-MW-18001
- JCW-MW-18004
- JCW-MW-18005
- JCW-MW-18006
- MW-50
- MW-51
- MW-52
- MW-53
- MW-53R
- MW-54R
- MW-55
- MW-58
- OW-57R OUT
- OW-55

Each sample was analyzed for one or more of 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
Total Phosphorus	SM-4500-P
Radium (Ra-226, Ra-228, Combined Ra-226 & Ra-228)	EPA 903.0, EPA 904.0

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

Data Usability Review Procedure

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

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

- Data for method blanks, equipment blanks, and field blanks. 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 metals, anions, TDS, alkalinity, and total phosphorus 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, IV, optional Piper Diagram analyses, and additional Part 115 constituents will be utilized for the purposes of the 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:

- Method blanks were analyzed for the radium 226 analysis only and radium 226 was not detected in the method blanks. A method blank for radium 228 was inadvertently not

analyzed by the laboratory; therefore, potential contamination arising from laboratory sample preparation and/or analytical procedures could not be evaluated for radium 228, where reported.

- An LCS and LCSD were analyzed with each analytical batch for radium; the following issues were noted:
  - The recoveries of radium 228 in the LCS 160-488925/1-A (74%) and LCSD 160-488925/2-A (70%) were below the lower control limit (75%); the positive and non-detect results for radium 228 are potentially biased low, as summarized in the attached Table 1.
- One field blank (FB-02) sample was collected. Target analytes were not detected in the field blank.
- One equipment blank (EB-02) was collected in this data set. Target analytes were not detected in the equipment with exception of potassium which was detected at a concentration <10x the concentrations detected in the groundwater samples; therefore, no data were affected.
- MS and MSD analyses were performed on sample JCW-MW-18001 for total metals, anions, alkalinity, and total phosphorus. 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 and MW-51; the relative percent differences (RPDs) between the parent and duplicate sample were within the QC limits.
- Laboratory duplicate analyses were not performed on a sample from this data set.
- Carrier recoveries, where applicable, were within 40-110%.

Table 1

Summary of Data Non-Conformances for Groundwater Analytical Data

JC Weadock Landfill – RCRA CCR Monitoring Program

Essexville, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JCW-MW-18001	10/13/2020	Radium 228	LCS/LCSD recoveries below acceptance limit (<75%). Positive and non-detect results are potentially biased low.
JCW-MW-18004	10/14/2020		
JCW-MW-18005	10/14/2020		
JCW-MW-18006	10/14/2020		
MW-50	10/13/2020		
MW-51	10/14/2020		
MW-52	10/14/2020		
MW-53	10/14/2020		
MW-53R	10/14/2020		
MW-54R	10/14/2020		
MW-55	10/14/2020		
OW-57R OUT	10/14/2020		
MW-58	10/14/2020		
DUP-02	10/14/2020		
EB-02	10/14/2020		

Attachment B
Weadock Bottom Ash Pond: Statistical Evaluation of October 2020 Assessment Monitoring Sampling Event

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Technical Memorandum

Date:	January 11, 2020
To:	J.R. Register, Consumers Energy
From:	Darby Litz, TRC Katy Reminga, TRC
Project No.:	367389.0001 Phase 003, Task 002
Subject:	Statistical Evaluation of the October 2020 Assessment Monitoring Sampling Event JC Weadock Bottom Ash Pond, Consumers Energy Company, Essexville, Michigan

During the statistical evaluation of the initial assessment monitoring event (May 2018), beryllium and lithium were present in one or more downgradient monitoring wells at statistically significant levels exceeding the Groundwater Protection Standards (GWPSs). Therefore, Consumers Energy Company (Consumers Energy) initiated an Assessment of Corrective Measures (ACM) within 90 days from when the Appendix IV exceedance was determined. The ACM was completed on September 11, 2019.

Currently, Consumers Energy is continuing semiannual assessment monitoring in accordance with §257.95 of the CCR Rule[1] at the JC Weadock Power Plant Bottom Ash Pond. The second semiannual assessment monitoring event for 2020 was conducted on October 13, 2020. In accordance with §257.95, the assessment monitoring data must be compared to GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs. GWPSs were established in accordance with §257.95(h), as detailed in the October 15, 2018 Groundwater Protection Standards technical memorandum, which was also included in the 2018 Annual Groundwater Monitoring Report (TRC, January 2019). The following narrative describes the methods employed and the results obtained and the Sanitas™ output files are included as an attachment.

The statistical evaluation of the sixth semiannual assessment monitoring event data indicate no constituents are present at statistically significant levels that exceed the GWPSs in downgradient monitoring wells at the Weadock Bottom Ash Pond.

Constituent	GWPS	#Downgradient Wells Observed

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

Previously, lithium and beryllium were present in downgradient well JCW-MW-15009 at statistically significant levels; however, the October 2020 statistical evaluation shows that the lower confidence limits for lithium and beryllium are currently below the GWPSs. Although no Appendix IV constituents are present at statistically significant levels above the GWPS based on this data evaluation, corrective

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

action has been triggered as a result of data collected during the previous assessment monitoring events. Source removal of CCR has been completed, as reported in the Weadock Bottom Ash Pond Removal Documentation Report (Golder, August 2020) and approved by the Michigan Department of Environment, Great Lakes, and Energy on December 18, 2020. For units that are closed by removal, two consecutive rounds of data below the GWPS are needed to demonstrate closure. Lithium and beryllium concentrations have been below the GWPS at JCW-MW-15009 for the past three semi-annual sampling events. 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.

Assessment Monitoring Statistical Evaluation

The four downgradient wells (JCW-MW-15007, JCW-MW-15009, JCW-MW-15010, and JCW-MW-15028) are located in accessible areas along the downgradient perimeter of the Weadock Bottom Ash Pond. Following the second semiannual assessment monitoring sampling event for 2020, compliance well data for the Weadock Bottom Ash Pond were evaluated in accordance with the Groundwater Statistical Evaluation Plan (Stats Plan) (TRC, October 2017).

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

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

For each detected Appendix IV constituent, the concentrations from each well were first compared directly to the GWPS, as shown on Table 1. Parameter-well combinations that included a direct exceedance of the GWPS within the past eight sampling events (August 2017 through October 2020)

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

were retained for further analysis. Arsenic in JCW-MW-15007 and JCW-MW-15010, barium in JCW-MW-15009, and beryllium and lithium in JCW-MW-15009 had individual results exceeding their respective GWPSs within this time period. Groundwater data were 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, as appropriate, were calculated for each of the CCR Appendix IV constituents using a per test[3] 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.

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. Initially, the baseline (December 2015 through August 2017) results and the assessment monitoring results (April 2018 through October 2020) were observed visually for potential trends. No outliers were identified. Arsenic and barium concentrations in JCW-MW-15007 appear to exhibit an upward trend on the time series charts (Attachment 1). Arsenic concentrations in JCW-MW-15010 and beryllium and lithium concentrations in JCW-MW-15009 appear to exhibit a downward trend on the time series charts (Attachment 1). These data sets were tested further in Sanitas™ utilizing Sen's Slope to estimate the average rate of change in concentration over time and utilizing the Mann-Kendall trend test to test for significance of the trend at the 98% confidence level. The trend tests show that beryllium and lithium in JCW-MW-15009 are generally decreasing with time, as evidenced by the negative Sen's Slope, and that the downward trends are statistically significant (Attachment 1). The trends are causing the confidence intervals to widen. Calculating a confidence interval around a trending data set incorporates not only variability present naturally in the underlying dataset, but also incorporates variability due to the trend itself. Beryllium and lithium concentrations have already triggered assessment monitoring (e.g., not newly identified GWPS exceedances) and an interim measure has been initiated through cessation of hydraulic loading to the bottom ash pond in April 2018; therefore, traditional confidence interval calculations are presented in this statistical evaluation until more data are available. Once additional

[3] Confidence level is assessed for each individual comparison (i.e. per well and per constituent)

data are collected in the absence of hydraulic loading, confidence bands may be a more appropriate assessment to determine compliance with the CCR Rule. Confidence bands are selected by the Unified Guidance as the appropriate method for calculating confidence intervals on trending data. A confidence band calculates upper and lower confidence limits at each point along the trend to reduce variability and create a narrower confidence interval. At least 8 to 10 measurements should be available when computing a confidence band around a linear regression.

The Sanitas™ software was then used to test compliance at the downgradient monitoring wells using the confidence interval method for the most recent 8 sampling events. Eight independent sampling events provide the appropriate density of data as recommended per the Unified Guidance yet are collected recently enough to provide an indication of current condition. The tests were run with a per-test significance of $\alpha = 0.01$. The software outputs are included in Attachment 1 along with data reports showing the values used for the evaluation. The percentage of non-detect observations are also included in Attachment 1. Non-detect data was handled in accordance with the Stats Plan for the purposes of calculating the confidence intervals.

The Sanitas™ software generates an output that includes graphs of the parametric or non-parametric confidence intervals for each well along with notes data transformations, as appropriate. In each case, the data sets were found to be normally distributed, with the exception of barium at JCW-15007 and beryllium at JCW-MW-15009, which were found to be non-normal and were evaluated using a non-parametric test. The confidence interval test compares the lower confidence limit to the GWPS. The statistical evaluation of the Appendix IV parameters shows no constituents present at statistically significant levels that exceed the GWPSs. The results of the assessment monitoring statistical evaluation are consistent with the previous (May 2020) assessment monitoring data statistical evaluation. Although no Appendix IV constituents are present at statistically significant levels above the GWPS based on this data evaluation, concentrations remain above background levels and corrective action has been triggered as a result of data collected during the previous assessment monitoring events. Once corrective action is triggered (i.e., the lower confidence limit is above the GWPS), the upper confidence limit must be below the GWPS to demonstrate achievement of the GWPS for units that were not closed by removal. For units that are closed by removal, two consecutive rounds of data below the GWPS are needed to demonstrate closure. Consumers Energy will continue to evaluate corrective measures per §257.96 and §257.97. Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Attachments

Table 1 Comparison of Groundwater Sampling Results to Groundwater Protection Standards – August 2017 to October 2020

Attachment 1 Sanitas™ Output Files

Table

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – August 2017 to October 2020
JC Weadock Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

						Sample Location:	JCW-MW-15007											
						Sample Date:	8/3/2017	8/3/2017	9/19/2017	9/19/2017	4/10/2018	5/23/2018	11/7/2018	4/9/2019	10/15/2019	10/15/2019	5/14/2020	10/13/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient											
Appendix III								Field Dup		Field Dup						Field Dup		
Boron	ug/L	NC	NA	619	NA		< 20.0	345	384	479	--	308	656	290	470	460	335	329
Calcium	mg/L	NC	NA	302	NA		182	171	140	153	--	145	153	200	130	120	217	413
Chloride	mg/L	250*	NA	2,440	NA		1,870	1,830	1,340	1,370	--	1,660	788	1,600	1,200	1,200	2,870	5,810
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 10,000 (1)	< 5,000(1)	< 5,000(1)	< 1,000	1,160
Sulfate	mg/L	250*	NA	407	NA		34.5	34.6	8.8	9.2	--	19.6	23.9	< 20	44	43	57.2	4.47
Total Dissolved Solids	mg/L	500*	NA	4,600	NA		3,410	3,500	2,560	2,530	--	3,210	1,790	3,400	2,300	2,400	5,080	11,200
pH, Field	SU	6.5 - 8.5*	NA	6.5-7.3	NA		6.8	--	7.1	--	7.1	7.2	7.1	7.2	7.1	--	7.6	7.3
Appendix IV																		
Antimony	ug/L	6	NA	1	6		< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Arsenic	ug/L	10	NA	21	**21**		< 1.0	**48.6**	--	--	16.7	**25.6**	**46.3**	9.8	**34**	**35**	19	**61**
Barium	ug/L	2,000	NA	1,300	**2,000**		< 1.0	934	--	--	957	941	1,060	950	970	970	1,180	**2,400**
Beryllium	ug/L	4	NA	1	**4**		< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 1.0	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Chromium	ug/L	100	NA	3	100		< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1	1
Cobalt	ug/L	NC	6	15	**15**		< 15.0	< 15.0	--	--	< 15.0	< 15.0	< 30.0 (1)	< 6.0	< 6.0	< 6.0	< 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	< 10,000 (1)	< 5,000(1)	< 5,000(1)	< 1,000	1,160
Lead	ug/L	NC	15	1	15		< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Lithium	ug/L	NC	40	180	**180**		100	97	--	--	80	88	87	67	70	67	103	94
Mercury	ug/L	2	NA	0.2	2		< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	6	100		< 5.0	< 5.0	--	--	6.4	7.6	< 25.0	6.2	9.7	9.6	< 5	< 5
Radium-226	pCi/L	NC	NA	NA	NA		1.82	1.23	--	--	0.878	0.239	1.33	0.628	0.659	0.442	0.728	1.71
Radium-228	pCi/L	NC	NA	NA	NA		1.07	< 0.671	--	--	0.761	0.795	0.975	0.492	0.796	0.543	0.698	1.67
Radium-226/228	pCi/L	5	NA	3.32	5		2.89	1.88	--	--	1.64	1.03	2.31	1.12	1.45	0.986	1.43	3.38
Selenium	ug/L	50	NA	2	50		< 1.0	< 1.0	--	--	1.2	< 1.0	< 1.0	3.2	< 1.0	< 1.0	< 1	< 1
Thallium	ug/L	2	NA	2	2		< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 10.0 (1)	< 2.0	< 2.0	< 2.0	< 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) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences. and/or concentrations of other constituents present.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – August 2017 to October 2020
JC Weadock Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

						Sample Location:	JCW-MW-15009								
						Sample Date:	8/2/2017	9/18/2017	4/10/2018	5/23/2018	11/7/2018	4/9/2019	10/15/2019	5/14/2020	10/13/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient								
Appendix III															
Boron	ug/L	NC	NA	619	NA		429	533	--	297	422	290	330	141	263
Calcium	mg/L	NC	NA	302	NA		554	470	--	530	589	510	520	314	560
Chloride	mg/L	250*	NA	2,440	NA		84.8	113	--	41	64.9	43	18	3.19	5.96
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 2,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	407	NA		2,680	3,090	--	1,690	1,980	1,600	1,400	611	1,060
Total Dissolved Solids	mg/L	500*	NA	4,600	NA		2,590	3,020	--	2,510	2,620	2,400	2,100	1,370	1,910
pH, Field	SU	6.5 - 8.5*	NA	6.5-7.3	NA		4.6	4.6	4.7	4.9	4.8	5.4	6.1	7.2	6.6
Appendix IV															
Antimony	ug/L	6	NA	1	6		< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Arsenic	ug/L	10	NA	21	**21**		< 1.0	--	1.6	1.4	< 5.0	< 1.0	< 1.0	< 1	1
Barium	ug/L	2,000	NA	1,300	**2,000**		16.6	--	12.3	14.4	14.8	14	66	58	51
Beryllium	ug/L	4	NA	1	**4**		**7.4**	--	**7.1**	**6.5**	**6.6**	**4.3**	< 1.0	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.20	--	< 0.20	< 0.20	< 1.0	0.24	< 0.20	< 0.2	< 0.2
Chromium	ug/L	100	NA	3	100		1.5	--	1.4	1.4	< 5.0	1.4	< 1.0	2	< 1
Cobalt	ug/L	NC	6	15	**15**		< 15.0	--	< 15.0	< 15.0	< 30.0 (1)	< 6.0	< 6.0	< 6	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 2,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1.0	--	< 1.0	< 1.0	< 5.0	< 1.0	< 1.0	< 1	< 1
Lithium	ug/L	NC	40	180	**180**		**270**	--	**210**	**190**	**240**	150	94	18	53
Mercury	ug/L	2	NA	0.2	2		< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	6	100		< 5.0	--	< 5.0	< 5.0	< 25.0	< 5.0	9.3	10	9
Radium-226	pCi/L	NC	NA	NA	NA		< 0.644	--	< 0.703	< 0.723	< 0.803	< 0.0879	0.175	< 0.125	< 0.352
Radium-228	pCi/L	NC	NA	NA	NA		0.833	--	0.707	1.11	1.25	< 0.411	0.548	< 0.491	< 0.495
Radium-226/228	pCi/L	5	NA	3.32	5		< 1.39	--	< 1.37	< 1.37	< 1.54	< 0.411	0.723	< 0.491	< 0.495
Selenium	ug/L	50	NA	2	50		1.4	--	14.2	5.2	< 5.0	2.0	2.0	1	< 1
Thallium	ug/L	2	NA	2	2		< 2.0	--	< 2.0	< 2.0	< 10.0 (1)	< 2.0	< 2.0	< 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) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences. and/or concentrations of other constituents present.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – August 2017 to October 2020
JC Weadock Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

						Sample Location:	JCW-MW-15010									
						Sample Date:	8/2/2017	9/19/2017	4/10/2018	5/22/2018	5/22/2018	11/7/2018	4/9/2019	10/14/2019	5/14/2020	10/13/2020	10/13/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient										
Appendix III											Field Dup						Field Dup
Boron	ug/L	NC	NA	619	NA		1,580	1,340	--	1,330	1,220	1,360	1,400	1,400	2,070	2,000	2,030
Calcium	mg/L	NC	NA	302	NA		69.9	63.6	--	78.3	78.8	84.4	120	110	286	218	204
Chloride	mg/L	250*	NA	2,440	NA		92.7	89.5	--	99.8	99.7	96.5	140	140	90.4	105	106
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	407	NA		59.0	39.9	--	24.3	23.2	22.3	36	30	553	254	255
Total Dissolved Solids	mg/L	500*	NA	4,600	NA		832	392	--	458	486	492	670	600	1,500	982	997
pH, Field	SU	6.5 - 8.5*	NA	6.5-7.3	NA		7.5	7.5	7.3	7.5	--	7.4	7.6	7.3	7.7	7.1	--
Appendix IV																	
Antimony	ug/L	6	NA	1	6		< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1
Arsenic	ug/L	10	NA	21	**21**		**23.2**	--	12.5	11.4	11.1	9.5	16	13	4	4	4
Barium	ug/L	2,000	NA	1,300	**2,000**		109	--	121	123	116	114	190	180	400	220	221
Beryllium	ug/L	4	NA	1	**4**		< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	NA	3	100		< 1.0	--	< 1.0	< 1.0	< 1.0	1.2	< 1.0	< 1.0	< 1	< 1	< 1
Cobalt	ug/L	NC	6	15	**15**		< 15.0	--	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	< 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	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1
Lithium	ug/L	NC	40	180	**180**		61	--	77	72	72	70	73	84	116	96	97
Mercury	ug/L	2	NA	0.2	2		< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	6	100		< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5	< 5	< 5
Radium-226	pCi/L	NC	NA	NA	NA		< 0.643	--	< 0.831	< 0.618	< 0.668	< 0.879	0.215	< 0.134	0.409	< 0.442	< 0.445
Radium-228	pCi/L	NC	NA	NA	NA		< 0.707	--	1.39	< 0.741	< 0.701	< 0.776	0.424	0.412	< 0.467	< 0.493	< 0.566
Radium-226/228	pCi/L	5	NA	3.32	5		< 1.35	--	< 2.04	< 1.36	< 1.37	< 1.66	0.639	0.536	0.781	< 0.493	< 0.566
Selenium	ug/L	50	NA	2	50		< 1.0	--	< 1.0	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1
Thallium	ug/L	2	NA	2	2		< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 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) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences. and/or concentrations of other constituents present.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – August 2017 to October 2020
JC Weadock Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

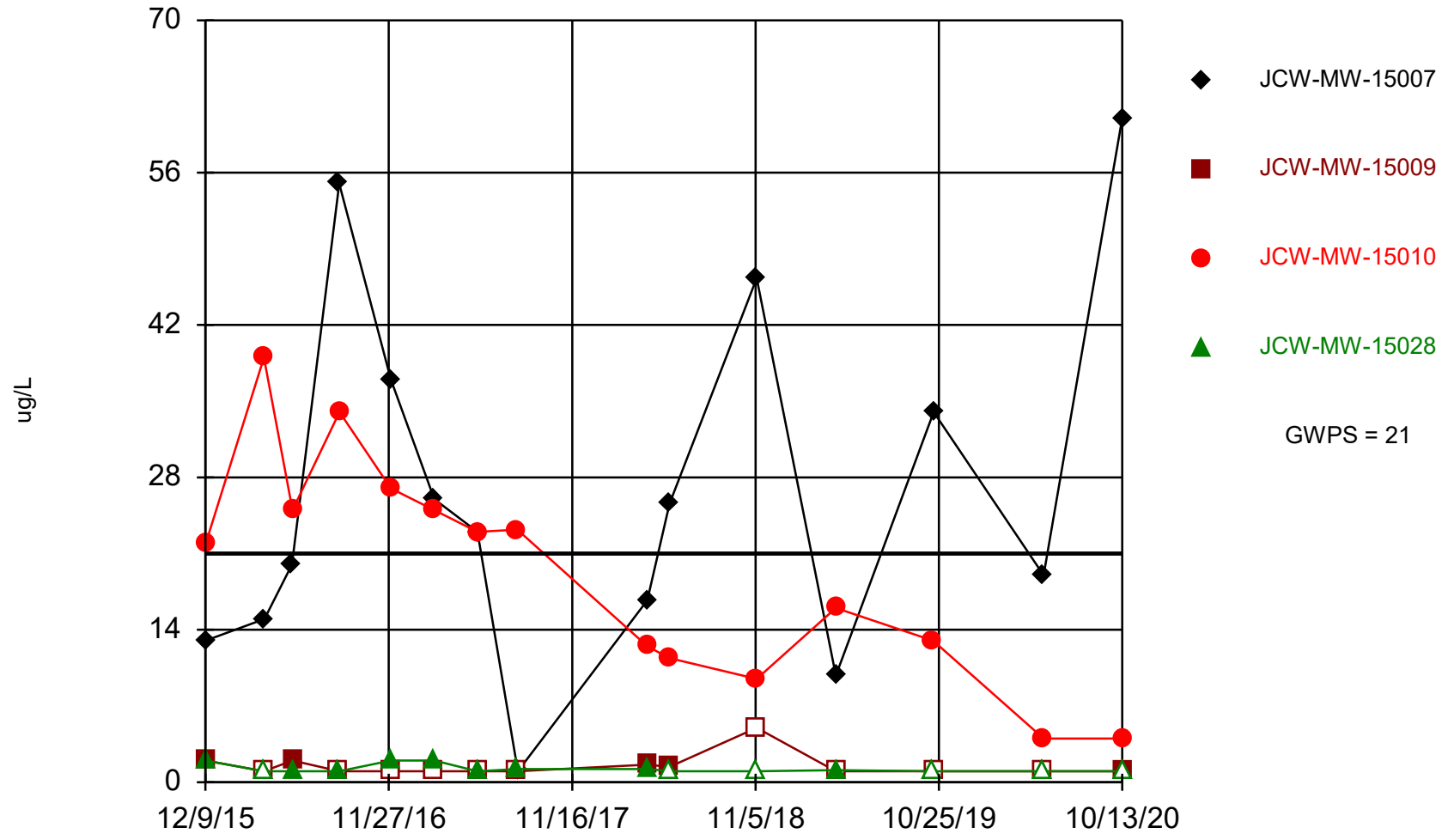
						Sample Location:	JCW-MW-15028												
						Sample Date:	8/2/2017	9/19/2017	4/11/2018	4/11/2018	5/23/2018	11/7/2018	11/7/2018	4/9/2019	4/9/2019	10/14/2019	5/14/2020	5/14/2020	10/13/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient												
Appendix III										Field Dup			Field Dup		Field Dup			Field Dup	
Boron	ug/L	NC	NA	619	NA		444	419	--	--	444	517	525	530	560	550	570	562	644
Calcium	mg/L	NC	NA	302	NA		92.4	75.5	--	--	125	153	153	170	180	170	205	204	221
Chloride	mg/L	250*	NA	2,440	NA		106	91	--	--	69.5	352	347	660	650	640	823	806	811
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 2,000	< 2,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	407	NA		93	85.7	--	--	32.2	111	110	120	120	120	128	122	99.8
Total Dissolved Solids	mg/L	500*	NA	4,600	NA		514	506	--	--	1,030	976	966	1,800	1,800	1,500	2,210	2,240	2,070
pH, Field	SU	6.5 - 8.5*	NA	6.5-7.3	NA		7.7	8.0	7.8	--	8.0	7.9	--	8.0	--	7.8	8.1	--	7.9
Appendix IV																			
Antimony	ug/L	6	NA	1	6		< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1
Arsenic	ug/L	10	NA	21	**21**		1.2	--	1.2	1.4	< 1.0	< 1.0	1.1	1.1	1.1	< 1.0	< 1	1	< 1
Barium	ug/L	2,000	NA	1,300	**2,000**		97.4	--	148	145	148	156	158	250	240	230	324	331	332
Beryllium	ug/L	4	NA	1	**4**		< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	NA	3	100		< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1
Cobalt	ug/L	NC	6	15	**15**		< 15.0	--	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 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	< 2,000	< 2,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	2
Lithium	ug/L	NC	40	180	**180**		35	--	48	47	48	51	49	53	51	48	60	60	53
Mercury	ug/L	2	NA	0.2	2		< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	6	100		< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5	< 5	< 5
Radium-226	pCi/L	NC	NA	NA	NA		< 0.952	--	< 0.934	< 0.450	< 0.739	1.13	0.786	0.621	0.384	0.576	0.515	< 0.136	0.697
Radium-228	pCi/L	NC	NA	NA	NA		< 0.772	--	0.988	0.874	< 0.676	< 0.685	<0.591	0.729	0.658	0.585	0.733	< 0.399	< 0.468
Radium-226/228	pCi/L	5	NA	3.32	5		< 1.72	--	1.65	1.30	< 1.42	1.60	1.26	1.35	1.04	1.16	1.25	< 0.399	1.15
Selenium	ug/L	50	NA	2	50		< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1
Thallium	ug/L	2	NA	2	2		< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2	< 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) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences. and/or concentrations of other constituents present.

Attachment 1
Sanitas™ Output Files

Hollow symbols indicate censored values.

Arsenic, Total

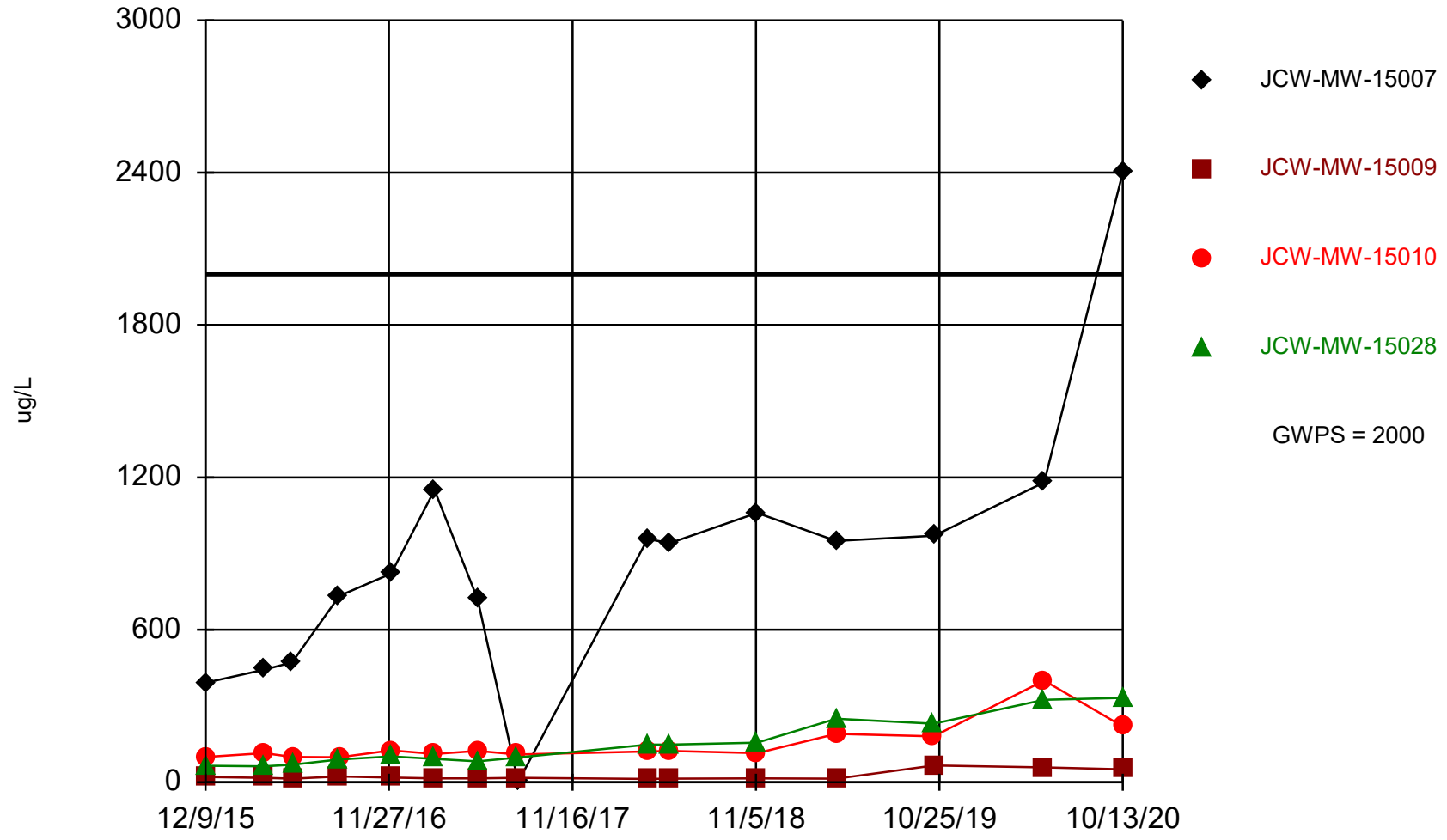


Time Series Analysis Run 12/7/2020 1:13 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23_KR

Hollow symbols indicate censored values.

Barium, Total

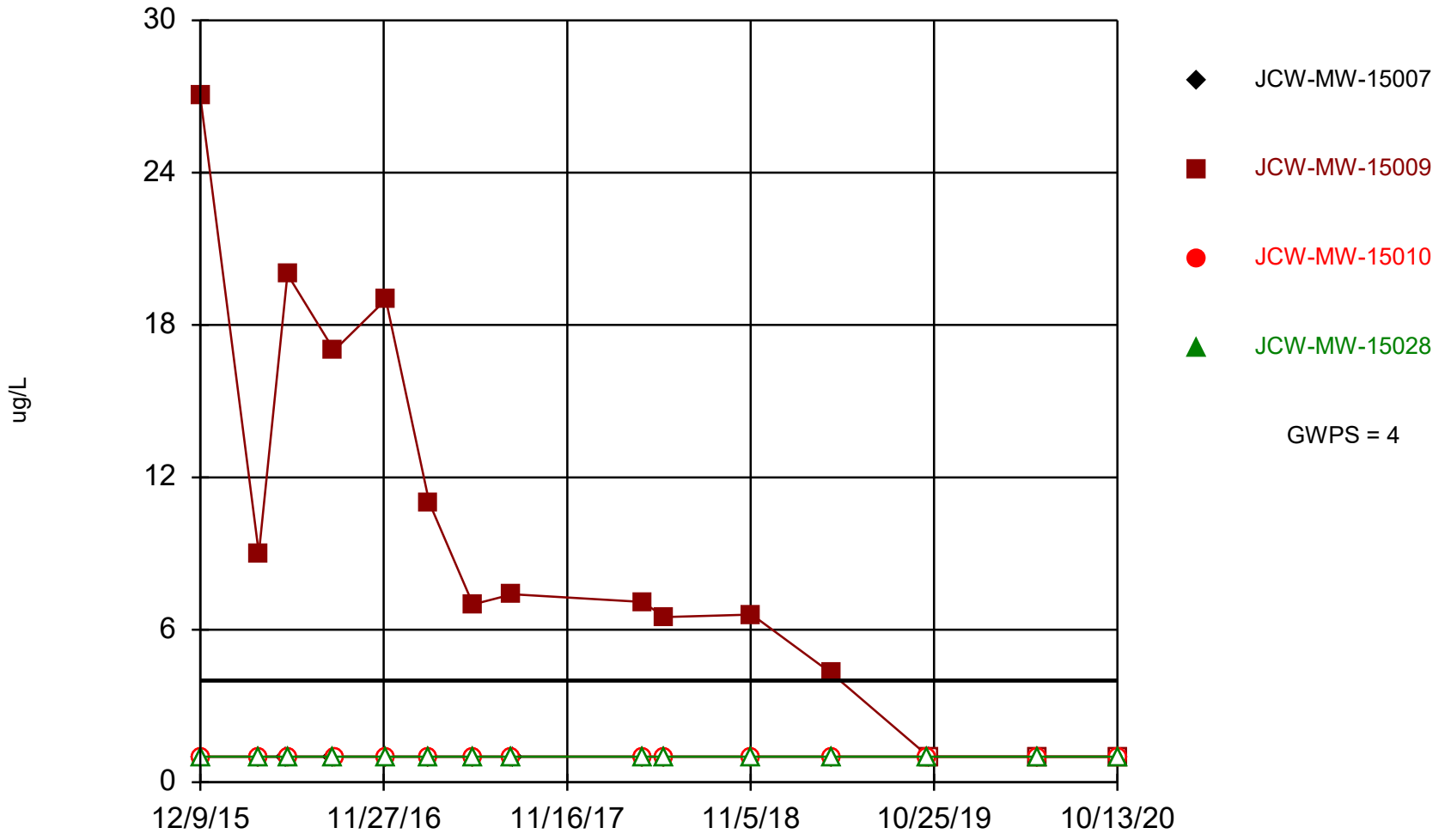


Time Series Analysis Run 12/8/2020 1:55 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23

Hollow symbols indicate censored values.

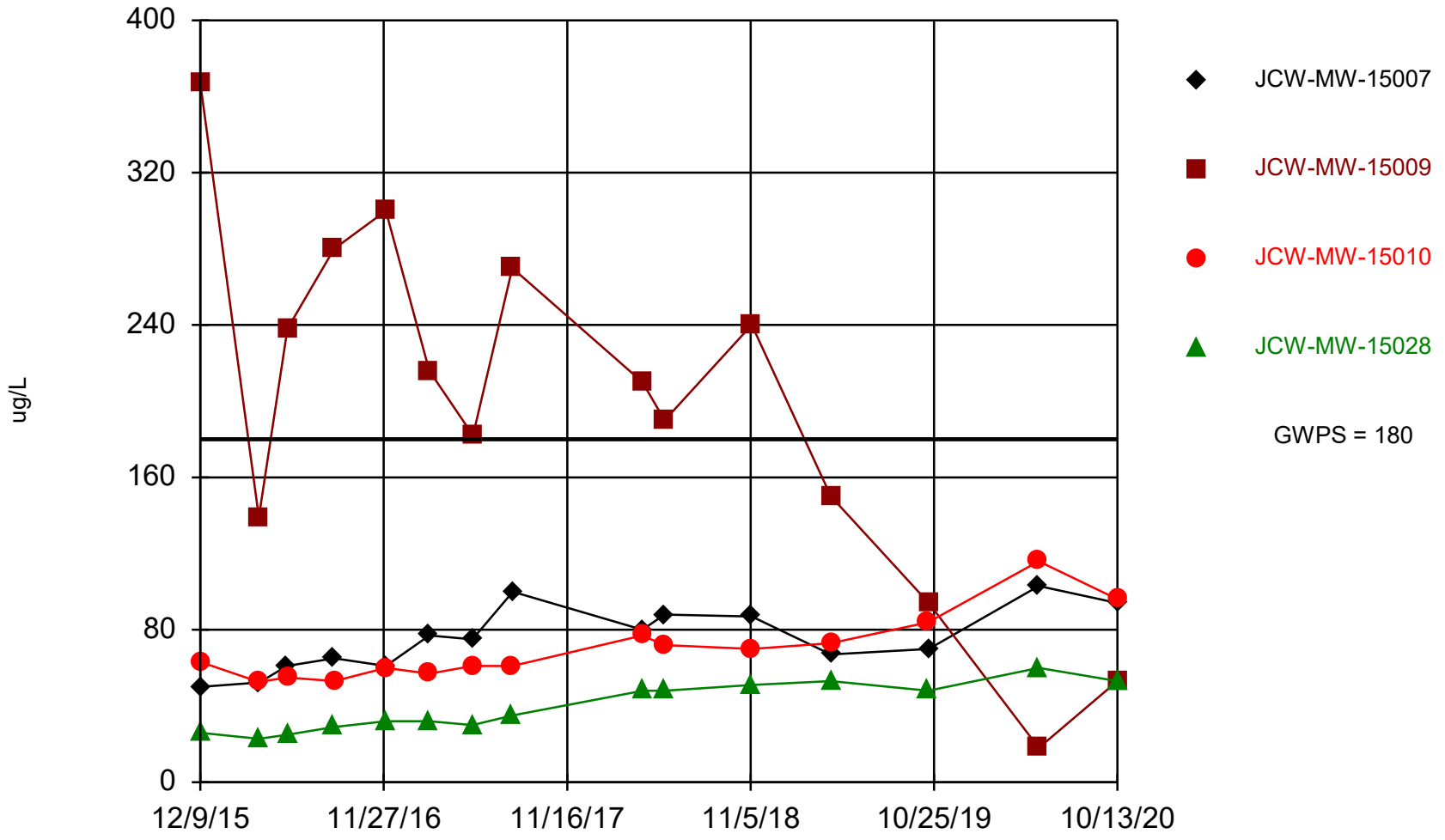
Beryllium, Total



Time Series Analysis Run 12/8/2020 1:56 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23

Lithium, Total



Time Series Analysis Run 12/8/2020 1:56 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23

Summary Report

Constituent: Arsenic, Total Analysis Run 12/4/2020 5:11 PM
Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23_KR

For observations made between 12/9/2015 and 10/13/2020, a summary of the selected data set:

Observations = 60
ND/Trace = 17
Wells = 4
Minimum Value = 1
Maximum Value = 61
Mean Value = 12.19
Median Value = 3
Standard Deviation = 14.84
Coefficient of Variation = 1.218
Skewness = 1.393

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JCW-MW-15007	15	1	1	61	26.83	23	16.93	0.6309	0.6514
JCW-MW-15009	15	10	1	5	1.467	1	1.044	0.7117	2.822
JCW-MW-15010	15	0	4	39	19.24	22	10.31	0.5358	0.1922
JCW-MW-15028	15	6	1	2	1.233	1	0.403	0.3267	1.396

Summary Report

Constituent: Barium, Total Analysis Run 12/4/2020 5:11 PM
Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23_KR

For observations made between 12/9/2015 and 10/13/2020, a summary of the selected data set:

Observations = 60
ND/Trace = 1
Wells = 4
Minimum Value = 1
Maximum Value = 2400
Mean Value = 300.6
Median Value = 114.5
Standard Deviation = 432
Coefficient of Variation = 1.437
Skewness = 2.521

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JCW-MW-15007	15	1	1	2400	879.3	941	531	0.6039	1.294
JCW-MW-15009	15	0	12.3	66	24.61	16.6	17.88	0.7266	1.515
JCW-MW-15010	15	0	98	400	148.5	121	78.57	0.5292	2.402
JCW-MW-15028	15	0	63	332	149.9	102	91.75	0.6121	0.963

Summary Report

Constituent: Beryllium, Total Analysis Run 12/4/2020 5:11 PM
Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23_KR

For observations made between 12/9/2015 and 10/13/2020, a summary of the selected data set:

Observations = 60
ND/Trace = 48
Wells = 4
Minimum Value = 1
Maximum Value = 27
Mean Value = 3.165
Median Value = 1
Standard Deviation = 5.346
Coefficient of Variation = 1.689
Skewness = 2.84

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JCW-MW-15007	15	15	1	1	1	1	0	0	NaN
JCW-MW-15009	15	3	1	27	9.66	7.1	7.759	0.8032	0.8425
JCW-MW-15010	15	15	1	1	1	1	0	0	NaN
JCW-MW-15028	15	15	1	1	1	1	0	0	NaN

Summary Report

Constituent: Lithium, Total Analysis Run 12/4/2020 5:11 PM
Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23_KR

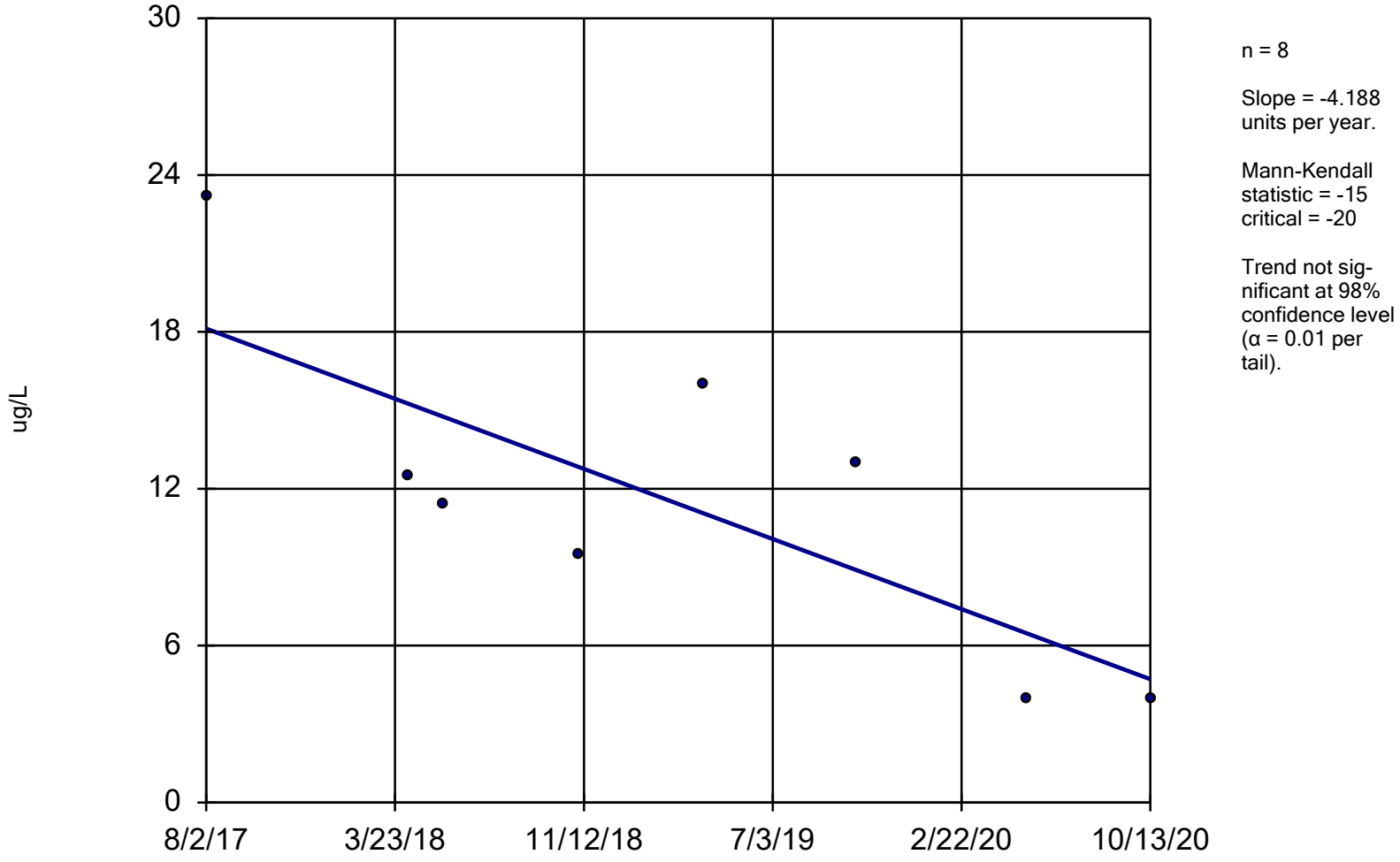
For observations made between 12/9/2015 and 10/13/2020, a summary of the selected data set:

Observations = 60
ND/Trace = 0
Wells = 4
Minimum Value = 18
Maximum Value = 367
Mean Value = 95.34
Median Value = 66
Standard Deviation = 77.14
Coefficient of Variation = 0.8091
Skewness = 1.745

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JCW-MW-15007	15	0	50	103	75.35	75	16.54	0.2195	0.1631
JCW-MW-15009	15	0	18	367	196.5	210	94.5	0.481	-0.2447
JCW-MW-15010	15	0	52.7	116	70.05	63	17.61	0.2515	1.339
JCW-MW-15028	15	0	22.7	60	39.51	35	12.38	0.3133	0.1404

Arsenic, Total

JCW-MW-15010



n = 8

Slope = -4.188 units per year.

Mann-Kendall statistic = -15
critical = -20

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

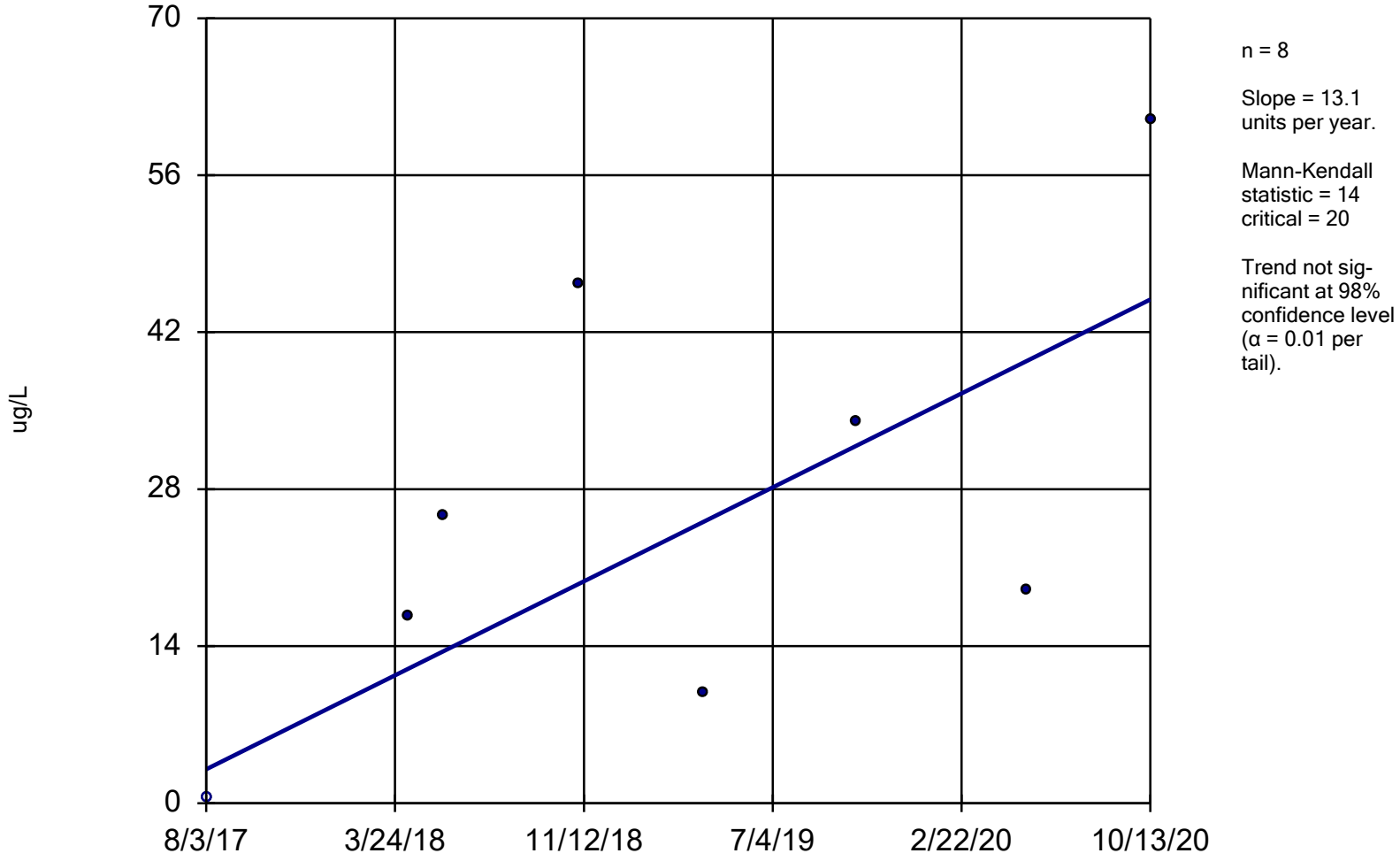
Sen's Slope Estimator Analysis Run 12/8/2020 1:58 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23

Hollow symbols indicate censored values.

Arsenic, Total

JCW-MW-15007



n = 8

Slope = 13.1 units per year.

Mann-Kendall statistic = 14
critical = 20

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

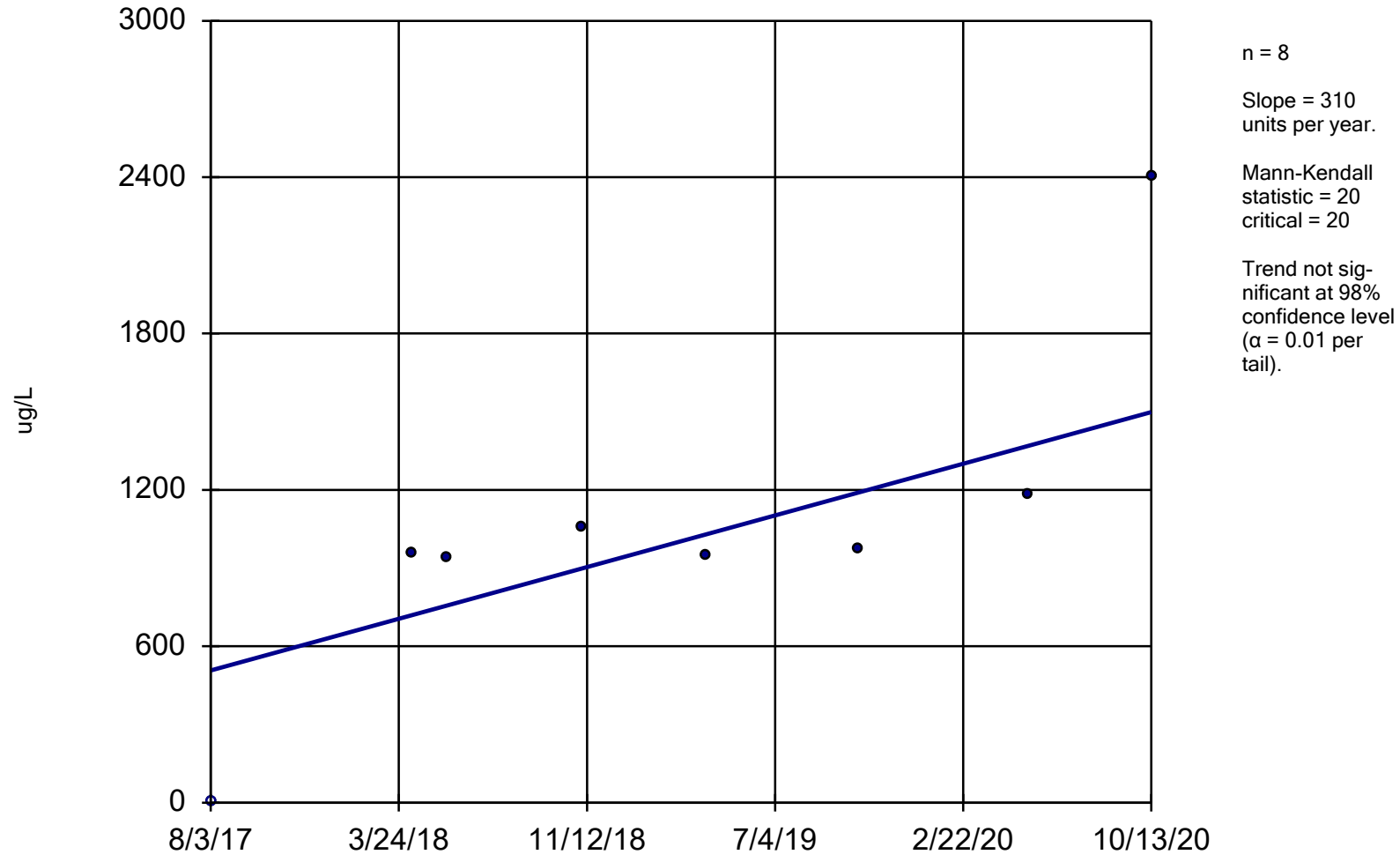
Sen's Slope Estimator Analysis Run 12/4/2020 5:28 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23_KR

Hollow symbols indicate censored values.

Barium, Total

JCW-MW-15007



n = 8

Slope = 310 units per year.

Mann-Kendall statistic = 20 critical = 20

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

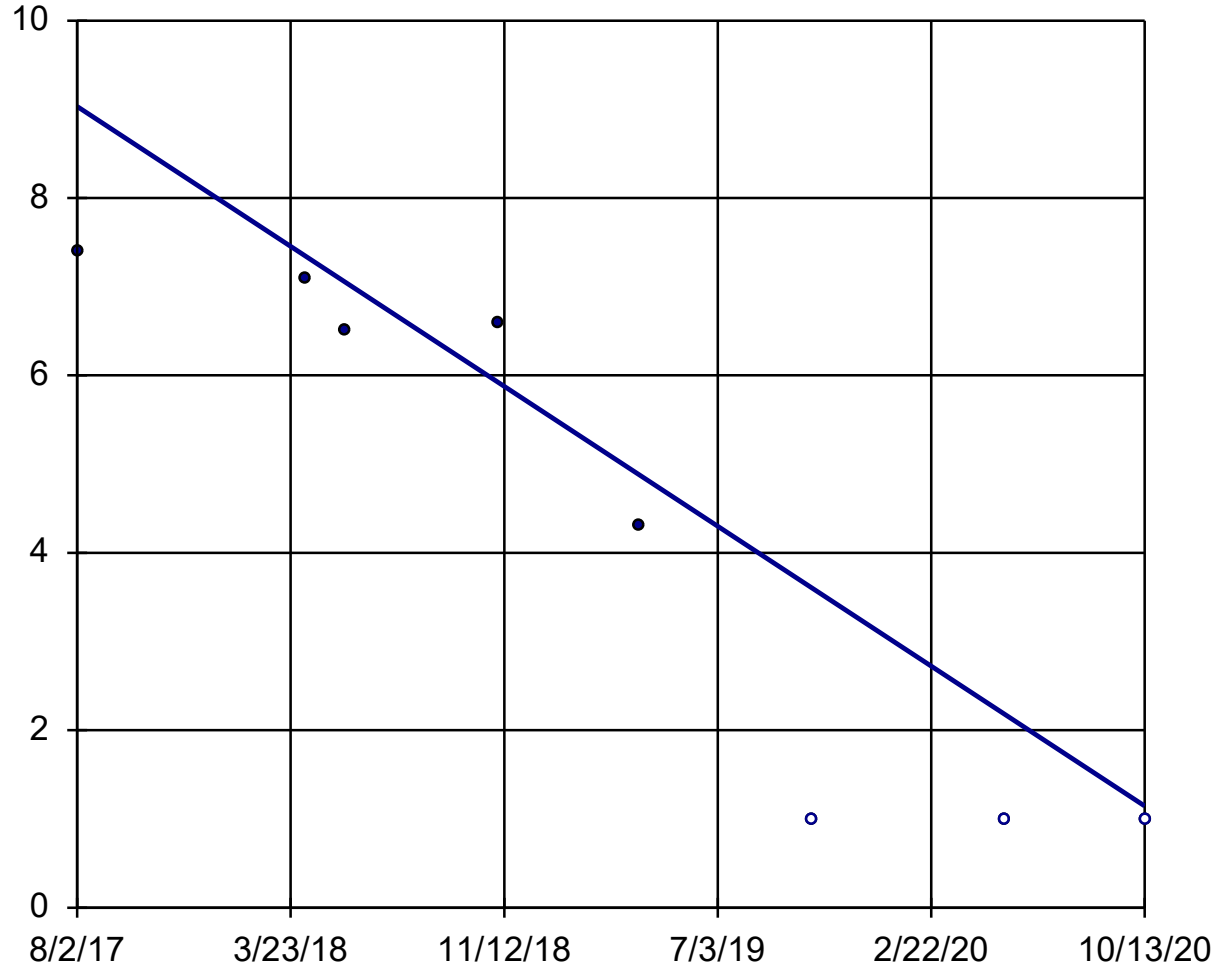
Sen's Slope Estimator Analysis Run 12/4/2020 5:27 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23_KR

Hollow symbols indicate censored values.

Beryllium, Total

JCW-MW-15009



n = 8

Slope = -2.465 units per year.

Mann-Kendall statistic = -23
critical = -20

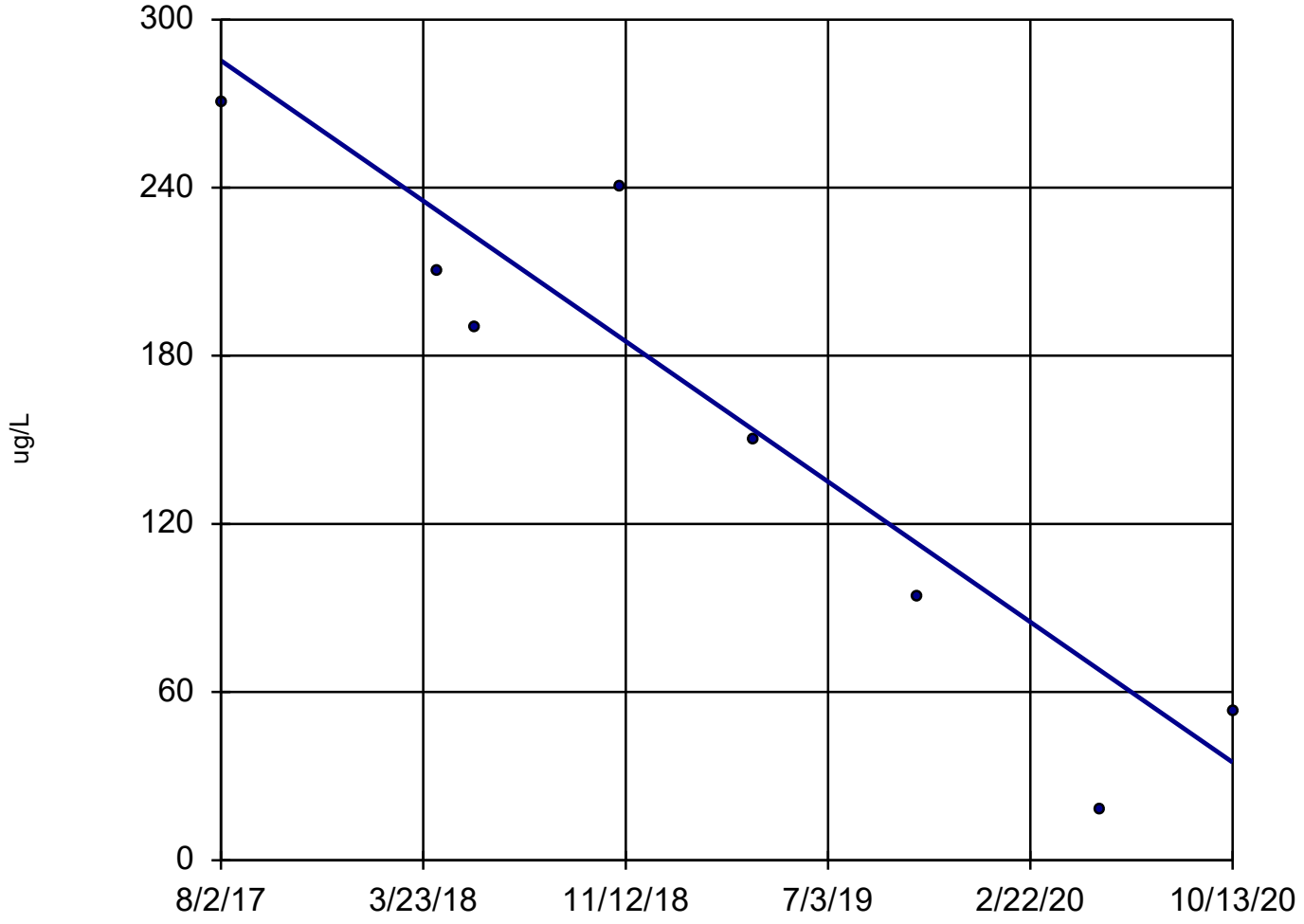
Decreasing trend significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 12/4/2020 5:25 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23_KR

Lithium, Total

JCW-MW-15009



n = 8

Slope = -78.23 units per year.

Mann-Kendall statistic = -22
critical = -20

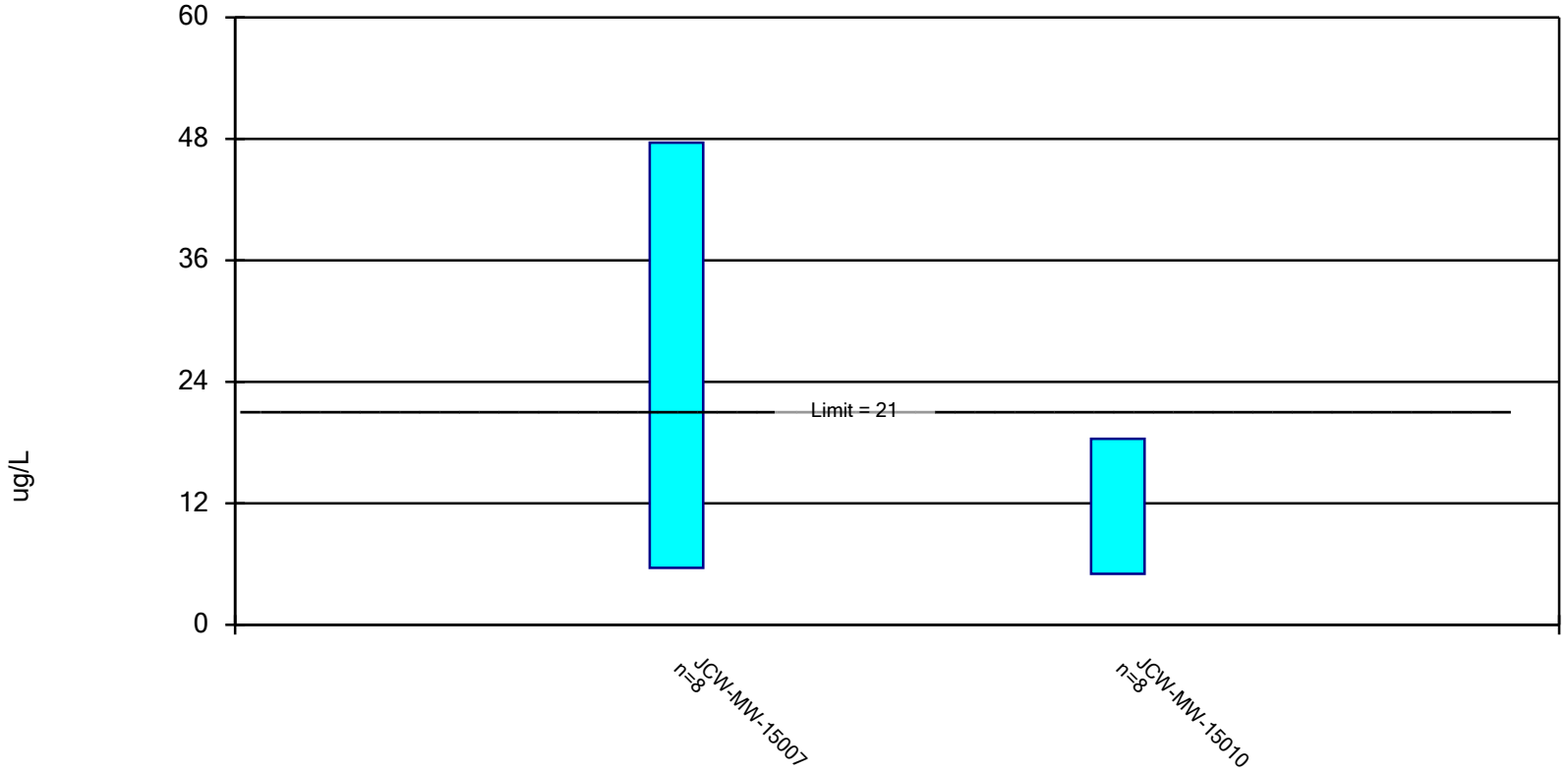
Decreasing trend significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 12/4/2020 5:25 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23_KR

Parametric Confidence Interval

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



Constituent: Arsenic, Total Analysis Run 12/8/2020 2:07 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23

Confidence Interval

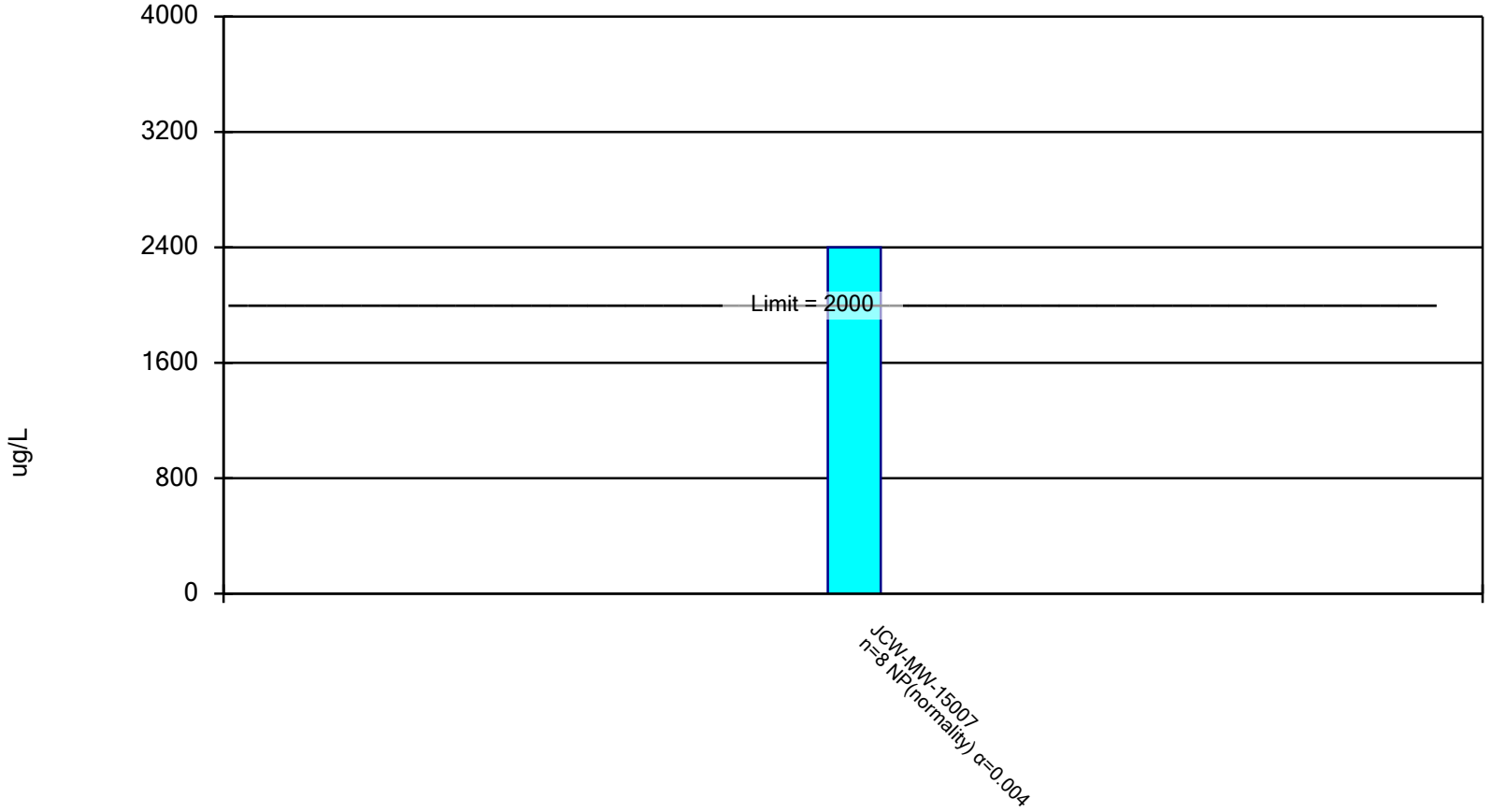
Constituent: Arsenic, Total (ug/L) Analysis Run 12/8/2020 2:07 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23

	JCW-MW-15007	JCW-MW-15010
8/2/2017		23.2
8/3/2017	<1	
4/10/2018	16.7	12.5
5/22/2018		11.4
5/23/2018	25.6	
11/7/2018	46.3	9.5
4/9/2019	9.8	16
10/14/2019		13
10/15/2019	34	
5/14/2020	19	4
10/13/2020	61	4
Mean	26.61	11.7
Std. Dev.	19.81	6.286
Upper Lim.	47.61	18.36
Lower Lim.	5.617	5.037

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: Barium, Total Analysis Run 12/7/2020 1:02 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23_KR

Confidence Interval

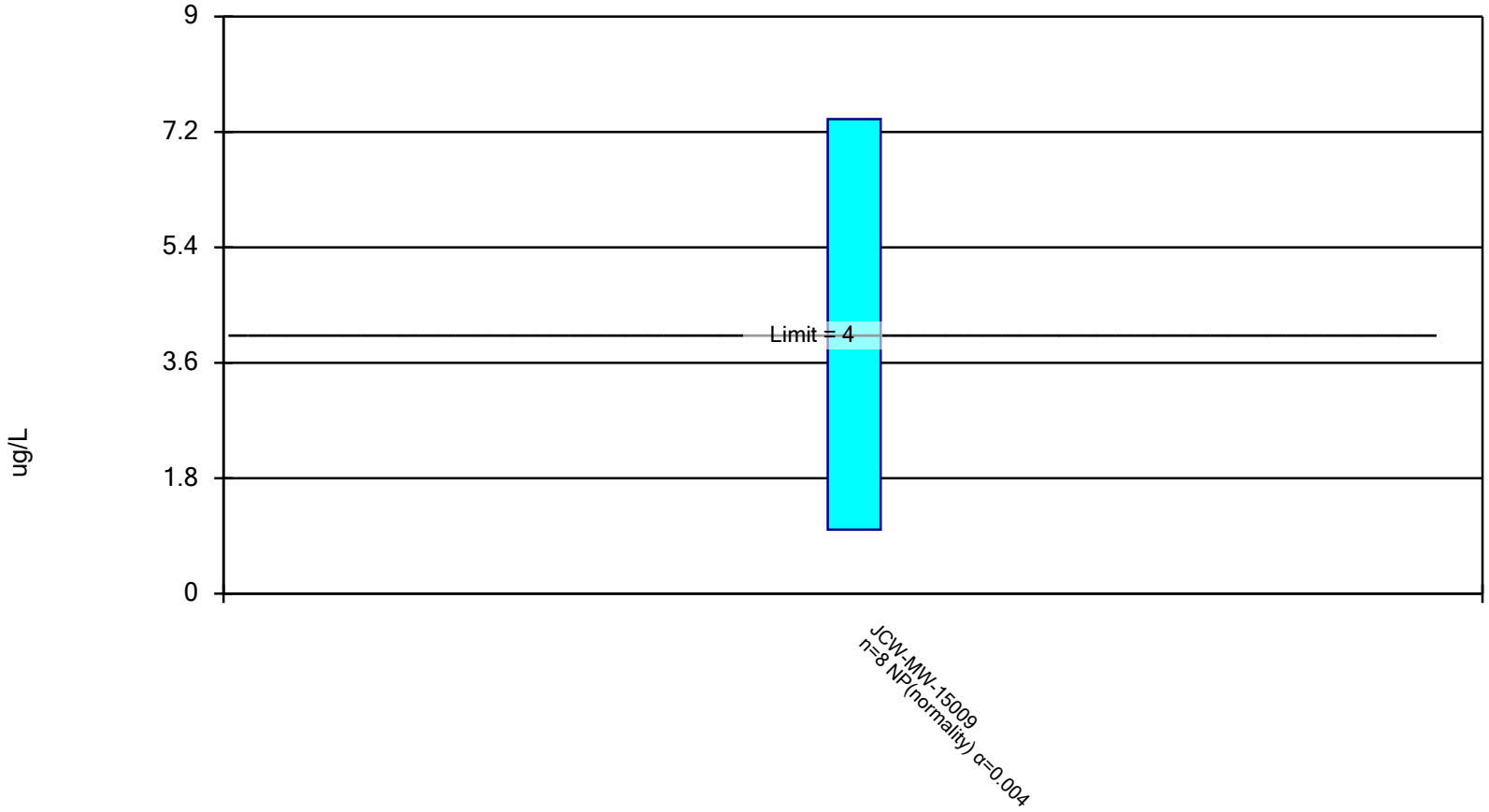
Constituent: Barium, Total (ug/L) Analysis Run 12/7/2020 1:03 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23_KR

	JCW-MW-15007
8/3/2017	<1
4/10/2018	957
5/23/2018	941
11/7/2018	1060
4/9/2019	950
10/15/2019	970
5/14/2020	1180
10/13/2020	2400
Mean	1057
Std. Dev.	652.2
Upper Lim.	2400
Lower Lim.	0.5

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: Beryllium, Total Analysis Run 12/7/2020 1:04 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23_KR

Confidence Interval

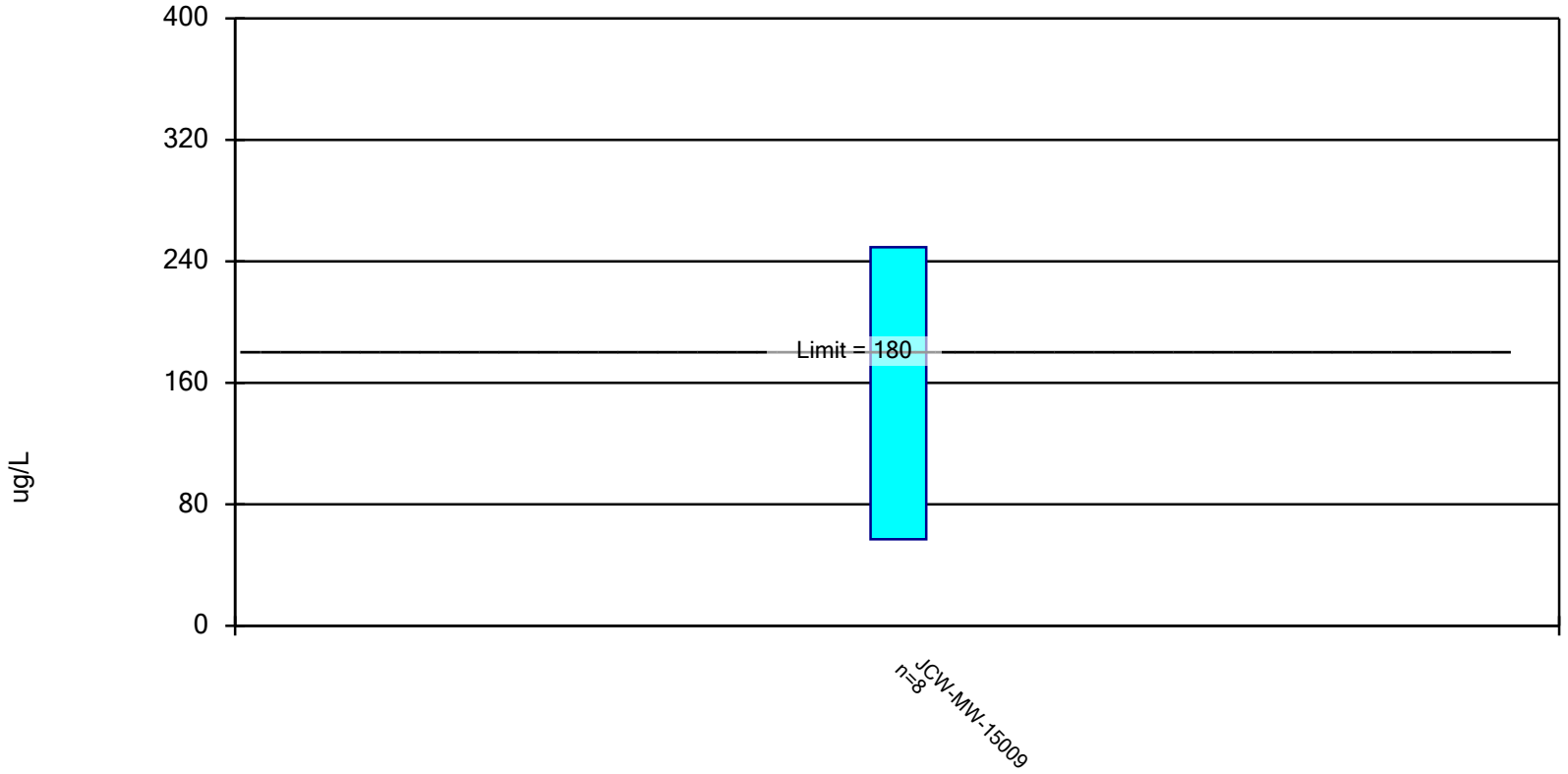
Constituent: Beryllium, Total (ug/L) Analysis Run 12/7/2020 1:05 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23_KR

	JCW-MW-15009
8/2/2017	7.4
4/10/2018	7.1
5/23/2018	6.5
11/7/2018	6.6
4/9/2019	4.3
10/15/2019	<1
5/14/2020	<1
10/13/2020	<1
Mean	4.363
Std. Dev.	2.933
Upper Lim.	7.4
Lower Lim.	1

Parametric Confidence Interval

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



Constituent: Lithium, Total Analysis Run 12/7/2020 1:06 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23_KR

Confidence Interval

Constituent: Lithium, Total (ug/L) Analysis Run 12/7/2020 1:06 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23_KR

	JCW-MW-15009
8/2/2017	270
4/10/2018	210
5/23/2018	190
11/7/2018	240
4/9/2019	150
10/15/2019	94
5/14/2020	18
10/13/2020	53
Mean	153.1
Std. Dev.	90.7
Upper Lim.	249.3
Lower Lim.	56.98

Attachment C
Weadock Landfill: Statistical Evaluation of October 2020 Assessment Monitoring Sampling Event

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Technical Memorandum

Date:	January 11, 2020
To:	J.R. Register, Consumers Energy
From:	Darby Litz, TRC Katy Reminga, TRC
Project No.:	367389.0000 Phase 003, Task 002
Subject:	Statistical Evaluation of October 2020 Assessment Monitoring Sampling Event JC Weadock Landfill, Consumers Energy Company, Essexville, Michigan

During the statistical evaluation of the initial assessment monitoring event (May 2018), arsenic was present in one or more downgradient monitoring wells at statistically significant levels exceeding the Groundwater Protection Standards (GWPSs). Therefore, Consumers Energy Company (Consumers Energy) initiated an Assessment of Corrective Measures (ACM) within 90 days from when the Appendix IV exceedance was determined. The ACM was completed on September 11, 2019.

Currently, Consumers Energy is continuing semiannual assessment monitoring in accordance with §257.95 of the CCR Rule[1] at the JC Weadock Power Plant Landfill. The second semiannual assessment monitoring event for 2020 was conducted on October 13 through October 14, 2020. In accordance with §257.95, the assessment monitoring data must be compared to GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs. GWPSs were established in accordance with §257.95(h), as detailed in the October 15, 2018 Groundwater Protection Standards technical memorandum, which was also included in the 2018 Annual Groundwater Monitoring Report (TRC, January 2019).

The evaluation of the initial semiannual assessment monitoring event data (April and May 2018) indicated that arsenic was present at statistically significant levels above the GWPS at one of the three downgradient wells. The three downgradient wells were located within a vent (e.g., opening) of the perimeter soil/bentonite slurry wall to assess the quality of groundwater passing the waste boundary. As discussed in detail below, in July 2018, a vent (e.g., opening) in the perimeter soil/bentonite slurry wall was closed and the slurry wall is now continuous along the entire perimeter of the Weadock Landfill. As a result of the change in groundwater flow conditions, the groundwater monitoring system was revised[2] prior to the November 2018 sampling event. The modified CCR monitoring well network now consists of eleven (11) downgradient monitoring wells. The statistical evaluation of the sixth semiannual assessment monitoring event data indicates that the following Appendix IV constituents are

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

[2] TRC. 2018. *Revised Groundwater Monitoring System Summary Report Technical Memorandum.* December.

present at statistically significant levels above the GWPSs in downgradient monitoring wells at the Weadock Landfill:

Constituent	GWPS	#Downgradient Wells Observed
Arsenic	21 µg/L	1 of 11

Arsenic concentrations at JCW-MW-18006 are considered statistically significant since the lower confidence limit (22 µg/L) slightly exceeds the GWPS (21 ug/L); however arsenic concentrations appear to be decreasing as of the two most recent events. The results of the statistical analysis for other wells/constituents are consistent with previous evaluations using the modified well network. Corrective action has been triggered as a result of data collected during the initial assessment monitoring event. Consumers Energy will continue to evaluate corrective measures per §257.96 and §257.97 and execute the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Assessment Monitoring Statistical Evaluation

When the monitoring well network was first established in October 2017, there was a 1,600-linear-foot section of the perimeter embankment dike that did not have a slurry wall in place. Groundwater flow beneath the Weadock Landfill was directed towards the discharge channel through this vent in the slurry wall for management under the existing NPDES discharge permit. The downgradient monitoring well network was established as three monitoring wells located in the vent area to assess the quality of groundwater passing the waste boundary (JCW-MW-15011, JCW-MW-15012, and JCW-MW-15023). In July 2018, the slurry wall vent was closed to reduced porewater flux around the entire perimeter of the Weadock Landfill. The three downgradient CCR compliance wells were decommissioned by over drilling, removing the well material, and sealing the borehole in order to allow for the slurry wall construction.

Given the change in groundwater flow conditions, a revised groundwater monitoring system has been established to assess slurry wall integrity and determine if there have been any releases from the Weadock Landfill. Consumers Energy installed an additional nine (9) monitoring wells in August 2018 to supplement the preexisting groundwater well network currently used under the approved 2015 HMP for Michigan Part 115 compliance to provide appropriate coverage for the collection of groundwater levels and water quality data along the perimeter of the Weadock Landfill.

Therefore, the modified CCR monitoring well network now consists of eleven (11) downgradient monitoring wells as discussed in the Sample and Analysis Plan (2018 SAP) and Statistical Analysis Plan (2018 Stats Plan). The downgradient monitoring wells include:

- JCW-MW-18001
- JCW-MW-18004
- JCW-MW-18005
- JCW-MW-18006
- MW-50
- MW-51
- MW-52
- MW-53
- MW-54R
- MW-55
- OW-57R Out

Following the second semiannual assessment monitoring sampling event for 2020, compliance well data for the Weadock Landfill were evaluated in accordance with the *Groundwater Statistical Analysis*

Plan (TRC, December 2018). 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 [3], the preferred method for comparisons to a fixed standard are confidence limits. Based on the number of historical observations in the representative sample population, the population mean, the population standard deviation, and a selected confidence level (i.e., 99 percent), an upper and lower confidence limit is calculated. The true concentration, with 99 percent confidence, will fall between the lower and upper confidence limits.

The concentrations observed in the downgradient wells are deemed to be a statistically significant exceedance when the 99 percent lower confidence limit of the downgradient data exceeds the GWPS. If the confidence interval straddles the GWPS (i.e. the lower confidence level is below the GWPS, but the upper confidence level is above), the statistical test result indicates that there is insufficient confidence that the measured concentrations are different from the GWPS and thus 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. Parameter-well combinations that included a direct exceedance of the GWPS within the most recent five sampling events (November 2018 to October 2020) were retained for further analysis. For the preexisting wells (MW-50 through MW-55), the statistical analysis is completed on the five assessment monitoring events (November 2018 through October 2020) to use a consistent range of data with the new wells (JCW-MW-18001, JCW-MW-18004, JCW-MW-18005, JCW-MW-18006, and OW-57R OUT). Data collected under the HMP monitoring program is not used for the assessment monitoring program for the preexisting wells. Arsenic in MW-51, MW-55, and JCW-MW-18006 and molybdenum in MW-55 had individual results exceeding the GWPS. The concentrations of arsenic and molybdenum at MW-55 are not a result of a release from the unit, as detailed in the *Alternate Source Demonstration* (TRC, December 2019); therefore, confidence intervals were not calculated.

Groundwater data were 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 for each of the CCR Appendix IV parameters using a per test[4] 99 percent confidence level, i.e., a significance level (α) of 0.01. The following narrative

[3] USEPA. 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*. Office of Conservation and Recovery. EPA 530/R-09-007.
[4] Confidence level is assessed for each individual comparison (i.e. per well and per constituent).

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.

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. Initially, the baseline (November 2018 through October 2020) results were observed visually for potential trends. No outliers were identified in the data set.

The Sanitas™ software was then used to test compliance at the downgradient monitoring wells using the confidence interval method for the most recent 5 sampling events. Four independent sampling events provide the minimum density of data as recommended per the Unified Guidance. The tests were run with a per-test significance of $\alpha = 0.01$. The software outputs are included in Attachment 1 along with data reports showing the values used for the evaluation. The percentage of non-detect observations are also included in Attachment 1. Non-detect data was handled in accordance with the Stats Plan for the purposes of calculating the confidence intervals.

The Sanitas™ software generates an output that includes graphs of the parametric or non-parametric confidence intervals for each well along with notes data transformations, as appropriate. The data set was transformed using a power transformation. The confidence interval test compares the lower confidence limit to the GWPS. Arsenic concentrations at JCW-MW-18006 are considered statistically significant since the lower confidence limit (22 µg/L) slightly exceeds the GWPS (21 ug/L); however arsenic concentrations appear to be decreasing as of the two most recent events. Concentrations trends will continue to be monitored. The results of the statistical analysis for other wells/constituents are consistent with previous evaluations using the new well network. Corrective action has been triggered as a result of data collected during the initial May 2018 assessment monitoring event. 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.

Attachments

Table 1 Comparison of Groundwater Sampling Results to Groundwater Protection Standards – November 2018 to October 2020

Attachment 1 Sanitas™ Output Files

Table

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – November 2018 to October 2020
JC Weadock Landfill – RCRA CCR Monitoring Program
Essexville, Michigan

					Sample Location:	MW-50				
					Sample Date:	11/7/2018	4/9/2019	10/10/2019	5/19/2020	10/13/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient				
Appendix III										
Boron	ug/L	NC	NA	619	NA	1,370	1,600	1,700	1,300	1,470
Calcium	mg/L	NC	NA	302	NA	249	200	280	380	368
Chloride	mg/L	250**	NA	2,440	NA	76.3	62	80	80.5	77.5
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250**	NA	407	NA	518	370	660	1,010	990
Total Dissolved Solids	mg/L	500**	NA	4,600	NA	1,360	1,200	1,400	1,710	1,950
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 7.3	NA	7.2	7.3	7.1	7.4	7.1
Appendix IV										
Antimony	ug/L	6	NA	1	6	< 1.0	< 1.0	< 1.0	< 1	< 1
Arsenic	ug/L	10	NA	21	**21**	< 5.0	1.1	2.8	1	3
Barium	ug/L	2,000	NA	1,300	2,000	239	220	180	163	147
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Chromium	ug/L	100	NA	3	100	< 5.0	< 1.0	1.4	< 1	< 1
Cobalt	ug/L	NC	6	15	15	< 30.0 (1)	< 6.0	< 6.0	< 6	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 5.0	< 1.0	< 1.0	< 1	< 1
Lithium	ug/L	NC	40	180	180	94	69	79	97	100
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	6	**100**	8.0	< 5.0	6.6	8	7
Radium-226	pCi/L	NC	NA	NA	NA	1.40	0.347	0.572	0.512	< 0.537
Radium-228	pCi/L	NC	NA	NA	NA	1.88	0.828	1.49	< 0.402	0.613
Radium-226/228	pCi/L	5	NA	3.32	5	3.28	1.17	2.06	0.814	1.01
Selenium	ug/L	50	NA	2	50	< 1.0	< 1.0	< 1.0	2	1
Thallium	ug/L	2	NA	2	2	< 10.0 (1)	< 2.0	< 2.0	< 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) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences and/or concentrations of other constituents present.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – November 2018 to October 2020
JC Weadock Landfill – RCRA CCR Monitoring Program
Essexville, Michigan

						Sample Location:	MW-51						
						Sample Date:	11/8/2018	4/9/2019	10/10/2019	10/10/2019	5/19/2020	5/19/2020	10/14/2020	10/14/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient							
Appendix III										Field Dup		Field Dup		Field Dup
Boron	ug/L	NC	NA	619	NA		851	940	890	900	944	967	739	798
Calcium	mg/L	NC	NA	302	NA		331	310	340	350	331	322	330	337
Chloride	mg/L	250**	NA	2,440	NA		55.8	84	88	88	93.8	94.2	74.2	75.4
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250**	NA	407	NA		505	500	570	580	487	474	522	537
Total Dissolved Solids	mg/L	500**	NA	4,600	NA		1,410	1,500	1,500	1,500	1,970	1,690	1,550	1,530
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 7.3	NA		6.6	7.0	6.7	--	7.4	--	6.8	--
Appendix IV														
Antimony	ug/L	6	NA	1	6		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	NA	21	**21**		**21.8**	17	20	19	12	12	17	17
Barium	ug/L	2,000	NA	1,300	2,000		163	190	180	180	150	153	147	150
Beryllium	ug/L	4	NA	1	4		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5		< 1.0	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	NA	3	100		< 5.0	1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1
Cobalt	ug/L	NC	6	15	15		< 30.0 (1)	< 6.0	< 6.0	< 6.0	< 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
Lead	ug/L	NC	15	1	15		< 5.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	40	180	180		71	59	49	50	55	57	51	55
Mercury	ug/L	2	NA	0.2	2		< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	6	**100**		< 25.0	< 5.0	< 5.0	< 5.0	< 5	< 5	< 5	< 5
Radium-226	pCi/L	NC	NA	NA	NA		< 0.715	0.216	0.316	0.365	0.461	0.299	1.35	< 0.352
Radium-228	pCi/L	NC	NA	NA	NA		1.12	0.643	1.68	1.26	0.719	0.745	< 0.588	0.776
Radium-226/228	pCi/L	5	NA	3.32	5		< 1.64	0.859	1.99	1.63	1.18	1.04	1.43	1.11
Selenium	ug/L	50	NA	2	50		< 1.0	< 1.0	< 1.0	< 1.0	1	< 1	< 1	< 1
Thallium	ug/L	2	NA	2	2		< 10.0 (1)	< 2.0	< 2.0	< 2.0	< 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) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences and/or concentrations of other constituents present.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – November 2018 to October 2020
JC Weadock Landfill – RCRA CCR Monitoring Program
Essexville, Michigan

						Sample Location:	MW-52						MW-53				
						Sample Date:	11/8/2018	11/8/2018	4/9/2019	10/10/2019	5/19/2020	10/14/2020	11/8/2018	4/10/2019	10/10/2019	5/19/2020	10/14/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient										
Appendix III								Field Dup									
Boron	ug/L	NC	NA	619	NA		774	896	1,200	1,200	1,160	1,110	519	1,500	900	1,750	2,720
Calcium	mg/L	NC	NA	302	NA		256	263	210	220	226	256	465	200	420	308	192
Chloride	mg/L	250**	NA	2,440	NA		97.2	96.6	95	89	15.1	73.3	84.5	39	150	118	38.6
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,140	< 1,000	< 1,000	< 1,000	< 1,000	1,020
Sulfate	mg/L	250**	NA	407	NA		517	512	480	520	< 1	572	811	330	960	549	269
Total Dissolved Solids	mg/L	500**	NA	4,600	NA		1,460	1,520	1,400	1,200	1,800	1,540	1,950	1,200	2,100	1,660	1,030
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 7.3	NA		6.8	--	7.1	6.9	7.5	7.0	6.6	7.1	6.7	7.3	7.2
Appendix IV																	
Antimony	ug/L	6	NA	1	6		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1	< 1
Arsenic	ug/L	10	NA	21	**21**		< 5.0	< 1.0	< 1.0	< 1.0	< 1	< 1	5.1	< 1.0	2.9	2	2
Barium	ug/L	2,000	NA	1,300	2,000		146	170	140	120	144	139	54.4	120	77	144	131
Beryllium	ug/L	4	NA	1	4		< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5		< 1.0	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 1.0	< 0.20	< 0.20	< 0.2	< 0.2
Chromium	ug/L	100	NA	3	100		< 5.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 5.0	1.6	< 1.0	6	< 1
Cobalt	ug/L	NC	6	15	15		< 30.0 (1)	< 6.0	< 6.0	< 6.0	< 6	< 6	< 30.0 (1)	< 6.0	< 6.0	< 6	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,140	< 1,000	< 1,000	< 1,000	< 1,000	1,020
Lead	ug/L	NC	15	1	15		< 5.0	< 1.0	< 1.0	< 1.0	< 1	< 1	< 5.0	< 1.0	< 1.0	< 1	< 1
Lithium	ug/L	NC	40	180	180		63	60	39	30	32	33	59	53	45	58	49
Mercury	ug/L	2	NA	0.2	2		< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	6	**100**		< 25.0	< 5.0	< 5.0	< 5.0	< 5	< 5	< 25.0	< 5.0	< 5.0	< 5	< 5
Radium-226	pCi/L	NC	NA	NA	NA		< 0.651	0.840	0.211	0.252	< 0.241	0.744	< 0.664	0.161	0.263	0.386	< 0.531
Radium-228	pCi/L	NC	NA	NA	NA		< 0.850	0.683	1.14	< 0.772	0.626	0.636	< 0.655	0.500	< 0.750	< 0.385	0.503
Radium-226/228	pCi/L	5	NA	3.32	5		< 1.50	1.52	1.35	1.01	0.740	1.38	< 1.32	0.661	0.962	0.725	0.823
Selenium	ug/L	50	NA	2	50		< 1.0	< 1.0	< 1.0	< 1.0	< 1	1	< 1.0	< 1.0	< 1.0	2	< 1
Thallium	ug/L	2	NA	2	2		< 10.0 (1)	< 2.0	< 2.0	< 2.0	< 2	< 2	< 10.0 (1)	< 2.0	< 2.0	< 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) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences and/or concentrations of other constituents present.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – November 2018 to October 2020
JC Weadock Landfill – RCRA CCR Monitoring Program
Essexville, Michigan

					Sample Location:	MW-54R					MW-55				
					Sample Date:	11/8/2018	4/11/2019	10/10/2019	5/19/2020	10/14/2020	11/8/2018	4/11/2019	10/11/2019	5/19/2020	10/14/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient									
Appendix III															
Boron	ug/L	NC	NA	619	NA	1,290	960	1,500	1,730	1,660	582	800	700	441	705
Calcium	mg/L	NC	NA	302	NA	173	180	180	181	174	202	140	190	188	170
Chloride	mg/L	250**	NA	2,440	NA	18.0	16	18	20.4	23.9	15.8	26	19	14.6	18
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	1,800	< 1,000	< 1,000	< 1,000	< 1,000	1,220
Sulfate	mg/L	250**	NA	407	NA	152	160	130	95.7	100	157	70	190	210	84
Total Dissolved Solids	mg/L	500**	NA	4,600	NA	710	770	710	755	743	894	770	950	1010	826
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 7.3	NA	7.0	6.9	6.9	7.4	7.1	7.0	7.1	6.9	7.6	7.2
Appendix IV															
Antimony	ug/L	6	NA	1	6	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1	< 1
Arsenic	ug/L	10	NA	21	**21**	< 1.0	1.6	2.3	2	3	**35.1**	**34**	**76**	**85**	**123**
Barium	ug/L	2,000	NA	1,300	2,000	59.9	74	88	95	103	158	200	250	223	223
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	0.32	< 0.20	< 0.20	0.4	< 0.2
Chromium	ug/L	100	NA	3	100	< 1.0	< 1.0	< 1.0	< 1	< 1	< 5.0	< 1.0	< 1.0	< 1	< 1
Cobalt	ug/L	NC	6	15	15	< 6.0	< 6.0	< 6.0	< 6	< 6	< 30.0 (1)	< 6.0	< 6.0	< 6	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	1,800	< 1,000	< 1,000	< 1,000	< 1,000	1,220
Lead	ug/L	NC	15	1	15	< 1.0	< 1.0	< 1.0	< 1	< 1	< 5.0	< 1.0	< 1.0	< 1	< 1
Lithium	ug/L	NC	40	180	180	62	48	53	58	57	40	17	27	27	33
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	6	**100**	< 5.0	< 5.0	6.2	< 5	5	**171**	93	**190**	**214**	**179**
Radium-226	pCi/L	NC	NA	NA	NA	< 1.09	< 0.332	0.328	< 0.192	< 0.334	< 0.932	0.188	0.409	0.448	< 0.447
Radium-228	pCi/L	NC	NA	NA	NA	< 0.786	< 0.480	< 0.828	0.499	< 0.504	< 0.679	< 0.660	1.05	< 0.460	0.566
Radium-226/228	pCi/L	5	NA	3.32	5	< 1.88	0.568	0.86	0.546	0.546	< 1.61	< 0.660	1.45	0.858	0.798
Selenium	ug/L	50	NA	2	50	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1	1
Thallium	ug/L	2	NA	2	2	< 2.0	< 2.0	< 2.0	< 2	< 2	< 10.0 (1)	< 2.0	< 2.0	< 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.

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All metals were analyzed as total unless otherwise specified.

(1) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences and/or concentrations of other constituents present.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – November 2018 to October 2020
JC Weadock Landfill – RCRA CCR Monitoring Program
Essexville, Michigan

					Sample Location:	OW-57ROUT					JCW-MW-18001				
					Sample Date:	11/8/2018	4/12/2019	10/14/2019	5/20/2020	10/14/2020	11/7/2018	4/12/2019	10/10/2019	5/18/2020	10/13/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient									
Appendix III															
Boron	ug/L	NC	NA	619	NA	1,850	1,700	1,700	1,600	1,730	1,330	1,400	1,500	1,360	1,370
Calcium	mg/L	NC	NA	302	NA	141	130	130	130	144	138	140	170	232	282
Chloride	mg/L	250**	NA	2,440	NA	70.3	68	58	64.9	49.4	51.5	67	58	71.5	73.8
Fluoride	ug/L	4,000	NA	1,000	NA	1,200	1,200	1,100	< 1,000	1,830	< 1,000	< 1,000	< 2,000	< 1,000	< 1,000
Sulfate	mg/L	250**	NA	407	NA	112	110	110	89.4	109	97.7	210	170	352	435
Total Dissolved Solids	mg/L	500**	NA	4,600	NA	808	780	750	834	782	678	860	870	1330	1,370
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 7.3	NA	7.0	7.1	6.8	7.5	7.1	7.2	7.2	7.0	7.4	7.1
Appendix IV															
Antimony	ug/L	6	NA	1	6	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1	< 1
Arsenic	ug/L	10	NA	21	**21**	1.4	< 1.0	1.7	< 1	< 1	5.8	2.3	2.5	3	3
Barium	ug/L	2,000	NA	1,300	2,000	73.7	72	73	72	73	169	200	220	252	273
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Chromium	ug/L	100	NA	3	100	< 1.0	< 1.0	5.4	2	1	< 1.0	< 1.0	< 1.0	< 1	< 1
Cobalt	ug/L	NC	6	15	15	< 6.0	< 6.0	< 6.0	< 6	< 6	< 6.0	< 6.0	< 6.0	< 6	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000	1,200	1,200	1,100	< 1,000	1,830	< 1,000	< 1,000	< 2,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1	< 1
Lithium	ug/L	NC	40	180	180	35	23	25	24	24	51	43	53	60	66
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	6	**100**	8.9	7.9	7.4	7	8	< 5.0	< 5.0	< 5.0	< 5	< 5
Radium-226	pCi/L	NC	NA	NA	NA	< 1.09	0.181	0.195	< 0.305	< 0.324	< 0.542	0.300	0.434	0.372	< 0.423
Radium-228	pCi/L	NC	NA	NA	NA	< 0.718	< 0.501	< 0.373	0.468	< 0.463	< 0.808	< 0.449	< 0.715	0.385	0.616
Radium-226/228	pCi/L	5	NA	3.32	5	< 1.81	< 0.501	< 0.373	0.688	0.499	< 1.35	0.590	1.07	0.76	1.03
Selenium	ug/L	50	NA	2	50	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1	< 1
Thallium	ug/L	2	NA	2	2	< 2.0	< 2.0	< 2.0	< 2	< 2	< 2.0	< 2.0	< 2.0	< 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) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences and/or concentrations of other constituents present.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – November 2018 to October 2020
JC Weadock Landfill – RCRA CCR Monitoring Program
Essexville, Michigan

					Sample Location:	JCW-MW-18004					JCW-MW-18005				
					Sample Date:	11/8/2018	4/11/2019	10/15/2019	5/19/2020	10/14/2020	11/8/2018	4/11/2019	10/11/2019	5/19/2020	10/14/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient									
Appendix III															
Boron	ug/L	NC	NA	619	NA	366	320	430	265	410	1,300	1,300	1,700	1,150	1,090
Calcium	mg/L	NC	NA	302	NA	296	470	270	308	323	156	340	270	419	195
Chloride	mg/L	250**	NA	2,440	NA	17.1	34	39	10.9	22.6	81.8	59	82	23.2	66.5
Fluoride	ug/L	4,000	NA	1,000	NA	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,100	< 1,000	< 1,000	< 1,000	1,640
Sulfate	mg/L	250**	NA	407	NA	727	840	930	361	756	125	680	470	817	185
Total Dissolved Solids	mg/L	500**	NA	4,600	NA	1,560	1,900	1,800	1,720	1,690	854	1,700	1,300	1,950	986
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 7.3	NA	6.8	6.6	6.6	7.3	6.9	6.9	6.6	6.7	7.2	7.0
Appendix IV															
Antimony	ug/L	6	NA	1	6	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1	< 1
Arsenic	ug/L	10	NA	21	**21**	< 5.0	4.4	< 1.0	< 1	< 1	2.2	5.3	11	12	8
Barium	ug/L	2,000	NA	1,300	2,000	36.3	80	43	28	34	103	180	180	141	98
Beryllium	ug/L	4	NA	1	4	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Chromium	ug/L	100	NA	3	100	< 5.0	19	< 1.0	< 1	< 1	< 1.0	2.0	12	< 1	< 1
Cobalt	ug/L	NC	6	15	15	< 30.0 (1)	< 6.0	< 6.0	< 6	< 6	< 6.0	< 6.0	< 6.0	< 6	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,100	< 1,000	< 1,000	< 1,000	1,640
Lead	ug/L	NC	15	1	15	< 5.0	5.6	< 1.0	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1	< 1
Lithium	ug/L	NC	40	180	180	36	38	37	31	37	36	49	50	53	33
Mercury	ug/L	2	NA	0.2	2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	6	**100**	< 5.0	< 5.0	< 5.0	< 5	< 5	5.8	< 5.0	< 5.0	< 5	< 5
Radium-226	pCi/L	NC	NA	NA	NA	< 1.04	< 0.310	< 0.135	< 0.256	< 0.424	0.785	0.369	0.397	0.381	1.07
Radium-228	pCi/L	NC	NA	NA	NA	< 0.633	< 1.47	< 0.495	< 0.368	1.04	1.02	< 0.704	< 0.635	0.457	0.540
Radium-226/228	pCi/L	5	NA	3.32	5	< 1.67	< 1.47	< 0.495	< 0.368	0.922	1.81	< 0.704	0.698	0.838	1.61
Selenium	ug/L	50	NA	2	50	< 1.0	1.5	< 1.0	1	< 1	< 1.0	< 1.0	< 1.0	1	< 1
Thallium	ug/L	2	NA	2	2	< 10.0 (1)	< 2.0	< 2.0	< 2	< 2	< 2.0	< 2.0	< 2.0	< 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) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences and/or concentrations of other constituents present.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – November 2018 to October 2020
JC Weadock Landfill – RCRA CCR Monitoring Program
Essexville, Michigan

						Sample Location:	JCW-MW-18006				
						Sample Date:	11/8/2018	4/11/2019	4/11/2019	10/14/2019	5/20/2020	10/14/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient					
Appendix III									Field Dup			
Boron	ug/L	NC	NA	619	NA		2,990	2,900	2,800	2,800	3,030	2,610
Calcium	mg/L	NC	NA	302	NA		188	190	190	170	179	167
Chloride	mg/L	250**	NA	2,440	NA		96.9	97	98	97	71.2	72.2
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250**	NA	407	NA		75.8	120	120	100	94.5	50.1
Total Dissolved Solids	mg/L	500**	NA	4,600	NA		1,040	990	980	910	988	861
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 7.3	NA		6.8	6.9	--	6.8	7.4	7.1
Appendix IV												
Antimony	ug/L	6	NA	1	6		< 1.0	< 2.0	< 2.0	< 1.0	< 1	< 1
Arsenic	ug/L	10	NA	21	**21**		**35.1**	**37**	**38**	**32**	**33**	**22**
Barium	ug/L	2,000	NA	1,300	2,000		534	420	450	480	500	489
Beryllium	ug/L	4	NA	1	4		< 1.0	< 2.0	< 2.0	< 1.0	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.20	< 0.40	< 0.40	< 0.20	< 0.2	< 0.2
Chromium	ug/L	100	NA	3	100		< 1.0	< 2.0	< 2.0	< 1.0	< 1	< 1
Cobalt	ug/L	NC	6	15	15		< 6.0	< 12	<12	< 6.0	< 6	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	15	1	15		< 1.0	< 2.0	< 2.0	< 1.0	< 1	< 1
Lithium	ug/L	NC	40	180	180		88	67	66	72	70	59
Mercury	ug/L	2	NA	0.2	2		< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	6	**100**		< 5.0	< 10	< 10	< 5.0	< 5	< 5
Radium-226	pCi/L	NC	NA	NA	NA		0.646	0.294	0.365	0.454	0.649	0.716
Radium-228	pCi/L	NC	NA	NA	NA		1.85	< 0.510	0.741	0.500	0.346	0.853
Radium-226/228	pCi/L	5	NA	3.32	5		2.50	0.709	1.11	0.954	0.995	1.57
Selenium	ug/L	50	NA	2	50		< 1.0	< 2.0	< 2.0	< 1.0	< 1	< 1
Thallium	ug/L	2	NA	2	2		< 2.0	< 4.0 (1)	< 4.0 (1)	< 2.0	< 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.

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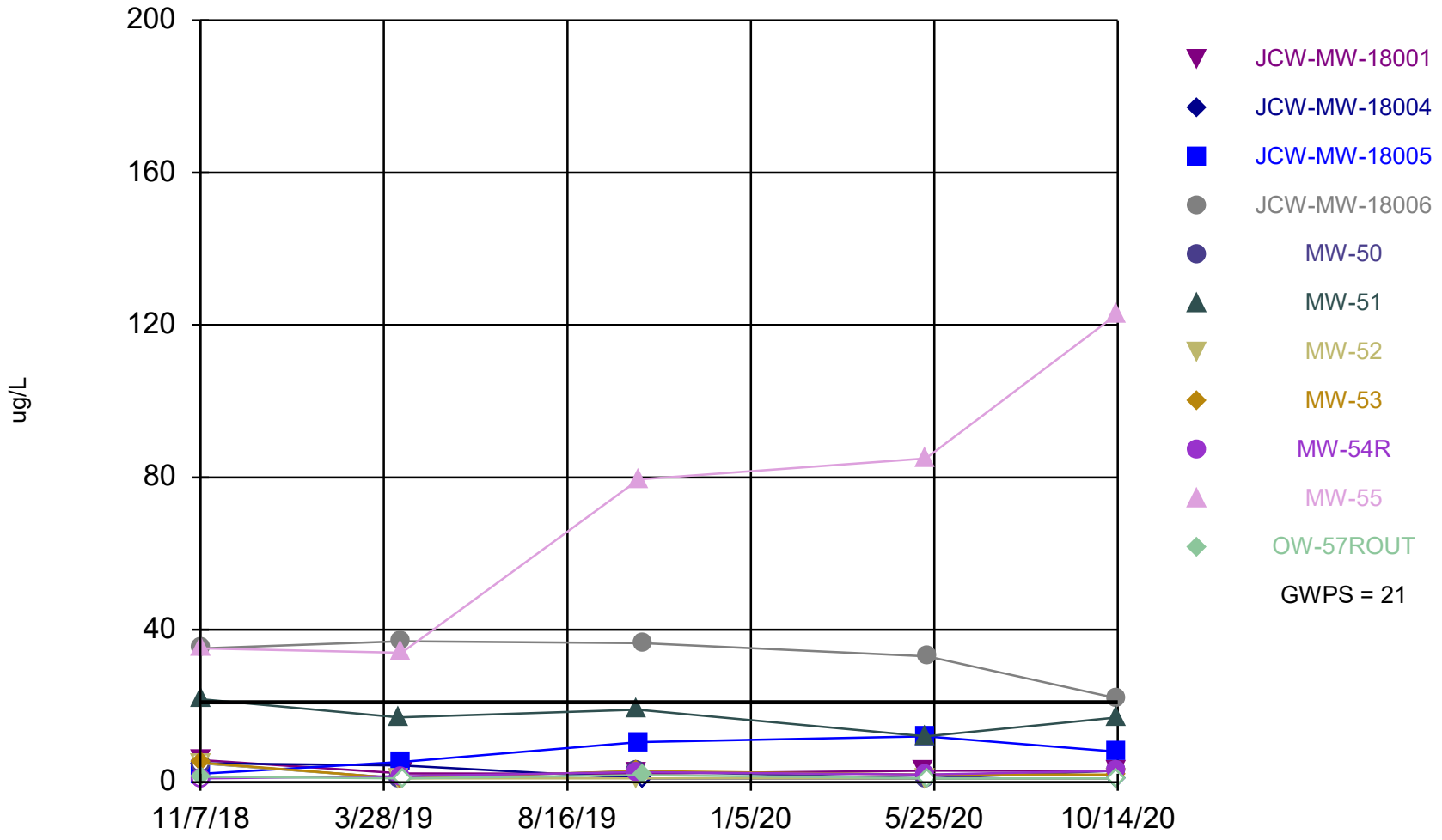
(1) Laboratory reporting limit exceeds GWPS due to sample dilutions performed as a result of sample matrix interferences and/or concentrations of other constituents present.

Attachment 1
Sanitas™ Output Files

Hollow symbols indicate censored values.

Arsenic, Total

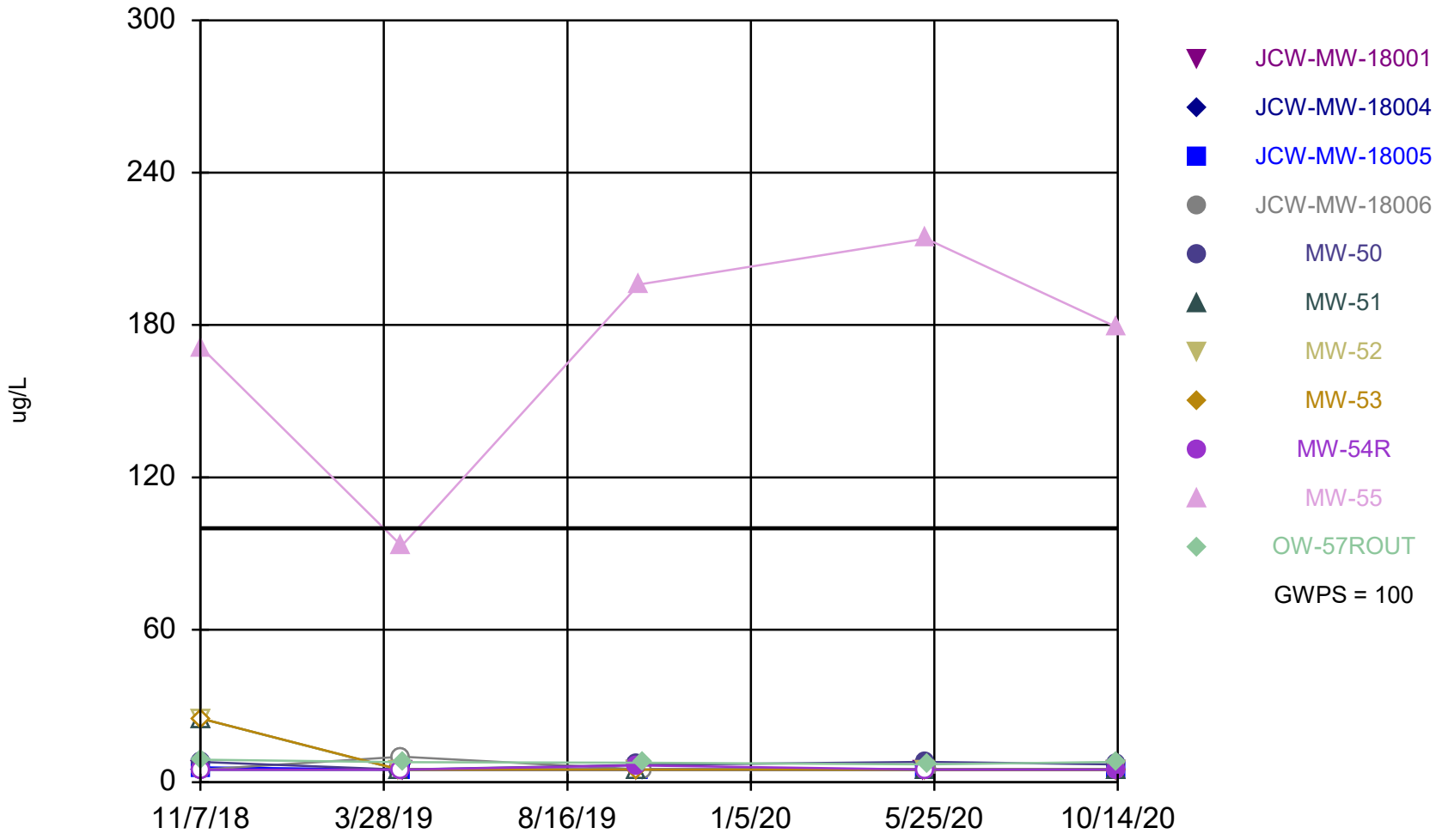


Time Series Analysis Run 12/14/2020 5:12 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23_KR

Hollow symbols indicate censored values.

Molybdenum, Total



Time Series Analysis Run 12/14/2020 5:13 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23_KR

Summary Report

Constituent: Arsenic, Total Analysis Run 12/8/2020 5:01 PM
Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23

For observations made between 11/7/2018 and 10/14/2020, a summary of the selected data set:

Observations = 55
ND/Trace = 14
Wells = 11
Minimum Value = 1
Maximum Value = 123
Mean Value = 13.19
Median Value = 3
Standard Deviation = 23.24
Coefficient of Variation = 1.763
Skewness = 2.98

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JCW-MW-18001	5	0	2.25	5.8	3.27	3	1.46	0.4465	1.273
JCW-MW-18004	5	4	1	5	2.48	1	2.038	0.8216	0.4412
JCW-MW-18005	5	0	2.2	12	7.6	8	3.949	0.5196	-0.2723
JCW-MW-18006	5	0	22	37	32.72	35.1	6.19	0.1892	-1.28
MW-50	5	1	1	5	2.6	2.9	1.645	0.6326	0.4049
MW-51	5	0	12	21.8	17.36	17	3.584	0.2065	-0.3772
MW-52	5	4	1	5	1.8	1	1.789	0.9938	1.5
MW-53	5	1	1	5.1	2.61	2	1.553	0.5952	0.8091
MW-54R	5	1	1	3	2.05	2	0.8016	0.391	-0.09525
MW-55	5	0	34	123	71.32	79.5	37.52	0.526	0.2204
OW-57ROUT	5	3	1	1.85	1.25	1	0.3775	0.302	0.8963

Summary Report

Constituent: Molybdenum, Total Analysis Run 12/8/2020 5:01 PM
Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23

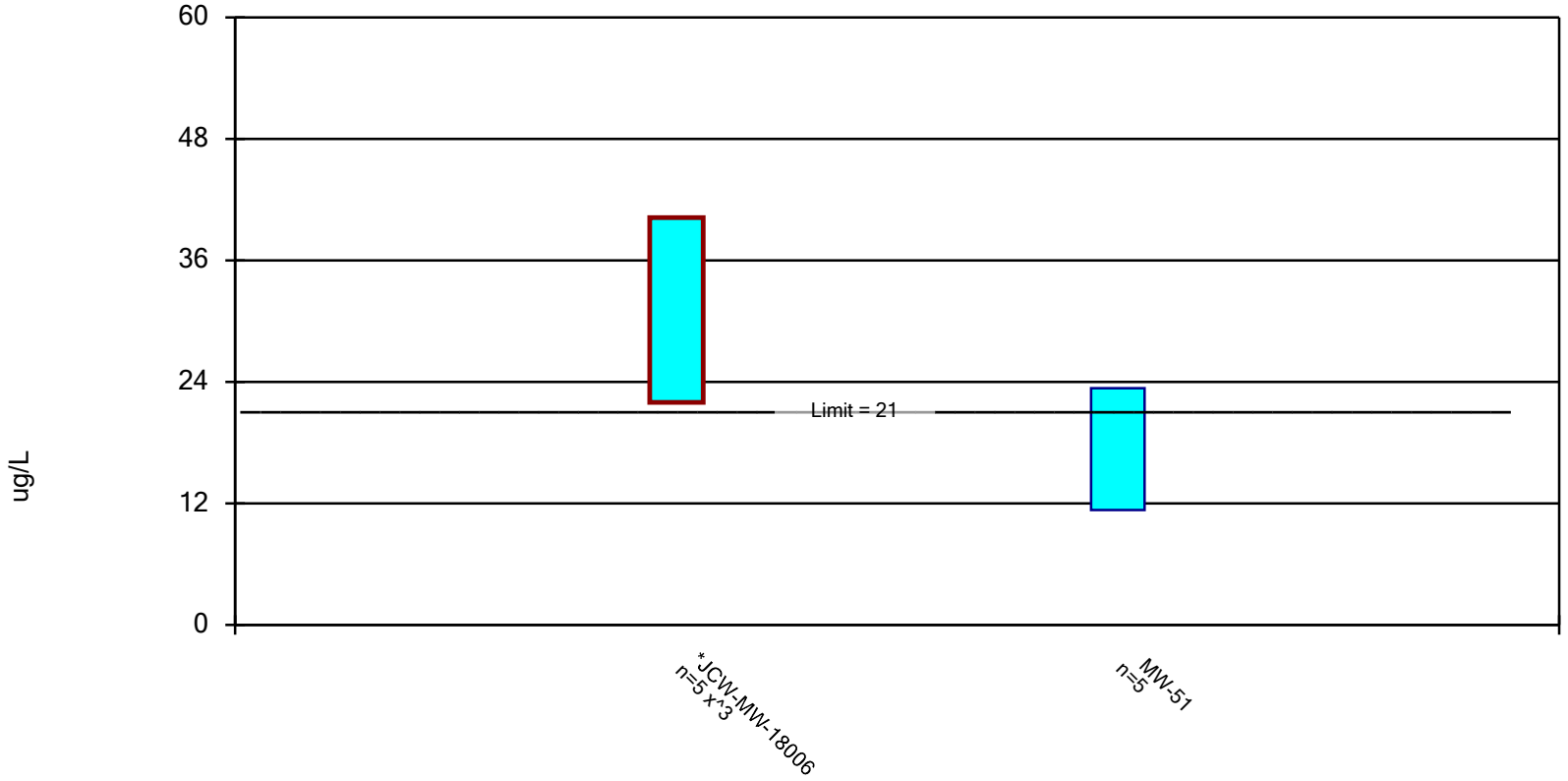
For observations made between 11/7/2018 and 10/14/2020, a summary of the selected data set:

Observations = 55
ND/Trace = 38
Wells = 11
Minimum Value = 5
Maximum Value = 214
Mean Value = 21.72
Median Value = 5
Standard Deviation = 49.38
Coefficient of Variation = 2.273
Skewness = 3.071

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
JCW-MW-18001	5	5	5	5	5	5	0	0	NaN
JCW-MW-18004	5	5	5	5	5	5	0	0	NaN
JCW-MW-18005	5	4	5	5.8	5.16	5	0.3578	0.06934	1.5
JCW-MW-18006	5	5	5	10	6	5	2.236	0.3727	1.5
MW-50	5	1	5	8	6.96	7	1.228	0.1764	-0.7975
MW-51	5	5	5	25	9	5	8.944	0.9938	1.5
MW-52	5	5	5	25	9	5	8.944	0.9938	1.5
MW-53	5	5	5	25	9	5	8.944	0.9938	1.5
MW-54R	5	3	5	6.6	5.32	5	0.7155	0.1345	1.5
MW-55	5	0	93	214	170.6	179	46.43	0.2721	-1.03
OW-57ROUT	5	0	7	8.9	7.9	7.9	0.6819	0.08632	0.2327

Parametric Confidence Interval

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



Constituent: Arsenic, Total Analysis Run 12/8/2020 5:03 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23

Confidence Interval

Constituent: Arsenic, Total (ug/L) Analysis Run 12/8/2020 5:04 PM

Client: Consumers Energy Data: JCW_CCR_Sanitas_20.11.23

	JCW-MW-18006	MW-51
11/8/2018	35.1	21.8
4/9/2019		17
4/11/2019	37	
10/10/2019		19 (D)
10/14/2019	36.5 (D)	
5/19/2020		12
5/20/2020	33	
10/14/2020	22	17
Mean	32.72	17.36
Std. Dev.	6.19	3.584
Upper Lim.	40.21	23.37
Lower Lim.	21.99	11.35