October 29, 2021

Margie Ring, Delegate Representative of the State Director
Michigan Department of Environment, Great Lakes, and Energy
Solid Waste Section

Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g) and Alternate Source Demonstration per §257.95(g)(3)(ii)

Consumers Energy Company (Consumers Energy) conducts semiannual assessment monitoring in accordance with §257.95 of the CCR Rule for the JH Campbell Power Plant (JHC) Bottom Ash Pond Unit 1-2 North and 1-2 South (collectively Ponds 1-2) located in West Olive, Michigan. During the statistical evaluation of the initial assessment monitoring event, arsenic was present in two out of five downgradient monitoring wells at statistically significant levels (SSLs) exceeding the Groundwater Protection Standard (GWPS). Therefore, Consumers Energy initiated an Assessment of Corrective Measures (ACM) (TRC, September 2019) within 90 days from when the Appendix IV exceedance was determined. Consumers Energy is in the process of evaluating corrective measures per §257.96 and §257.97 and is continuing semiannual assessment monitoring in accordance with §257.95 as summarized in the Semiannual Progress Report – Selection of Remedy, JH Campbell Ponds 1-2 North and 1-2 South CCR Unit, JH Campbell Pond A CCR Unit (Consumers Energy, July 30, 2021).

Consumers Energy conducted the first semiannual assessment monitoring event of 2021 at Ponds 1-2 on April 12 through 14, 2021 in accordance with the Sample Analysis Plan for JH Campbell Ponds 1-2 and Pond 3 (SAP) (TRC, January 2021). As discussed in the Statistical Evaluation of April 2021 Assessment Monitoring Sampling Event technical memorandum (TRC, July 30, 2021) the results of the statistical evaluation of the April 2021 assessment monitoring parameters using confidence interval analysis indicated a new SSL above the GWPS for:

- Selenium at JHC-MW-15005.

The new SSL above the GWPS for selenium at JHC-MW-15005 resulted from increases in concentrations observed after the cessation of hydraulic loading at Ponds 1-2 in 2018 and an associated change in localized groundwater flow. TRC has developed an Alternate Source Demonstration (ASD) for the new SSL in accordance with §257.95(g)(3)(ii). The multiple lines of evidence presented in the ASD (attached) show that the SSL is from a source other than Ponds 1-2.

Consumers Energy
1945 W Parnall Rd
Jackson, MI 49201

Environmental Services

A site-wide Remedial Action Plan addressing exceedances of applicable State of Michigan criteria associated with CCR at JH Campbell, including selenium in groundwater observed at JHC-MW-15005, was submitted to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) on October 1, 2021 in accordance with WMRPD Agreement No. 115-01-2018.

Regards,
Consumers Energy Company

Bethany Swanberg, PE
(517) 788-0282
Bethany.Swanberg@cmsenergy.com

Consumers Energy
Count on Us®

A CMS Energy Company

Date: October 28, 2021

To: Operating Record

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

RE: Alternate Source Demonstration Professional Engineer Certification, §257.95(g)3
Bottom Ash Pond 1-2 North and 1 2 South CCR Unit

Professional Engineer Certification Statement [40 CFR 257.95(g)3]

I hereby certify that the alternative source demonstration presented within this *Alternative Source Demonstration: Selenium at JHC-MW-15005, Consumers Energy, JH Campbell Site, Bottom Ash Pond 1-2 North and 1 2 South CCR Unit, West Olive, Michigan* been prepared to meet the requirements of Title 40 CFR §257.95(g)3 of the Federal CCR Rule. This document is accurate and has been prepared in accordance with good engineering practices, including the consideration of applicable industry standards, and with the requirements of Title 40 CFR §257.95(g)3.

Harold D. Register, Jr.

Signature

October 28, 2021

Date of Certification

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

Name

6201056266

Professional Engineer Certification Number

10/28/2021

Enclosure

TRC (October 2021). *Alternative Source Demonstration: Selenium at JHC-MW-15005, Consumers Energy, JH Campbell Site, Bottom Ash Pond 1-2 North and 1 2 South CCR Unit, West Olive, Michigan*

1540 Eisenhower Pl.
Ann Arbor, MI 48108

T 734.971.7080
TRCcompanies.com

October 28, 2021

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

Subject: Alternative Source Demonstration: Selenium at JHC-MW-15005
Consumers Energy, JH Campbell Site, Bottom Ash Pond 1-2 North and 1 2 South CCR Unit, West Olive, Michigan

Dear Ms. Swanberg:

TRC was retained by Consumers Energy Company (Consumers Energy) to conduct semiannual assessment monitoring in accordance with §257.95 of the CCR Rule[1] for the JH Campbell Power Plant (JHC) Bottom Ash Pond Unit 1-2 North and 1-2 South (collectively Ponds 1-2) located in West Olive, Michigan. In January 2019, during the statistical evaluation of the initial assessment monitoring event, arsenic was present in two out of five downgradient monitoring wells at statistically significant levels (SSLs) exceeding the Groundwater Protection Standard (GWPS). Therefore, Consumers Energy initiated an Assessment of Corrective Measures (ACM) (TRC, September 2019) within 90 days from when the Appendix IV exceedance was determined. Consumers Energy is in the process of evaluating corrective measures per §257.96 and §257.97 and is continuing semiannual assessment monitoring in accordance with §257.95 as summarized in the *Semiannual Progress Report – Selection of Remedy*, *JH Campbell Ponds 1-2 North and 1-2 South CCR Unit, JH Campbell Pond A CCR Unit* (Consumers Energy, July 30, 2021).

Consumers Energy conducted the first semiannual assessment monitoring event of 2021 at Ponds 1-2 on April 12 through 14, 2021 in accordance with the *Sample Analysis Plan for JH Campbell Ponds 1-2 and Pond 3* (SAP) (TRC, January 2021). As discussed in the *Statistical Evaluation of April 2021 Assessment Monitoring Sampling Event* technical memorandum (TRC, July 30, 2021) and shown on Table 1, the results of the statistical evaluation of the April 2021 assessment monitoring parameters using confidence interval analysis indicated a new SSL above the GWPS for:

- Selenium at JHC-MW-15005.

The new SSL above the GWPS for selenium at JHC-MW-15005 resulted from increases in constituent concentrations observed subsequent to the cessation of hydraulic loading in 2018 and the associated change in localized groundwater flow. In accordance with §257.95(g)(3)(ii), an owner or operator is

[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).

allowed 90 days to:

"*Demonstrate that a source other than the CCR unit caused the contamination, or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality*."

On behalf of Consumers Energy, TRC has prepared this Alternate Source Demonstration (ASD) for selenium at JHC-MW-15005 in response to the aforementioned SSL identified in the April 2021 assessment monitoring event. The multiple lines of evidence presented in this ASD show that an increase in constituent concentrations of selenium resulting in the SSL at JHC-MW-15005 is from a source other than the former Ponds 1-2 CCR unit.

Site Overview and Background

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

Currently, there are no remaining active CCR surface impoundments at the JHC solid waste disposal facility. The CCR disposal area had contained two primary components: a system of wet ash ponds and a dry ash disposal facility (i.e., the JHC Dry Ash Landfill). The CCR surface impoundments located within the former wet ash pond area are Pond 1-2 Bottom Ash Ponds (Ponds 1-2), Pond 3 North and Pond 3 South Bottom Ash Pond (collectively Pond 3), and Pond A. All of these impoundments have been deactivated and decommissioned. Dry, moisture-conditioned CCR from the three coal-fired electric generating units continues to be managed in the licensed solid waste landfill which is regulated under Part 115 of the Natural Resources and Environmental Protection Act (NREPA), PA 451 of 1994, as amended.

Prior to the use of the surface impoundments and the Dry Ash Landfill, CCR was managed historically at Closed Ponds B-K shown on Figure 2. The surface impoundments in the wet ash pond areas were decommissioned starting in 2017 and replaced with concrete bottom ash treatment tanks. Bottom ash is currently sluiced to the concrete tanks where it is dewatered. The settled and dewatered bottom ash is beneficially reused or managed at the Dry Ash Landfill. Sluice water decanted from the tanks flows through a permitted ditching system to the recirculation pond. Water in the recirculation pond is then discharged through a National Pollutant Discharge Elimination System (NPDES) permitted outfall and into Pigeon River. The purpose of the dry ash disposal facility is to contain dry bottom and fly ash produced as a result of burning coal for power production. Dry ash from all of the generating units is stored in silos until it is placed into the facility or is sold and shipped off site.

Geology/Hydrogeology

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

Pond A CCR surface impoundments and generally flows to the south-southeast toward the Pigeon River. The subsurface materials encountered at the JH Campbell site generally consist of approximately 40 to 60 feet of poorly graded, fine-grained lacustrine sand. A laterally extensive clay-rich till is generally encountered within approximately 40 to 60 ft bgs across the site that according to deep drilling logs conducted at the JH Campbell Power Plant (just west of the CCR units) is on the order of 80 feet thick and extends to the top of shale bedrock approximately 140 ft bgs. Details regarding the hydrogeology at Ponds 1-2 specific to this demonstration are provided below.

Alternate Source Demonstration

As discussed above, CCR removal was completed at Ponds 1-2 pursuant to closure by removal per §257.102(c) in conformance with the CCR Rule. The removal and decontamination of all areas affected by releases from Ponds 1-2 is documented and the groundwater assessment monitoring program continues to be performed until the groundwater monitoring concentrations do not exceed the groundwater protection standard established pursuant to §257.95(h) for Appendix IV constituents.

The confidence interval analysis for the April 2021 assessment monitoring event showed selenium present at SSLs above the GWPS (Table 1). The following discussion presents the ASD for the selenium SSLs at JHC-MW-15005. This discussion shows that the increases in selenium concentrations at this location are not due to a release of CCR constituents from the Ponds 1-2 CCR unit nor a result of failing to decontaminate the CCR unit, rather they are due to upgradient alternate sources. Lines of evidence for this demonstration were developed in consideration of the alternate source demonstration criteria set forth in the *EPA Solid Waste Disposal Facility Criteria Technical Manual* (USEPA November 1993, Revised April 1998) and document that:

1. An alternate source exists.
2. Hydraulic connection exists between the alternative source and the well with the significant increase.
3. Constituent(s) (or precursor constituents) are present at the alternative source or along the flow path from the alternative source prior to possible release from the monitored CCR unit.
4. The relative concentration and distribution of constituents in the zone of contamination are more strongly linked to the alternative source than to the monitored CCR unit when the fate and transport characteristics of the constituents are considered.
5. The concentration observed in groundwater could not have resulted from the CCR unit given the waste constituents and concentrations in the CCR unit leachate and wastes, and site hydrogeologic conditions.
6. The data supporting conclusions regarding the alternative source are historically consistent with hydrogeologic conditions and findings of the monitoring program.

The lines of evidence provided in support of this demonstration are as follows:

- **Pond removal and decontamination** – Consumers Energy has performed CCR removal at Ponds 1-2 as documented in the *JH Campbell Generating Facility Bottom Ash Ponds 1-2 Closure Plan* pursuant to §257.102 (Golder, January 2018). The December 2017 *Bottom Ash Ponds 1-2 Closure Work Plan* was submitted to the EGLE on December 5, 2017, and approved by the EGLE on February 26, 2018. Dewatering and removal of ash from Ponds 1-2 for beneficial reuse

began in June 2018 and continued through September 2018. CCR removal activities were completed in October 2018 and Consumers Energy submitted final documentation of CCR removal to EGLE in the *JHC Campbell Generating Facility Bottom Ash Ponds 1-2 N/S CCR Removal Documentation Report* (CCR Removal Documentation Report) (Golder, August 2019). On October 22, 2019, EGLE provided written concurrence that all bottom ash had been removed from Ponds 1-2 based on multiple lines of evidence described in the approved closure work plan. Following CCR removal, the Ponds 1-2 excavation was backfilled with clean fill to promote stormwater drainage and minimize the potential for ponding of surface water.

Ponds 1-2 were dewatered during CCR excavation in late August and early September 2018. Approximately 800,000 gallons of water were removed per day during the dewatering period, for a total removal of nearly 11.5 million gallons.

As detailed in the CCR Removal Documentation Report, CCR from Ponds 1-2 was excavated to at least the elevation of the base of CCR. Following initial excavation, CCR removal was verified visually at nodes established according to EGLE guidance *Sampling Strategies and Statistics Training Materials for Part 201 Cleanup Criteria (S3TM)*. If any CCR were visible, additional material was removed. When no CCR or only trace amounts of CCR remained, a colorimetric analysis using a digital colorimeter to precisely measure the color of a soil sample was developed to confirm CCR removal. Sampled grid nodes passed colorimetric confirmation testing if the remaining surface contained no more than 5 percent CCR material. Grid nodes which did not pass colorimetric testing were further examined by microscopy. Microscopic analysis confirmed that these grid nodes contained no more than 5 percent CCR material. If the remaining surface at a grid node was confirmed to contain more than 5 percent CCR material, additional excavation was performed. These multiple lines of evidence confirmed that all CCR material was removed from Ponds 1-2.

The fact that all the CCR has been removed from Ponds 1-2 demonstrates that the elevated selenium concentration observed in groundwater could not have resulted from a new release from the Ponds 1-2 CCR unit given that there is no longer any CCR material present in Ponds 1-2 to contribute to groundwater concentrations.

- **Timelines for CCR loading, dewatering, removal –** Sluicing of bottom ash to Ponds 1-2 was ceased in November 2017. Pond dewatering and CCR removal occurred from June 5, 2018 through September 11, 2018 as shown on the timeline below. As mentioned above, the CCR removal was documented in the CCR Removal Documentation Report. This timeline is key in evaluating groundwater concentrations observed at the Ponds 1-2 monitoring wells. As discussed in more detail below, there were several significant hydrogeological and geochemical changes in groundwater that were observed following the decommissioning of Ponds 1-2, including the selenium increase at JHC-MW-15005, indicating an alternate source.

- **Presence of an alternative source** – The alternative source of the SSL above the GWPS for selenium at JHC-MW-15005 is historic Closed Ponds B-K, which includes the historic Pond A.

  Historic Closed Ponds B-K and the historic Pond A (collectively called Ponds B-K) are shown on Figure 2 and were used for historic CCR management at the facility. Ponds B-K are not regulated under the scope of the federal CCR Rule; however, they are regulated under Michigan's Part 115 solid waste program and subject to a site-wide remedial action plan. Historic Pond A is not to be confused with the former Pond A CCR Unit that is located farther to the east and regulated under the CCR Rule. The Pond A CCR Unit is closed and capped. To avoid confusion, "Ponds B-K" is used throughout this report as a term inclusive of historic Pond A and Ponds B-K.

Ponds B-K are present immediately upgradient and are hydraulically connected to groundwater at the Ponds 1-2 well network. Since 2018 Ponds 1-2 is no longer hydraulically loading and controlling the groundwater flow in the vicinity of monitoring well JHC-MW-15005 (in addition to JHC-MW-15002 and JHC-MW-15003) (Figures 3 through 7). Rather, groundwater flows toward these three monitoring wells from within the historic Ponds B-K footprint. Shallow groundwater is situated within sandy soil and flows at a rate on the order of 400 ft/year across Ponds 1-2 using static water level data collected from February 2019 through April 2021. Ponds B-K are unlined and contain CCR fill material. Surface water run-off at Ponds B-K has the potential to percolate downward through the subsurface into groundwater.

There is also the potential that some areas of Ponds B-K contain ash in direct hydraulic communication with groundwater. As shown in Appendix A, ash within historic Pond A is present to an average elevation of approximately 603 ft. The original soil boring logs for monitoring wells JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 show ash present to elevations of 602 ft, 608 ft, and 613 ft, respectively. Ash at JHC-MW-15005 was excavated during the removal of CCR at Ponds 1-2, where the new ground surface is at an elevation of 606 ft post-CCR removal. From late 2018 to present, after Ponds 1-2 were dewatered, the water table has been below the bottom of the ash. Prior to 2018, before Ponds 1-2 were dewatered, static water elevation data indicate that there was direct communication between the ash and groundwater at some of the Ponds 1-2 wells (e.g. JHC-MW-15002). Therefore, groundwater data from monitoring wells JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 can be used to establish a geochemical fingerprint of the historic Pond A. The fingerprinting results are provided in detail below. Water table and ground surface elevation data are summarized on Table 2.

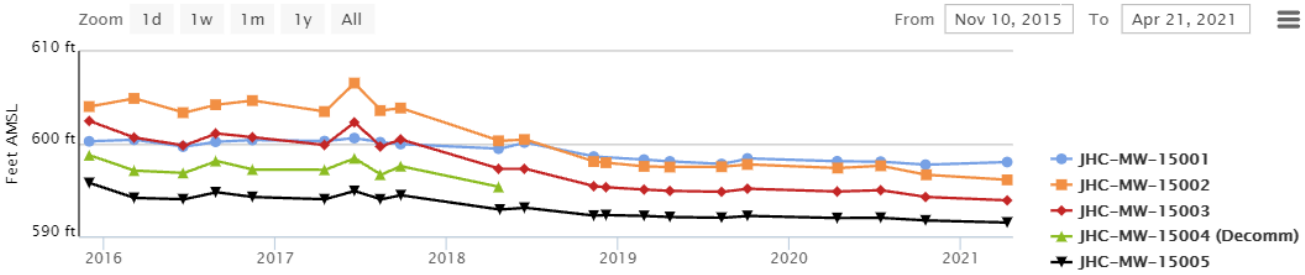
Pond C is located farther upgradient, immediately north of the historic Pond A cell, which also contains historic CCR fill material. Soil boring PZ-21-01 completed in 2021 shows that approximately 26 feet of ash fill is present at that location to an elevation of approximately 603 ft. The water table was observed at 603 ft during drilling. Static water level data collected from piezometer PZ-21-01 shows water levels are generally around an elevation of 598 ft. Water level data from other piezometers throughout the Ponds B-K area (e.g. Pond B, Pond G2, Pond H, Pond J) show that the water level is in some areas above or very close (within a foot) to the bottom of the ash (Table 2). This shows that at times, there is a direct hydraulic connection between ash and groundwater throughout the Ponds B-K area, in addition to infiltration as surface water run-off percolates downward through the fill material and interacts with groundwater. Soil boring logs for the aforementioned piezometers and monitoring wells are included in Appendix B.

- **Hydrogeologic changes** – During active hydraulic loading to the ponds, groundwater mounding was observed with localized radial flow outward around the ponds (Figure 3). The initial monitoring well network was developed under active loading conditions, in which all monitoring wells were downgradient relative to Ponds 1-2. Groundwater flow changed significantly subsequent to the cessation of hydraulic loading and decommissioning of the ponds. Sluicing to Ponds 1-2 was ceased in November 2017. In 2018, a southern groundwater flow direction was established across Ponds 1-2 and has continued to the present (Figures 4 through 7). Following the change in groundwater flow direction several of the monitoring wells were no longer positioned downgradient of Ponds 1-2, including JHC-MW-15002 and JHC-MW-15003 where arsenic SSLs above the GWPS were first observed. This change also increased the potential for alternate upgradient sources (e.g. Ponds B-K) to influence groundwater quality at the Ponds 1-2 wells. Groundwater passing beneath the Ponds B-K now flows across the eastern edge of Ponds 1-2 (Figures 4 through 7).

Monitoring wells JHC-MW-15002 and JHC-MW-15003 are installed within the footprint of the historic Pond A and JHC-MW-15005 is immediately downgradient, resulting in very short travel times for groundwater beneath the historic Pond A footprint to reach these monitoring wells. Travel time from Pond C to the three eastern Ponds 1-2 wells ranges from 0.6 years at JHC-MW-15002 to 2.1 years at JHC-MW-15005, using static water elevation data collected from February 2019 through April 2021. These travel times align with the timing of the changes observed in groundwater post-dewatering.

The water table in the vicinity of Ponds 1-2 also dropped significantly post-dewatering. As shown in the Ponds 1-2 Static Water Level Chart below, the groundwater table dropped post-cessation of sluicing in November 2017 and following dewatering and CCR removal in June 2018 such that JHC-MW-15001 went dry. Subsequently, JHC-MW-15001 was removed from the monitoring program given that it was no longer downgradient, never had a statistically significant increase for Appendix III, and Appendix IV concentrations remained below the respective GWPSs.

Ponds 1-2 Static Water Level Chart



- **Concentration trends** – Distinct changes occurred after dewatering (Figures 8 through 10), including the observed increase in selenium concentrations at JHC-MW-15005. Arsenic, which triggered the corrective action, is generally decreasing, while other constituents such as boron, barium, calcium, sulfate, selenium, thallium, cobalt, lead, and lithium, show increasing concentrations following removal of CCR from Ponds 1-2. The pH and oxidation/reduction potential (ORP) also changed significantly before and after dewatering at several of the monitoring wells. The pH was generally more basic during active loading (>9 standard units [SU]) and decreased post-loading (<9 SU) (Figures 8 through 10). Statistical analyses using two-sample t-tests was performed to assess whether there is a statistically significant difference between the means of the dataset before and dataset after dewatering. The results of the t-tests show that the concentrations of arsenic, bicarbonate, boron, calcium, magnesium, molybdenum, and sulfate at each well before dewatering are significantly different (at 95% confidence) than concentrations after loading. None of these parameters show evidence of statistically significant changes in the background monitoring wells over the same time periods. Therefore, there was a significant change in the subsurface geochemistry around wells JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 after cessation of hydraulic loading. This change correlates with the timing of the switch in groundwater flow direction along the east edge of Ponds 1-2. The t-test results are included in Appendix C.

  The significance of these changes in chemistry are further discussed below, but it should be noted that this change in chemistry immediately following CCR removal is evidence that the elevated selenium concentration is not due to a release from Ponds 1-2 CCR.

- **Geochemistry** – In order to determine the source of the concentration changes illustrated in the time-series plots (Figures 8 through 10), TRC performed a robust geochemical analysis of the data. This analysis evaluated metal behaviors including the following:
  - Metal availability and phase change,
  - Influence of pH and oxidation/reduction potential on ionic mobility,
  - Adsorption/desorption reactions due to cation exchange, and
  - Conservative versus dependent tracer concentration ratios.

  It should be noted that the presence of metals in groundwater is not, by itself, evidence of CCR impact. Achieving cleanup goals post-CCR removal can be complicated because metals are present naturally in the subsurface, in both soil and groundwater. Each of the analytes referenced above exists naturally in Michigan soils and groundwater as well as the sediments and water of Lake Michigan (Korkisch et al., 1977, Mason et al., 2000, Lee et al., 2016).

  In addition to metal behavior, the geochemical evaluation considered the location of JHC-MW-15005 in relation to groundwater mass sources as well as other monitoring wells. As noted above, JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 are within the historic Pond A footprint and directly downgradient from the Ponds B-K.

  The groundwater geochemistry for the Ponds 1-2 (pre- and post- 2018), former Pond C, former Pond D North, former Pond D South, former Pond J, former Pond K, and background were evaluated using geochemical “fingerprinting” analysis to characterize the various groundwater masses.

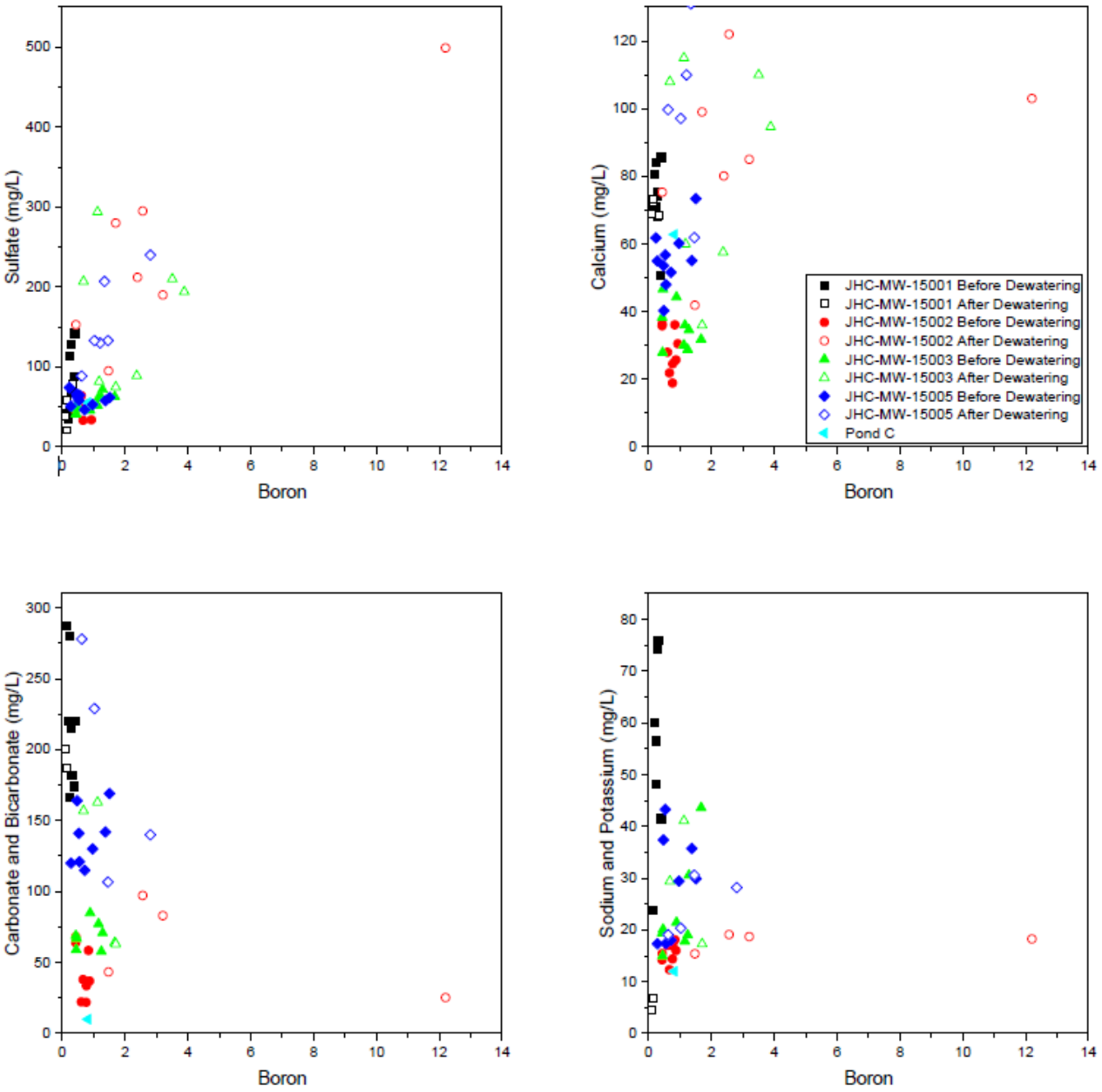
  Following fingerprinting, the oxidation/reduction potential (represented by Eh) and pH were evaluated. The Eh-pH speciation of various metals was assessed to determine phase changes before and after dewatering (pre- and post- 2018). Monitoring well JHC-MW-15001 was also included as a control because it was least affected by the operation and decommissioning of Ponds 1-2. The selected approach uses the molar ratios of relatively mobile species (dependent) in comparison to less-mobile phases (conservative). Using these ratios, fingerprints for each of the potential sources and each monitoring well were developed. Groundwater data collected from the Ponds 1-2 well network from December 5, 2015 to April 25, 2018 (pre-dewatering) and from Pond C well PZ-21-01 collected March 22, 2021, were used in this analysis. These fingerprints were then compared to groundwater data collected from the Ponds 1-2 wells post-dewatering from June 19, 2018 to April 14, 2021. Data from these same date ranges were used in the Eh-pH speciation. The analyses and the results are discussed in more detail below.

  - **Geochemical fingerprinting analysis** – Boron was used as the conservative tracer for the fingerprinting analysis. Monitoring well JHC-MW-15001 is located to the west of Ponds 1-2, farthest from the potential alternate sources (Ponds B-K) and upgradient of Ponds 1-2 after dewatering; therefore, JHC-MW-15001 is unlikely to be affected by an alternate source or Ponds 1-2 and was maintained as a control group.

    The ion fingerprinting analysis compared conservative tracers using sulfate, calcium, carbonate and bicarbonate, and sodium and potassium relative to boron (ion/boron ratios) pre- and post-dewatering for Ponds 1-2 monitoring wells JHC-MW-15001, JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005, and Pond C (PZ-21-05) as shown in the Ponds 1-2 Conservative Tracers Fingerprinting Diagram below. The closed symbols represent the pre-dewatering condition and the open symbols show the post-dewatering condition. The concentration of the conservative tracers generally increase 2- to 3-fold at JHC-MW-15002,

JHC-MW-15003, and JHC-MW-15005 post-dewatering. Monitoring well JHC-MW-15001 showed little to no change. This indicates that a significant change is similarly affecting the three wells, which is also indicative of influence from another source to monitoring wells JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 after dewatering and CCR removal at Ponds 1-2. Given the differences between the ratios at the three eastern wells and JHC-MW-15001, this potential alternate source is not influencing JHC-MW-15001.

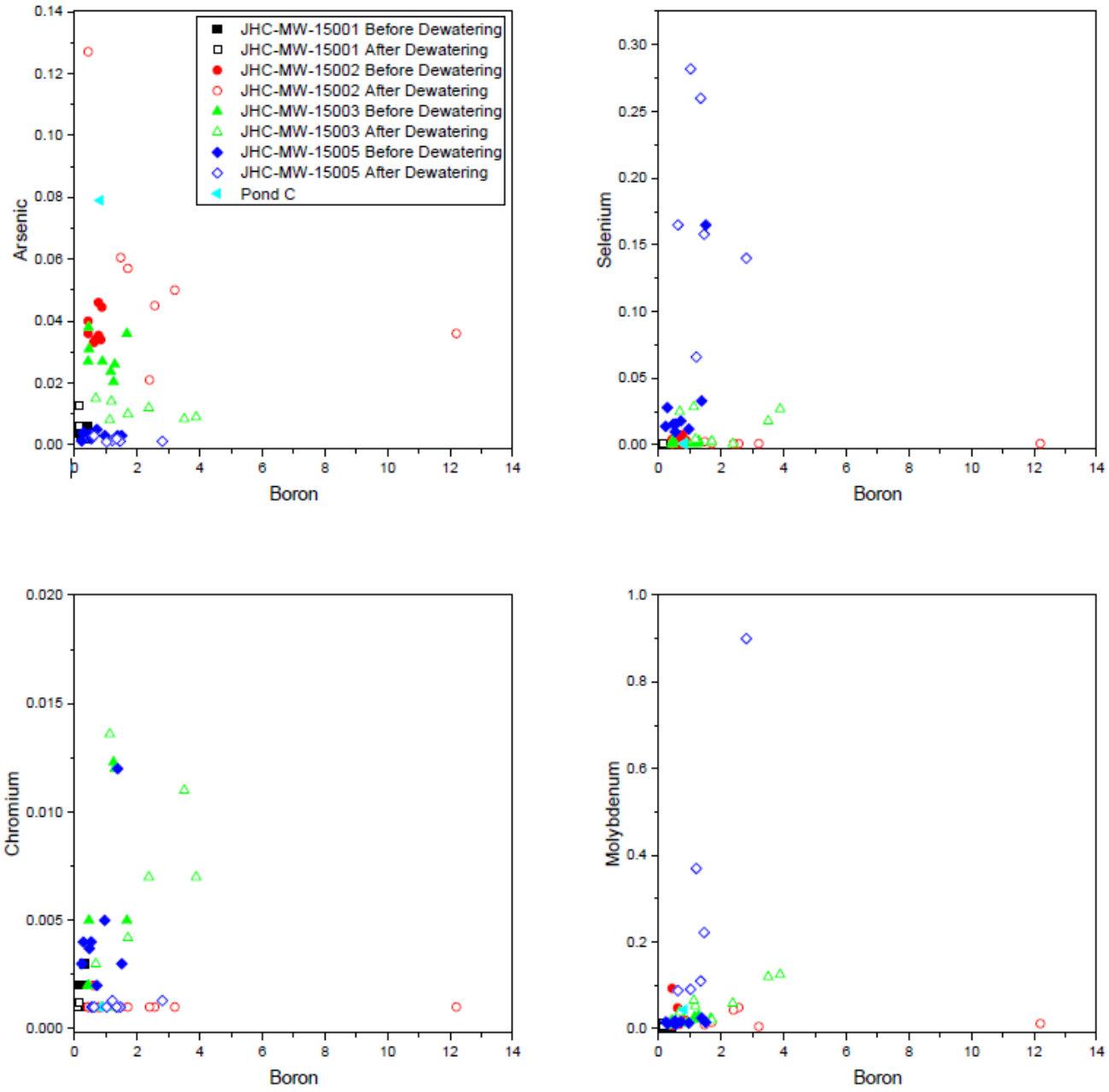
Ponds 1-2 Conservative Tracers Fingerprinting Diagram



Metals constituent concentrations were also evaluated pre- and post-dewatering by reviewing ratios of arsenic, selenium, chromium, and molybdenum to boron before and after

dewatering as shown in the Ponds 1-2 Metals Fingerprinting Diagram below. The closed symbols represent the pre-dewatering condition and the open symbols show the post-dewatering condition. The results show that the arsenic and chromium at JHC-MW-15002 (located closest to Pond C) are approaching the Pond C fingerprint, while selenium and molybdenum decrease. Arsenic and chromium decrease, and selenium and molybdenum increase at JHC-MW-15003 and JHC-MW-15005. This demonstrates that arsenic in groundwater at JHC-MW-15002 is consistent with influence from the Pond C source after dewatering and CCR removal at Ponds 1-2. It also indicates there is a significant change occurring that is influencing selenium and molybdenum concentrations at all three wells and all of the metals at JHC-MW-15003 and JHC-MW-15005. There is a weak correlation between the metals at the three Ponds 1-2 monitoring wells and the Pond C fingerprint, suggesting that there is also a flux of metals upgradient of Pond C. This source is further elucidated by comparing the concentration and molar ratios of bicarbonate, calcium, magnesium, and sulfate with boron. By comparing Ponds 1-2 fingerprints before and after dewatering, it can be seen that the data trend toward the fingerprints of the ponds upgradient of the historic Pond A. For these reasons it can be seen that the groundwater flux is primarily from the historic Pond A with remnant influence of further upstream Ponds B-K.

Ponds 1-2 Metals Fingerprinting Diagram



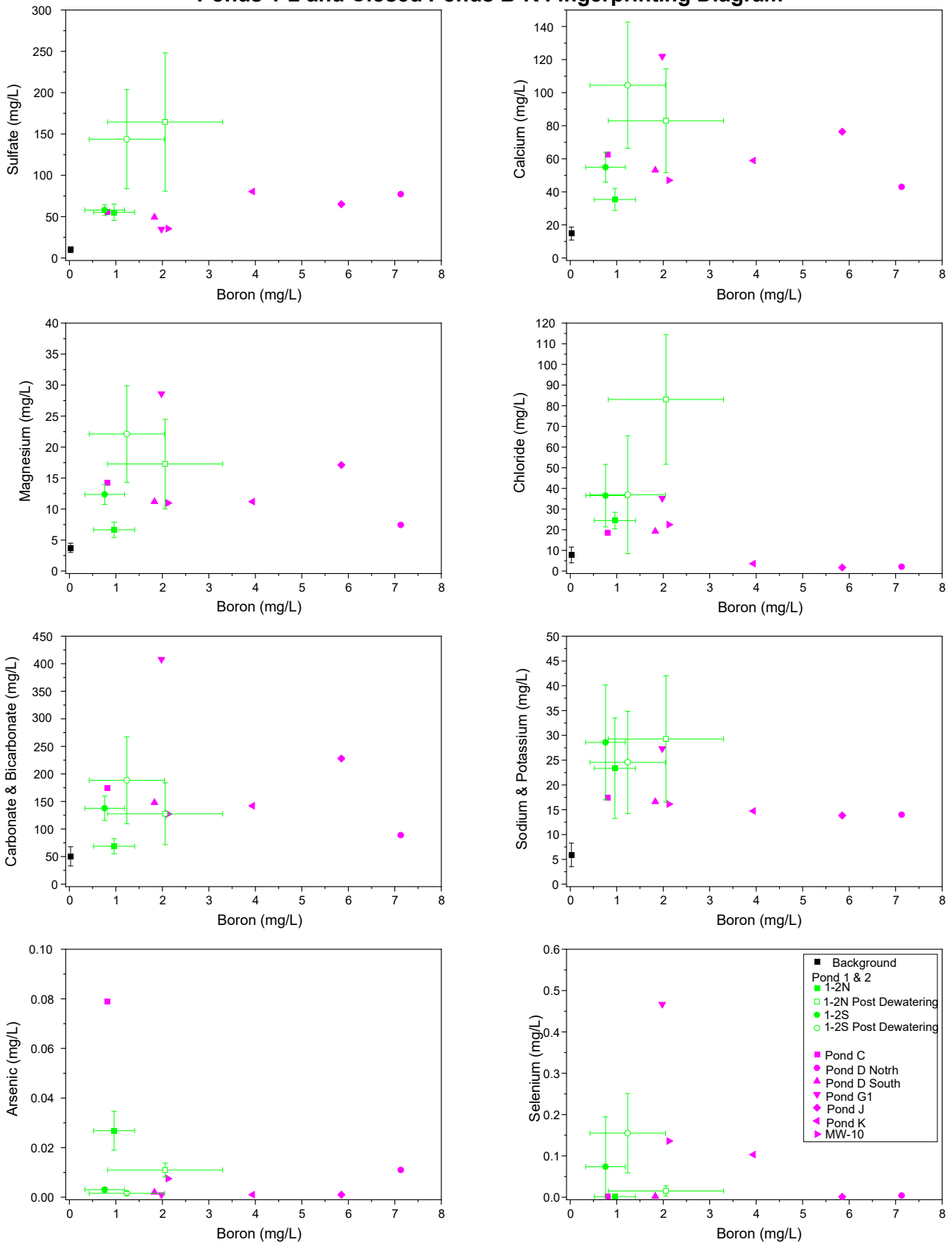
Given the location of JHC-MW-15002 and JHC-MW-15003 within the historic Pond A footprint and the aforementioned hydrogeologic changes that took place post-dewatering of Ponds 1-2, the post-dewatering major ion/boron ratios and metals ratios at JHC-MW-15002 and JHC-MW-15003 (located side gradient to the former Ponds 1-2 CCR unit) are representative of the historic Pond A fingerprint. The conservative tracer data for all three wells, most notably for sulfate and calcium, are consistent with one another, demonstrating that groundwater at JHC-MW-15005 is also influenced by the same source, historic Pond A.

Eh and pH were also evaluated to better understand the differences in the metals results, particularly for selenium at JHC-MW-15005. This is presented below in the phase change discussion.

The groundwater geochemistry for the Ponds 1-2 (pre- and post- 2018) (wells JHC-MW-15002, JHC-MW-15003 and JHC-MW-15005), former Pond C (PZ-21-01), former Pond D North (PZ-21-05), former Pond D South (PZ-21-02), former Pond J (PZ-21-06), former Pond K (PZ-21-03), and background (JHC-MW-15024, JHC-MW-15025, JHC-MW-15026, JHC-MW-15027, and JHC-MW-15028) were evaluated using fingerprinting analysis to characterize the various groundwater masses. These results are shown below in the Ponds 1-2 and Ponds B-K Fingerprinting Diagram.

As shown in the diagram below, the Ponds 1-2 post-dewatering fingerprint is distinctly different than the pre-dewatering fingerprint. The post-dewatering fingerprint plots in the same area of several of the Ponds B-K fingerprints. As discussed above, the post-dewatering Ponds 1-2 fingerprint is representative of the historic Pond A fingerprint. Conservative tracers such as calcium, magnesium, bicarbonate, potassium, and sodium match more closely than reactive ions such as selenium. This indicates that the historic Pond A fingerprint (represented by the Ponds 1-2 wells) is consistent with the other historic ponds.

Ponds 1-2 and Closed Ponds B-K Fingerprinting Diagram



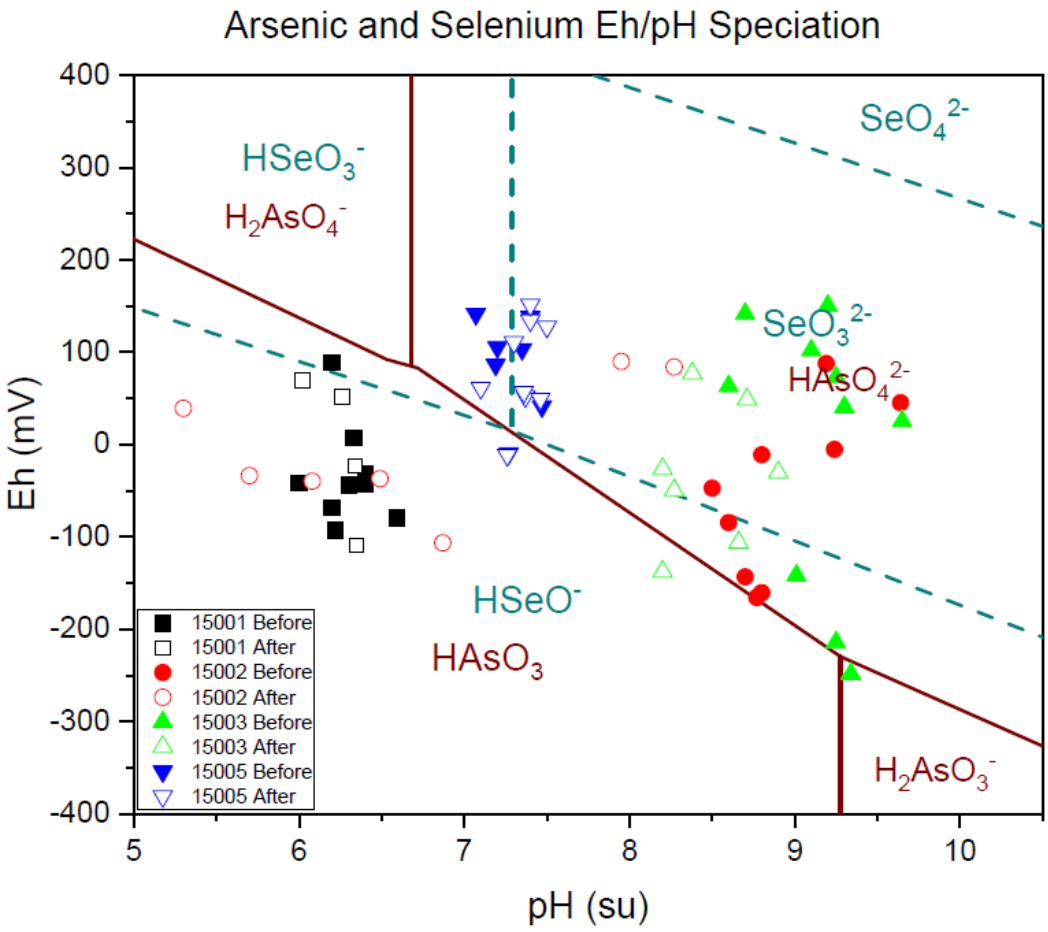
– **Phase changes** – Selenium and arsenic are susceptible to phase changes in geochemistry that mobilize or demobilize certain species and cause a change in groundwater concentration. These phase changes are principally between charged active surface sites on soil within the saturated zone and dissolved phase selenium and arsenic. Selenium is highly susceptible to pH and oxidation/reduction potential. Dissolved-phase selenium concentrations typically decrease in sub-oxic conditions via reductive precipitation, whereas arsenic is primarily controlled by pH.

  Selenium (Se) occurs in four redox states in the natural environment, which include:

  - Se(VI) – selenate: occurs under oxic conditions as an anion (SeO_4^{2-}). Selenate is generally soluble and is only weakly adsorbed by iron and aluminum oxides, hence it is relatively mobile in groundwater.
  - Se(IV) – selenite: occurs under mildly anoxic conditions also as an anion ($HSeO_3^-$ or SeO_3^{2-}). Selenite is generally soluble but is more strongly adsorbed on iron and aluminum oxides than selenate, hence it is less mobile in groundwater than selenate
  - Se(0) – elemental selenium: occurs under reducing conditions. The metal is insoluble and so immobile.
  - Se(-II) – selenide: occurs under very strongly reducing conditions and is generally insoluble.

  In order to further explore the cause of the increase in selenium at JHC-MW-15005, Eh/pH diagrams were developed to speciate the arsenic and selenium observed at Ponds 1-2 before and after dewatering, as shown below.

Ponds 1-2 Eh-Ph Diagram



JHC-MW-15001 was maintained as a control. The closed symbols are representative of the active loading condition (pre-June 2018) and the open symbols represent groundwater conditions after dewatering (post-June 2018). The results of the Eh/pH speciation show that there is a significant shift of selenium at JHC-MW-15002 and JHC-MW-15003 from selenite (SeO_3^{2-}) to elemental ($HSeO^-$) or potentially selenide (lower pH range outside the limits of the Eh/pH diagram). Selenate (SeO_4^{2-}) is not observed. JHC-MW-15002 is likely undergoing the most reductive precipitation followed by JHC-MW-15003, and JHC-MW-15005 remained in oxic/mobile conditions. This implies the source of the reducing conditions is upgradient (northeast) of JHC-MW-15002. No statistically significant Eh/pH change was observed in monitoring well JHC-MW-15001. The conditions at JHC-MW-15001 and JHC-MW-15005 are similar before and after dewatering, suggesting that the change in selenium concentration at JHC-MW-15005 is not driven by a change in geochemistry, rather the change is a result of influence from the alternate source.

- **Selenium characteristics** – As described above, selenium is highly mobile at neutral pH and oxic conditions in the environment. Many significant hydrogeological and geochemical changes took place at monitoring wells JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 as a result of deactivating and decommissioning Ponds 1-2. CCR was removed from Ponds 1-2, eliminating the potential for any new releases associated with Ponds 1-2 CCR. Groundwater flow directions

changed from radial to south-southeast, allowing historic Pond A and Pond C to influence groundwater quality along the east edge of Ponds 1-2. There were also significant pH changes at JHC-MW-15002 and pH and Eh changes at JHC-MW-15003. The influence from these upgradient sources explain the changes observed in groundwater quality post-dewatering and the increase in selenium at JHC-MW-15005.

While the same alternate sources are influencing groundwater at these three wells, selenium concentrations at JHC-MW-15005 are relatively higher than JHC-MW-15002 and JHC-MW-15003 post-2018. A significant increase in selenium at JHC-MW-15005 post-2018 is observed while the pH and redox conditions in groundwater did not change significantly pre- and post-dewatering. Given the hydrogeological changes, this indicates that as the groundwater flow shifts to the south, historic Pond A and Pond C begin to influence groundwater quality at JHC-MW-15005. The lack in significant selenium concentration change post-2018 at the other two wells (JHC-MW-15002 and JHC-MW-15003) located farther upgradient from JHC-MW-15005, side gradient from Ponds 1-2, and closer to the historic Pond A and Pond C source areas is explained by considering the fate and transport characteristics of selenium. As mentioned above, changes to pH and Eh occurred at these two wells post-2018, causing a shift to a less-mobile phase of selenium. As a result, there is a lack of significant selenium concentration increase at these locations as selenium precipitates out of groundwater due to the geochemical influences around those wells.

Based on the characteristics of selenium, coupled with the relationships of several other less reactive, more conservative constituents, groundwater at these three wells are clearly being influenced by a similar source unrelated to Ponds 1-2. The alternate source in this case is primarily attributed to historic Pond A and Pond C with added complexities of hydrogeologic and geochemical condition changes prompted by the decommissioning of Ponds 1-2.

Conclusions and Recommendations

The information provided in this report serves as the ASD for selenium at JHC-MW-15005, was prepared in accordance with §257.95(g) of the CCR Rule, and demonstrates that the selenium SSL from the first semiannual 2021 groundwater monitoring event is not due to a release of CCR into the groundwater from the former Ponds 1-2 CCR unit nor a result of failing to decontaminate the CCR unit. The documentation assembled for this ASD set forth in the *EPA Solid Waste Disposal Facility Criteria Technical Manual* (USEPA November 1993, Revised April 1998) is summarized as follows:

- *An alternate source exists.* Ponds B-K are located immediately upgradient from JHC-MW-15005, they are unlined and contain historic CCR fill material.
- Hydraulic connection exists between the alternative source and the well(s) with the significant increase. Surface water run-off at Ponds B-K has the potential to percolate downward through the subsurface into groundwater. There is also the potential that some areas of Ponds B-K contain ash in direct hydraulic communication with groundwater. Following the change in groundwater flow direction post-dewatering, several of the Ponds 1-2 monitoring wells were no longer positioned downgradient of Ponds 1-2, including JHC-MW-15002 and JHC-MW-15003. This change increased the potential for Ponds B-K to influence groundwater quality at the Ponds 1-2 wells. Groundwater passing beneath Ponds B-K now flows across the eastern edge of Ponds 1-2 and groundwater travel times indicate there has been sufficient time for Ponds B-K to influence JHC-MW-15005.
- *Constituent(s) (or precursor constituent(s)) are present at the alternative source or along the flow path from the alternative source prior to possible release from the monitored CCR unit.*

Ponds B-K were in existence prior to construction of Ponds 1-2 and both were used to manage CCR material. However, they contain different ratios of CCR constituents and major ions as shown in the geochemical fingerprinting analysis and CCR was removed from Ponds 1-2 prior to the statistically significant increase in selenium was observed at JHC-MW-15005.

Selenium and arsenic are susceptible to phase changes in geochemistry that mobilize or demobilize certain species and cause a change in groundwater concentration. These phase changes are principally between charged active surface sites on soil within the saturated zone and dissolved phase selenium and arsenic. Selenium is highly susceptible to pH and oxidation/reduction potential changes. Dissolved-phase selenium concentrations typically decrease in sub-oxic conditions via reductive precipitation, whereas arsenic is primarily controlled by pH. The results of the Eh/pH speciation show that JHC-MW-15002 is likely undergoing the most reductive precipitation followed by JHC-MW-15003, and JHC-MW-15005 remained in oxic/mobile conditions. This implies the source of the reducing conditions is upgradient (northeast) of JHC-MW-15002. No statistically significant Eh/pH change was observed in monitoring well JHC-MW-15001. The conditions at JHC-MW-15001 and JHC-MW-15005 are similar before and after dewatering, suggesting that the change in selenium concentration at JHC-MW-15005 is not driven by a change in geochemistry, rather the change is a result of influence from the alternate source.

– *The relative concentration and distribution of constituents in the zone of contamination are more strongly linked to the alternative source than to the monitored CCR unit when the fate and transport characteristics of the constituents are considered.* A significant increase in selenium at JHC-MW-15005 post-2018 is observed while the pH and redox conditions in groundwater did not change significantly pre- and post-dewatering. Given the hydrogeological changes, this indicates that as the groundwater flow shifts to the south, historic Pond A and Pond C begin to influence groundwater quality at JHC-MW-15005. The lack in significant selenium concentration change post-2018 at the other two wells (JHC-MW-15002 and JHC-MW-15003) located farther upgradient from JHC-MW-15005, side gradient from Ponds 1-2, and closer to the historic Pond A and Pond C source areas is explained by considering the fate and transport characteristics of selenium. Changes to pH and Eh occurred at these two wells post-2018, causing a shift to a less-mobile phase of selenium. As a result, there is a lack of significant selenium concentration increase at these locations as selenium precipitates out of groundwater due to the geochemical influences around those wells.

  Based on the characteristics of selenium, coupled with the relationships of several other less reactive, more conservative constituents, groundwater at all three of these wells are clearly being influenced by a similar source unrelated to Ponds 1-2. The alternate source in this case is primarily attributed to Ponds B-K with added complexities of hydrogeologic and geochemical condition changes prompted by the decommissioning of Ponds 1-2.

– *The concentration observed in groundwater could not have resulted from the CCR unit given the waste constituents and concentrations in the CCR unit leachate and wastes, and site hydrogeologic conditions.* Multiple lines of evidence confirmed that all CCR material was removed from Ponds 1-2 and actions were taken to decontaminate the CCR unit. The fact that all the CCR has been removed from Ponds 1-2 demonstrates that the elevated selenium concentration observed in groundwater could not have resulted from a new release from the Ponds 1-2 CCR unit given that there is no longer any CCR material present in Ponds 1-2 to contribute to groundwater concentrations.

Further, the conservative tracers observed in the Ponds 1-2 wells post-dewatering are consistent with the geochemical fingerprints developed for Ponds B-K. The post-dewatering fingerprint from Ponds 1-2 plots in the same area of several of the Ponds B-K fingerprints.

– *The data supporting conclusions regarding the alternative source are historically consistent with the hydrogeologic conditions and findings of the monitoring program.* Monitoring well JHC-MW-15001, located to the west of Ponds 1-2 and farthest from the potential alternate sources, showed little to no change before and after dewatering. The concentration of the conservative tracers generally increase 2- to 3-fold at JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 post-dewatering. This indicates that a significant change is similarly affecting the three wells east of Ponds 1-2, which is also indicative of influence from another source to monitoring wells JHC-MW-15002, JHC-MW-15003, and JHC-MW-15005 after dewatering and CCR removal at Ponds 1-2. Given the differences between the ratios at the three eastern wells and JHC-MW-15001, this potential alternate source is not influencing JHC-MW-15001. This aligns with the hydrogeologic conditions and groundwater monitoring data collected.

Hydrogeological and geochemical changes post-CCR removal from Ponds 1-2 have resulted in observations of new increases in groundwater constituent concentrations for several Appendix III and Appendix IV parameters in the Ponds 1-2 monitoring network, including selenium at JHC-MW-15005, that are unrelated to Ponds 1-2 and are occurring as groundwater responds and re-equilibrates to the new geochemical conditions coupled with the constituent concentrations from upgradient historic CCR management sources.

Therefore, based on the information provided in this ASD, Consumers Energy plans to continue the assessment monitoring program per §257.95 at Ponds 1-2 and is also revisiting the groundwater monitoring system established per §257.91 to continue evaluating corrective measures for arsenic per §257.96 and §257.97. Concurrently, Consumers Energy is in the process of addressing Ponds B-K through a remedial action plan under the state program.

A copy of this report will be placed in the facility operating record and included in the forthcoming annual groundwater monitoring report per §257.95(g).

Sincerely,

TRC

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

Clint Miller, Ph D.
Project Geochemist

cc: Harold Register, Jr., Consumers Energy

Attachments

Tables

Table 1

Summary of Groundwater Protection Standard Exceedances – April 2021

JH Campbell Ponds 1-2N/1-2S

West Olive, Michigan

Constituent	Units	GWPS	JHC-MW-15002[(1)] (Side gradient)		JHC-MW-15003[(1)] (Side gradient)		JHC-MW-15005 (Downgradient)		JHC-MW-18005 (Downgradient)	
			LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL
Arsenic	ug/L	10	28	110	8.2	14	--	--	7.2	9.6
Cobalt	ug/L	15	--	--	6.0	47	--	--	--	--
Lithium	ug/L	40	12	160	--	--	27	57	--	--
Molybdenum	ug/L	100	--	--	19	110	16	470	--	--
Selenium	ug/L	50	--	--	--	--	58	310	9.2	102
Thallium	ug/L	2	--	--	--	--	1.2	5.5	--	--

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.

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

Table 2
Monitoring Well and Piezometer Survey and Construction Data
JH Campbell
West Olive, Michigan

Well Location	Northing	Easting	Ground Surface Elevation (ft NAVD 88)	TOC Elevation (ft NAVD 88)	Date Installed	Geologic Unit of Screen Interval	Well Construction	Screen Interval Depth (ft BGS)	Screen Interval Elevation (ft)	Borehole Terminus Depth (ft BGS)	Borehole Terminus Elevation (ft)
Background											
JHC-MW-15023	521927.21	12638205.16	617.01	619.98	10/1/2015	Sand	2" PVC, 10 Slot	14.0 to 24.0	603.0 to 593.0	25.0	592.0
JHC-MW-15024	522366.01	12637322.68	613.79	616.62	10/1/2015	Sand	2" PVC, 10 Slot	7.0 to 17.0	606.8 to 596.8	20.0	593.8
JHC-MW-15025	522702.98	12636668.15	614.14	617.17	10/1/2015	Sand	2" PVC, 10 Slot	7.0 to 17.0	607.1 to 597.1	20.0	594.1
JHC-MW-15026	522495.09	12635971.82	615.09	618.04	10/2/2015	Sand	2" PVC, 10 Slot	8.0 to 18.0	607.1 to 597.1	20.0	595.1
JHC-MW-15027	522394.86	12635097.51	614.77	617.30	10/2/2015	Sand	2" PVC, 10 Slot	10.0 to 20.0	604.8 to 594.8	20.0	594.8
JHC-MW-15028	521646.20	12634105.34	611.02	613.80	10/2/2015	Sand	2" PVC, 10 Slot	8.0 to 18.0	603.0 to 593.0	20.0	591.0
JHC-MW-15029	520503.52	12633774.30	608.08	610.95	10/5/2015	Sand	2" PVC, 10 Slot	8.0 to 18.0	600.1 to 590.1	20.0	588.1
JHC-MW-15030	519760.83	12633044.37	604.05	607.17	10/5/2015	Sand	2" PVC, 10 Slot	4.0 to 14.0	600.1 to 590.1	20.0	584.1
Pond 1N, 1S, 2N, 2S											
JHC-MW-15001	518586.88	12633422.01	607.02	609.53	9/16/2015	Sand	2" PVC, 10 Slot	3.5 to 8.5	603.5 to 598.5	15.0	592.0
JHC-MW-15002(1)	518378.92	12633974.82	618.18	621.27	9/16/2015	Sand	2" PVC, 10 Slot	20.2 to 30.2	598.0 to 588.0	30.2	588.0
JHC-MW-15003(1)	518069.86	12633990.37	623.16	627.20	9/17/2015	Sand	2" PVC, 10 Slot	22.8 to 32.8	600.3 to 590.3	32.8	590.3
JHC-MW-15004	*517864.56*	*12633547.12*	*624.92*	*628.44*	*9/17/2015*	*Sand*	*2" PVC, 10 Slot*	*24.0 to 34.0*	*600.9 to 590.9*	*40.0*	*584.9*
JHC-MW-15005(1)	517781.42	12633905.01	606.22	609.99	9/18/2015	Sand	2" PVC, 10 Slot	8.8 to 18.8	597.4 to 587.4	21.8	584.4
JHC-MW-18004	518008.46	12633506.26	602.92	605.72	12/4/2018	Sand	2" PVC, 10 Slot	6.0 to 16.0	596.9 to 586.9	16.0	586.9
JHC-MW-18005	517786.01	12633652.86	600.30	603.16	12/5/2018	Sand	2" PVC, 10 Slot	5.0 to 15.0	595.3 to 585.3	15.0	585.3
Cells B-K Piezometers											
PZ-1203	519899.11	12637640.74	628.97	631.41	6/7/2012	Sand/Silt	2" PVC, 10 Slot	23.0 to 28.0	606.0 to 601.0	30.0	599.0
PZ-1204	519795.71	12636150.86	628.16	631.08	6/7/2012	Silty Sand	2" PVC, 10 Slot	30.0 to 35.0	598.2 to 593.2	38.0	590.2
PZ-1205	519055.39	12637550.96	626.71	629.08	6/7/2012	Silty Sand	2" PVC, 10 Slot	27.0 to 32.0	599.7 to 594.7	34.0	592.7
PZ-1206	517989.93	12636306.77	623.36	626.26	6/7/2012	Silt	2" PVC, 10 Slot	19.0 to 24.0	604.4 to 599.4	26.0	597.4
PZ-1207	518881.99	12636545.82	628.45	631.47	6/8/2012	Silt	2" PVC, 10 Slot	24.5 to 29.5	604.0 to 599.0	32.0	596.5
PZ-1208	518744.27	12635662.83	629.32	633.05	6/11/2012	Sand	2" PVC, 10 Slot	28.5 to 33.5	600.8 to 595.8	34.0	595.3
PZ-1210	517887.21	12634948.30	626.43	629.07	6/11/2012	Sandy Silt	2" PVC, 10 Slot	17.0 to 22.0	609.4 to 604.4	24.0	602.4
PZ-1212	518280.88	12634521.36	626.92	628.74	6/11/2012	Sandy Silt	2" PVC, 10 Slot	18.0 to 23.0	608.9 to 603.9	25.0	601.9
PZ-21-01	518976.4	12634661.8	629.9	632.7	3/15/2021	Sand	2" PVC, 10 Slot	30.0 to 35.0	599.9 to 594.9	39.0	590.9
PZ-21-02	518335.3	12635691.8	629.2	631.8	3/16/2021	Sand	2" PVC, 10 Slot	36.0 to 41.0	593.2 to 588.2	48.5	580.7
PZ-21-03	518494.9	12636907.0	625.9	628.5	3/16/2021	Sand	2" PVC, 10 Slot	36.0 to 41.0	589.9 to 584.9	41.0	584.9
PZ-21-04	519757.0	12636972.7	628.9	631.6	3/17/2021	Sand	2" PVC, 10 Slot	37.0 to 42.0	591.9 to 586.9	42.0	586.9
PZ-21-05	519701.9	12635379.6	629.3	631.9	3/18/2021	Sand	2" PVC, 10 Slot	35.0 to 40.0	594.3 to 589.3	40.0	589.3
PZ-21-06	519095.3	12636607.1	628.6	631.2	3/17/2021	Sand	2" PVC, 10 Slot	38.0 to 43.0	590.6 to 585.6	48.0	580.6

Notes:
Survey conducted November 2016, October 2017, April 2018, December 2018, August 2019, and April 2021 by Nederveld Inc., Grand Rapids, Michigan.
Staff gauges were surveyed by Nederveld on July 16, 2020.
Recovery Wells RW1 through RW7 surveyed at top of steel well cover.
Elevation in feet relative to National American Vertical Datum of 1988 (NAVD 88)
TOC: Top of well casing.
ft BTOC: Feet below top of well casing.
ft BGS: Feet below ground surface.
(1) - Ground surface has been altered post well installation during pond decommissioning.
(2) - TOC elevation has been altered post well installation during pond decommissioning.
(3) - Staff gauge reference elevations corrected to the zero mark for purpose of calculating surface water elevation.
* - MW-B4 was originally installed on 03/26/2007. It was decommissioned and replaced on 05/23/2011 utilizing the same name.
All *gray and italized text* are indicative of wells that have been decommissioned and are no longer part of the active well network.

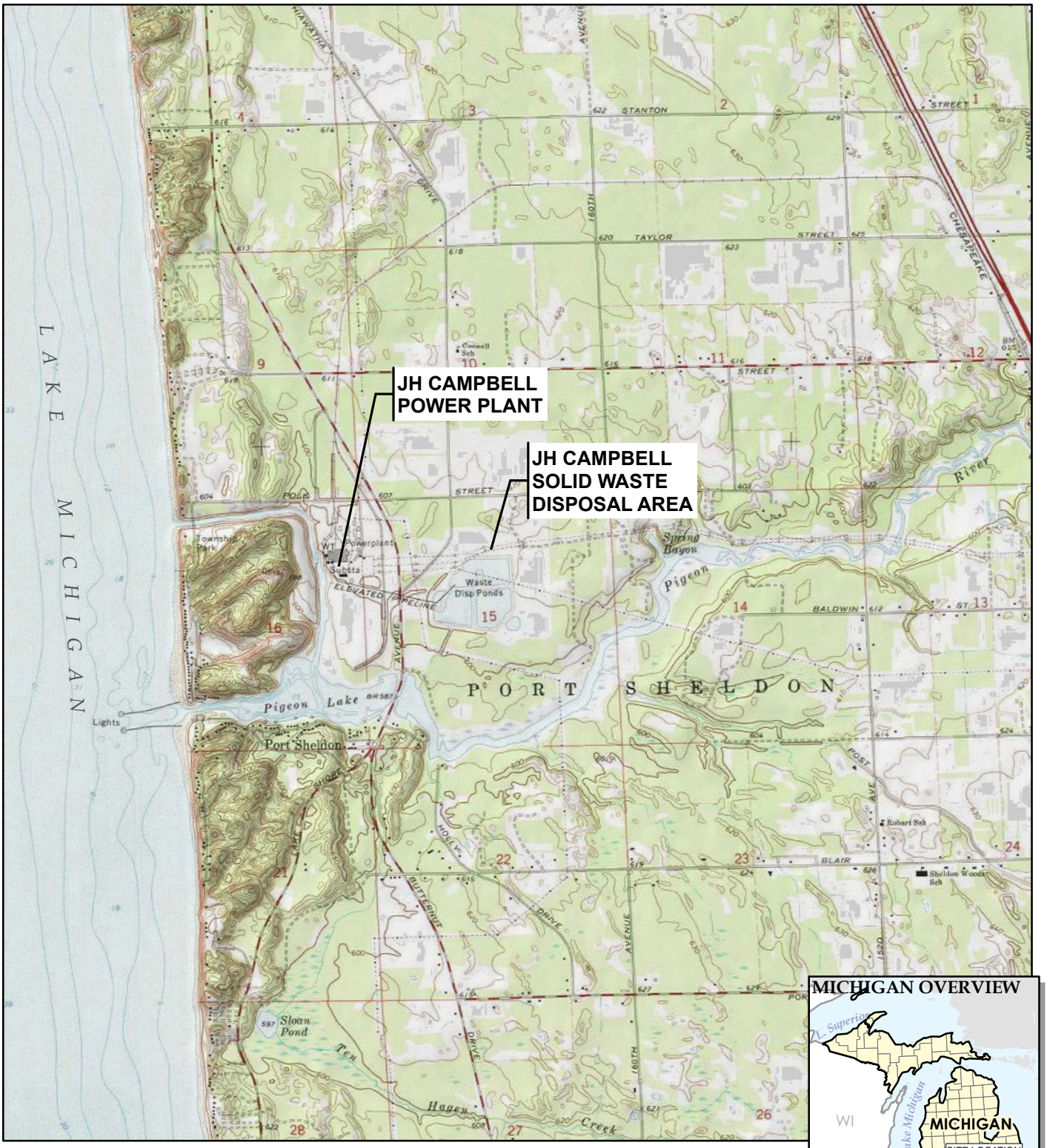
Table 3
Ponds B-K Static Water Elevation Data
JH Campbell
West Olive, Michigan

Closed Ponds B-K Piezometers	Pond Name	TOC (ft)	Top of Screen (ft)	Bottom of Screen (ft)	Bottom Elevation of Ash (ft)	10/3/2018		7/14/2020		10/19/2020		2/22/2021		4/12/2021		8/16/2021	
						Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
PZ-1203	Pond G1	631.41	606.0	601.0	600.2	37.72	593.69	36.04	595.37	37.82	593.59	Dry		Dry		Dry	
PZ-1204	Pond G2	631.08	598.2	593.2	593.8	--		29.40	601.68	Dry		Dry		Dry		Dry	
PZ-1205	Pond H	629.08	599.7	594.7	593.4	35.46	593.62	33.40	595.68	Dry		Dry		35.91	593.17	Dry	
PZ-1207	Pond J	631.47	604.0	599.0	598.9	--		Dry		Dry		Dry		Dry		Dry	
PZ-1208	Pond D Middle South	633.05	600.8	595.8	607.6	34.53	598.52	33.34	599.71	35.90	597.15	37.10	595.95	37.23	595.82	Dry	
PZ-1210	Pond B	629.07	609.4	604.4	602.6	--		--		--		--		--		--	
PZ-1212	Pond B	628.74	608.9	603.9	604.2	--		Dry		Dry		24.65	604.09	Dry		Dry	
PZ-1215	Pond H	631.25	585.9	580.9	630.7	42.73	588.52	--		--		--		--		--	
PZ-21-01	Pond C	632.71	599.9	594.9	603.0	--		--		--		--		33.83	598.88	33.17	599.54
PZ-21-02	Pond D South	631.80	593.2	588.2	605.0	--		--		--		--		37.15	594.65	36.91	594.89
PZ-21-03	Pond K	628.50	589.9	584.9	601.0	--		--		--		--		37.74	590.76	37.77	590.73
PZ-21-04	Pond G1	631.62	591.9	586.9	596.0	--		--		--		--		38.34	593.28	38.27	593.35
PZ-21-05	Pond D North	631.85	594.3	589.3	601.0	--		--		--		--		33.28	598.57	32.89	598.96
PZ-21-06	Pond J	631.23	590.6	585.6	597.5	--		--		--		--		38.37	592.86	38.20	593.03

Notes

Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).
TOC = Top of Casing (Survey conducted by Nederveld Inc. April 2021)
ft = Feet; ft BTOC = Feet below top of well casing.
-- Not Measured
Denotes static water elevation > or within 1 foot of bottom elevation of ash.

Figures



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

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

0 3,000 6,000
FEET

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

PROJECT:

CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:

SITE LOCATION MAP

DRAWN BY:	S. MAJOR
CHECKED BY:	B. YELEN
APPROVED BY:	S. HOLMSTROM
DATE:	JANUARY 2021
PROJ. NO.:	367390
FILE:	367390-001-007.mxd

FIGURE 1

S:\1-PROJECTS\Consumers_Energy_Company\Michigan\CCR_GW\2017_269767\367390-001-007.mxd -- Saved By: SMAJOR on 1/13/2021, 09:37:27 AM

TRC - GIS

Plot Date: 10/26/2021, 16:54:28 PM by AFOJTIK -- LAYOUT: ANSI B (11"x17")
Path: E:\Projects\ConsumersEnergy\CCR_GW\2017_269767\418422-001-000_20211025.mxd
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

WEST LEACHATE RETENTION POND
EAST LEACHATE RETENTION POND
CELL 1
CELL 2
CELL 3
CELL 4
CELL 5
CELL 6
DRY ASH LANDFILL
APPROXIMATE EXTENT OF PONDS B-K AREA
APPROXIMATE EXTENT OF HISTORIC POND A AREA
FORMER BOTTOM ASH POND 3N
FORMER BOTTOM ASH POND 3S
FORMER BOTTOM ASH POND 1-2N
FORMER BOTTOM ASH POND 1-2S
POND F (CLOSED)
POND C (CLOSED)
POND B (CLOSED)
POND D NORTH (CLOSED)
POND D MID (CLOSED)
POND D MID-SOUTH (CLOSED)
POND D SOUTH (CLOSED)
POND G1 (CLOSED)
POND G2 (CLOSED)
POND H (CLOSED)
POND J (CLOSED)
POND K (CLOSED)
FORMER POND A
RECIRCULATION POND
MW-3
JHC MW-15025
JHC MW-15026
JHC MW-15027
JHC MW-15024
MW-4
MW-5
JHC MW-15023
JHC MW-15028
MW-1
JHC MW-15034
JHC MW-15033
JHC MW-15032
JHC MW-15017
JHC MW-15018
JHC MW-15019 (NOTE 8)
JHC MW-15020 (NOTE 4)
JHC MW-15021 (NOTE 4)
MW-A1
MW-A2
MW-A3 (NOTE 8)
JHC MW-15029
JHC MW-15022
JHC MW-15035
JHC MW-15031
JHC MW-15036
JHC MW-15037
MW-B2D
MW-B1
MW-B2
MW-B3
MW-B4
MW-B5
MW-B6
MW-B7
MW-08
MW-08C
MW-08B
PZ-1203
PZ-1204
PZ-21-04
PZ-21-05
JHC MW-15016
JHC MW-15015
JHC MW-15030
JHC MW-18001
JHC MW-15014 (NOTE 3)
JHC MW-18002
JHC MW-15012 (NOTE 5)
JHC MW-15013
JHC MW-18003
PZ-1215
SG-21-01
PZ-21-06
PZ-1205
PZ-1207
MW-15
MW-11A
SG-21-02
PZ-37
JHC MW-15001
JHC MW-15002
PZ-1208
MW-09C
MW-09B
MW-09AR
MW-09D
PZ-21-03
TW-19-01A
TW-19-01B
PZ-21-02
PZ-1212
TW-19-02A
TW-19-02B
JHC MW-15003
TW-19-03A
TW-19-03B
JHC MW-18004
JHC MW-15004 (NOTE 4)
JHC MW-15005
JHC MW-18005
PZ-1210
JHC MW-15010 (NOTE 9)
PZ-1206
JHC MW-15009R
MW-10A
MW-10AR
JHC MW-15009 (NOTE 9)
MW-10B
MW-12-96
TW-19-04A
JHC MW-15007R
JHC MW-15008R
TW-19-04B
JHC MW-15011R
JHC MW-15011 (NOTE 9)
JHC MW-15006
JHC MW-15007 (NOTE 9)
JHC MW-15008 (NOTE 7)
MW-13
TW-19-05
PZ-23
PZ-23D
PZ-23S
TW-19-06A
TW-19-06B
MW-14
MW-14S
SG-21-03
MW-14D
PZ-24
PZ-24D
PZ-24S
PZ-40S
PZ-40

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADIENT LANDFILL MONITORING WELL
- PIEZOMETER 2021
- DOWNGRADIENT POND A MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- DECOMMISSIONED MONITORING WELL
- NEW DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2018)
- NEW DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL (2018)
- DOWNGRADIENT MONITORING WELLS
- STAFF GAUGE
- TEMPORARY WELL/ PIEZOMETER
- HMP WELL

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2021.
2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH 8/14/2019.
3. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
4. MONITORING WELL DECOMMISSIONED JUNE 14, 2018.
5. MONITORING WELL DECOMMISSIONED OCTOBER 10, 2018.
6. JHC-MW-1800X MONITORING WELLS INSTALLED IN DECEMBER 2018.
7. MONITORING WELL DECOMMISSIONED JUNE 24, 2019.
8. MONITORING WELLS DECOMMISSIONED MAY 25, 2021.
9. MONITORING WELLS DECOMMISSIONED JULY 20-21, 2021.

0 700 1,400 Feet

1 " = 700 '
1:8,400

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

TITLE:
SITE PLAN

DRAWN BY:	A. FOJTIK	PROJ NO.:	418422-0003
CHECKED BY:	B. YELEN		
APPROVED BY:	S. HOLMSTROM		**FIGURE 2**
DATE:	OCTOBER 2021		

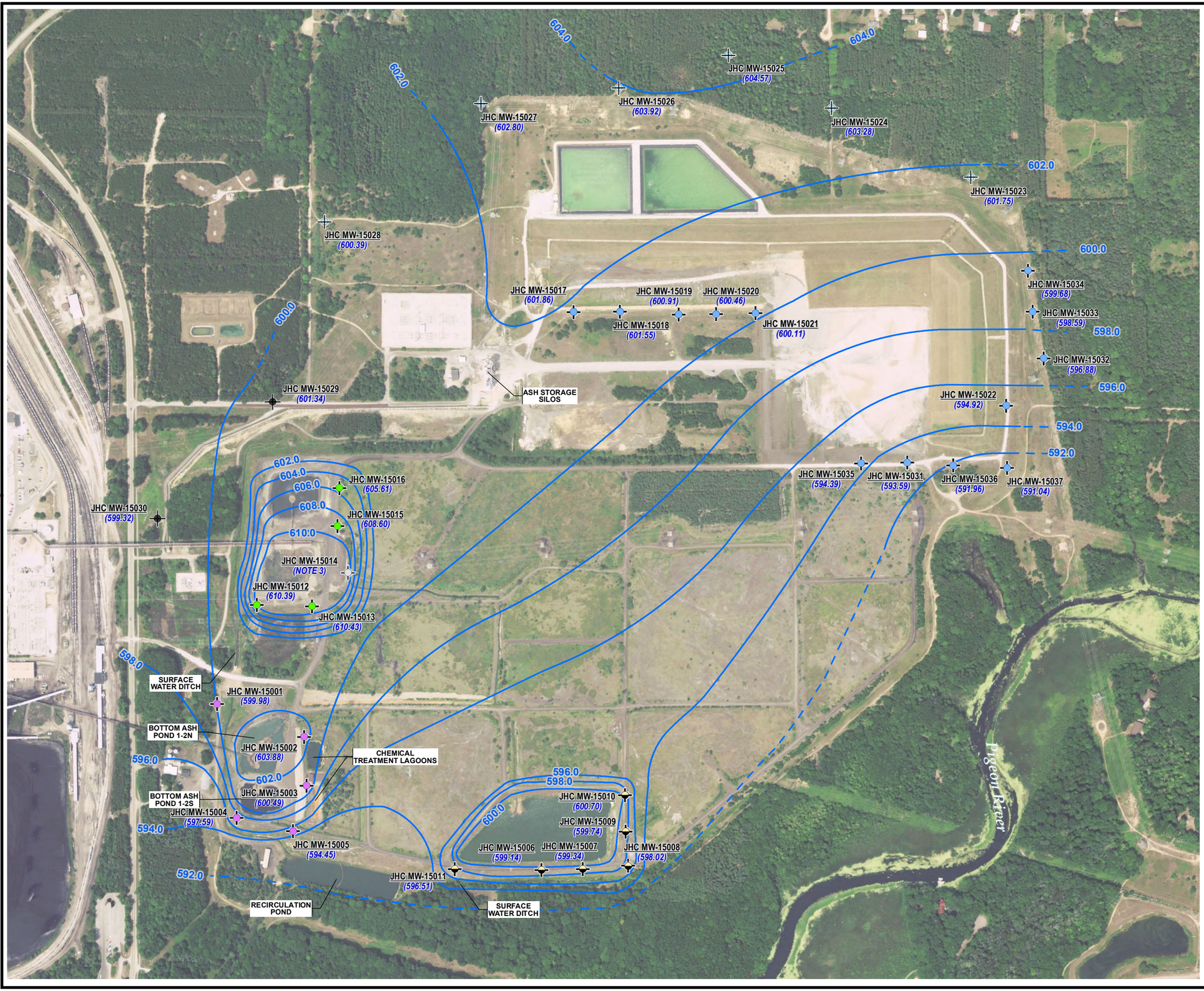
TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trccompanies.com

FILE NO.: 418422-001-000_20211025.mxd

TRC - GIS

Plot Date: 1/12/2018, 11:29:17 AM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\Consumers Energy\CCR_GW\2017_269767\269767-005-012.mxd

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



LEGEND

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

NOTES

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

N

0 600 1,200
Feet

1 " = 600 '
1:7,200

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

TITLE:
GROUNDWATER CONTOUR MAP SEPTEMBER 25, 2017

DRAWN BY:	S. MAJOR	PROJ NO.:	269767-001
CHECKED BY:	C. SCIESZKA		
APPROVED BY:	S. HOLMSTROM		**FIGURE 3**
DATE:	JANUARY 2018		

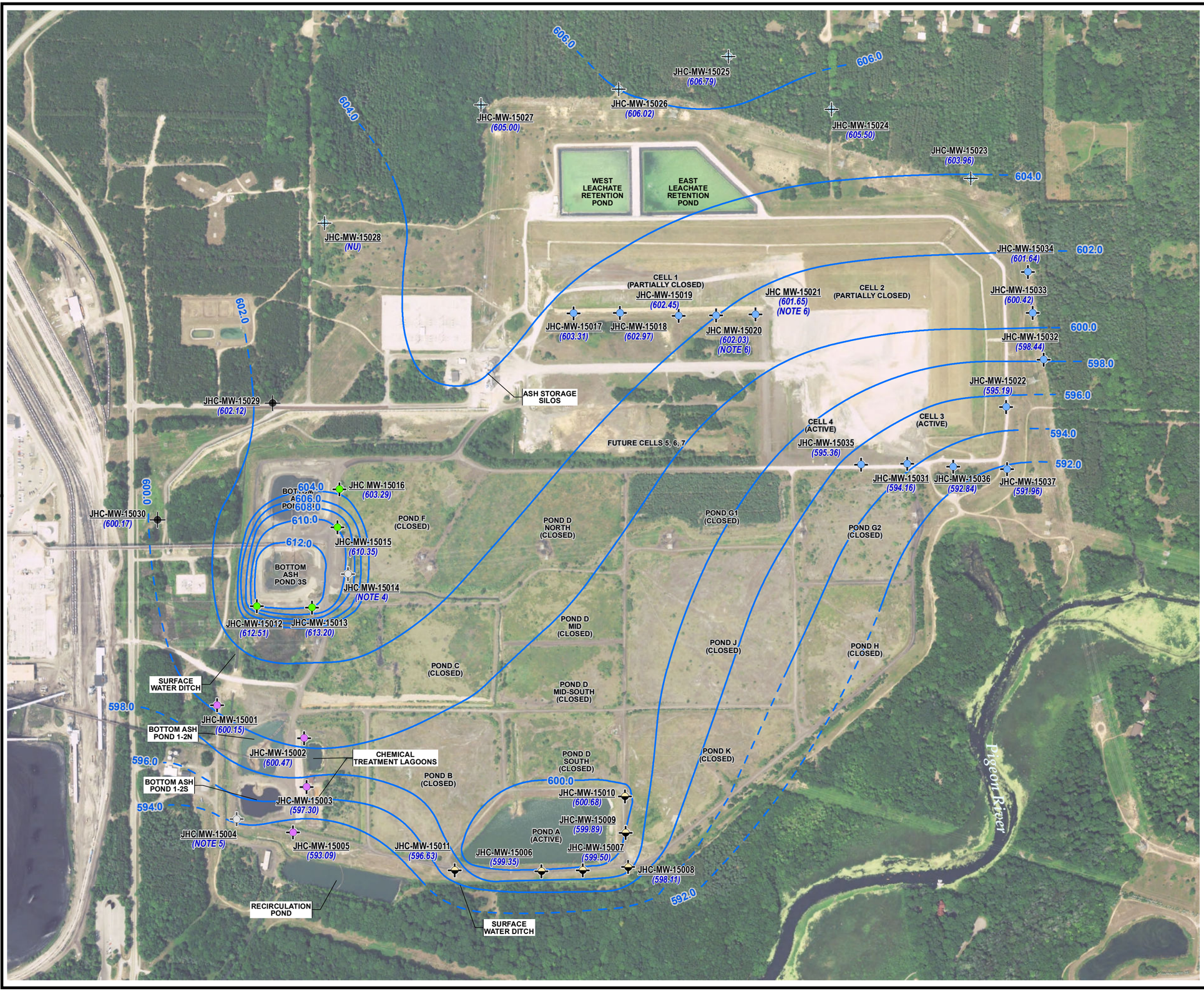
TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 269767-005-012.mxd

TRC - GIS

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

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



LEGEND

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

NOTES

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

N

0 600 1,200 Feet

1 " = 600 '
1:7,200

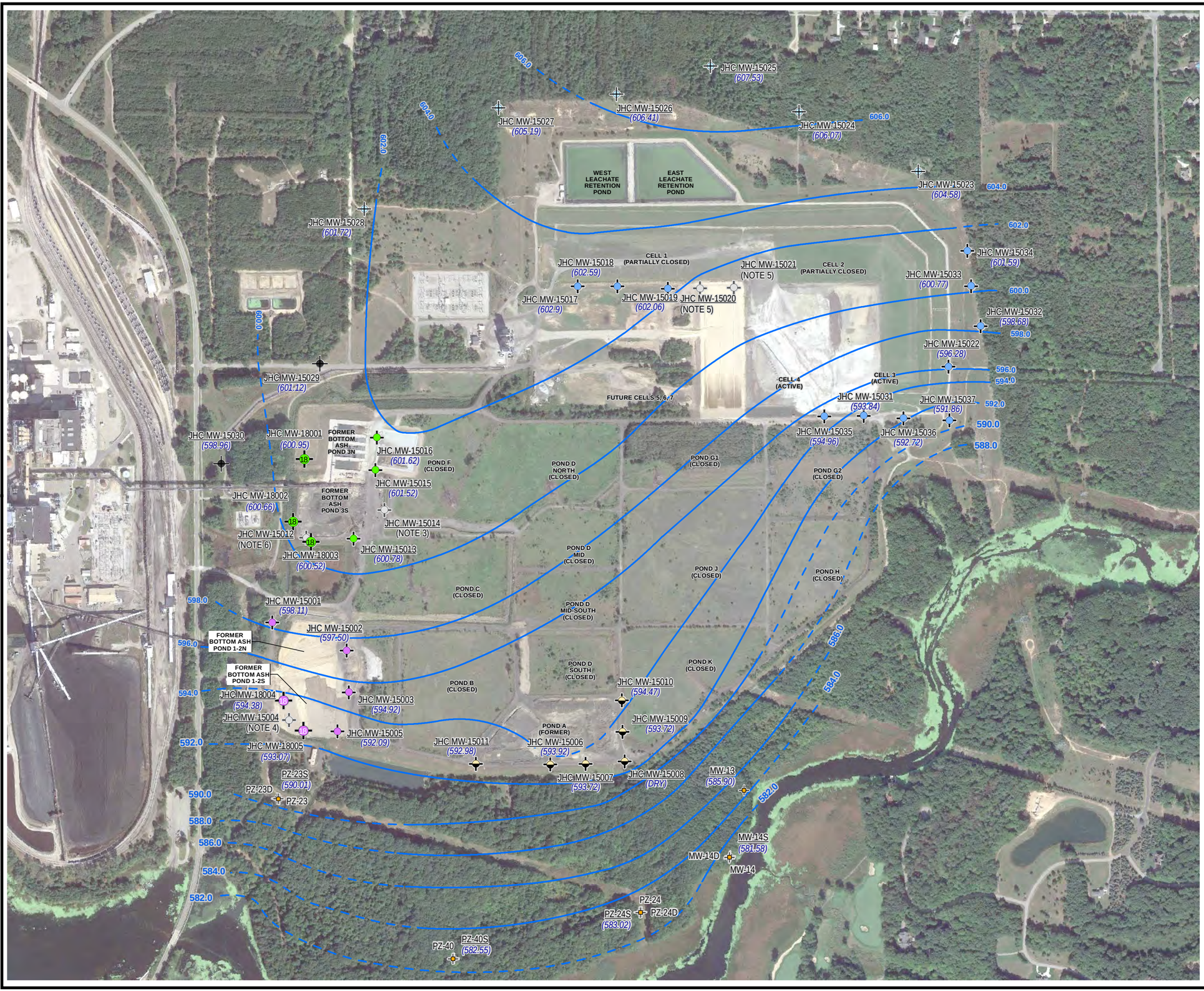
PROJECT:
CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:
GROUNDWATER CONTOUR MAP JUNE 18, 2018

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

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

FILE NO.: 290806-001-010.mxd



LEGEND

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

NOTES

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

N

0 700 1,400 Feet

1 " = 700 '

1:8,400

PROJECT:

CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:

GROUNDWATER CONTOUR MAP APRIL 2019

DRAWN BY:	S. MAJOR	PROJ NO.:	322174-001
CHECKED BY:	B. YELEN		
APPROVED BY:	S. HOLMSTROM		**FIGURE 5**
DATE:	JANUARY 2020		

TRC

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

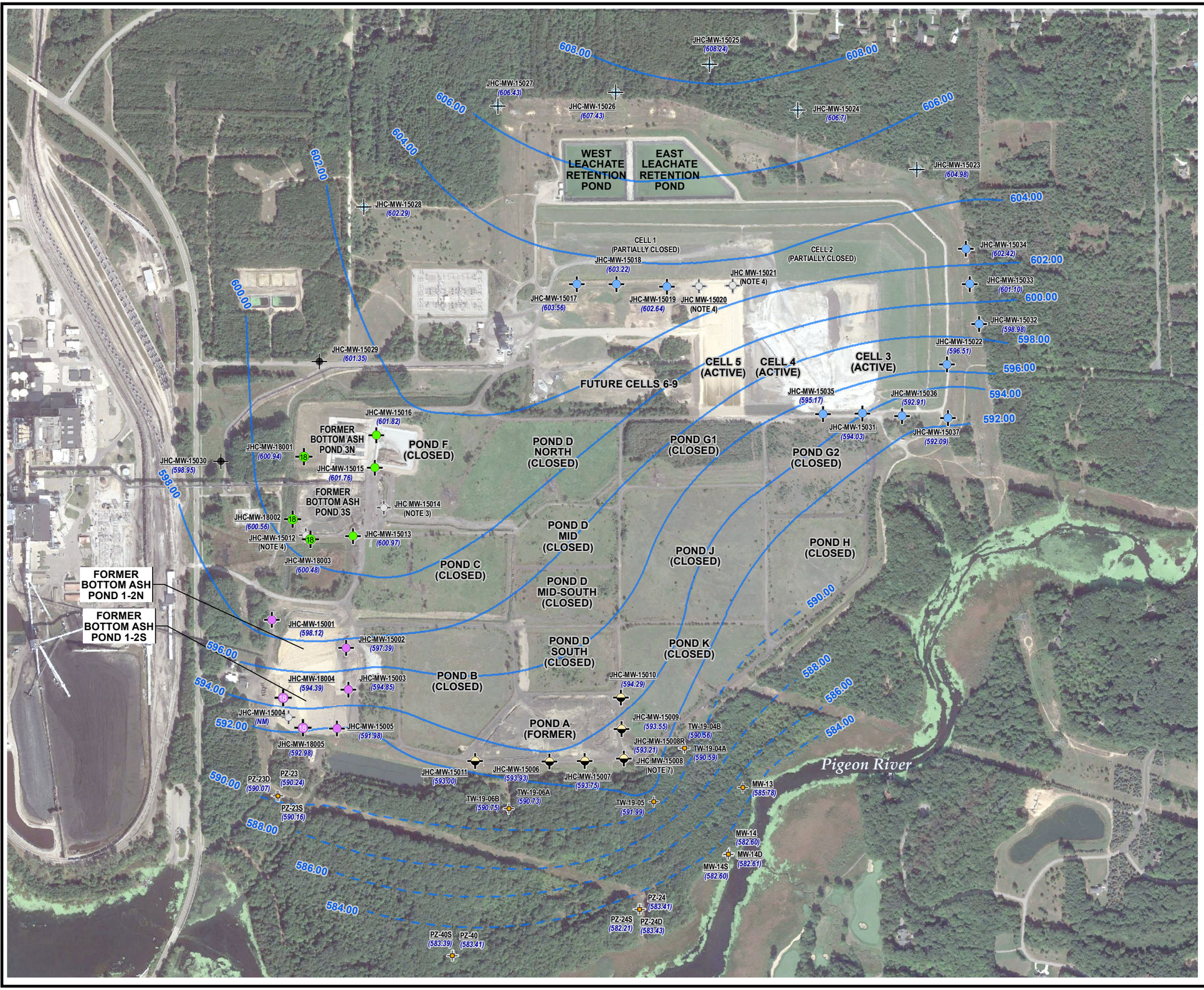
FILE NO.: 322174-001-024.mxd

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

TRC - GIS

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

Plot Date: 7/26/2020, 19:03:02 PM by AHORRIE -- LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_26976\367390-001-003.mxd



LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADIENT LANDFILL MONITORING WELL
- DOWNGRADIENT POND A MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- DECOMMISSIONED MONITORING WELL
- NEW DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2018)
- NEW DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL (2018)
- NATURE AND EXTENT WELL
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- (600.97) GROUNDWATER ELEVATION (FEET) SHALLOW WELLS
- (NM) NOT MEASURED

NOTES

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

N

0 700 1,400 Feet

1 " = 700 '
1:8,400

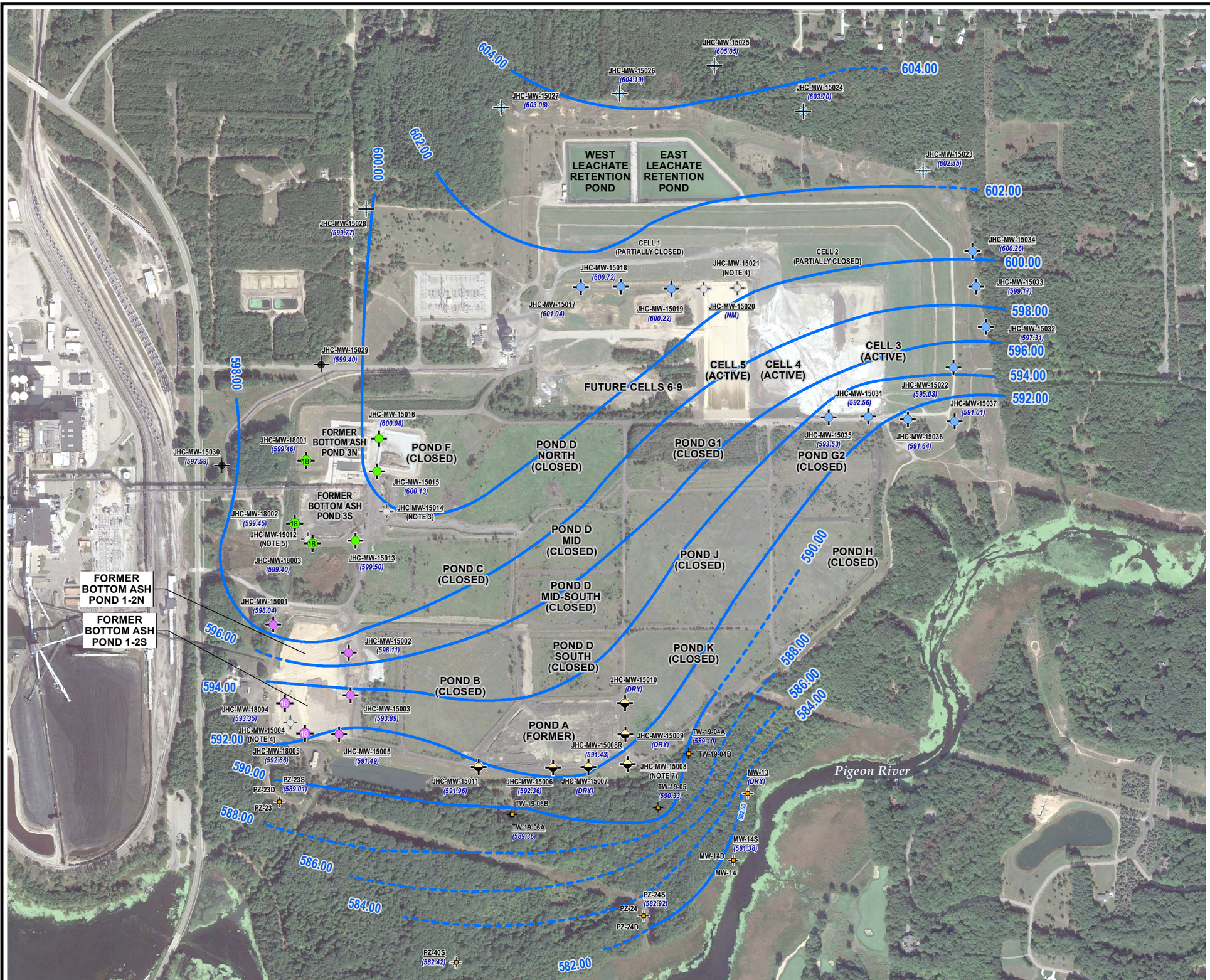
PROJECT:
CONSUMERS ENERGY COMPANY
JH CAMPBELL POWER PLANT
WEST OLIVE, MICHIGAN

TITLE:
GROUNDWATER CONTOUR MAP
APRIL 2020

DRAWN BY:	S. MAJOR	PROJ NO.:	367390.0001.0000
CHECKED BY:	K. LOWERY		
APPROVED BY:	S. HOLMSTROM		**FIGURE 6**
DATE:	JULY 2020		

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

FILE NO.: 367390-001-003.mxd



LEGEND

- BACKGROUND MONITORING WELL
- BOTTOM ASH POND 1/2 N/S MONITORING WELL
- BOTTOM ASH POND 3 N/S MONITORING WELL
- DOWNGRADIENT LANDFILL MONITORING WELL
- DOWNGRADIENT POND A MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- DECOMMISSIONED MONITORING WELL
- NEW DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL (2018)
- NEW DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL (2018)
- NATURE AND EXTENT WELL
- (600.97) GROUNDWATER ELEVATION (FEET) SHALLOW WELLS
- (NM) NOT MEASURED

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH 12/07/2018.
3. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
4. MONITORING WELL DECOMMISSIONED JUNE 14, 2018.
5. MONITORING WELL DECOMMISSIONED OCTOBER 10, 2018.
6. JHC-MW-1800X MONITORING WELLS INSTALLED IN DECEMBER 2018.
7. MONITORING WELL DECOMMISSIONED JUNE 24, 2019.
8. JHC-MW-15008R AND TW-19-XX MONITORING WELLS INSTALLED IN JUNE 2019.
9. STATIC WATER ELEVATIONS IN NORTH AMERICAN VERTICAL DATUM 1988, NAVD 88.

N

0 700 1,400 Feet

1 " = 700 '

1:8,400

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

TITLE:
GROUNDWATER CONTOUR MAP APRIL 2021

DRAWN BY:	A. ADAIR	PROJ NO.:	418422.0000
CHECKED BY:	K. LOWERY		
APPROVED BY:	K. LOWERY		**FIGURE 7**
DATE:	JULY 2021		

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

FILE NO.: 418422_200_003.mxd

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

Plot Date: 7/16/2021, 06:23:30 AM by AADAIR - - LAYOUT: ANSI B(11"x17")
Path: S:\1-PROJECTS\Consumers_Energy_Company\Michigan\CCR_GW\2017_26976?\2_JHC\2021_MXDs\2021_002_APRIL\418422_200_003.mxd

TRC - GIS

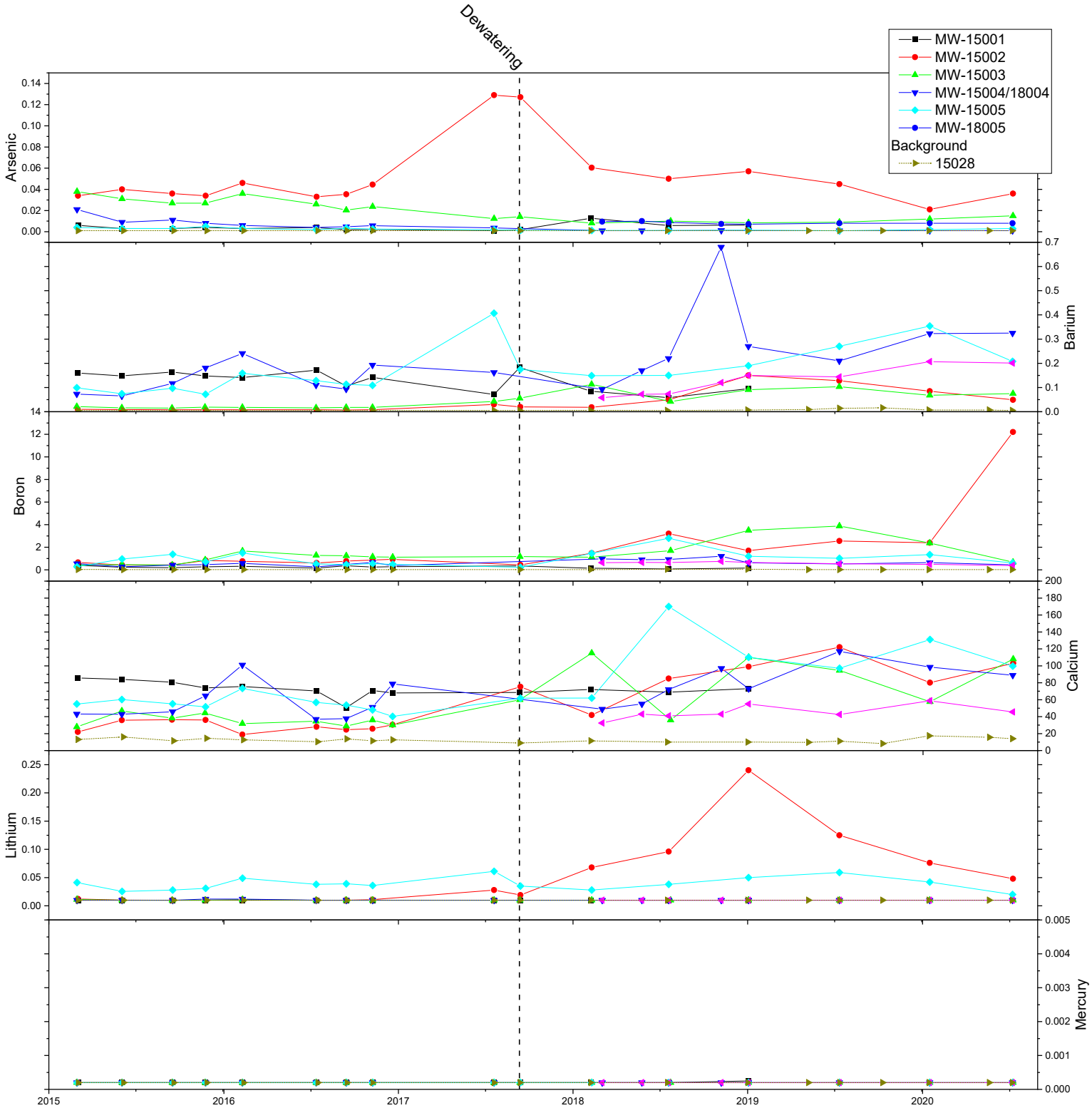


FIGURE 8
Time-Series - Analyte Group 1
JH Campbell Ponds 1-2 - West Olive, MI

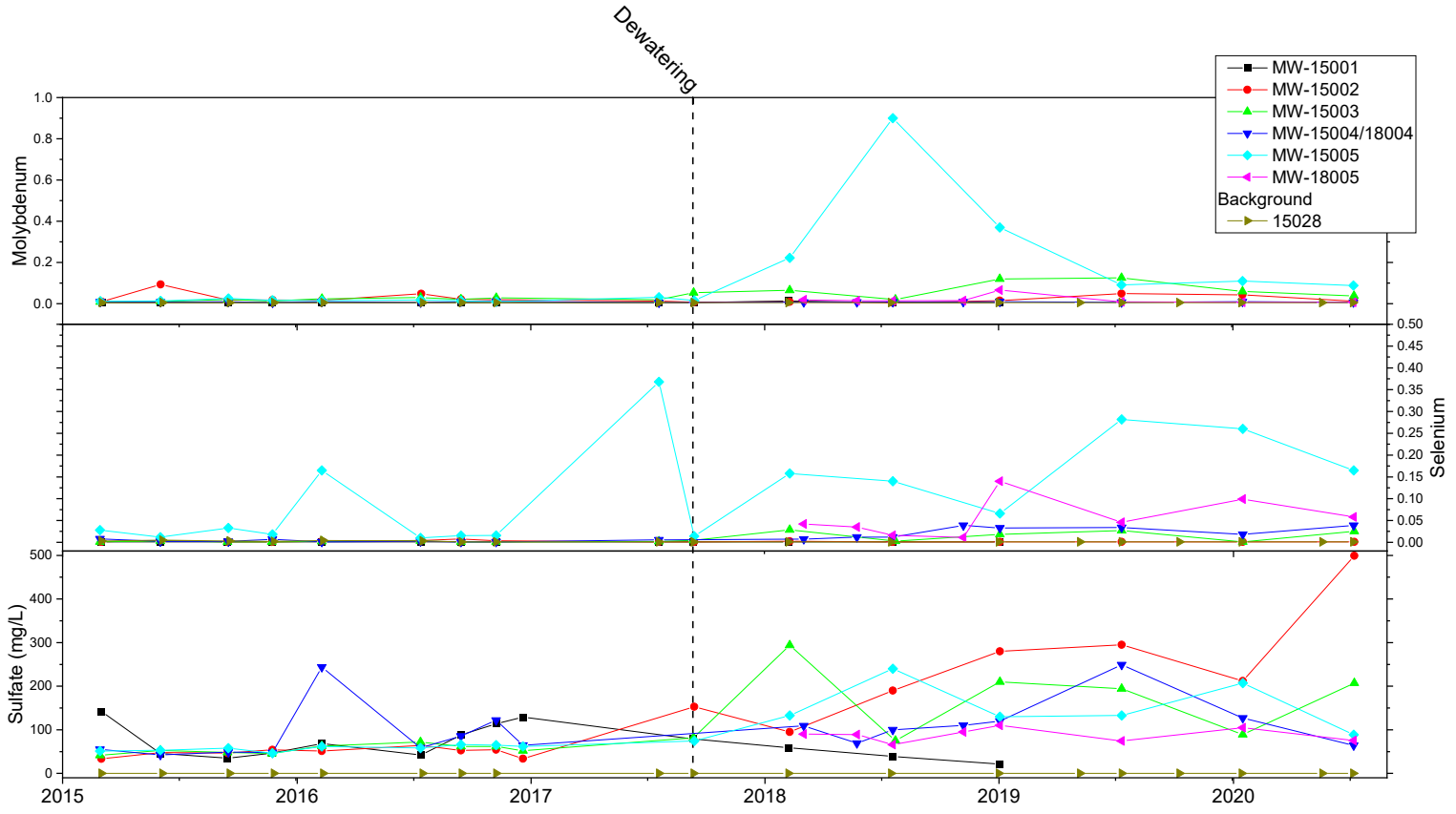


FIGURE 9
Time-Series - Analyte Group 2
JH Campbell Ponds 1-2 - West Olive, MI

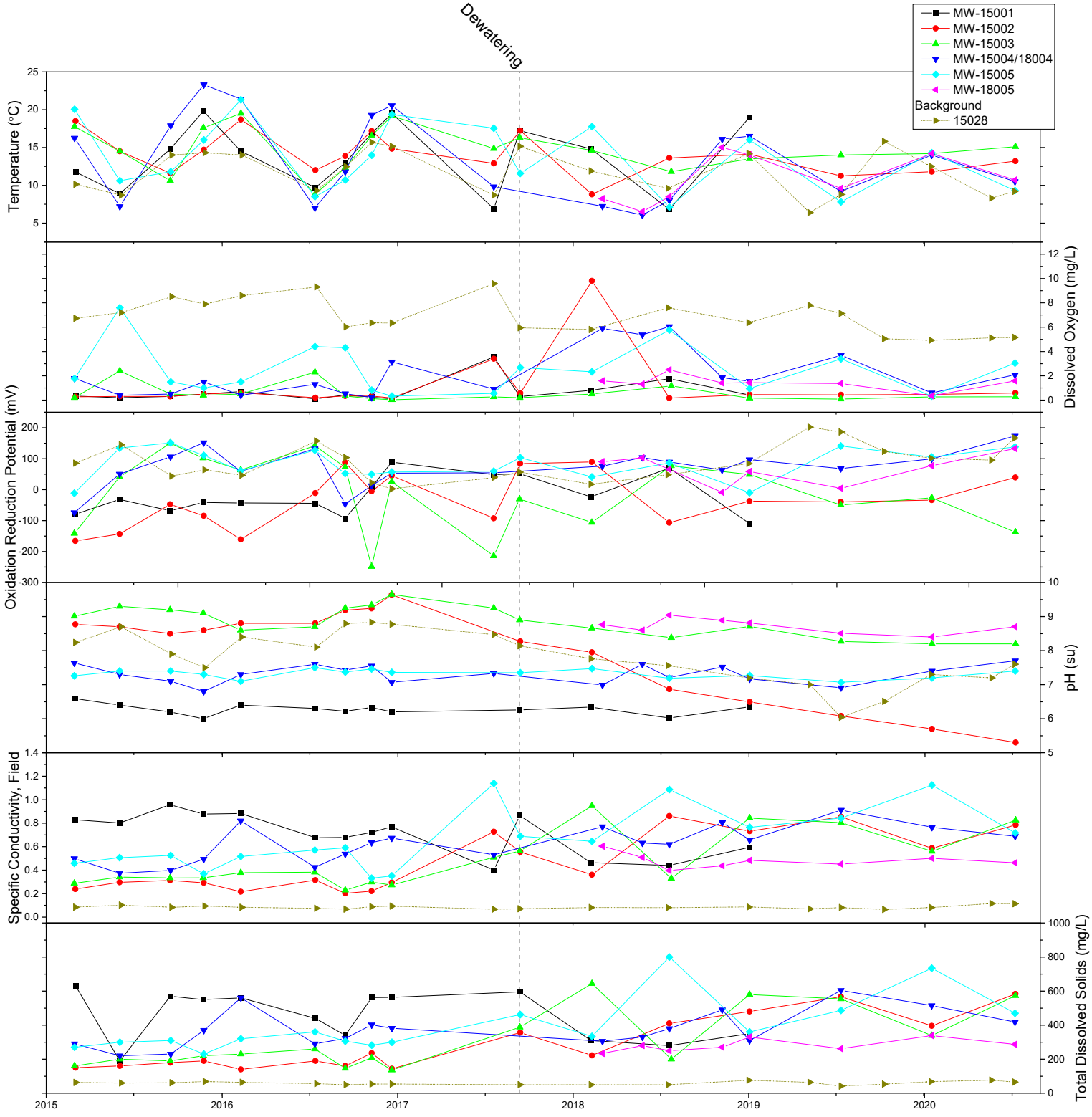


FIGURE 10
Time-Series - Field Parameters
JH Campbell Ponds 1-2 - West Olive, MI

Appendix A
Historic Pond A Area Figures

LEGEND

- EXISTING MAJOR CONTOUR (10' INTERVAL)
- EXISTING MINOR CONTOUR (2' INTERVAL)
- EXISTING CLAY LAYER MAJOR CONTOUR (10' INTERVAL)
- EXISTING CLAY LAYER MINOR CONTOUR (2' INTERVAL)
- APPROXIMATE CELL BOUNDARY
- APPROXIMATE ROAD LOCATION
- APPROXIMATE OVERHEAD WIRE LOCATION
- IRRIGATION LINE
- DITCH LINE
- CLOSED AREA
- OBSCURED AREA
- PERMANENT SURFACE WATER
- CROSS SECTION LINE
- TREE/TREE LINE
- POWER POLE
- POWER LINE TOWER
- MONITORING WELL
- TEST PIT
- SOIL BORING
- CONTROL POINT

NOTES

1. EXISTING TOP OF ASH CONTOURS FOR THE NORTHERN SITE WERE GENERATED FROM SURVEYS COMPLETED BY ENGINEERING & ENVIRONMENTAL SOLUTIONS, LLC ON NOVEMBER 11, 2011 AND APRIL 3, 2012 AND DEPICT THE PHASE 4 COVER COMPLETION.
2. CONTOURS WITHIN EXISTING CLOSURE BOUNDARIES REPRESENT FINAL COVER GRADES AT THE TIME OF CLOSURE.
3. CONTOURS WITHIN CELL 4 REPRESENT TOP OF BOTTOM ASH DRAINAGE LAYER (BOTTOM OF WASTE) FROM TIME OF CONSTRUCTION.
4. CELL BOUNDARIES, ROADS, AND LAKE/RIVER LOCATIONS ARE APPROXIMATE ONLY.
5. EXISTING CONTOURS FOR THE SOUTHERN SITE WERE GENERATED FROM AN AERIAL SURVEY PERFORMED BY ROWE PROFESSIONAL SERVICES IN APRIL 2012.
6. SOIL BORINGS SB-1201 THRU SB-1217 WERE SURVEYED BY ENGINEERING & ENVIRONMENTAL SOLUTIONS, LLC IN JULY 2012 AND AUGUST 2012. ALL OTHER SOIL BORING AND WELL LOCATIONS ARE APPROXIMATE OFF OF OLD PLANS AND FIELD MEASUREMENTS.
7. CLAY CONTOURS FROM HISTORIC INFORMATION AND SOIL BORINGS.

0 300 600
SCALE: 1"=300'

Engineering & Environmental Solutions, LLC
400 136th Avenue, Building 100, Suite B, Holland, Michigan 49424
Phone/Fax: (616) 994-6541
www.goEESolutions.com

RCRA VERTICAL EXPANSION FEASIBILITY

J.H. CAMPBELL ASH STORAGE FACILITY

SECTIONS 10, 11, 14, 15 T. 6 N., R. 16 W., PORT SHELDON TOWNSHIP, OTTAWA COUNTY

CONSUMERS ENERGY COMPANY

WEST OLIVE, MICHIGAN

MARK	DATE	DESCRIPTION
	12-05-2012	ISSUED WITH FINAL REPORT
	11-16-2012	ISSUED FOR FINAL REVIEW

DESIGNED BY:	--
DRAWN BY:	DJS
CHECKED BY:	BAL
PROJECT NO:	005-12-003

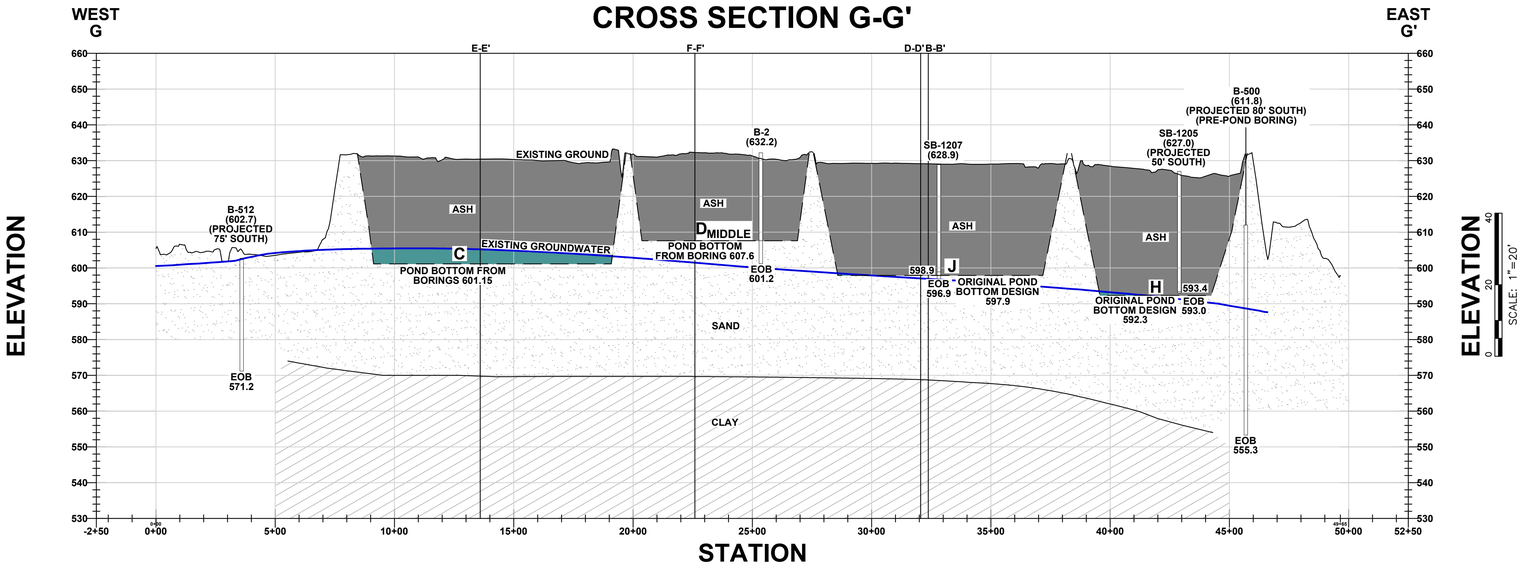
SHEET TITLE

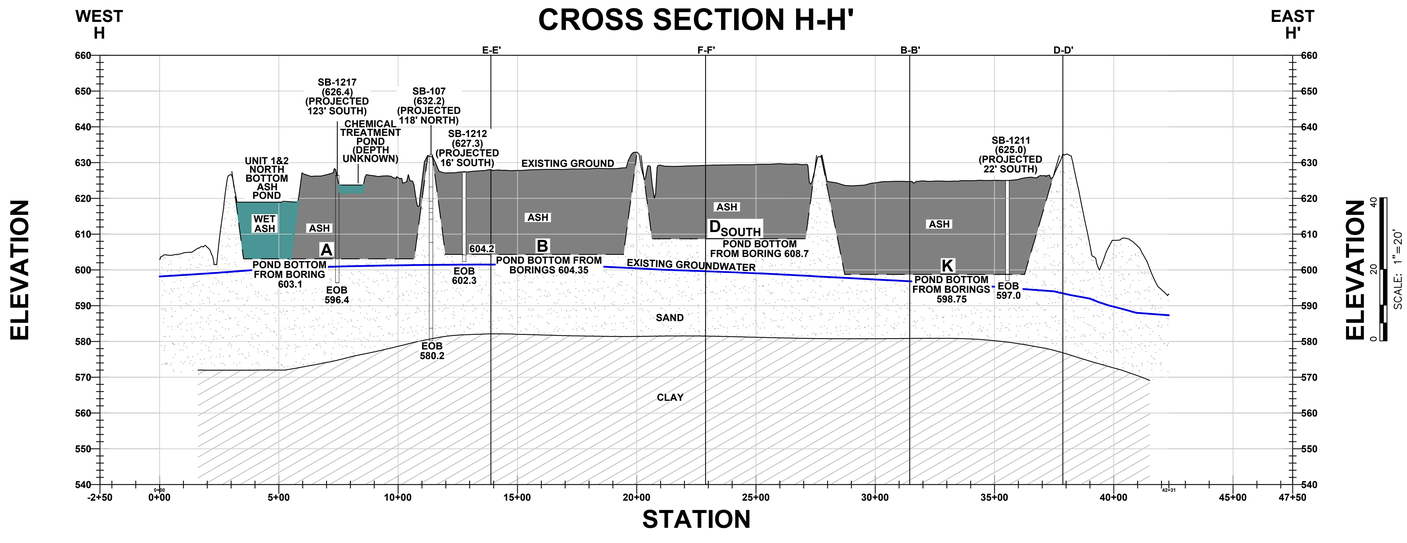
EXISTING CLAY LAYER CONTOURS

SHEET 4 OF 15

V-102

C:\Civil 3D Projects\Vault\005-12-003\005-12-003-CLAY-A.dwg 11/30/2012 9:48 AM


CROSS SECTION G-G'
WEST
G
EAST
G'
ELEVATION
STATION
E-E'
F-F'
D-D'
B-D'
B-512
(602.7)
(PROJECTED
75' SOUTH)
EXISTING GROUND
ASH
B-2
(632.2)
SB-1207
(628.9)
SB-1205
(627.0)
(PROJECTED
50' SOUTH)
B-500
(611.8)
(PROJECTED 80' SOUTH)
(PRE-POND BORING)
C
EXISTING GROUNDWATER
POND BOTTOM FROM
BORINGS 601.15
D MIDDLE
POND BOTTOM
FROM BORING 607.6
EOB
601.2
598.9
J
EOB = ORIGINAL POND
596.9 BOTTOM DESIGN
597.9
H
593.4
ORIGINAL POND = EOB
BOTTOM DESIGN 593.0
592.3
SAND
CLAY
EOB
571.2
EOB
555.3
SCALE: 1"=20'



LEGEND

SB-1206
(623.8)

BORING/WELL

EXISTING SAND
EXISTING CLAY
EXISTING ASH
PERMANENT WATER
EXISTING WET ASH
PERMITTED ASH

EXISTING SURFACE PROFILE
ORIGINAL POND DESIGN PROFILE
AUGUST 2012
GROUNDWATER PROFILE

0 300 600
HORIZONTAL SCALE: 1"=300'

NOTES

1. STATIONING IS RELATIVE TO CROSS-SECTION LINE AND IS NOT TIED TO PLANT COORDINATES.

Engineering & Environmental Solutions, LLC
400 136th Avenue, Building 100, Suite B, Holland, Michigan 49424
Phone/Fax: (616) 994-6541
www.goEESolutions.com

RCRA VERTICAL EXPANSION FEASIBILITY
J.H. CAMPBELL ASH STORAGE FACILITY
SECTIONS 10, 11, 14, 15 T. 6 N., R. 16 W., PORT SHELDON TOWNSHIP, OTTAWA COUNTY
CONSUMERS ENERGY COMPANY
WEST OLIVE, MICHIGAN

MARK	DATE	DESCRIPTION
	12-05-2012	ISSUED WITH FINAL REPORT
	11-16-2012	ISSUED FOR FINAL REVIEW

DESIGNED BY:	---
DRAWN BY:	DJS
CHECKED BY:	BAL
PROJECT NO:	005-12-003

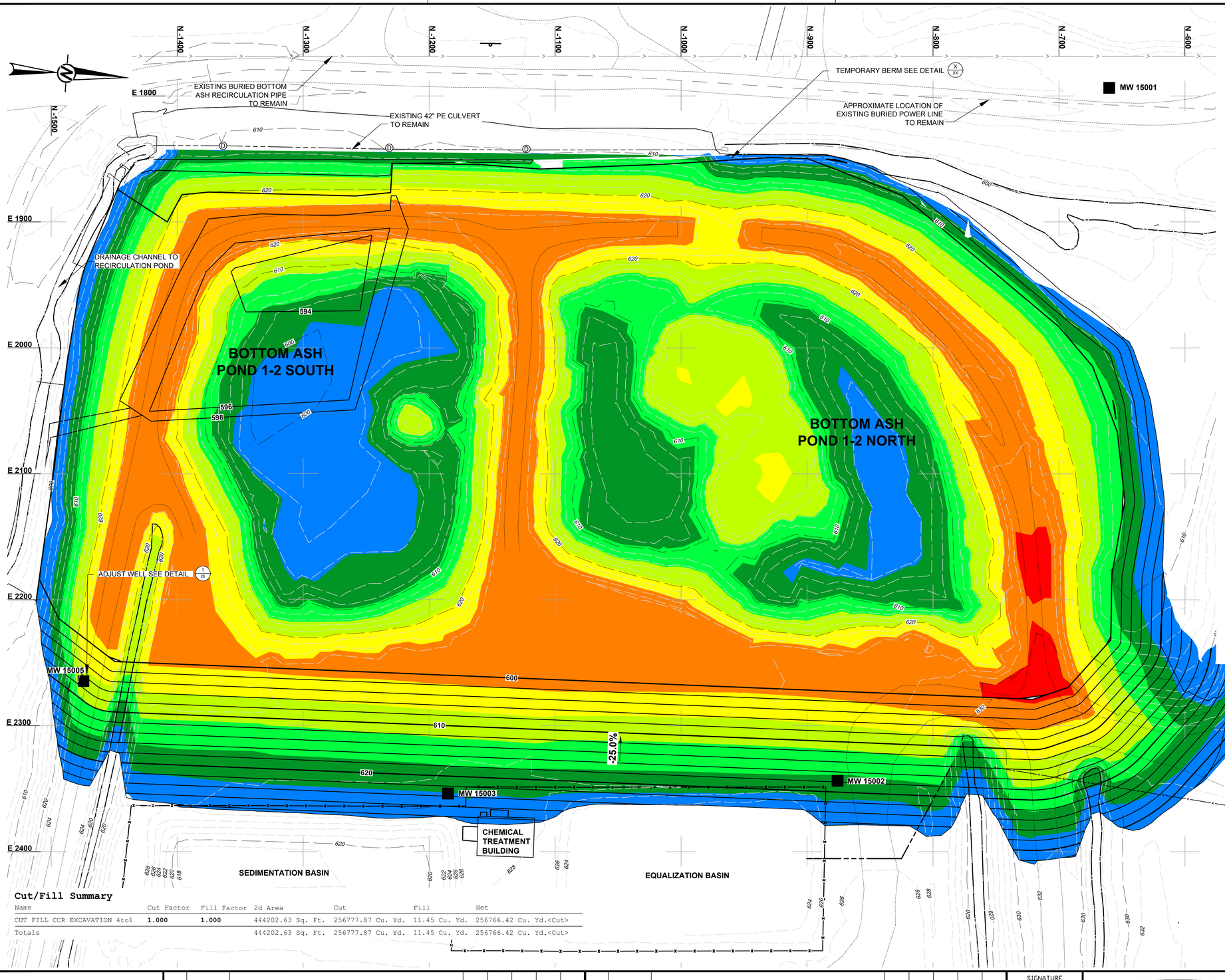
SHEET TITLE

EXISTING CROSS SECTIONS G-G' AND H-H'

SHEET 8 OF 15

V-106

C:\Civil 3D Projects\Vault\005-12-003\005-12-003-surfaces-A.dwg 12/3/2012 4:31 PM



LEGEND

- EXISTING GROUND TOPOGRAPHY
- PROPOSED GROUND TOPOGRAPHY
- EXISTING STORM LINE
- EXISTING UNDERGROUND PIPE
- EXISTING DITCH
- EXISTING BURIED POWER LINE
- EXISTING FENCE
- EXISTING BOTTOM ASH RECIRCULATION LINE
- EXISTING ROAD
- EXISTING MONITORING WELL
- EXISTING LIGHT POLE
- EXISTING SIGN
- EXISTING DRAIN INLET

NOTE(S)

1. EXISTING CONDITIONS MAY VARY FROM THOSE SHOWN DUE TO ONGOING CCR DISPOSAL OPERATIONS.
2. CONTRACTOR IS RESPONSIBLE FOR DEVELOPING AND IMPLEMENTING STORMWATER MANAGEMENT AND EROSION CONTROL PLANS CONSISTENT WITH THE SITE SWPPP.
3. CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ADHERENCE TO CONSUMERS ENERGY COMPANY'S HEALTH AND SAFETY PROCEDURES AS WELL AS ANY STATE AND FEDERAL HEALTH AND SAFETY REQUIREMENTS.
4. CONSTRUCTION MATERIALS, SUBCONTRACTORS, AND STOCKPILE LOCATIONS SHALL BE SUBJECT TO APPROVAL BY CONSUMERS ENERGY COMPANY OR ITS DESIGNATED REPRESENTATIVE.
5. TEMPORARY ROADS FOR SITE ACCESS AND STOCKPILE ACCESS TO BE APPROVED BY CONSUMERS ENERGY COMPANY OR ITS DESIGNATED REPRESENTATIVE.
6. CONTRACTOR SHALL VERIFY ALL DIMENSIONS, ELEVATIONS, AND SITE CONDITIONS PRIOR TO STARTING WORK AND SHALL NOTIFY THE ENGINEER IF CONFLICTS EXIST ON THE DRAWINGS.
7. CONTRACTOR IS RESPONSIBLE FOR SURVEY CONTROL AND FOR RECORD-KEEPING REQUIRED TO PRODUCE AS-BUILT DRAWINGS.
8. CONTRACTOR SHALL PERFORM HOUSEKEEPING DUTIES ON A DAILY BASIS TO KEEP WORK AREAS CLEAN. HOUSEKEEPING SHALL BE PERFORMED AT THE COMPLETION OF THE WORK TO THE SATISFACTION OF THE OWNER.
9. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL MATERIALS REQUIRED TO FULLY CONSTRUCT THE SYSTEM ACCORDING TO THE DESIGNS IN THESE DRAWINGS.
10. EXCAVATIONS SHALL CONFORM TO CONSUMERS ENERGY COMPANY AND OSHA REQUIREMENTS.
11. WELLS MW15002 AND MW15003 SHOULD NOT BE REMOVED OR DAMAGED DURING CONSTRUCTION. IF DAMAGED DURING CONSTRUCTION THE CONTRACTOR WILL BE RESPONSIBLE FOR THE OWNER'S COST FOR INSTALLATION OF A NEW REPLACEMENT WELL. CONTRACTOR TO LOWER WELL MW15005 AS PER DETAIL 1/29. CONTRACTOR IS RESPONSIBLE FOR FIXING OR REPLACING WELL IF ANY DAMAGE IS BELOW THE BENTONITE SEAL.
12. EXISTING VEGETATION NOT SHOWN ON THIS PLAN FOR CLARITY. SEE "EXISTING CONDITIONS" DRAWING FOR LOCATIONS AND NOTES.

REFERENCE(S)

1. SITE LOCATION: SECTION 15, T6N, R16W, OTTAWA COUNTY, MICHIGAN.
2. EXISTING GROUND TOPOGRAPHY WAS PROVIDED BY A GROUND SURVEY PERFORMED BY ENGINEERING AND ENVIRONMENTAL SOLUTIONS, LLC IN MAY 2016 AND SEPTEMBER 2016.
3. COORDINATE SYSTEM:
   VERTICAL: CONSUMERS ENERGY J.H. CAMPBELL LOCAL PLANT DATUM, NGVD29.
   HORIZONTAL: CONSUMERS ENERGY J.H. CAMPBELL LOCAL PLANT DATUM.

0 1200 2400
1" = 1200' FEET

Cut/Fill Summary

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
CUT FILL CCR EXCAVATION 4to1	1.000	1.000	444202.63 Sq. Ft.	256777.87 Cu. Yd.	11.45 Cu. Yd.	256766.42 Cu. Yd.<Cut>
Totals			444202.63 Sq. Ft.	256777.87 Cu. Yd.	11.45 Cu. Yd.	256766.42 Cu. Yd.<Cut>

CUT/FILL TABLE (- = CUT, + = FILL)

NUMBER	MIN. DEPTH (FT)	MAX. DEPTH (FT)	COLOR
1	-32	-30	
2	-30	-25	
3	-25	-20	
4	-20	-15	
5	-15	-10	
6	-10	-5	
7	-5	0	

REFERENCE DRAWINGS	REV	DATE	DESCRIPTION	DR	BY	CHK	APP	CO

REV	DATE	DESCRIPTION	DR	BY	CK	APP	CO
	04-27-16	ISSUED FOR 60% DESIGN REVIEW MEETING	AM	DS	BW	JP	

SIGNATURE
NAME
MICHIGAN P.E. No.

Consumers Energy
JH CAMPBELL PLANT
WEST OLIVE, MI

BOTTOM ASH PONDS 1-2 N/S EXCAVATION PLAN

SCALE:
JOB:
DRAWING NO. 690-XXXXX
SHEET 4
REV.

Appendix B
Soil Boring Logs

Date Start: 9/15/15
Date Finish: 9/16/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mouver
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): NA
Water Level Finish (ft. btoc.): 9.31

Northing: 158586.883
Easting: 12633422.01
Casing Elevation: 609.532

Borehole Depth (ft. bgs.): 15.0
Surface Elevation: 607.017

Descriptions By: A. Westhuis

Well/Boring ID: JHC MW-15001

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgl.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
610									TOC = 609.532 (ft. above msl)
0 / 605							(0.0 - 0.3') Grass, Topsoil. (0.3 - 10.0') SAND, fine to medium, subrounded; trace silt; well sorted.		2" PVC Well Casing (-3.0-3.5' bgs) Concrete (0.0-1.0' bgs) Bentonite Pellets (1.0-2.5' bgs)
5 / 600	1	0.0-10.0'	10	NA					Sand Pack K&E WP1 (2.5-15' bgs) 2" PVC 10 Slot Well Screen (3.5-8.5' bgs)
10 / 595	2	10.0-15.0'	3	NA			(10.0 - 15.0') SAND, fine to medium, subrounded; trace silt; well sorted; wet; brown (10YR 4/3) to yellowish brown (10YR 5/4).		
15 / 590							End of boring 15.0' bgs.		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 6.0' bgs.
Groundwater encountered at 10.0' bgs during drilling.
Water level at development was 9.31' btoc
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 600.28 feet

Date Start: 9/16/15
Date Finish: 9/16/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mouver
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 11.0
Water Level Finish (ft. btoc.): 24.51

Northing: 518378.917
Easting: 12633974.82
Casing Elevation: 628.867

Borehole Depth (ft. bgs.): 38.0
Surface Elevation: 625.967

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15002**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
0 / 625							(0.0 - 0.3') Grass, Topsoil.		TOC = 625.967 (ft. above msl); Concrete (0.0-1.0' bgs)
5 / 620	1	0.0-10.0'	10	NA			(0.3 - 11.0') ASH; trace fine sand, subrounded; well sorted; moist to wet; dark gray (10YR 4/1). NOTE: Fill material.		
10 / 615							(11.0 - 24.0') ASH; well sorted; soft; wet; light gray (10YR 7/1) to dark gray (10YR 4/1). NOTE: Fill material.		Bentonite/Cement Grout (1.0-24.0' bgs); 2" PVC Well Casing (-3.0-28.0' bgs)
15 / 610	2	10.0-20.0'	1.8	NA					

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 24.0' bgs during drilling.
Water level at development was 24.51' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 604.04 feet

Date Start: 9/16/15
Date Finish: 9/16/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mouver
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 11.0
Water Level Finish (ft. btoc.): 24.51

Northing: 518378.917
Easting: 12633974.82
Casing Elevation: 628.867

Borehole Depth (ft. bgs.): 38.0
Surface Elevation: 625.967

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15002**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
20 / 605									
25 / 600	3	20.0-30.0'	8	NA			(24.0 - 25.0') SAND, fine, little very fine sand, subrounded; trace silt; well sorted; wet; yellowish brown (10YR 5/6). (25.0 - 38.0') SAND, fine, little very fine, subrounded; trace silt; well sorted; wet; very pale brown (10YR 7/4).		Bentonite Pellets (24.0-26.0' bgs)
30 / 595	4	30.0-38.0'	6	NA					Sand Pack K&E WP1 (26.0-38.0' bgs) 2" PVC 10 Slot Well Screen (28.0-38.0 bgs)
35 / 590							End of boring 38.0' bgs.		
40									

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 24.0' bgs during drilling.
Water level at development was 24.51' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 604.04 feet

Date Start: 9/16/15
Date Finish: 9/17/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 28.0
Water Level Finish (ft. btoc.): 30.57

Northing: 518069.863
Easting: 12633990.37
Casing Elevation: 630.632

Borehole Depth (ft. bgs.): 38.0
Surface Elevation: 628.307

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15003**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
630									TOC = 628.307 (ft. above msl)
0							(0.0 - 0.3') Grass, Topsoil.		Concrete (0.0-1.0' bgs)
							(0.3 - 12.0') ASH; trace fine sand, subrounded; well sorted; moist to wet; dark gray (10YR 4/1). NOTE: Fill material.		
625									
5	1	0.0-10.0'	10	NA					
620									
10									
							(12.0 - 20.0') ASH; well sorted; soft; moist to wet; light gray (10YR 7/1) to dark gray (10YR 4/1). NOTE: Fill material.		Bentonite/Cement Grout (1.0-24.0' bgs)
615									2" PVC Well Casing (-3.0-28.0' bgs)
15	2	10.0-20.0'	9	NA					

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 28.0' bgs during drilling.
Water level at development was 30.57' btoc
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 602.48 feet

Date Start: 9/16/15
Date Finish: 9/17/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 28.0
Water Level Finish (ft. btoc.): 30.57

Northing: 518069.863
Easting: 12633990.37
Casing Elevation: 630.632

Borehole Depth (ft. bgs.): 38.0
Surface Elevation: 628.307

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15003**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
610									
20							(20.0 - 21.0') SAND, fine, subrounded; trace silt; well sorted; moist; brownish yellow (10YR 6/8). NOTE: Trace small roots at this depth.		
							(21.0 - 28.0') SAND, fine, subrounded; trace silt; well sorted; moist; very pale brown (10YR 7/4).		
605									
25	3	20.0-30.0'	5	NA					Bentonite Pellets (24.0-26.0' bgs)
600							(28.0 - 38.0') SAND, fine, little medium; trace granules, subrounded; trace silt; well sorted; wet; brownish yellow (10YR 6/6).		
30									
595									Sand Pack K&E WP1 (26.0-38.0' bgs)
									2" PVC 10 Slot Well Screen (28.0-38.0' bgs)
35	4	30.0-38.0'	8	NA					
590							End of boring at 38.0' bgs.		
40									

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 28.0' bgs during drilling.
Water level at development was 30.57' btoc
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 602.48 feet

Date Start: 9/17/15
Date Finish: 9/17/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 27.0
Water Level Finish (ft. btoc.): 31.67

Northing: 517864.558
Easting: 12633547.12
Casing Elevation: 628.422

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 624.917

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15004**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
0	625							(0.0 - 0.3') Grass, Topsoil.		TOC = 628.442 (ft. above msl)
								(0.3 - 10.0') ASH and SAND, fine to medium, subrounded; stiff; dry to moist; dark grayish brown (10YR 4/2). NOTE: Fill material.		Concrete (0.0-1.0' bgs)
5	620	1	0.0-10'	10	NA					
10	615							(10.0 - 19.0') ASH and SAND, fine to medium, subrounded; soft; moist to wet; dark grayish brown (10YR 4/2). NOTE: Fill material.		Bentonite/Cement Grout (1.0-20.0' bgs)
		2	10.0-15.0'	4	NA			NOTE: Trace small pebbles from 12.0 to 13.0' bgs.		2" PVC Well Casing (-3.0-24.0' bgs)
15	610									
		3	15.0-20.0'	4	NA					

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 27.0' bgs during drilling.
Water level at development was 31.67' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 598.77 feet

Date Start: 9/17/15
Date Finish: 9/17/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 27.0
Water Level Finish (ft. btoc.): 31.67

Northing: 517864.558
Easting: 12633547.12
Casing Elevation: 628.422

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 624.917

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15004**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
								(19.0 - 20.0') SAND, fine; trace medium sand, subrounded; trace silt; well sorted; dry to moist; brownish yellow (10YR 6/8).		
20	605							(20.0 - 30.0') SAND, fine, trace medium, subrounded; trace silt; well sorted; dry; very pale brown (10YR 7/4).		
25	600	4	20.0-30.0'	4	NA			NOTE: Wet at 27.0' bgs.		
30	595							(30.0 - 40.0') SAND, fine to medium; trace coarse sand; trace granules; subrounded; well sorted; wet; pale brown (10YR 6/3).		
35	590	5	30.0-40.0'	8	NA					
40	585							End of boring at 40.0' bgs.		

Bentonite Pellets (20.0-22.0' bgs)
Sand Pack K&E WP1 (22.0-40.0' bgs)
2" PVC 10 Slot Well Screen (24.0-34.0 bgs)

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 27.0' bgs during drilling.
Water level at development was 31.67' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 598.77 feet

Date Start: 9/18/15
Date Finish: 9/18/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 29.0
Water Level Finish (ft. btoc.): 33.26

Northing: 517781.423
Easting: 12633905.01
Casing Elevation: 627.297

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 624.367

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15005**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 70 F Cloudy

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
625									TOC = 627.297 (ft. above msl)
0							(0.0 - 0.3') Grass, Topsoil.		Concrete (0.0-1.0' bgs)
							(0.3 - 10.0') ASH and SAND, fine to medium; trace granules, subrounded; moist; soft to stiff; poorly sorted; brown (10YR 5/3) to dark grayish brown (10YR 4/2). NOTE: Fill material.		
620									
5	1	0.0-10.0'	10	NA					
615									
10							(10.0 - 11.0') ASH; well sorted; medium stiff to stiff; moist; dark gray (10YR 4/1). NOTE: Fill material.		
							(11.0 - 13.0') SAND, medium, little to some fine sand, subrounded; trace silt; well sorted; dry; brown (10YR 5/3) to yellowish brown (10YR 5/4).		Bentonite/Cement Grout (1.0-23.0' bgs)
							(13.0 - 16.0') SAND, medium; little fine sand, subrounded; trace silt; well sorted; dry; very pale brown (10YR 7/4).		2" PVC Well Casing (-3.0-27.0' bgs)
610									
15	2	10.0-20.0'	6	NA					
							(16.0 - 19.5') SAND, medium; trace fine, subrounded; trace silt; dry; light yellowish brown (10YR 6/4).		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 29.0' bgs during drilling.
Water level at development encountered at 33.26' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 595.77 feet

Date Start: 9/18/15
Date Finish: 9/18/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 29.0
Water Level Finish (ft. btoc.): 33.26

Northing: 517781.423
Easting: 12633905.01
Casing Elevation: 627.297

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 624.367

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15005**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 70 F Cloudy

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
605							(19.5 - 19.8') SAND, medium; trace fine, subrounded; little to some silt; moist, brown (10YR 4/3).		
20							(19.8 - 29.0') SAND, medium, trace fine, subrounded; trace silt; well sorted; dry; very pale brown (10YR 7/4).		
600	3	20.0-30.0'	6	NA					Bentonite Pellets (23.0-25.0' bgs)
25									
595							(29.0 - 31.0') SAND, medium, little fine, trace coarse, subrounded; trace silt; well sorted; wet; pale brown (10YR 6/3).		
30									Sand Pack K&E WP1 (25.0-40.0' bgs)
							(31.0 - 33.0') SAND, medium to coarse, little fine, subrounded; trace silt; well sorted; wet; pale brown (10YR 6/3).		2" PVC 10 Slot Well Screen (27.0-37.0 bgs)
							(33.0 - 40.0') SAND, fine, some medium, subrounded; well sorted; wet; pale brown (10YR 6/3).		
590									
35	4	30.0-40.0'	9	NA					
585									Sand Pack K&E WP1 (37-40' bgs)
40							End of boring at 40.0' bgs.		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 29.0' bgs during drilling.
Water level at development encountered at 33.26' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 595.77 feet

WELL CONSTRUCTION LOG

WELL NO. JHC-MW-18004

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
CEC JH Campbell	12/4/18	12/4/18	290806.0000 P1T5

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns Drilling Company	Geoprobe	602.9	605.71	15.0	4

Boring Location: West side of Pond 1-2S N: 518007.60 E: 12633480.87	Personnel Logged By - P. Lancaster Driller - R. Christiansen	Drilling Equipment: 6620 DT

Civil Town/City/or Village:	County:	State:	Water Level Observations:
West Olive	Ottawa	Michigan	While Drilling: Date/Time 12/4/18 00:00 ▽ Depth (ft bgs) 8.0 After Drilling: Date/Time 12/4/18 08:45 ▼ Depth (ft bgs) 8.1

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 GP	85		0	**SILTY SAND** mostly fine sand, little medium sand, little silt, dark grayish brown (10YR 3/2), moist, loose.	SM			
				SAND mostly fine to medium sand, light yellowish brown (10YR 6/4), moist, loose.				
			5	Change to medium sand, very pale brown (10YR 7/2) at 5.0 feet.				
2 GP	100			▼ Change to very moist at 8.0 feet.	SP			
			10	Change to yellowish brown (10YR 5/6), wet at 9.8 feet. Change to medium sand, trace to few coarse sand, yellowish brown (10YR 6/5) at 10.0 feet.				
3 GP	100			Grades to coarse sand, light yellowish brown (10YR 6/4) at 13.0 feet.				
4 GP	0		15	Blind push from 15.0 to 16.0 feet; lithology assumed sand based on prior investigations at site.				
				End of boring at 16.0 feet below ground surface.				
			20					

SOIL BORING WELL CONSTRUCTION LOG 290806.0000_P1_T5.GPJ TRC_CORP.GDT 290806.0000 P1T5 1/24/19

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

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC JH Campbell		WELL ID:	C-M -18004
PROJ. NO: 290806.0002	DATE INSTALLED: 12/4/2018 INSTALLED BY: Paula Lancaster	CHECKED BY:	J. Krenz

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
605.71	2.8	TOP OF CASING
602.92	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: MEDIUM CHIPS
		GROUT/BACKFILL METHOD: FILL FROM ABOVE
8.79		RISER PIPE LENGTH
	NA	GROUT
		BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	4.0	BENTONITE SEAL
596.92	6.0	TOP OF SCREEN
		FILTER PACK MATERIAL: WASHED SAND & NATURAL COLLAPSE
10.00		SCREEN LENGTH
586.92	16.0	BOTTOM OF SCREEN
	16.0	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NA
586.92	16.0	HOLE BOTTOM

NOTES:
Well pro-cover filled with sand, and labeled using paint marker. No lock installed at time of installation.

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SOLVENT USED? NO

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER:	4.0	IN. FROM	0	TO	16	FT.
	NA	IN. FROM	NA	TO	NA	FT.
SURF. CASING DIAMETER:	NA	IN. FROM	NA	TO	NA	FT.
	NA	IN. FROM	NA	TO	NA	FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.3 HOURS

WATER REMOVED: 17 GALLONS

WATER ADDED: < 5 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: OPAQUE

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR; 8.07 NTUs

COLOR AFTER: NONE

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	19.50	T/PVC	12/5/2018	1425
DTB AFTER DEVELOPING:	19.05	T/PVC	12/7/2018	945
SWE BEFORE DEVELOPING:	11.00	T/PVC	12/5/2018	1425
SWE AFTER DEVELOPING:	11.02	T/PVC	12/7/2018	945
OTHER SWE:		T/PVC		
OTHER SWE:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☐ YES ☑ NO

LOCK KEY NUMBER: _____

WELL CONSTRUCTION LOG

WELL NO. JHC-MW-18005

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
CEC JH Campbell	12/5/18	12/5/18	290806.0000 P1T5

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns Drilling Company	Geoprobe	600.3	603.16	15.0	4

Boring Location: South side of Pond 1-2S N: 517784.97 E: 12633627.70	Personnel Logged By - P. Lancaster Driller - R. Christiansen	Drilling Equipment: 6620 DT

Civil Town/City/or Village:	County:	State:	Water Level Observations:
West Olive	Ottawa	Michigan	While Drilling: Date/Time 12/5/18 00:00 ▽ Depth (ft bgs) 8.0 After Drilling: Date/Time 12/5/18 23:00 ▼ Depth (ft bgs) 7.7

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 GP	100		0	**SILTY SAND** mostly fine sand, few to little silt, very dark grayish brown (10YR 3/2), moist, loose.	SM			
				SAND mostly medium sand, brownish yellow (10YR 6/6), moist, loose.				
				Change to light brownish gray at 3.0 feet.				
			5	Change to brownish yellow (10YR 6/6) at 5.0 feet.				
2 GP	100			▽ Change to wet with 1" coarse sand seam at 8.0 feet.	SP			
3 GP	100		10	Change to mostly coarse sand, little medium sand, trace fine gravel, wet at 10.0 feet.				
			15	End of boring at 15.0 feet below ground surface.				
			20					

SOIL BORING WELL CONSTRUCTION LOG 290806.0000_P1_T5.GPJ TRC_CORP.GDT 290806.0000 P1T5 1/24/19

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

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC JH Campbell		WELL ID:	C-M -18005
PROJ. NO: 290806.0002	DATE INSTALLED: 12/5/2018 INSTALLED BY: Paula Lancaster	CHECKED BY:	J. Krenz

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
603.16	2.9	TOP OF CASING
600.30	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: MEDIUM CHIPS
		GROUT/BACKFILL METHOD: FILL FROM ABOVE
7.86		RISER PIPE LENGTH
	NA	GROUT
		BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	3.5	BENTONITE SEAL
595.30	5.0	TOP OF SCREEN
10.00		SCREEN LENGTH
		FILTER PACK MATERIAL: WASHED SAND & NATURAL COLLAPSE
585.30	15.0	BOTTOM OF SCREEN
	15.0	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NA
585.30	15.0	HOLE BOTTOM

NOTES:
Well pro-cover filled with sand, and labeled using paint marker. No lock installed at time of installation.

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SOLVENT USED? NO

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER:	4.0	IN. FROM	0	TO	15	FT.
	NA	IN. FROM	NA	TO	NA	FT.
SURF. CASING DIAMETER:	NA	IN. FROM	NA	TO	NA	FT.
	NA	IN. FROM	NA	TO	NA	FT.

ELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.25 HOURS

WATER REMOVED: 27 GALLONS

WATER ADDED: < 5 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: OPAQUE

COLOR BEFORE: YELLOWISH-BROWN

CLARITY AFTER: CLEAR; 8.39 NTUs

COLOR AFTER: NONE

ODOR (IF PRESENT): NONE

ATER LEVEL SMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	17.95	T/PVC	12/5/2018	1340
DTB AFTER DEVELOPING:	17.97	T/PVC	12/7/2018	1230
SWE BEFORE DEVELOPING:	7.40	T/PVC	12/5/2018	1340
SWE AFTER DEVELOPING:	9.77	T/PVC	12/7/2018	1230
OTHER SWE:		T/PVC		
OTHER SWE:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☐ YES ☑ NO

LOCK KEY NUMBER: _____

Engineering & Environmental Solutions, LLC

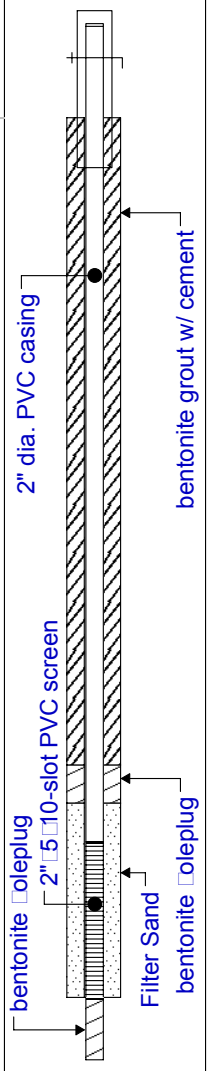
400 136th Avenue
Building 100, Suite B
Holland, Michigan 49424
Phone/Fax: (616) 994-6541
www.goEESolutions.com

Project Name: RCRA Vertical E□p. Feasibility
Project Number: 005-12-003
Site Location: J.H. Campbell□West Oli□e□MI
Drilling Met□od: 8.25" OD HSA
Sampling Met□od: 2□Split Spoon
Ground Ele□ation □feet□: 628.7
Top of Casing Ele□ation □feet□: 631.60
Logged By: Kurt Van Appledorn
Comments:

Log of Borehole: PZ/SB-1203

Start Date: 6-7-12
End Date: 6-7-12
Driller: Remedial Ser□ices Di□ision
Crew C□ief: Da□e Hill
Dept□ to Water □ft BGS during drilling□: 25
Easting: 4542.2
Nort□ing: 505.8

SUBSURFACE PROFILE				SAMPLE					
Dept□ □feet BGS□	Symbol	Description	Dept□/Ele□	Sample Lengt□	Reco□ery □feet□	Blow Counts □per 6 in□	N	Water Content □Percent□ 10 30 50	Well Completion Details
		Ground Surface	628.7						
0		0-0.7□Fine sand si□e ASH□dry	0.0						
1		0.7-3□Silt si□e ASH□wit□2-3" seams of fine sand si□e as□□moist.		2	2.0	0-1-1-1	2	•	
2									
3		3-26□Gray fine sand si□e ASH□dry□wit□wet dark gray 0.2 to 0.4□silt si□e as□seams.	625.7 3.0						
4				2	1.3	0-1-1-1	2	•	
5									
6									
7									
8									
9									
10				2	1.7	0-0-1-1	1	•	
11									
12									
13									
14									
15				2	1.6	0-0-0-1	0	•	
16									
17									
18									
19									
20				2	0	0-1-0-1	1	•	
21				2	2.0	0-1-1-2	2	•	
22									
23									
24			603.7	2	1.9	0-1-0-1	1	•	
25		Wet at 25□	25.0						
26		26.0-28.5□Silt si□e ASH□little fine sand si□e as□□wet		2	1.9	0	0	•	
27									
28		T□in □□1/8"□black material between as□and sand	600.2 28.5	2	1.5	0-3-8-15	11	•	
29		28.5-30□Brown fine SAND	598.7						
30		End of Boring	30.0						



Engineering & Environmental Solutions, LLC

400 136th Avenue
Building 100, Suite B
Holland, Michigan 49424
Phone/Fax: (616) 994-6541
www.goEESolutions.com

Project Name: RCRA Vertical E□p. Feasibility
Project Number: 005-12-003
Site Location: J.H. Campbell□West Oli□e□MI
Drilling Met□od: 8.25" OD HSA
Sampling Met□od: 2□Split Spoon
Ground Ele□ation □feet□: 629.3
Top of Casing Ele□ation □feet□: 631.92
Logged By: Kurt Van Appledorn
Comments:

Log of Borehole: PZ/SB-1204

Start Date: 6-7-12
End Date: 6-7-12
Driller: Remedial Ser□ices Di□ision
Crew C□ief: Da□e Hill
Dept□ to Water □ft BGS during drilling□:
Easting: 6033.8
Nort□ing: 585.6

Dept□ □feet BGS□	Description	Dept□/Ele□	Sample Lengt□	Reco□ery □feet□	Blow Counts □per 6 in□	N	Water Content □Percent□ (10 30 50)
	Ground Surface	629.3					
0	0-3.0□Very dark gray silt si□e ASH wit□ 1" fine sand si□e seams□wet seam at 1.8-2□	0.0	2	2.0	0-1-2-2	3	
3	3.0-16.1□Fine sand wit□ silt si□e ASH□moist	626.3 3.0					
5	wet at 5-5.7□		2	1.7	0-1-1-1	2	
11			2	2.0	0-0-0-1	0	
15	dark gray and lig□t brown at 15.9-16.1□	614.3 15.0	2	2.0	1-2-3-3	5	
16	16.1-35.5□Silt si□e ASH□moist						
19	Wet at 16.9□	609.3					
20	20-21.1□Find sand and silt si□e ASH□moist	20.0	2	2.0	1-2-3-2	5	
21	Wet at 21.1□						
23	1" to 2" fine sand si□e seam @ 22□		2	1.9	1-1-1-2	2	
24	1" to 2" fine sand si□e seam @ 23□		2	2.0	0-1-0-1	1	
26			2	2.0	0-1-0-1	1	
28			2	1.8	0	0	
31		597.3	2	2.0	0	0	
32	32-35.5□Silty fine sand si□e as□	32.0	2	1.7	0	0	
34	1" dense fine material at bottom of as□	593.8	2	2.0	0-1-3-10	4	
36	35.5-38.0□Black fine SAND□wet	35.5					
37	Gray to brown at 37□to tip	591.3	2	1.4	1-10-16-19	26	
38	End of Boring	38.0					

Well Completion Details: 2" dia. PVC casing; bentonite grout w/ cement; bentonite □oleplug; 2"□5□10-slot PVC screen; Filter Sand; bentonite □oleplug

Engineering & Environmental Solutions, LLC

400 136th Avenue
Building 100, Suite B
Holland, Michigan 49424
Phone/Fax: (616) 994-6541
www.goEESolutions.com

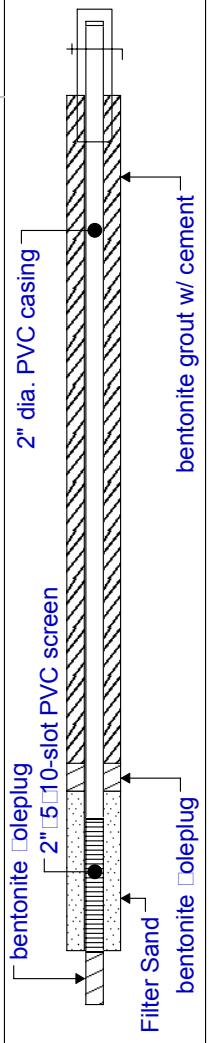
Project Name: RCRA Vertical E□p. Feasibility
Project Number: 005-12-003
Site Location: J.H. Campbell□West Oli□e□MI
Drilling Met□od: 8.25" OD HSA
Sampling Met□od: 2□Split Spoon
Ground Ele□ation □feet□: 627.0
Top of Casing Ele□ation □feet□: 629.60
Logged By: Kurt Van Appledorn
Comments:

Log of Borehole: PZ/SB-1205

Start Date: 6-7-12
End Date: 6-7-12
Driller: Remedial Ser□ices Di□ision
Crew C□ief: Da□e Hill
Dept□ to Water □ft BGS during drilling□:
Easting: 5930.8
Nort□ing: -256.7

Dept□ □feet BGS□	Symbol	Description	Dept□/Ele□	Sample Lengt□	Reco□ery □feet□	Blow Counts □per 6 in□	N	Water Content □Percent□ (10 30 50)
		Ground Surface	627.0					
0		0-3.0□Dark gray silt si□e ASH□little fine sand si□e□moist.	0.0	2	1.8	1-1-2-2	3	
3		3.0-7.0□Gray fine sand and silt si□e ASH□ slig□tly moist to dry□1" seams of sandier si□e as□wit□ t□in black layers.	624.0 3.0					
6		wet at 5-5.7□	620.0	2	2.0	1-2-2-4	4	
7		7.0-18.0□Dark gray SILT si□e as□□some fine SAND si□e□1/4" seams of sandier si□e as□□ becomes sandier wt□ dept□□slig□tly moist.	7.0					
11				2	1.9	1-3-4-5	7	
15		15.3-15.7□fine sand si□e seam. 15.8□1" wet seam. 16.5-16.7□fine sand seam.	612.0 15.0	2	1.7	1-1-1-1	2	
18		18-23.7□Dark gray silt si□e ASH□wet at 20.4.	609.0 18.0					
21				2	2.0	0	0	
23			603.3	2	1.8	0	0	
24		23.7-26.0□Dark gray fine sand si□e ASH□slig□tly moist.	23.7	2	1.4	0-1-2-1	3	
26		26.0-32.0□Alternating 3-5" seams of silt and fine sand si□e ASH□wet□1-3" sand si□e seams below 28□wet	601.0 26.0	2	1.6	0-0-0-1	0	
29				2	2.0	0	0	
31			595.0	2	2.0	0	0	
32		32.0-33.6□Silty si□e ASH□wet. 1/4" -1/2" clay between as□and natural sand.	32.0 593.4	2	2.0	0-0-0-2	0	
34		33.6-34.0□Gray fine SAND□wet	33.6					
36		End of Boring						

Well Completion Details



Sheet: 1 of 1

Engineering & Environmental Solutions, LLC

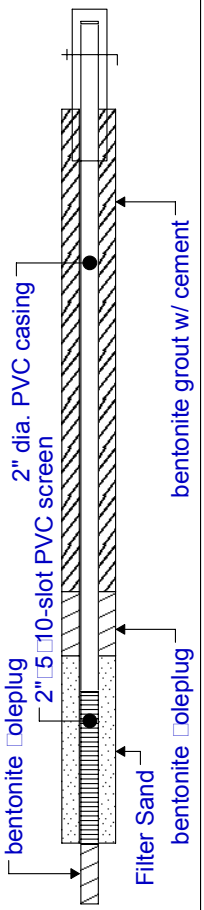
400 136th Avenue
Building 100, Suite B
Holland, Michigan 49424
Phone/Fax: (616) 994-6541
www.goEESolutions.com

Project Name: RCRA Vertical E□p. Feasibility
Project Number: 005-12-003
Site Location: J.H. Campbell□West Oli□e□MI
Drilling Met□od: 8.25" OD HSA
Sampling Met□od: 2□Split Spoon
Ground Ele□ation □feet□: 623.8
Top of Casing Ele□ation □feet□: 629.69
Logged By: Kurt Van Appledorn
Comments:

Log of Borehole: PZ/SB-1206

Start Date: 6-7-12
End Date: 6-7-12
Driller: Remedial Ser□ices Di□ision
Crew C□ief: Da□e Hill
Dept□ to Water □ft BGS during drilling□:
Easting: 4669.7
Nort□ing: -1302.5

S□BS□RFACE PROFILE				SAMPLE					
Dept□ □feet BGS□	Symbol	Description	Dept□/Ele□	Sample Lengt□	Reco□ery □feet□	Blow Counts □per 6 in□	N	Water Content □Percent□ 10 30 50	Well Completion Details
0		Ground Surface	623.8						
0		0-03□Gray wit□ t□in black layers□sand si□e ASH□dry.	0.0	2	1.5	0-2-1-1	3		
2		0.3-0.9□Dark gray silt si□e ASH□slig□tly moist.							
3		0.9-3.0□Black and gray layers□ fine sand si□e ASH.	620.8 3.0						
5		3.0-8.0□Fine sand si□e ASH□some silt si□e□ moist□dark gray 3-6.2□and gray 6.2-8□		2	2.0	1-1-2-2	3		
8			615.8 8.0						
8		8.0-13.0□Gray wit□ 1" black layers□fine sand si□e ASH□little silt si□e□slig□tly moist.		2	1.7	2-2-2-2	4		
13			610.8 13.0						
13		13.0-15.9□Gray wit□ t□in blacklayers□fine sand si□e ASH□slig□tly moist.							
16		15.9-18.0□Dark Gray silt si□e ASH□wet.	607.9 15.9	2	2.0	1-1-1-1	2		
18			605.8 18.0						
18		18.0-25.1□Dark gray silt si□e ASH□wet.		2	20	0-1-0-1	1		
23				2	1.8	1-1-1-1	2		
25			598.7 25.1	2	1.9	1-1-2-6	3		
26		25.1-26.0□Brown fine SAND□wet□1/2" of sand directly below as□ o□erlaying 1" clayey silt							
26		End of Boring							



Engineering & Environmental Solutions, LLC

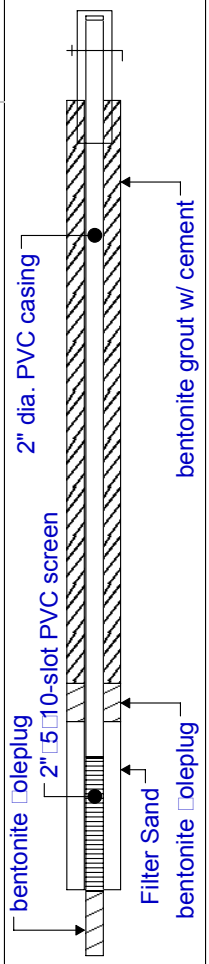
400 136th Avenue
Building 100, Suite B
Holland, Michigan 49424
Phone/Fax: (616) 994-6541
www.goEESolutions.com

Project Name: RCRA Vertical E□p. Feasibility
Project Number: 005-12-003
Site Location: J.H.Campbell□West Oli□e□MI
Drilling Met□od: 8.25" OD HSA
Sampling Met□od: 2□Split Spoon
Ground Ele□ation □feet□: 628.9
Top of Casing Ele□ation □feet□: 631.98
Logged By: Kurt Van Appledorn
Comments:

Log of Borehole: PZ/SB-1207

Start Date: 6-8-12
End Date: 6-8-12
Driller: Remedial Ser□ices Di□ision
Crew C□ief: Da□e Hill
Dept□ to Water □ft BGS during drilling□:
Easting: 4922.8
Nort□ing: -414.3

Dept□ □feet BGS□	Symbol	Description	Dept□/Ele□	Sample Lengt□	Reco□ery □feet□	Blow Counts □per 6 in□	N	Water Content □Percent□ (10 30 50)	Well Completion Details
		Ground Surface	628.9						
0		0-0.6□Gray fine sand si□e ASH□dry.	0.0						
1		0.6-1.1□Dark gray silt si□e ASH wit□ 1" sand si□e as□.		2	1.5	0-0-0-1	0	•	
2			625.9						
3		1.1-3.0□Gray fine sand si□e ASH.	3.0						
4		3.0-8.0□Fine sand si□e ASH□some silt si□e□ moist□2" seams of silt si□e as□.							
5									
6				2	2.0	1-1-1-1	2	•	
7									
8			620.9						
9		8.0-10.5□Dark gray fine sandy silt si□e ASH□wet seam @ 10.3-10.4□	8.0						
10			618.4						
11		10.5-13.0□Gray fine sand si□e ASH□moist.	10.5	2	1.4	0-1-2-2	3	•	
12									
13			615.9						
14		13.0-15.7□Dark gray silty fine SAND si□e ASH□ moist.	13.0						
15									
16			613.2						
17		15.7-18.0□Black and gray t□in layers□fine sand si□e ASH□moist.	15.7	2	1.8	1-1-1-1	2	•	
18			610.9						
19		18.0-22.0□Dark gray sandy silt si□e ASH□□ery moist wit□ wet seam @ 20.4-20.7□	18.0						
20									
21				2	1.6	0-1-5-5	6	•	
22			606.9						
23		22.0-22.7□Dark gray and gray silty fine sand si□e ASH□moist.	22.0	2	2.0	0-1-0-1	1	•	
24		22.7-23.8□Sandy silt si□e ASH□wet□loose 23.3-23.6□	605.1						
25			23.8	2	2.0	0	0		
26		23.8-24.0□Black fine sand si□e ASH□moist.							
27		24.0-30.0□Dark gray silt si□e ASH□wet□loose.		2	2.0	0	0		
28									
29				2	1.3	0	0		
30			598.9						
31		30.0-32.0□Black fine SAND□color grades into gray and brown below 30.7□□ery wet to wet.	30.0	2	1.6	5-10-19-30	29	•	
32			596.9						
33		End of Boring	32.0						
34									
35									
36									



Engineering & Environmental Solutions, LLC

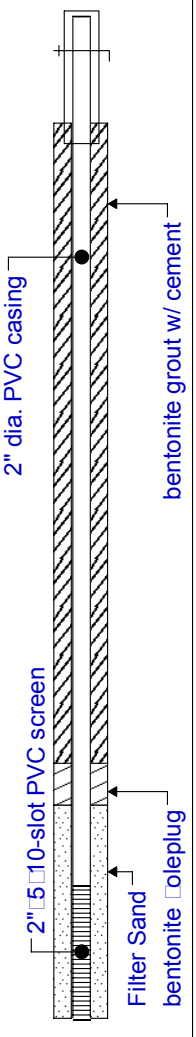
400 136th Avenue
Building 100, Suite B
Holland, Michigan 49424
Phone/Fax: (616) 994-6541
www.goEESolutions.com

Project Name: RCRA Vertical E□p. Feasibility
Project Number: 005-12-003
Site Location: J.H. Campbell□West Oli□e□MI
Drilling Met□od: 8.25" OD HSA
Sampling Met□od: 2□Split Spoon
Ground Ele□ation □feet□: 629.6
Top of Casing Ele□ation □feet□: 633.57
Logged By: Kurt Van Appledorn
Comments:

Log of Borehole: PZ/SB-1208

Start Date: 6-11-12
End Date: 6-11-12
Driller: Remedial Ser□ices Di□ision
Crew C□ief: Da□e Hill
Dept□ to Water □ft BGS during drilling□: 29
Easting: 4037.5
Nort□ing: -538.0

SUBSURFACE PROFILE				SAMPLE					
Dept□ □feet BGS□	Symbol	Description	Dept□/Ele□	Sample Lengt□	Reco□ery □feet□	Blow Counts □per 6 in□	N	Water Content □Percent□ (10 30 50)	Well Completion Details
		Ground Surface	629.6						
0		0-3.0□Dark gray silt si□e ASH□moist□dry wit□ roots @0-0.3□ 1" fine sand si□e seam at 1.8□	0.0	2	1.9	1-1-2-3	3	•	
3		3.0-12.4□Dark gray fine sandy silt si□e ASH□ moist. Loose□wet seams at 5.5-5.7□and 6.1-6.5□	626.6 3.0	2	1.9	0-1-0-1	1		
10		Loose□wet silt seam at 10.7-11.1□ Fine sand si□e seam at 11.1-11.2□	618.9 10.7	2	1.7	1-1-1-1	2	•	
12		12.4-13.2□Dark gray silty fine sand si□e ASH□ moist.	617.2 12.4	2	2.0	1-1-1-2	2	•	
15		13.2-16.0□Dark gray fine sandy silt si□e ASH□ moist. Wet silt si□e seam @ 13.9□ 1" silty sand si□e seams at 14.1□14.5□and 14.9□	613.6	2	1.6	0-0-0-1	0	•	
16		16.0-22.0□Silt si□e ASH□wet. Loose at 17-18□ and at 21-22□	16.0	2	2.0	0	0		
				2	2.0	0	0		
21			607.6	2	1.7	0	0		
22		22.0-34□Brown fine SAND□moist. Wet at 29□	22.0	2	1.3	3-6-8-7	14	•	
25				2	1.0	3-4-5-5	9	•	
30				2	1.1	2-5-7-6	12	•	
34		End of Boring	595.6 34.0						



Engineering & Environmental Solutions, LLC

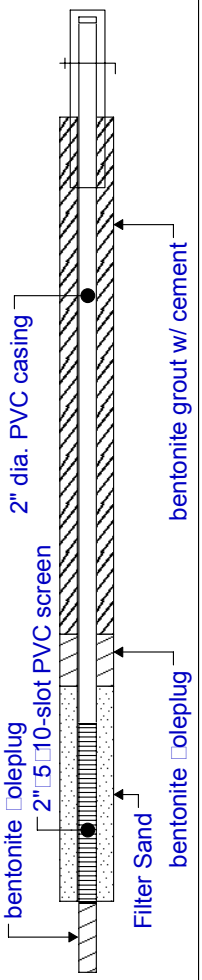
400 136th Avenue
Building 100, Suite B
Holland, Michigan 49424
Phone/Fax: (616) 994-6541
www.goEESolutions.com

Project Name: RCRA Vertical E□p. Feasibility
Project Number: 005-12-003
Site Location: J.H. Campbell□West Oli□e□MI
Drilling Met□od: 8.25" OD HSA
Sampling Met□od: 2□Split Spoon
Ground Ele□ation □feet□: 626.9
Top of Casing Ele□ation □feet□: 629.52
Logged By: Kurt Van Appledorn
Comments:

Log of Borehole: PZ/SB-1210

Start Date: 6-11-12
End Date: 6-12-12
Driller: Remedial Ser□ices Di□ision
Crew C□ief: Bob
Dept□ to Water □ft BGS during drilling□: 29
Easting: 3309.1
Nort□ing: -1383.7

S□BS□RFACE PROFILE				SAMPLE					
Dept□ □feet BGS□	Symbol	Description	Dept□/Ele□	Sample Lengt□	Reco□ery □feet□	Blow Counts □per 6 in□	N	Water Content □Percent□ 10 30 50	Well Completion Details
		Ground Surface	625.0						
0-1-2-3		0-3.0□Dark gray silt si□e ASH□dry. 1" silty fine sand si□e seams.	0.0	2	1.5	1-2-3-3	5		
			622.0						
3-4-5-6-7-8-9-10-11-12-13		3.0-13.0□Dark gray silt si□e ASH□moist to wet. Wet seam at 4.6-4.8□	3.0	2	2.0	1-1-2-2	3		
		Moist□sitly fine sand seams at 9.4-9.9□10-10.1□ 10.2-10.4□	615.6 9.4	2	2.0	1-2-2-2	4		
			612.0						
13-14-15-16		13.0-18.0□Dark gray silt si□e ASH□little fine sand□moist. Wet at 14.5-16□. 1" silty fine sand si□e seam at 15.3□. Soft at 15.4-16□.	13.0	2	2.0	0-0-1-0	1		
			608.8						
16-17-18		Fine sand si□e seams at 16.2-16.7□and 17.0-17.2□ Wet sandy silt si□e seam at 17.5-18□	16.2	2	1.9	1-1-1-1	2		
			607.0						
18-19-20		18.0-21.0□Dark gray sandy silt si□e ASH□wet. Little fine sand si□e at 19-20□	18.0	2	2.0	1-1-2-1	3		
			604.0						
21-22		21.0-22.4□Dark gray silt si□e ASH□wet.	21.0	2	2.0	0-1-2-1	3		
			602.6						
22-23-24		22.4-24.0□Brown fine SAND□moist. Darker brown 3" below as□.	22.4	2	1.4	0-2-3-5	5		
			601.0						
25		End of Boring	24.0						



Sheet: 1 of 1

Engineering & Environmental Solutions, LLC

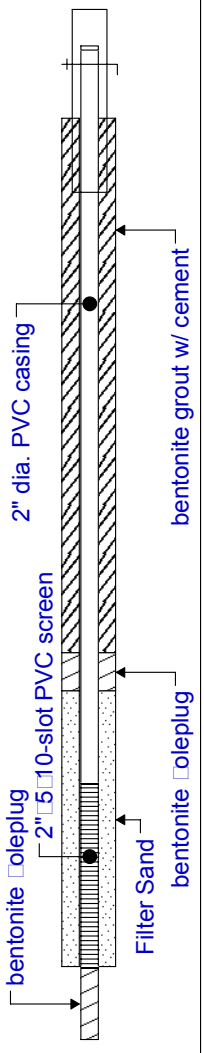
400 136th Avenue
Building 100, Suite B
Holland, Michigan 49424
Phone/Fax: (616) 994-6541
www.goEESolutions.com

Log of Borehole: PZ/SB-1212

Project Name: RCRA Vertical E□p. Feasibility
Project Number: 005-12-003
Site Location: J.H. Campbell□West Oli□e□MI
Drilling Met□od: 8.25" OD HSA
Sampling Met□od: 2□Split Spoon
Ground Ele□ation □feet□: 627.3
Top of Casing Ele□ation □feet□: 629.14
Logged By: Kurt Van Appledorn
Comments:

Start Date: 6-11-12
End Date: 6-11-12
Driller: Remedial Ser□ices Di□ision
Crew C□ief: Bob
Dept□ to Water □ft BGS during drilling□:
Easting: 2888.7
Nort□ing: -983.0

S□BS□RFACE PROFILE				SAMPLE					
Dept□ □feet BGS□	Symbol	Description	Dept□/Ele□	Sample Lengt□	Reco□ery □feet□	Blow Counts □per 6 in□	N	Water Content □Percent□ 10 30 50	Well Completion Details
		Ground Surface	627.3						
0		0-6.6□Dark gray fine sandy silt si□e ASH□dry to 1□moist below 1□. 1/2" fine sand si□e seams at 0.6□and 0.7□and fine sand si□e seam at 1.0-1.2□.	0.0	2	2.0	0-4-4-3	8		
5		Gray and blackfine sand si□e as□seams at 5.2-5.4□and 6.0-6.1□moist.	622.1 5.2 620.7	2	2.0	0-1-1-1	2		
7		6.6-11.8□Dark gray silt si□e ASH□moist to wet.	6.6						
11			615.5	2	2.0	0-1-0-1	1		
12		11.8-17.0□Black silt si□e wit□t□in layers of fine sand si□e ASH□moist. Brownis□gray at 15-16.9□.	11.8						
16			610.3	2	2.0	0	0		
17		17.0-20.7□Sandy silt si□e ASH□wet.	17.0						
18		Brownis□black silty fine sand si□e as□at 18.1-18.2□ □ery moist.	609.1 18.2	2	1.9	1-3-2-1	5		
19		Brownis□gray at 18.2-19□	608.0						
20		1/4" Black and gray layers□wet□at 19.5-20.7□	19.3 606.6	2	2.0	0-0-0-1	0		
21		20.7-22.1□Brownis□gray silt si□e ASH□wet□soft.	20.7						
22			605.2	2	1.1	0-0-0-1	0		
23		23.1-23.1□Brownis□gray and black layers□silty fine sand si□e ASH□wet. 1/8" black sandy silt layer abo□e natural sand.	22.1						
24		23.1-25.0□Grayis□brown fine SAND□wet.	602.3	2	1.1	3-4-5-4	9		
25		End of Boring	25.0						



LOG OF PIEZOMETER PZ-21-01

Barr Engineering Company
3005 Boardwalk St, Suite 100
Ann Arbor, MI 48103
Telephone: 734-922-4400

Project:	Consumers JH Campbell Piezometer Installation	Surface Elevation:	629.9 ft	Top of Casing Elev.:	632.7 ft
Project No.:	22/701071.01	Drilling Method:	Rotasonic	Unique Well No.:	PZ-21-01
Location:	West Olive, MI	Sampling Method:	Continuous		
Coordinates:	N 518,976.4 ft E 12,634,661.8 ft				
Datum:	NAD83 MI State Plane South International Feet	Completion Depth:	39.0 ft		

Depth, feet	Sample Type & Recovery	Sample No.	ENVIRONMENTAL DATA	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0		HA	**PID:**0.5 **D/O/S:**None/ None/ None			TOPSOIL. ASH: very fine to fine grained; gray; moist.	Stick-up Protective Cover Installed in Sand	
5		1	**PID:**0.9 **D/O/S:**None/ None/ None			From 6-7 ft, wet; clay-like; very soft; cohesive.		625
10			**PID:**0.2 **D/O/S:**None/ None/ None			From 9-13 ft, loose; trace dark gray lenses.	Bentonite Grout 2-23.5 ft	620
15		2	**PID:**0.5 **D/O/S:**None/ None/ None			From 13-16 ft, very fine; blocky. At 14 ft, cave in. From 15-16 ft, moist to wet. From 16-27 ft, very fine; moist to wet; blocky; cohesive; less than 0.25-inch compacted layers visible.		615
20			**PID:**0.0 **D/O/S:**None/ None/ None					610
25		3	**PID:**0.0 **D/O/S:**None/ None/ None				Bentonite Seal 23.5-27.6 ft	605
						POORLY GRADED SAND WITH SILT (SP-SM): fine grained; tan with trace gray; moist to wet.	Sand Pack 27.6-35 ft	
30			**PID:**0.0 **D/O/S:**None/ None/ None **G/S/F:**0%/ 90%/ 10%	SP-SM			10-slot PVC Screen 30-35 ft	600
35		4	**PID:**0.2 **D/O/S:**None/ None/ None			POORLY GRADED SAND (SP): fine to medium grained; tan to grayish tan; wet; few silt.		595
			PID:0.0 **D/O/S:**None/ None/ None **G/S/F:**0%/ 95%/ 5%	SP		From 37-39 ft, medium grained with trace coarse grained sand.		
40						End of piezometer 39.0 feet		590
45								585
50								580

Date Boring Started:	3/15/21 12:50 pm
Date Boring Completed:	3/15/21 3:45 pm
Logged By:	AMS3
Drilling Contractor:	Stearns
Drill Rig:	Geoprobe 8140LS

Remarks: Set piezometer from 30-35 feet (ft) below ground surface (bgs). Collected grab bag samples to hold for leach testing from 5-6 ft, 15-16 ft, 25-26 ft, and 35-36 ft bgs.

PID = Headspace; D/O/S = Discoloration/Odor/Sheen; FID/MC = FID/Methane Corrected; G/S/F = Gravel/Sand/Fines
Additional data may have been collected in the field which is not included on this log.

O:\GINT\PROJECTS\22701071 JH CAMPBELL ADDITIONAL DATA COLLECTION\22701071 JH CAMPBELL ADDITIONAL DATA COLLECTION.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Barr Engineering Company
3005 Boardwalk St, Suite 100
Ann Arbor, MI 48103
Telephone: 734-922-4400

LOG OF PIEZOMETER PZ-21-02

Project:	Consumers JH Campbell Piezometer Installation	Surface Elevation:	629.2 ft	Top of Casing Elev.:	631.8 ft
Project No.:	22/701071.01	Drilling Method:	Rotasonic	Unique Well No.:	PZ-21-02
Location:	West Olive, MI	Sampling Method:	Continuous		
Coordinates:	N 518,335.3 ft E 12,635,691.8 ft				
Datum:	NAD83 MI State Plane South International Feet	Completion Depth:	48.5 ft		

Depth, feet	Sample Type & Recovery	Sample No.	ENVIRONMENTAL DATA	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0		HA	**PID:**0.0 **D/O/S:**None/ None/ None			ASH: gray/brown gray; moist to wet. From 0-2 ft, gray with trace black; cohesive; blocky.	Stick-up Protective Cover Installed in Sand	
		1				From 2-6 ft, gray to brownish gray; loose; moist.		625
5			**PID:**0.0 **D/O/S:**None/ None/ None			From 6-7 ft, gray with brownish gray; moist; less than 0.25-inch compacted layers; cohesive. From 7-14 ft, grayish brown/brownish gray; loose to very loose; moist; trace black flecks.		
10			**PID:**0.0 **D/O/S:**None/ None/ None					620
		2				From 14-16 ft, gray and dark gray less than 0.25-inch alternating layers; moist.		615
15			**PID:**0.0 **D/O/S:**None/ None/ None			From 16-18 ft, gray; very fine; moist to wet; soft; cohesive; sponge-like texture.	Bentonite Grout 2-28.9 ft	
						From 18-21 ft, gray with dark gray layers; moist; cohesive; moderately compacted.		610
20			**PID:**0.0 **D/O/S:**None/ None/ None			From 21-23 ft, gray; fine to medium sand and ash mix; moist.		
		3				From 23-24 ft, brownish gray; moist to wet; very soft; cohesive.		605
25			**PID:**0.0 **D/O/S:**None/ None/ None **G/S/F:**0%/ 90%/ 10%	SP-SM		POORLY GRADED SAND WITH SILT (SP-SM): fine grained; tan; moist to wet; few silt.		
30			**PID:**0.0 **D/O/S:**None/ None/ None				Bentonite Seal 28.9-34 ft	600
			PID:0.0 **D/O/S:**None/ None/ None					
		4				At 34 ft, collapse.	Sand Pack 34-41 ft	595
35			**PID:**0.0 **D/O/S:**None/ None/ None					
40			**PID:**0.0 **D/O/S:**None/ None/ None	SW		WELL GRADED SAND (SW): fine to coarse grained; tan; moist to wet; few silt.	10-slot PVC Screen 36-41 ft	590
		5	**G/S/F:**0%/ 95%/ 5%			SILT (ML): gray; moist; stiff; few sand.		
45			**PID:**0.0 **D/O/S:**None/ None/ None **G/S/F:**0%/ 5%/ 95%	ML				585
50						End of piezometer 48.5 feet		580

Date Boring Started:	3/16/21 9:10 am
Date Boring Completed:	3/16/21 11:20 am
Logged By:	AMS3
Drilling Contractor:	Stearns
Drill Rig:	Geoprobe 8140LS

Remarks: Set piezometer from 36-41 feet (ft) below ground surface (bgs). Collected grab bag samples to hold for leach testing from 5-6 ft, 15-16 ft, 22-23 ft, 35-36 ft, and 45-46 ft bgs.

PID = Headspace; D/O/S = Discoloration/Odor/Sheen; FID/MC = FID/Methane Corrected; G/S/F = Gravel/Sand/Fines
Additional data may have been collected in the field which is not included on this log.

LOG OF PIEZOMETER PZ-21-03

Barr Engineering Company
3005 Boardwalk St, Suite 100
Ann Arbor, MI 48103
Telephone: 734-922-4400

Project:	Consumers JH Campbell Piezometer Installation	Surface Elevation:	625.9 ft	Top of Casing Elev.:	628.5 ft
Project No.:	22/701071.01	Drilling Method:	Rotasonic	Unique Well No.:	PZ-21-03
Location:	West Olive, MI	Sampling Method:	Continuous		
Coordinates:	N 518,494.9 ft E 12,636,907.0 ft				
Datum:	NAD83 MI State Plane South International Feet	Completion Depth:	41.0 ft		

Depth, feet	Sample Type & Recovery	Sample No.	ENVIRONMENTAL DATA	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0		HA	**PID:**0.0 **D/O/S:**None/ None/ None			ASH: dark gray; moist to wet. From 0-4 ft, dark gray and gray mixed; fine to medium; moist; powdery.	Stick-up Protective Cover Installed in Sand	625
5		1	**PID:**0.1 **D/O/S:**None/ None/ None			From 4-10 ft, light gray; very fine; moist to wet; cohesive; waxy/silty-like.		620
10		2	**PID:**0.1 **D/O/S:**None/ None/ None			From 10-15 ft, light gray/gray alternating less than 0.25-inch compacted layers.		615
15			**PID:**0.3 **D/O/S:**None/ None/ None			From 15-23 ft, very dark gray; powdery; transitions to light gray and moist; to very dark gray "swirled" layers.	Bentonite Grout 2-29.8 ft	610
20		3	**PID:**0.0 **D/O/S:**None/ None/ None			From 23-25 ft, gray; moist; fine to medium grained sand and ash mix.		605
25			**PID:**0.0 **D/O/S:**None/ None/ None	SP		POORLY GRADED SAND (SP): very fine to fine grained; light tan; moist to wet; trace to few silt.		600
30			**PID:**0.0 **D/O/S:**None/ None/ None				Bentonite Seal 29.8-33.5 ft	595
35		4	**PID:**0.0 **D/O/S:**None/ None/ None **G/S/F:**0%/ 95%/ 5%			At 36 ft, changes to fine to medium; tan.	Sand Pack 33.5-41 ft	590
40			**PID:**0.0 **D/O/S:**None/ None/ None			NO SAMPLE COLLECTED. End of piezometer 41.0 feet	10-Slot PVC Screen 36-41 ft	585
45								580
50								

Date Boring Started:	3/16/21 1:45 pm
Date Boring Completed:	3/16/21 3:00 pm
Logged By:	AMS3
Drilling Contractor:	Stearns
Drill Rig:	Geoprobe 8140LS

Remarks: Set piezometer from 36-41 feet (ft) below ground surface (bgs). Collected grab bag samples to hold for leach testing from 5-6 ft, 13-14 ft, 22-23 ft, and 35-36 ft bgs.

PID = Headspace; D/O/S = Discoloration/Odor/Sheen; FID/MC = FID/Methane Corrected; G/S/F = Gravel/Sand/Fines
Additional data may have been collected in the field which is not included on this log.

O:\GINT\PROJECTS\22701071 JH CAMPBELL ADDITIONAL DATA COLLECTION\22701071 JH CAMPBELL ADDITIONAL DATA COLLECTION.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

LOG OF PIEZOMETER PZ-21-04

Barr Engineering Company
3005 Boardwalk St, Suite 100
Ann Arbor, MI 48103
Telephone: 734-922-4400

Project:	Consumers JH Campbell Piezometer Installation	Surface Elevation:	628.9 ft	Top of Casing Elev.:	631.6 ft
Project No.:	22/701071.01	Drilling Method:	Rotasonic	Unique Well No.:	PZ-21-04
Location:	West Olive, MI	Sampling Method:	Continuous		
Coordinates:	N 519,757.0 ft E 12,636,972.7 ft				
Datum:	NAD83 MI State Plane South International Feet	Completion Depth:	42.0 ft		

Depth, feet	Sample Type & Recovery	Sample No.	ENVIRONMENTAL DATA	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0		HA	**PID:**0.8 **D/O/S:**None/ None/ None			ASH: gray; moist to wet. From 0-7 ft, dark gray/light gray; loose; moist; not compacted.	Stick-up Protective Cover Installed in Sand	
		1						625
5			**PID:**0.0 **D/O/S:**None/ None/ None			From 7-9 ft, dark gray; fine sand; sponge-like; moist to saturated.		
						From 9-17 ft, light gray and gray; loose; occasional compacted lens.		620
10			**PID:**0.1 **D/O/S:**None/ None/ None					
		2						615
15			**PID:**0.0 **D/O/S:**None/ None/ None				Bentonite Grout 2-31.4 ft	
						From 17-33 ft, brownish gray; very soft; very fine; saturated; liquid-like.		610
20								
		3						605
25								
								600
30								
		4		SP		POORLY GRADED SAND (SP): fine to medium grained; dark brown; moist; trace ash and wood debris.	Bentonite Seal 31.4-34.7 ft	595
35			**PID:**0.0 **D/O/S:**None/ None/ None **G/S/F:**0%/ 95%/ 5%	SP-SM		POORLY GRADED SAND WITH SILT (SP-SM): fine to medium grained; tan; moist to wet; loose; few silt.	Sand Pack 34.7-42.3 ft	
			PID:0.0 **D/O/S:**None/ None/ None **G/S/F:**0%/ 90%/ 10%			NO SAMPLE COLLECTED.	10-Slot PVC Screen 37-42 ft	590
40								
						End of piezometer 42.0 feet		585
45								
50								580

Date Boring Started:	3/17/21 1:00 pm
Date Boring Completed:	3/17/21 3:00 pm
Logged By:	AMS3
Drilling Contractor:	Stearns
Drill Rig:	Geoprobe 8140LS

Remarks: Set piezometer from 37-42 feet (ft) below ground surface (bgs). Collected grab bag samples to hold for leach testing from 7-8 ft, 16-17 ft, 27-28 ft, and 33-34 ft bgs.

PID = Headspace; D/O/S = Discoloration/Odor/Sheen; FID/MC = FID/Methane Corrected; G/S/F = Gravel/Sand/Fines
Additional data may have been collected in the field which is not included on this log.

O:\GINT\PROJECTS\22701071 JH CAMPBELL ADDITIONAL DATA COLLECTION.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

LOG OF PIEZOMETER PZ-21-05

Barr Engineering Company
3005 Boardwalk St, Suite 100
Ann Arbor, MI 48103
Telephone: 734-922-4400

Project:	Consumers JH Campbell Piezometer Installation	Surface Elevation:	629.3 ft	Top of Casing Elev.:	631.9 ft
Project No.:	22/701071.01	Drilling Method:	Rotasonic	Unique Well No.:	PZ-21-05
Location:	West Olive, MI	Sampling Method:	Continuous		
Coordinates:	N 519,701.9 ft E 12,635,379.6 ft				
Datum:	NAD83 MI State Plane South International Feet	Completion Depth:	40.0 ft		

Depth, feet	Sample Type & Recovery	Sample No.	ENVIRONMENTAL DATA	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0		HA	**PID:**0.0 **D/O/S:**None/ None/ None			ASH: gray; moist to wet. From 0-8.5 ft, gray; moist; powdery to slightly compacted; trace light gray layers less than 0.25-inch.	Stick-up Protective Cover Installed in Sand	
		1						625
5			**PID:**0.1 **D/O/S:**None/ None/ None					
						From 8.5-10.5 ft, gray; moist to wet; sponge-like; trace brownish gray alternated layers/swirls; trace roots.		620
10			**PID:**0.0 **D/O/S:**None/ None/ None			From 10.5-12 ft, gray to dark gray; moist; crumbles easily; loose.		
		2				From 12-16 ft, gray; moist; homogenous; cohesive; massive; trace brownish gray lenses/layers less than 0.25-inch.		
15			**PID:**0.0 **D/O/S:**None/ None/ None				Bentonite Grout 2-28.1 ft	615
						From 16-18.5 ft, dark gray; moist; crumbles easily; loose to very loose; trace light gray bands.		
20			**PID:**0.1 **D/O/S:**None/ None/ None			From 18.5-28 ft, gray; fine sand; moist to wet; very soft; liquid-like.		610
		3						
25			**PID:**0.0 **D/O/S:**None/ None/ None					605
			PID:0.1 **D/O/S:**None/ None/ None			POORLY GRADED SAND WITH SILT (SP-SM): fine to medium grained; tan; moist to wet; few silt (5-10%).		
30			**G/S/F:**0%/ 90%/ 10%				Bentonite Seal 28.1-32.6 ft	600
		4	**PID:**0.0 **D/O/S:**None/ None/ None	SP-SM			Sand Pack 32.6-40 ft	
35			**PID:**0.0 **D/O/S:**None/ None/ None				10-Slot PVC Screen 35-40 ft	595
						NO SAMPLE COLLECTED.		
40						End of piezometer 40.0 feet		590
45								585
50								580

Date Boring Started:	3/18/21 8:50 am
Date Boring Completed:	3/18/21 10:30 am
Logged By:	AMS3
Drilling Contractor:	Stearns
Drill Rig:	Geoprobe 8140LS

Remarks: Set piezometer from 35-40 feet (ft) below ground surface (bgs). Collected grab bag samples to hold for leach testing from 6-7 ft, 15-16 ft, 25-26 ft, and 35-36 ft bgs.

PID = Headspace; D/O/S = Discoloration/Odor/Sheen; FID/MC = FID/Methane Corrected; G/S/F = Gravel/Sand/Fines
Additional data may have been collected in the field which is not included on this log.

LOG OF PIEZOMETER PZ-21-06

Barr Engineering Company
3005 Boardwalk St, Suite 100
Ann Arbor, MI 48103
Telephone: 734-922-4400

Project:	Consumers JH Campbell Piezometer Installation	Surface Elevation:	628.6 ft	Top of Casing Elev.:	631.2 ft
Project No.:	22/701071.01	Drilling Method:	Rotasonic	Unique Well No.:	PZ-21-06
Location:	West Olive, MI	Sampling Method:	Continuous		
Coordinates:	N 519,095.3 ft E 12,636,608.1 ft				
Datum:	NAD83 MI State Plane South International Feet	Completion Depth:	48.0 ft		

Depth, feet	Sample Type & Recovery	Sample No.	ENVIRONMENTAL DATA	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0		HA	**PID:**0.2 **D/O/S:**None/ None/ None			ASH: gray. From 0-18 ft, gray; very soft to soft; very fine; moist; homogenous; no layering visible.	Stick-up Protective Cover Installed in Sand	
		1						625
5			**PID:**0.3 **D/O/S:**None/ None/ None					
								620
10			**PID:**0.3 **D/O/S:**None/ None/ None					
		2						615
15			**PID:**0.1 **D/O/S:**None/ None/ None			From 16-17 ft, very soft; wet.	Bentonite Grout 2-29.8 ft	
						From 18-25 ft, gray; moist; more compacted; some alternating light gray/gray layering visible less than 0.25-inch; blocky, crumbles easily.		610
20			**PID:**0.2 **D/O/S:**None/ None/ None					
		3						605
25			**PID:**0.2 **D/O/S:**None/ None/ None			From 25-31 ft, gray; very soft; very fine; moist to wet; homogeneous; liquid-like.		
								600
30			**PID:**0.5 **D/O/S:**None/ None/ None **G/S/F:**0%/ 95%/ 5%	SP		POORLY GRADED SAND (SP): fine grained; dark gray to gray; moist; few silt, few ash.	Bentonite Seal 29.8-35.3 ft	
		4				POORLY GRADED SAND WITH SILT (SP-SM): fine to medium grained; light tan to tan; moist to wet; light tan from 32-37 ft; few silt.		595
35	▼		**PID:**0.1 **D/O/S:**None/ None/ None **G/S/F:**0%/ 90%/ 10%				Sand Pack 35.3-43 ft	
			PID:0.1 **D/O/S:**None/ None/ None					590
40			**PID:**0.2 **D/O/S:**None/ None/ None	SP-SM			10-Slot PVC Screen 38-43 ft	
		5						585
45			**PID:**0.2 **D/O/S:**None/ None/ None					
						End of piezometer 48.0 feet		580
50								

Date Boring Started:	3/17/21 8:45 am
Date Boring Completed:	3/17/21 10:15 am
Logged By:	AMS3
Drilling Contractor:	Stearns
Drill Rig:	Geoprobe 8140LS

Remarks: Set piezometer from 38-43 feet (ft) below ground surface (bgs). Collected grab bag samples to hold for leach testing from 0-8 ft, 12-13 ft, 26-27 ft, 31-32 ft, and 45-46 ft bgs.

PID = Headspace; D/O/S = Discoloration/Odor/Sheen; FID/MC = FID/Methane Corrected; G/S/F = Gravel/Sand/Fines
Additional data may have been collected in the field which is not included on this log.

O:\GINT\PROJECTS\22701071 JH CAMPBELL ADDITIONAL DATA COLLECTION\22701071 JH CAMPBELL ADDITIONAL DATA COLLECTION.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Appendix C
T-Test Results

Two sample t Test (8/19/2021 08:52:00)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 08:52:00
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book5]"JHC-MW-15003 Before"!I"Arsenic"	[1:10]
2nd Data Range	[Book5]"JHC-MW-15003 After"!I"Arsenic"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Arsenic"		9	0.02683	0.0078	0.0026	0.027
		7	0.01094	0.00279	0.00106	0.01
	Difference		0.01589		0.00311	
	Overall	16	0.01988	0.01009	0.00252	0.0177

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	5.10975	14	1.58817E-4
Equal Variance NOT Assumed (Welch Correction)	5.66497	10.47484	1.74934E-4

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is significantly different from 0

Two sample t Test (8/19/2021 08:44:07)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 08:44:07
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book5]"JHC-MW-15003 Before"!O"Boron"	[1:9]
2nd Data Range	[Book5]"JHC-MW-15003 After"!O"Boron"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Boron"		9	0.96244	0.44219	0.1474	1.12
		7	2.05914	1.23884	0.46824	1.7
	Difference		-1.0967		0.44207	
	Overall	16	1.44225	1.01681	0.2542	1.16

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-2.48085	14	0.02643
Equal Variance NOT Assumed (Welch Correction)	-2.2341	7.19504	0.05959

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 08:42:53)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 08:42:53
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book5]"JHC-MW-15003 Before"!T"Calcium"	[1:9]
2nd Data Range	[Book5]"JHC-MW-15003 After"!T"Calcium"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Calcium"		9	35.38889	6.68177	2.22726	34.6
		7	83.02857	31.34675	11.84796	94.6
	Difference		-47.63968		10.6504	
	Overall	16	56.23125	31.82158	7.9554	41.3

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-4.47304	14	5.25645E-4
Equal Variance NOT Assumed (Welch Correction)	-3.9517	6.42554	0.00656

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is significantly different from 0

Two sample t Test (8/19/2021 08:41:18)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 08:41:18
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book5]"JHC-MW-15003 Before" !E"Alkalinity Sum"	[1:8]
2nd Data Range	[Book5]"JHC-MW-15003 After"!E "Alkalinity Sum"	[2:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Alkalinity Sum"		8	68.7125	9.08255	3.21117	67.95
		3	127.66667	56.08327	32.37969	157
	Difference		-58.95417		18.70201	
	Overall	11	84.79091	38.01477	11.46189	68.9

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-3.15229	9	0.01169
Equal Variance NOT Assumed (Welch Correction)	-1.81183	2.03948	0.20926

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 08:48:51)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 08:48:51
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book5]"JHC-MW-15003 Before"!Y"Chloride"	[1:9]
2nd Data Range	[Book5]"JHC-MW-15003 After"!Y"Chloride"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Chloride"		9	24.44444	4.02185	1.34062	24
		7	26.08571	11.71828	4.42909	22.3
	Difference		-1.64127		4.15856	
	Overall	16	25.1625	8.01631	2.00408	23.15

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-0.39467	14	0.69903
Equal Variance NOT Assumed (Welch Correction)	-0.35467	7.10505	0.73313

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is NOT significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 08:45:00)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 08:45:00
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book5]"JHC-MW-15003 Before" !AJ"Magnesium"	[1:8]
2nd Data Range	[Book5]"JHC-MW-15003 After"!AJ"Magnesium"	[2:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Magnesium"		8	6.64875	1.2506	0.44216	6.545
		3	17.26667	8.82968	5.09782	20.9
	Difference		-10.61792		2.91518	
	Overall	11	9.54455	6.42537	1.93732	7.05

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-3.64229	9	0.00538
Equal Variance NOT Assumed (Welch Correction)	-2.07504	2.03017	0.17177

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 09:06:22)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:06:22
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book5]"JHC-MW-15003 Before"!AM"Molybdenum"	[1:10]
2nd Data Range	[Book5]"JHC-MW-15003 After"!AM"Molybdenum"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Molybdenum"		9	0.01951	0.00736	0.00245	0.02
		7	0.06861	0.03972	0.01501	0.059
	Difference		-0.0491		0.0134	
	Overall	16	0.04099	0.03596	0.00899	0.0261

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-3.66383	14	0.00255
Equal Variance NOT Assumed (Welch Correction)	-3.22764	6.32163	0.0167

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is significantly different from 0

Two sample t Test (8/19/2021 09:07:28)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:07:28
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book5]"JHC-MW-15003 Before"!AX"Selenium"	[1:10]
2nd Data Range	[Book5]"JHC-MW-15003 After"!AX"Selenium"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Selenium"		9	0.0017	8.68907E-4	2.89636E-4	0.0011
		7	0.01527	0.01219	0.00461	0.018
	Difference		-0.01357		0.00404	
	Overall	16	0.00764	0.0104	0.0026	0.00255

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-3.36202	14	0.00465
Equal Variance NOT Assumed (Welch Correction)	-2.93873	6.04741	0.02575

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is significantly different from 0

Two sample t Test (8/19/2021 08:50:06)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 08:50:06
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book5]"JHC-MW-15003 Before"!BE"Sulfate (mg/L)"	[1:9]
2nd Data Range	[Book5]"JHC-MW-15003 After"!BE"Sulfate (mg/L)"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Sulfate (mg/L)"		9	55.36667	9.83438	3.27813	52.7
		7	164.41429	83.716	31.64167	194
	Difference		-109.04762		27.87205	
	Overall	16	103.075	77.30729	19.32682	67.4

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-3.91244	14	0.00156
Equal Variance NOT Assumed (Welch Correction)	-3.42798	6.12896	0.01355

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is significantly different from 0

Two sample t Test (8/19/2021 09:44:47)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:44:47
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book7]"JHC-MW-15005 Before"!O"Boron"	[1:9]
2nd Data Range	[Book7]"JHC-MW-15005 After"!O"Boron"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Boron"		9	0.75878	0.4275	0.1425	0.546
		7	1.23614	0.8117	0.30679	1.2
	Difference		-0.47737		0.31342	
	Overall	16	0.96763	0.64871	0.16218	0.8325

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-1.52307	14	0.15001
Equal Variance NOT Assumed (Welch Correction)	-1.41118	8.56901	0.19345

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is NOT significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 09:46:16)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:46:16
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book7]"JHC-MW-15005 Before"!T"Calcium"	[1:9]
2nd Data Range	[Book7]"JHC-MW-15005 After"!T"Calcium"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Calcium"		9	54.88889	8.99548	2.99849	55
		7	104.5	38.16325	14.42435	99.7
	Difference		-49.61111		13.04863	
	Overall	16	76.59375	35.66246	8.91562	61

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-3.80202	14	0.00194
Equal Variance NOT Assumed (Welch Correction)	-3.36741	6.52063	0.01331

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is significantly different from 0

Two sample t Test (8/19/2021 09:43:16)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:43:16
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book7]"JHC-MW-15005 Before"!E"Alkalinity Sum"	[1:10]
2nd Data Range	[Book7]"JHC-MW-15005 After"!E"Alkalinity Sum"	[2:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Alkalinity Sum"		10	134.2	19.35516	6.12064	125.5
		5	198.74	72.14907	32.26604	229
	Difference		-64.54		23.62864	
	Overall	15	155.71333	52.15243	13.4657	140

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-2.73143	13	0.01713
Equal Variance NOT Assumed (Welch Correction)	-1.9652	4.29058	0.11602

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 09:51:44)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:51:44
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book7]"JHC-MW-15005 Before"!Y"Chloride"	[1:9]
2nd Data Range	[Book7]"JHC-MW-15005 After"!Y"Chloride"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Chloride"		9	36.51111	15.13245	5.04415	29.3
		7	36.91286	28.54045	10.78728	30
	Difference		-0.40175		11.04045	
	Overall	16	36.68688	21.16586	5.29147	29.65

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-0.03639	14	0.97149
Equal Variance NOT Assumed (Welch Correction)	-0.03374	8.60223	0.97386

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is NOT significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 09:48:30)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:48:30
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book7]"JHC-MW-15005 Before"!AJ"Magnesium"	[1:8]
2nd Data Range	[Book7]"JHC-MW-15005 After"!AJ"Magnesium"	[2:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Magnesium"		8	12.3625	1.61594	0.57132	11.8
		4	22.1	7.78117	3.89059	23.7
	Difference		-9.7375		2.73806	
	Overall	12	15.60833	6.41567	1.85204	12.75

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-3.55635	10	0.00521
Equal Variance NOT Assumed (Welch Correction)	-2.47628	3.13015	0.08604

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 09:56:15)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:56:15
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book7]"JHC-MW-15005 Before"!AM"Molybdenum"	[1:10]
2nd Data Range	[Book7]"JHC-MW-15005 After"!AM"Molybdenum"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Molybdenum"		9	0.01713	0.00681	0.00227	0.015
		7	0.25667	0.30643	0.11582	0.11
	Difference		-0.23954		0.10113	
	Overall	16	0.12193	0.22945	0.05736	0.0215

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-2.36865	14	0.03278
Equal Variance NOT Assumed (Welch Correction)	-2.06781	6.0046	0.08411

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 09:57:37)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:57:37
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book7]"JHC-MW-15005 Before"!AX"Selenium"	[1:10]
2nd Data Range	[Book7]"JHC-MW-15005 After"!AX"Selenium"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Selenium"		9	0.07391	0.12063	0.04021	0.018
		7	0.155	0.09599	0.03628	0.158
	Difference		-0.08109		0.05581	
	Overall	16	0.10939	0.11477	0.02869	0.0495

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-1.45294	14	0.16828
Equal Variance NOT Assumed (Welch Correction)	-1.49722	13.97666	0.15657

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is NOT significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 09:50:00)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:50:00
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book7]"JHC-MW-15005 Before"!BC"Sodium + Potassium"	[1:8]
2nd Data Range	[Book7]"JHC-MW-15005 After"!BC"Sodium + Potassium"	[2:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Sodium + Potassium"		8	28.575	10.07744	3.56291	29.675
		4	24.5575	5.70121	2.8506	24.28
	Difference		4.0175		5.50589	
	Overall	12	27.23583	8.79791	2.53974	28.825

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	0.72967	10	0.48233
Equal Variance NOT Assumed (Welch Correction)	0.88047	9.62631	0.40005

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is NOT significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is NOT significantly different from 0

Two sample t Test (8/19/2021 09:53:21)

Notes

X-Function	Two sample t Test
User Name	CMMiller
Time	8/19/2021 09:53:21
Data Filter	No

Input Data

	Data	Range
1st Data Range	[Book7]"JHC-MW-15005 Before"!BE"Sulfate (mg/L)"	[1:9]
2nd Data Range	[Book7]"JHC-MW-15005 After"!BE"Sulfate (mg/L)"	[1:7]

Descriptive Statistics

		N	Mean	SD	SEM	Median
"Sulfate (mg/L)"		9	57.94444	6.56527	2.18842	58.3
		7	143.72857	59.89938	22.63984	133
	Difference		-85.78413		19.91931	
	Overall	16	95.475	58.22266	14.55566	65.45

Standard Error of Mean (SEM) of difference is computed under the condition that equal variance is assumed.

t-Test Statistics

	t Statistic	DF	Prob>|t|
Equal Variance Assumed	-4.30658	14	7.24265E-4
Equal Variance NOT Assumed (Welch Correction)	-3.7715	6.11225	0.00896

Null Hypothesis: mean1-mean2 = 0
Alternative Hypothesis: mean1-mean2 <> 0
At 0.05 level, when equal variance is assumed, Mean1 - Mean2 is significantly different from 0
At 0.05 level, when equal variance is NOT assumed, Mean1 - Mean2 is significantly different from 0

Appendix D
References

References

Consumers Energy. July 30, 2021. Semiannual Progress Report – Selection of Remedy, JH Campbell Ponds 1-2 North and 1-2 South CCR Unit, JH Campbell Pond A CCR Unit.

Golder Associates Inc. December 2017. JH Campbell Generating Facility Bottom Ash Ponds 1-2 Closure Work Plan, West Olive, Michigan. Prepared for Consumers Energy Company.

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

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

Lee, Seungyeol, Zhizhang Shen, and Huifang Xu. 2016. "Study on nanophase iron oxyhydroxides in freshwater ferromanganese nodules from Green Bay, Lake Michigan, with implications for the adsorption of As and heavy metals." American Mineralogist 101.9 (2016): 1986-1995.

Korkisch, J., I. Steffan, and G. Arrhenius. 1977. "Chemical analysis of manganese nodules: Part III. Determination of Thallium, Molybdenum and Vanadium after Anion-Exchange Separation." Analytica Chimica Acta 94.2 (1977): 237-244.

Mason, R. P., J-M. Laporte, and S. Andres. 2000. "Factors controlling the bioaccumulation of mercury, methylmercury, arsenic, selenium, and cadmium by freshwater invertebrates and fish." Archives of Environmental Contamination and Toxicology 38.3 (2000): 283-297.

TRC. January 2021. Sample Analysis Plan for JH Campbell Ponds 1-2 and Pond 3. Prepared for Consumers Energy Company.

TRC. July 30, 2021. Statistical Evaluation of April 2021 Assessment Monitoring Sampling Event Technical Memorandum. Prepared for Consumers Energy Company.

USEPA. November 1993; Revised April 13, 1998. Solid Waste Disposal Facility Criteria Technical Manual. EPA530-R-93-017.