



Assessment of Corrective Measures

**Consumers Energy Company
JH Campbell Ponds 1-2 North and 1-2 South and Pond A
Coal Combustion Residual Units**

West Olive, Michigan

September 2019



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*Prepared For
Consumers Energy Company*

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Executive Summary

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule), as amended July 30, 2018. The CCR Rule, which became effective on October 19, 2015 (amendment effective August 29, 2018), applies to the JH Campbell (JHC) Ponds 1-2 North and Ponds 1-2 South Bottom Ash Ponds (Ponds 1-2) and Pond A. The CCR Rule 40 CFR §257.96(a) requires that an owner or operator initiate an assessment of corrective measures (ACM) to prevent further release, to remediate any releases, and to restore affected areas to original conditions if any Appendix IV constituent has been detected at a statistically significant level exceeding a Groundwater Protection Standard (GWPS).

The ACM is required whenever an Appendix IV constituent has been detected at a statistically significant level exceeding the established federal GWPS. TRC has prepared this ACM for the JH Campbell Ponds 1-2 and Pond A, on behalf of Consumers Energy, to evaluate the effectiveness of potential corrective measures in meeting the requirements and objectives of selecting a remedy that is protective of human health and the environment, achieves the GWPS, and source control. The requirements for conducting the ACM are contained in the CCR Rule.

On January 14, 2019, Consumers Energy provided notification that arsenic was present at statistically significant levels above the federal GWPS in one or more downgradient monitoring wells at Ponds 1-2 and Pond A. This notification was followed up with a Response Action Plan submitted to the Michigan Department of Environment, Great Lakes, and Energy (EGLE)¹ on March 15, 2019 laying out the preliminary understanding of water quality and actions that were underway to mitigate or eliminate unacceptable risk associated with the identified release from the CCR unit. This plan also described the development and submittal of the ACM under the timeframes provided under the CCR Rule.

As documented in the September 2018 Notification of Intent to Initiate Closure letters submitted in accordance with §257.102(g), Consumers Energy is in the process of closing Ponds 1-2 under the RCRA Rule's closure by removal provisions in §257.102(c) and Pond A under the RCRA Rule's closure in place provisions in §257.102(d). Consumers Energy submitted a Ponds 1-2 closure work plan to EGLE (Golder, December 2017). CCR removal has been completed at Ponds 1-2 and results are documented in the *Bottom Ash Ponds 1-2 N/S CCR Removal Documentation Report* (Golder) provided to EGLE on August 9, 2019. Closure activities at Pond

¹ Effective Monday, April 22, 2019, the Michigan Department of Environmental Quality (MDEQ) became known as the Michigan Department of Environment, Great Lakes, and Energy (EGLE).

A began in second quarter 2019. Final cover construction was completed in summer 2019 and the closure certification is being developed.

The groundwater nature and extent has been defined, as required in §257.95(g)(1). The nature and extent characterization was performed using additional data collected from existing groundwater monitoring wells, as well as shallow and deep step-out wells nested with existing downgradient step-out wells. The nature and extent data consist of data collected between March 2016 and April 2019 from the downgradient CCR monitoring well networks, several pre-existing downgradient wells from the state monitoring well network, and nested step-out wells installed in April 2018.

Nature and Extent (N&E) Evaluation Wells			
JHC CCR Background Wells	JHC Pond A CCR Unit Wells	JHC Ponds 1-2 CCR Unit Wells	N&E Delineation Wells
JHC-MW-15023	JHC-MW-15006	JHC-MW-15001	MW-13
JHC-MW-15024	JHC-MW-15007	JHC-MW-15002	MW-14
JHC-MW-15025	JHC-MW-15008	JHC-MW-15003	MW-14S
JHC-MW-15026	JHC-MW-15009	JHC-MW-15004	MW-14D
JHC-MW-15027	JHC-MW-15010	JHC-MW-15005	PZ-23
JHC-MW-15028	JHC-MW-15011	JHC-MW-18004	PZ-23S
		JHC-MW-18005	PZ-23D
			PZ-24
			PZ-24S
			PZ-24D
			PZ-40
			PZ-40S

Arsenic concentrations in groundwater, although present in groundwater monitoring locations above the GWPS, are delineated within the limits of the property owned by Consumers Energy. Although arsenic has been identified in groundwater at concentrations exceeding applicable criteria, an evaluation of risk demonstrates that there are **currently no adverse effects on human health or the environment** from either surface water or groundwater due to CCR management at Ponds 1-2 and Pond A.

Several groundwater remediation alternatives evaluated in this ACM are considered technically feasible to reduce groundwater concentrations to below the GWPS as discussed in Sections 4 and 5. Consumers Energy plans to utilize an adaptive management strategy for selecting the final groundwater remedy for Ponds 1-2 and Pond A in coordination with the specified CCR source material management strategies. Under this remedy selection strategy, measures that remove source material, reduce infiltration, and/or minimize the potential for future migration during the closure process may be implemented to address existing conditions followed by

monitoring and evaluation of the performance after closure. Adjustments will be made to the corrective measure remedy, as needed, to achieve the remedial goals (e.g. GWPS and/or risk/exposure/pathway-based criteria).

Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98, which includes semiannual assessment monitoring in accordance with §257.95 to monitor groundwater conditions and inform the remedy selection. The next semiannual assessment monitoring event is scheduled to occur in October 2019 with results summarized in the 2019 Annual Groundwater Monitoring Report issued in January 2020.

Consumers Energy will, as soon as feasible, select remedies for affected groundwater at Ponds 1-2 and Pond A that, at a minimum, meet the federal standards of §257.97(b). A public meeting with interested and affected parties will be scheduled in accordance with §257.96(e) once one or more preferred remedial approach(s) for groundwater are identified. A final report describing the selected remedies and how they meet the standards specified in §257.97 will be prepared following selection of a final remedy for each of the two units.

Section 1

Introduction

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule), as amended July 30, 2018. The CCR Rule, which became effective on October 19, 2015 (amendment effective August 29, 2018), applies to the JH Campbell (JHC) Ponds 1-2 North and Ponds 1-2 South Bottom Ash Ponds (Ponds 1-2) and Pond A. The CCR Rule 40 CFR §257.96(a) requires that an owner or operator initiate an assessment of corrective measures (ACM) to prevent further release, to remediate any releases, and to restore affected areas to original conditions if any Appendix IV constituent has been detected at a statistically significant level exceeding a Groundwater Protection Standard (GWPS). Per §257.96(a), the ACM must be completed within 90 days. The CCR Rule allows up to an additional 60 days to complete the ACM if a demonstration is made that more time is needed due to site-specific conditions or circumstances. A certification from a qualified professional engineer attesting that the demonstration is accurate is required. The owner or operator must include the certified demonstration in the annual groundwater monitoring and corrective action report required by §257.90(e). For informational purposes, the 60-day extension is included in this report as Appendix A.

1.1 Purpose/Objectives

The purpose of this report is to present the ACM for Ponds 1-2 and Pond A to meet the requirements of the CCR Rule §257.96. TRC has prepared this ACM for Ponds 1-2 and Pond A, on behalf of Consumers Energy, to evaluate the effectiveness of potential corrective measures in meeting the requirements and objectives of selecting a remedy that is protective of human health and the environment, achieves the GWPS, and source control. Although this ACM has been prepared to comply with the Federal CCR Rule, state regulations and cleanup criteria have also been considered as part of assessing the corrective measures presented in this report.

Consumers Energy previously evaluated source material management technologies and determined to utilize a source removal strategy for Ponds 1-2 and closure in place for Pond A as documented in Section 3.1 of this ACM. Closure by removal was the method of closure for the Ponds 1-2 selected and implemented by Consumers Energy prior to triggering the requirements for assessing corrective measures. The performance standards that must be achieved in order to close by removal are anticipated to support some of the performance standards for the assessment of corrective measures, especially with respect to addressing source control. Based on these strategies, this ACM focuses on the evaluation of viable alternatives for groundwater

management in conjunction with the closure by CCR removal and closure in place source material control options.

Table 1 provides a visual evaluation of the relative effectiveness of each groundwater treatment alternative. Balancing criteria were selected based on remedy selection criteria in §257.97 and R 299.4444. In addition, R 299.4443 for an ACM under Part 115 requires the ACM to comply with the requirements for feasibility studies contained in Part 201. As such, the balancing criteria encompass the criteria for remedial action selection under Section 20120(1).

Each groundwater treatment alternative was evaluated with regards to each balancing criterion based on its anticipated effectiveness, implementability, and sustainability. Color-coding is used to categorize each alternative on a scale from ineffective to highly effective. The evaluation of each alternative is discussed in Section 4. The relative effectiveness of each alternative compared to other alternatives based on the balance of the criteria is also included in Table 1.

This ACM was initiated on April 14, 2019, following the January 14, 2019 *Notification of Appendix IV Constituent Exceeding Groundwater Protection Standards per §257.95(g)* for Ponds 1-2 and Pond A, which documented that arsenic was present at statistically significant levels above the federal GWPS in one or more downgradient monitoring wells at Ponds 1-2 and Pond A. The professional engineer certification attesting to the accuracy of the demonstration justifying the 60-day time extension was placed in the operating record on July 12, 2019.

1.2 Assessment of Corrective Measures Requirements

1.2.1 Federal Requirements

In accordance with §257.96, this ACM evaluates the effectiveness of potential corrective measures in meeting the requirements and objectives of the remedy specified in §257.97, including protectiveness of human health and the environment, achievement of the GWPS, and source control. Remedy selection shall commence upon completion of this assessment and will be completed as soon as feasible. The ACM is an analysis of the effectiveness of potential corrective measures and addresses the following factors: `

- The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to any residual contamination;
- The time required to begin and complete the remedy; and
- The institutional requirements, such as state or local permit requirements or other requirements that may affect implementation of the remedy.

These requirements are the basis for evaluation of each corrective measures approaches tabulated for comparison in Table 1. Description of the potential remedy approach are provided in Section 3 and then discussed in context of applicability at Ponds 1-2 and Pond A based on site-specific characteristics in Section 4. The remedy evaluation summary is discussed in Section 5 leading to considerations and limitations in selection of a remedy presented in Section 6.

The ACM will be considered completed when it is placed in the facility's operating record as required by §257.105(h)(10).

1.2.2 State Requirements

Although this ACM has been prepared to comply with the Federal CCR Rule, state regulations and cleanup criteria have been considered as part of assessing the corrective measures presented in this report. Groundwater monitoring is conducted in adherence to the facility's state-approved hydrogeological monitoring plans (HMPs). In addition, on December 21, 2018, Consumers Energy and the EGLE executed Consent Agreement No. 115-01-2018. As outlined in Section 4.5 of the agreement, on or before October 1, 2021, Consumers Energy agrees to revise the existing Remedial Action Plan (RAP) that became effective July 3, 2005. The revised RAP will address exceedances of generic groundwater criteria for the entire JH Campbell Solid Waste Disposal facility, including Ponds 1- 2 and Pond A under the Part 115 framework. Multiple characterization activities that have been or are currently being performed under various regulatory frameworks (CCR Rule, Part 115 HMPs, RAP) will be coalesced into a comprehensive site-wide characterization and used to develop a site-wide response action strategy for the JH Campbell Solid Waste Disposal facility. As stated in the Consent Agreement, this site-wide RAP is being developed by Consumers Energy for submittal to the EGLE prior to October 1, 2021.

1.3 Program Summary

The CCR Rule applies to Ponds 1-2 and Pond A. In accordance with the schedule defined in §257.90(b)(1), a groundwater monitoring system has been installed around the CCR units as required by §257.91, and background groundwater monitoring well sampling has been completed as required by §257.93.

As documented in the January 14, 2019 *Notification of Appendix IV Constituent Exceeding Groundwater Protection Standards per §257.95(g)* for each unit, arsenic was present at statistically significant levels above the federal GWPSs in one or more downgradient monitoring wells at Pond A and Ponds 1-2, thus necessitating the development of this ACM.

Evaluation of groundwater under the CCR Rule focused on the following constituents that were collected *unfiltered* in the field:

CCR Rule Monitoring Constituents	
Appendix III	Appendix IV
Boron	Antimony
Calcium	Arsenic
Chloride	Barium
Fluoride	Beryllium
pH	Cadmium
Sulfate	Chromium
Total Dissolved Solids (TDS)	Cobalt
	Fluoride
	Lead
	Lithium
	Mercury
	Molybdenum
	Radium 226/228
	Selenium
	Thallium

1.4 Ponds 1-2 Closure

Pursuant to §257.102, Consumers Energy prepared the “*JH Campbell Generating Facility Bottom Ash Ponds 1-2 Closure Plan*,” (Golder, January 2018). Ponds 1-2 is undergoing closure by removal of CCR in accordance with §257.102(c). The December 2017 “*Bottom Ash Ponds 1-2 Closure Work Plan*” was submitted to and approved by EGLE. Dewatering and removal of ash from Ponds 1-2 for beneficial reuse began in June 2018 and continued through September 2018. CCR removal activities were completed in October 2018 and Consumers Energy submitted final documentation of CCR removal to EGLE in August 2019.

1.5 Pond A Closure

Pursuant to §257.102, Consumers Energy prepared the “*JH Campbell Generating Facility Pond A Closure Plan, West Olive, Michigan*” (Golder, October 2016) and an updated closure plan detailing the final cover system that was submitted to the EGLE in February 2019. Pond A is undergoing closure in place in accordance with the requirements for CCR landfills under RCRA (§257.102(d)). Details regarding the cover system structural components, construction, and estimated schedule are included in the closure plan for Pond A. In general, Pond A closure activities were conducted in the following sequence: dewatering and grading activities; subgrade preparation; geosynthetics deployment; protective cover/topsoil; vegetative layer. Cover construction was completed in summer 2019 and the Closure Certification Report is being developed for submission to EGLE.

Section 2

Hydrogeology/Current Conditions

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

2.1 Description of CCR Units

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 Dry Ash Landfill). The CCR surface impoundments located within the former wet ash pond area are Ponds 1-2, Pond 3 North and Pond 3 South Bottom Ash Pond (collectively Pond 3), and Pond A. All of these impoundments have been deactivated and are in various stages of decommissioning. The existing Dry Ash Landfill is a double-composite geomembrane lined landfill which is licensed and permitted for CCR disposal and includes two double-lined leachate and contact water retention ponds. Site features are shown on Figure 1.

Dry, moisture-conditioned CCR from the three coal fired electric generating units continues to be managed in the Dry Ash Landfill which is regulated under Part 115 of the Natural Resources and Environmental Protection Act (NREPA), PA 451 of 1994, as amended, and monitored in adherence to the facility's EGLE-approved *Hydrogeological Monitoring Plan (HMP) for JH Campbell Ash Storage Facility, Consumers Power Company, Solid Waste Disposal Area, Coal Ash, Type III* (September 1996).

The surface impoundments in the wet ash pond areas were decommissioned starting in 2017 and replaced with concrete bottom ash treatment tanks. In June 2017, decommissioning of Pond 3 North began with recovery of CCR from the pond for beneficial reuse prior to backfilling with clean fill. The above-grade concrete treatment tanks were constructed within the footprint of the Pond 3 North area to manage bottom ash and became operational in July 2018. In addition, hydraulic loading was ceased at Ponds 1-2 and Pond A in June 2018 and the southern portion of Pond 3 in July 2018 (when the concrete tanks were in service).

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/discharge channel and into Pigeon River.

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

2.2 Geologic/Hydrogeologic Setting

The subsurface materials encountered at the JH Campbell property generally consist of approximately 40 to 60 feet of poorly graded, fine-grained lacustrine sand. A laterally extensive clay-rich till is present beneath the sand, generally within approximately 40 to 60 feet below ground surface (ft bgs) across the site based on soil boring data collected at the site as part of a vertical expansion feasibility investigation. According to deep drilling logs conducted at the JHC Power Plant (just west of the CCR units), the clay is on the order of 80 feet thick and extends to the top of shale bedrock (Coldwater Shale) approximately 140 ft bgs, as presented in the Natural Resource Technology (NRT) *Hydrogeologic Site Conceptual Model* dated December 10, 2015.

Pond A and Ponds 1-2 are located north of the Recirculation Pond, north-northwest of the Pigeon River and/or Spring Bayou and northeast of Pigeon Lake. The upgradient/background wells are located to the north-northwest of Pond A and Ponds 1-2. Groundwater is typically encountered around 30 to 35 ft bgs, except in the recently excavated areas Ponds 1-2, and Pond 3 where groundwater is now within 5 to 10 ft bgs due to grade changes, and generally flows to the south-southeast toward the Pigeon River. Mounding of groundwater was historically observed in the immediate vicinity of the CCR units during hydraulic loading, such that there was a localized radial flow component around each of the units.

2.3 Environmental Setting and Monitoring Network

In accordance with §257.91, Consumers Energy established a groundwater monitoring system for Pond A, which consists of 12 monitoring wells (six background monitoring wells and six downgradient monitoring wells) that are screened in the uppermost aquifer and a groundwater monitoring system for Ponds 1-2, which consists of 11 monitoring wells (six background monitoring wells and five downgradient monitoring wells) that are screened in the uppermost aquifer. The monitoring well locations are shown on Figure 1. Six monitoring wells

located north-northeast of Pond A and Ponds 1-2 provide data on background groundwater quality that has not been impacted by the CCR units (JHC-MW-15023 through JHC-MW-15028). Background groundwater quality data from these six background wells are additionally used for the CCR groundwater monitoring program at the Dry Ash Landfill and Pond 3.

One of the Ponds 1-2 downgradient monitoring wells (JHC-MW-15004) was decommissioned on June 14, 2018 to accommodate CCR removal activities. Subsequent to the completion of the CCR removal activities, two additional monitoring wells were installed along the south and southwest edges of Ponds 1-2 during the week of December 3, 2018. The Ponds 1-2 monitoring system is currently being re-evaluated post-deconstruction, following equilibration of the water table and installation of the new wells to determine which monitoring wells are appropriately positioned to assess groundwater quality downgradient from Ponds 1-2.

In addition, Pond A monitoring well JHC-MW-15008 was decommissioned and replaced with JHC-MW-15008R on June 24, 2019. The water table in the area of Pond A has continued to drop as groundwater equilibrates post-cessation of hydraulic loading and placement of the cover at Pond A. As a result, the water table had dropped below the well screen at JHC-MW-15008 such that the monitoring well could no longer be used to collect groundwater samples. Therefore, monitoring well JHC-MW-15008 was decommissioned and replaced with JHC-MW-15008R. The replacement well was installed at a location adjacent to and side-gradient from the original well location and screened at a lower depth (across the water table) in order to monitor groundwater quality downgradient from Pond A. Monitoring well JHC-MW-15008R replaces JHC-MW-15008 in the Pond A assessment monitoring program. Groundwater samples were collected from the replacement well in August 2019 and will be included in the forthcoming annual groundwater monitoring report.

2.4 On-Site Groundwater Flow Conditions

Prior to surface impoundment decommissioning, mounding of groundwater was observed in the immediate vicinity of Pond A, Ponds 1-2, and Pond 3 such that there was a localized radial flow component around each unit. The groundwater mounding previously observed in the immediate vicinity of Ponds 1-2 and Pond 3 is no longer apparent subsequent to completing decommissioning activities at both units in September and October 2018, respectively. Slight mounding is still observed in the vicinity of Pond A as groundwater continues to equilibrate in response to permanent discontinuation of hydraulic loading in June 2018.

Groundwater elevation data collected during the most recent semiannual assessment monitoring event (April 2019) were generally similar to data collected previously in the background, detection monitoring events, and previous assessment monitoring events. The data showed that groundwater within the uppermost aquifer generally flows to the south-southeast across the Site, with a southwesterly groundwater flow component on the western

edge of the Site. Groundwater elevations measured during the April 2019 sampling event were used to construct the groundwater contour map provided on Figure 2. The figure shows that current groundwater flow is generally consistent with previous monitoring events since the background sampling events commenced in December 2015.

Vertical hydraulic gradients were evaluated in the paired shallow and deep step-out wells. The majority of static water level data indicate upward or neutral (i.e., no gradient) flow potential; however, there are times where there is a downward vertical gradient at some of the wells located farther away from the river (e.g., PZ-23). Given that these wells are not immediately adjacent to the river, they do not represent actual vertical gradients at the river's edge. Monitoring wells located closer to the river (e.g., MW-14S/D) typically show upward or neutral gradients.

Well boring data and site geology indicate that there is not a strong downward gradient in the vicinity of the Pigeon River. Given that the Pigeon River is a regional discharge feature, and the saturated thickness of the uppermost sand is relatively low adjacent to the river, vertical gradients are likely upward near the river as demonstrated by MW-14S/D data. The vertical gradient present at the river prevents onsite groundwater from flowing underneath the river. Additionally, similar to flow conditions observed onsite, horizontal groundwater flow on the south/east side of the river would be toward the river, further preventing migration of onsite groundwater to the south or east side of the river.

2.5 Nature and Extent of Environmental Impacts

Since one or more Appendix IV constituents were detected at Ponds 1-2 and Pond A at statistically significant levels above their GWPS, the nature and extent of the release is described below to meet the requirements of §257.95(g)(1).

2.5.1 Ponds 1-2: Potential Extent of CCR Source Materials

Characterization activities for the CCR and underlying materials were performed at Ponds 1-2 in 2016 to support decommissioning of the pond. This work included collecting and analyzing samples from seven soil borings in Ponds 1-2. Soil borings were completed during active bottom ash sluicing and extended throughout the ponded ash and up to approximately 20-ft from the top of ash into the underlying materials including the native soil beneath the CCR. Samples were collected at varying depths within the CCR and underlying native soil and analyzed for select metals.

Compositional analysis showed that CCR present in Ponds 1-2 generally contained arsenic, chromium, selenium, boron, and thallium concentrations that exceeded Michigan Part 201 nonresidential drinking water protection or groundwater surface water interface (GSI) protection criteria for soils. Native soils underlying the ponded CCR contained notably

lower concentrations of metals. Fewer constituents and lower concentrations of those constituents were observed at deeper sampling intervals. Arsenic concentrations from compositional analyses on the east side of the pond were slightly higher; this boring was closest to JHC-MW-15002 and JHC-MW-15003 where statistically significant exceedances above the GWPS were noted. CCR removal activities have been completed at Ponds 1-2.

2.5.2 Pond A: Potential Extent of CCR Source Materials

Characterization activities for the CCR and underlying materials were performed at Pond A in 2016 to support decommissioning of the pond. This work included collecting and analyzing samples from two soil borings in Pond A. Soil borings were completed during active bottom ash sluicing and extended throughout the ponded ash and up to approximately 20-ft from the top of ash into the underlying materials including the native soil beneath the CCR. Samples were collected at varying depths within the CCR and underlying native soil and analyzed for select metals.

Analysis of CCR from Pond A generally showed concentrations of arsenic, selenium, and boron that exceeded Michigan Part 201 nonresidential drinking water protection or GSI protection criteria for soils. Although only eight samples from two borings were completed to characterize CCR in Pond A, the native soils underlying the ponded CCR contained lower concentrations of metals. Fewer constituents and lower concentrations of those constituents were observed at deeper sampling intervals. No significant variability of concentration was noted within the CCR materials. Hydraulic loading of Pond A was discontinued in June 2018.

2.5.3 Groundwater: Potential Receptors and Exposure Pathways

The primary potential exposure pathway relevant to this ACM is the drinking water (DW) pathway and attainment of the GWPS. The GSI exposure pathway is also relevant and will be considered during the final remedy selection. Due to the physical/chemical properties of the Appendix III and Appendix IV constituents, volatilization is unlikely to occur; therefore, the groundwater volatilization to indoor/ambient air pathways are not relevant.

Relevant Groundwater Exposure Pathways		
Exposure Pathway	Applicable Criteria	Potential Source Areas
GSI	Michigan Part 201	Ponds 1-2, Pond A
Drinking Water	Michigan Part 201/Federal GWPS	Ponds 1-2, Pond A

2.5.4 Characterization of Groundwater

Following the initial and subsequent assessment monitoring sampling events (April and June 2018), the compliance well groundwater concentrations for Appendix IV constituents at Ponds 1-2 and Pond A were compared to the GWPSs to determine if a statistically significant exceedance had occurred in accordance with §257.93 as detailed in the *Statistical Evaluation of Initial Assessment Monitoring Sampling Event* (TRC, January 2019) for each unit. The statistical evaluation of the June 2018 Appendix IV constituents showed arsenic was present at statistically significant levels (i.e., lower confidence limit was above the GWPS). The remaining Appendix IV constituents were not present at statistically significant levels during the June 2018 assessment monitoring event. Therefore, for the purposes of this ACM, the site constituent of concern (COC) is arsenic.

	Constituent	Site GWPS	Units	GWPS Exceedance ²
Appendix IV	Antimony	6	µg/L	
	Arsenic	10	µg/L	✓
	Barium	2,000	µg/L	
	Beryllium	4	µg/L	
	Cadmium	5	µg/L	
	Chromium	100	µg/L	
	Cobalt	15	µg/L	
	Fluoride	4,000	µg/L	
	Lead	15	µg/L	
	Lithium	40	µg/L	
	Mercury	2	µg/L	
	Molybdenum	100	µg/L	
	Radium 226+228	5	pCi/L	
	Selenium	50	µg/L	
Thallium	2	µg/L		

µg/L: micrograms per liter; pCi/L: picoCuries per liter

Consumers Energy placed a notification of the statistical exceedances into the operating record on January 14, 2019 as required in §257.95(g) and within the timeframe required by §257.105(h)(8). In addition, as required in §257.95(g)(1), nature and extent groundwater sampling was conducted as described below.

² An exceedance occurs when the lower confidence limit of the downgradient data is above the GWPS.

The nature and extent characterization was performed using additional data collected from existing and recently installed site wells. The nature and extent data consist of Appendix III and IV constituents collected from the background, Ponds 1-2 and Pond A downgradient CCR monitoring well networks, and from supplemental downgradient wells in the HMP monitoring well network. In addition to the existing HMP wells, TRC, on behalf of Consumers Energy, installed shallow and deep step-out wells nested with existing downgradient wells MW-14, PZ-23, PZ-24, and PZ-40 (shallow well only) in April 2018 to further characterize the GSI pathway and vertical distribution of Appendix III and IV constituents in groundwater downgradient from the CCR units and evaluate vertical hydraulic gradients. The locations of the additional downgradient step-out wells (MW-14S, MW-14D, PZ-23S, PZ-23D, PZ-24S, PZ-24D, PZ-40S) are shown on Figure 1.

Nature and Extent (N&E) Evaluation Wells			
JHC CCR Background Wells	JHC Pond A CCR Unit Wells	JHC Ponds 1-2 CCR Unit Wells	N&E Delineation Wells
JHC-MW-15023	JHC-MW-15006	JHC-MW-15001	MW-13
JHC-MW-15024	JHC-MW-15007	JHC-MW-15002	MW-14
JHC-MW-15025	JHC-MW-15008	JHC-MW-15003	MW-14S
JHC-MW-15026	JHC-MW-15009	JHC-MW-15004	MW-14D
JHC-MW-15027	JHC-MW-15010	JHC-MW-15005	PZ-23
JHC-MW-15028	JHC-MW-15011	JHC-MW-18004	PZ-23S
		JHC-MW-18005	PZ-23D
			PZ-24
			PZ-24S
			PZ-24D
			PZ-40
			PZ-40S

Given the proximity of the CCR units at the JHC facility, the nature and extent of contamination was assessed from a site-wide perspective rather than on a per CCR unit basis. The nature and extent of groundwater impacted by a release from the units overlaps. Additionally, looking at impacted groundwater on a site-wide basis was more practical from a risk mitigation standpoint, given the following factors:

- The likely age of the release(s);
- A long operational history of ash management;
- The historical use of CCR as fill; and
- The influence of geochemistry on several of the Appendix IV constituent concentrations in groundwater.

These factors combined make it difficult, if not impossible, to determine the quantity of the material released from the CCR unit as required by the CCR rule.

The distribution of arsenic in the shallow water-bearing unit as compared to the GWPS is presented in Figure 3. Two categories were assigned, as follows:

- White – No Statistically Significant Exceedances
- Orange – Statistically Significant GWPS Exceedance: the lower confidence limit is above the GWPS

As shown on the figure, the arsenic concentrations in groundwater are below the GWPS at each of the downgradient step-out wells.

Arsenic

Arsenic is present at statistically significant levels above the GWPS at two wells near Ponds 1-2 (JHC-MW-15002 and JHC-MW-15003) and one well near Pond A (JHC-MW-15011). Arsenic is also present at individual concentrations directly exceeding the GWPS at two wells along the western perimeter of Ponds 1-2 (JHC-MW-15001 and JHC-MW-15004). Arsenic concentrations are not detected above the GWPS in any of the downgradient step-out wells.

Other Potential COCs

In addition to arsenic, additional Appendix III and Appendix IV constituents shown below have also been identified as potential COCs based on their concentrations compared to state cleanup criteria (i.e., Part 201).

	Constituent	DW Exceedance	GSI Exceedance
Appendix III	Boron	✓	
	Sulfate	✓	
	Total Dissolved Solids (TDS)	✓	✓
	pH	✓	✓
Appendix IV	Arsenic	✓	✓
	Chromium		✓
	Molybdenum	✓	
	Selenium	✓	✓
	Thallium	✓	✓

2.5.5 Risk Evaluation

Although COCs have been identified in the groundwater at concentrations exceeding applicable criteria, an evaluation of risk demonstrates that there are **currently no adverse effects on human health or the environment** from either surface water or groundwater due to CCR management at Ponds 1-2 or Pond A. The property is owned and operated by Consumers Energy and groundwater in the vicinity of and downgradient from Ponds 1-2 and Pond A is not used for drinking water. Groundwater is restricted at a portion of the property through land use and drinking water use restrictions downgradient from Pond A, as detailed in the restrictive covenants filed for JH Campbell. In addition, ongoing monitoring and reporting is being performed in accordance with the Part 115 HMP that includes the shallow monitoring wells downgradient from the CCR units. Drinking water well information is provided in Figure 4. As shown in Figure 4, several potable water wells associated with the JH Campbell Power Generation Facility are located northwest of Ponds 1-2. The nearest residential drinking water wells are located north and east of the Dry Ash Landfill (north of the background monitoring wells and north of Pond A and Ponds 1-2) and to the south-southeast of the two CCR units, on the opposite side of the Pigeon River.

Groundwater in the vicinity of Ponds 1-2 and Pond A does not pose a risk to drinking water. As shown on Figure 2, groundwater flow is generally to the south (with some flow components south of the Dry Ash Landfill toward the eastern and western edges of the Site). Groundwater flows in the downgradient direction, along the path of least resistance toward regional discharge features, which in this case is the Pigeon River and Spring Bayou – groundwater does not flow hydraulically upgradient or laterally (i.e., side gradient). As such, groundwater from Ponds 1-2 and Pond A cannot physically flow north or east toward the residential drinking water wells located north of the Dry Ash Landfill. Further, groundwater data in the background monitoring well network shows groundwater concentrations are below drinking water criteria for the Appendix III and Appendix IV chemical constituents.

The area of Ponds 1-2 and Pond A is bound to the south by the Recirculation Pond/Discharge Channel and the Pigeon River surface water bodies toward which groundwater flows and vents.

As discussed above, vertical hydraulic gradients indicate upward or neutral (i.e., no gradient) flow potential at the river's edge. Given that the Pigeon River is a regional discharge feature, and the saturated thickness of the uppermost sand is relatively low adjacent to the river, vertical gradients are likely upward near the river. The vertical gradient present at the river prevents onsite groundwater from flowing underneath the river. Additionally, horizontal groundwater flow on the south/east side of the river

would be toward the river, further preventing migration of onsite groundwater to the south or east side of the river. In addition, all of the Appendix IV concentrations in groundwater are below their respective GWPS at each of the downgradient step-out wells.

A restrictive covenant prohibiting future withdrawal of groundwater for potable use would be appropriate, if deemed necessary, following source control and remedial activities as necessary to mitigate this risk pathway. It may also be appropriate to mitigate any remaining risks by revising the existing mixing-zone based GSI criteria approved by the state in 2015; however, this is unlikely to be necessary given that the step-out wells demonstrate that GSI compliance is met. Consumers Energy has performed CCR removal at Ponds 1-2 and has decommissioned Pond A in place and continues to monitor groundwater under the RCRA CCR Rule and Michigan Part 115 HMPs.

Consumers Energy continues evaluating site-wide risk under the federal and state regulatory framework to use in the development of an active remedy, as appropriate, and site-wide RAP strategy to mitigate any remaining risk.

Section 3

Identification of Remedial Options to Develop Corrective Measure Alternatives

In order to perform a thorough assessment of the corrective measure alternatives, Consumers Energy identified and evaluated several technologies for both CCR source material management and groundwater remediation. Section 3.1 describes the previously selected source material management option and Section 3.2 identifies and briefly describes the applicable groundwater remediation technologies. Additional remediation technologies may be evaluated at a later date if determined to be applicable through additional data collection/evaluation or identification of an emerging technology. The assessment of the corrective measure alternatives is detailed in Section 4.

3.1 CCR Source Material Management Technologies

Consumers Energy evaluated source material management technologies and determined to close Pond A under the RCRA Rule's closure in place provisions in §257.102(d) as documented in the October 2016 Closure Plan and Ponds 1-2 under the RCRA Rule's closure by removal provisions in §257.102(c) as documented in the January 2018 Closure Plan. Source material management strategies were made based on site-specific considerations. Both closure plans are available on the Consumers Energy CCR Rule Compliance Data and Information webpage: <https://www.consumersenergy.com/community/sustainability/environment/waste-management/coal-combustion-residuals>.

3.1.1 No Action

A source material management strategy of no action involves making no efforts to contain or remove CCR as it currently exists, or as it will exist at the end of the useful life of the unit. CCR would be left in the unit without construction of a low permeability cover or additional containment. A no action CCR source material management strategy is not considered viable due to its ineffectiveness of reducing potential exposures to the CCR material or potential migration of CCR material beyond the confines of the specified unit. A no action CCR source material management strategy is not a regulatory option per the CCR Rule, but was included as a comparative baseline option for the evaluation of corrective measure alternatives for both Ponds 1-2 and Pond A.

3.1.2 Ponds 1-2 Closure by CCR Removal

Consumers Energy performed source removal by excavation of CCR from Ponds 1-2 consistent with the Closure Plan (Golder, 2018) and the December 2017 EGLE-approved Workplan as discussed in Section 1.4 of this ACM. CCR removal from Ponds 1-2 was complete in 2018 and final documentation for CCR removal for Ponds 1-2 was submitted to EGLE in August 2019.

As documented in the Ponds 1-2 Closure Plan, the ponds were dewatered, its hydraulic structures were abandoned, and the remaining CCR removed.

The first phase of closure activities includes CCR removal and documentation. Excavation has been completed to remove CCR to elevations identified during investigations with visual observations and laboratory testing made to confirm the CCR removal objective is achieved. Documentation of CCR removal has been performed to provide lines of evidence to validate the extent of the excavation and visual observations made in the field.

Leaching and compositional analysis was performed on soil and CCRs to spatially determine the potential leachability of various constituents. These soil-CCR interfaces were then compiled to form a subsurface excavation profile that determined the initial depth of excavation before other lines of evidence are sought to determine if the limits of excavation will be satisfied based on the Quality Assurance protocol developed and detailed in the Workplan submitted to EGLE (Golder, 2017). The approved workplan provides additional details regarding the multiple line of evidence approach to CCR removal. With the CCR removal complete, Consumers Energy prepared and submitted the *Bottom Ash Ponds 1-2 N/S CCR Removal Documentation Report* (Golder) to EGLE on August 9, 2019. The excavated area has been restored by backfilling and grading with clean fill to promote stormwater drainage and minimize the potential for ponding of surface water or future infiltration of precipitation into the excavated footprint.

3.1.3 Pond A Closure in Place

As documented in the September 2018 Notification of Intent to Initiate Closure letter submitted in accordance with §257.102(g) and discussed in Section 1.5 of this ACM, Consumers Energy is in the process of closing Pond A under the RCRA Rule's closure in place provisions in §257.102(d) as documented in the October 2016 Closure Plan that is available on the public facing website. Dewatering and grading activities were conducted throughout June 2018 to October 2018. Final cover construction was conducted in summer 2019 and the final cover certification is being developed.

Pond A was closed by:

- Decanting ponded water via pumping downstream through the NPDES permitted outfall;
- Removal of influent and effluent piping;
- Bringing the grades up to design grades using CCR excavated from Ponds 1-2 and Pond 3;
- Construction of the final cover system;
- Construction of surface water ditches and drains; and
- Revegetating the disturbed areas.

A protective cover has been installed at ground surface to contain the CCR, minimize or eliminate infiltration into the former basin, prevent future impoundment of water, and to prevent the contained materials from migrating or affecting groundwater. The protective cover, along with evidence showing a lack of vertical gradients, will serve to minimize or eliminate the post-closure infiltration of liquid into the CCR.

The protective cover serves to isolate the CCR and to minimize the potential for further migration of constituents. Groundwater monitoring and cap maintenance will take place regularly for at least 30 years after closure, in accordance with the Post-Closure Plan (Golder, 2019).

3.2 CCR – Impacted Groundwater Management Technologies

Several management technologies exist to eliminate potential risks of CCR-impacted groundwater migration to downgradient receptors. Institutional Controls (ICs) in the form of deed/access restrictions may also be used in conjunction with other remediation technologies to address unacceptable risks to potential receptors. The following list of viable management technologies will be further assessed and reviewed herein:

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

Each of these technology options are described in the following subsections and evaluated in Section 4 relative to anticipated effectiveness of the potential corrective measure in meeting the requirements and objectives of the remedy as described under §257.96(c).

3.2.1 Alternative 1: No Source Control and Groundwater Monitoring and Institutional Controls

Long-term groundwater monitoring relies on physical, chemical, and/or biological *in situ* processes to act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of constituents in the subsurface environment. This groundwater management technology includes implementation of a long-term groundwater monitoring approach in conjunction with a No Action source material management strategy.

Regular monitoring of select groundwater monitoring wells for specific constituents is conducted to ensure COCs in groundwater are stable or attenuating over time.

3.2.2 Alternative 2a: Source Control and Post Source Control/Removal Monitoring

Post source control/removal groundwater monitoring is a strategy that can be implemented in combination with a closure in place or closure by removal CCR source material management strategy. Similar to the long-term groundwater monitoring strategy discussed in Section 3.2.1, this approach relies on physical, chemical, and/or biological *in situ* processes to act without human intervention to reduce the residual mass, toxicity, mobility, volume, or concentration of constituents in the subsurface environment; however, it can be demonstrated that source control/removal would expedite the reduction in concentrations of COCs to levels below regulatory criteria.

For this technology to be effective, the contaminant source areas must be limited in extent, and any residual constituents are separated from any nearby receptors by a sufficient time of groundwater travel (affected by distance, permeability, and/or hydraulic gradient) such that any naturally-occurring *in situ* remediation process may effectively eliminate the potential for the contaminant to reach the receptor at concentrations above applicable criteria.

Regular monitoring of select groundwater monitoring wells for specific constituents is conducted to ensure COCs in groundwater are attenuating over time.

3.2.3 Alternative 2b: Source Control and Groundwater Capture/Control

Groundwater capture approaches are utilized to provide hydraulic control to reduce or prevent the mobility of COCs from migrating offsite and/or to surface water receptors.

Capture of groundwater can be accomplished through the use of a conventional vertical groundwater extraction well network screened within the water bearing zone(s), horizontal groundwater extraction wells, or recovery trenches used to intercept groundwater flow. System components for an extraction management strategy typically include extraction points, pumps, electrical feed, well vaults, flow meters, and other miscellaneous appurtenances, and a discharge/treatment option for extracted groundwater. The efficiency of each approach is dependent on site-specific contaminant and hydrogeologic conditions.

3.2.4 Alternative 2c: Source Control and Impermeable Barrier

Impermeable barriers can be installed below the ground surface to inhibit lateral flow of groundwater. An impermeable barrier typically consists of a sheet pile or slurry containment wall. A slurry wall is a mixture of soil, water and bentonite clay that is poured into trenches to create an impermeable vertical wall. A sheet pile wall consists of driven rigid materials (pilings) into the ground to form an impermeable barrier.

Impermeable barriers are often used in conjunction with a groundwater capture/control approach to reduce the number of wells required to reduce or prevent COC migration from the CCR unit. Barriers installed without groundwater extraction can be useful in preventing COC migration; however, altered flow conditions due to the barrier may cause water and COC migration around or beneath the installed barrier.

3.2.5 Alternative 2d: Source Control and Active Geochemical Sequestration

Active geochemical sequestration can be an effective *in situ* groundwater treatment technology to either remove or transform COCs. Active geochemical sequestration relies on an energy dependent operating delivery system to introduce amendments continuously or at scheduled intervals to alter the natural geochemistry to conditions favorable for a reduction in mass or mobility of the constituents of concern.

Performance monitoring would determine the effectiveness and operation schedule.

One example technology for this category would be air sparging. *In situ* treatment of coal ash related constituents in groundwater may be feasible via Air Sparging.

Typically, injection below the water table of air, pure oxygen, or other gases is used to remove contaminants by volatilization or bioremediation; however, the technology can also be used to immobilize contaminants through chemical changes such as precipitation.

3.2.6 Alternative 2e: Source Control and Passive Geochemical Sequestration

Passive geochemical sequestration can be an effective *in situ* groundwater treatment technology to either remove or transform COCs. Geochemical amendments are introduced through discrete direct injection events or trenching rather than continuously as through an active geochemical sequestration approach. One example would be using a permeable reactive barrier installed between the contaminant source and the point(s) of compliance. A permeable reactive barrier is a wall of a designed reactive material constructed *in situ* and perpendicular to the path of groundwater flow using conventional trenching techniques. Permeable reactive barriers are constructed with materials that destroy, transform, or enhance the degradation of the constituents or trap the constituents through adsorption or precipitation. The reactive amendment is blended into the trench to form a continuous, flow-through barrier across the plume. The permeability of the installed permeable reactive barrier is targeted to be higher than the native aquifer materials so that the flow through the wall is not impeded at the time of installation or throughout the wall's operational life. Performance monitoring would determine the effectiveness and schedule consideration for reapplication of the amendment.

Section 4

Evaluation of Corrective Measure Alternatives

Section 4 describes the evaluation of the corrective measure alternatives for groundwater remediation identified in Section 3. Each identified alternative has been assessed using the CCR Rule and Michigan Part 115 corrective measure balancing criteria.

Table 1 provides a visual evaluation of the relative effectiveness of each groundwater treatment alternative to address COCs identified in Section 2.5.4. Each groundwater treatment alternative was evaluated with regards to each balancing criterion based on its anticipated effectiveness, implementability, and sustainability. Color-coding is used to categorize the alternative on a scale from ineffective to highly effective. The evaluation of each alternative is discussed in the following sub-sections. The relative effectiveness of each alternative compared to other alternatives based on the summation of the balancing criteria ratings is also included in Table 1.

The discussion in this section highlights the benefits and drawbacks of each option based on currently available data. Additionally, potential COCs will be considered during final remedy selection. The evaluation of these technologies is based on literature review of remediation profiles using these technologies with characteristics similar to the Ponds 1-2 and Pond A, government guidance documents, and previous activities. The extent and magnitude of COC-affected groundwater will be considered for evaluation of the final remedy.

Balancing criteria were selected based on remedy selection criteria in §257.97 and R 299.4444 described in Section 4.1.

4.1 Groundwater Management Balancing Criteria

The evaluation process for groundwater management technologies contained herein will generally consist of a weighted comparison of each alternative based on the benefits and drawbacks of each option for eliminating the relevant GSI and drinking water exposure pathways, addressing the ACM factors required in §257.96, and considering the following remedy selection balancing criteria specified in §257.97, R 299.4444 of Part 115, and Section 20120 of Part 201:

- Effectiveness in Protecting Health, Safety, Welfare, and the Environment;
- Long-Term Uncertainties;
- Persistence, Toxicity, Mobility, and Propensity to Bioaccumulate of the Hazardous Substances;
- Short- and Long-Term Adverse Health Effects;

- Cost of Remedial Action including Long-Term Maintenance;
- Reliability of the Alternatives;
- Potential for Future Response Activity Costs if Alternative Fails;
- Potential Threats associated with Excavation, Transportation, Redisposal, or Containment;
- Ability to Monitor Remedial Performance; and
- Public's Perspective about Extent to which the Proposed Remedial Action Effectively Addresses Requirements.

The selected corrective measures, as determined during the final remedy selection process described in Section 6, will be based on the balance between these various criteria for each alternative, rather than basing the corrective measure selection on only one of the criteria (e.g., reliability).

Analysis of viable alternatives for groundwater management identified in Section 3 are evaluated in conjunction with the planned source material control options as specified for the Site. Source removal by excavating CCR has been implemented as a source control strategy for Ponds 1-2. Therefore, groundwater management alternatives for Ponds 1-2 will be retained for consideration in conjunction with source removal. Closure in place with a protective cover has been implemented as a source control strategy for Pond A. Therefore, groundwater management alternatives for Pond A will be retained for consideration in conjunction with closure in place. Each alternative is discussed in the following sub-sections and are summarized in Table 1.

4.2 Ponds 1-2 Groundwater Management Alternatives

Source removal has been selected as the source control strategy for Ponds 1-2. Therefore, groundwater management alternatives for Ponds 1-2 will be considered in conjunction with source removal. Each alternative is discussed in the following sub-sections and are summarized in Table 1a.

4.2.1 Ponds 1-2 Alternative 1: No Source Control Action with Long Term Groundwater Monitoring and Institutional Controls (Baseline)

A source material management strategy of no action involves making no efforts to contain or remove CCR as it currently exists, or as it will exist at the end of the useful life of the unit. CCR would be left in the unit without construction of a low permeability cover or additional containment. A no action CCR source material management strategy is not considered viable due to its ineffectiveness of reducing potential exposures to the CCR material or potential migration of CCR material beyond the confines of the specified unit, nor is it a regulatory option. The no action CCR source

material management strategy was included in the alternatives evaluation to provide a comparative baseline for other corrective measures alternatives.

Typically, a long-term groundwater monitoring approach works best where contaminant source areas have been effectively removed, remediated, and any residual constituents are separated from any nearby receptors by a sufficient time of groundwater travel (affected by distance, permeability, and/or hydraulic gradient) such that any naturally-occurring *in situ* remediation process may effectively eliminate the potential for the contaminant to reach the receptor at concentrations above applicable criteria. As no efforts to contain or remove CCR would be implemented under this alternative, long-term groundwater monitoring is not considered viable due to the ineffectiveness in protecting health, safety, welfare, and the environment, and the length of time needed to achieve the remedial goals. This alternative also has a high likelihood for future response activities as the reliability is low.

4.2.2 Ponds 1-2 Alternative 2a: Source Removal with Post Remedy Monitoring

Source removal and post-remedy groundwater monitoring generally offers an advantage over other options considered in that no active remediation system requires installation or maintenance, thus reducing operational costs and long-term uncertainties. As discussed in Section 2.1, closure by removal was the method of closure selected for the Ponds 1-2 prior to triggering the requirements for assessing corrective measures; therefore, post-excavation placement of a cap was not considered within this alternative. This approach is likely effective at Ponds 1-2 since the contaminant source has been removed. Residual constituents are separated from any nearby receptors such that any naturally-occurring *in situ* remediation process may effectively eliminate the potential for the contaminant to reach the receptor at concentrations above the applicable criteria. Groundwater chemistry is still equilibrating following CCR removal, and there is some uncertainty surrounding how changes in oxidation-reduction potential (redox) may affect contaminant transport. Since this groundwater monitoring remedy with source removal relies on naturally occurring processes that are often hard to predict, this alternative has a relatively high potential need for future response activities. Post-remedy monitoring could be initiated immediately following source removal utilizing the existing monitoring well network. Monitoring would continue until two consecutive rounds of data are below the GWPSs.

4.2.3 Ponds 1-2 Alternative 2b: Source Removal with Groundwater Capture/Control

A groundwater extraction system, if designed, installed, operated, and maintained appropriately in conjunction with source removal could offer an effective remediation solution for Ponds 1-2.

Groundwater extraction can be accomplished using vertical wells screened within water bearing zones (as with the existing groundwater extraction system) or with recovery trenches. Necessary system components for an extraction management strategy include extraction points, pumps, electrical feed, well vaults, flow meters, and other miscellaneous appurtenances. Due to the expected complexity of trench construction around Ponds 1-2, capital costs associated with a trench construction would likely surpass costs expected of an equally effective groundwater extraction well system.

Design and operation of a system shall consider COC migration control, potential changes in oxidation state within water bearing zones that could cause unwanted scale formation in well screens and/or extraction equipment, or the introduction of facultative bacteria within the water bearing zone causing unwanted biogrowth that could affect rates of extraction, or in the case of arsenic, increased solubility and mobilization due to the creation of a more reduced aquifer condition. A routine system inspection and maintenance program would be required to maximize groundwater recovery rates while minimizing system downtime resulting from chemical and/or biological activity. Maintenance activities include cleaning of pumps and flow meters, redevelopment of extraction wells, replacement of pumps and motors, and jetting of sections of discharge line to reduce build-up.

A groundwater extraction system is expected to be highly effective at capturing groundwater prior to venting to surface water, thus protecting potential receptors. However, this alternative has high capital and long-term costs due to the installation and ongoing operation and maintenance of the groundwater extraction system. Reliability of a groundwater capture/control system is higher than active or passive geochemical sequestration, but is less reliable than an impermeable barrier due to operation, maintenance, and overall effectiveness. Design and construction of a groundwater extraction system would take longer to implement than groundwater monitoring.

4.2.4 Ponds 1-2 Alternative 2c: Source Removal with Impermeable Barrier

An impermeable barrier wall, constructed of either sheet pile or slurry, could be installed to restrict the groundwater flow paths directly from Ponds 1-2 to surface water. The impermeable wall would need to be installed into the clay confining unit underlying the uppermost groundwater aquifer. However, because these flow paths are simply diverted, extraction wells located at each edge of the wall may be required to capture/contain this diverted groundwater. In order to evaluate this alternative further, groundwater modeling would be performed to assess the need for groundwater extraction.

An impermeable barrier would effectively minimize the movement of affected groundwater, providing better protection than remediation relying on physical, chemical, or biological processes. However, due to the high seepage velocity and depth to the clay confining unit observed at the site, the cost of the remedial action is higher than other options considered due to the high capital cost of construction for installing a relatively deep slurry wall with a potentially robust groundwater extraction system to prevent mounding or flow-around. Installation of an impermeable barrier combined with groundwater extraction would also have considerably longer construction duration when compared to other options considered.

4.2.5 Ponds 1-2 Alternative 2d: Source Removal with Active Geochemical Sequestration

Air sparge is one geochemical sequestration option that could be an effective *in situ* groundwater treatment technology to either remove or transform COCs. Air Sparge can immobilize contaminants through chemical changes (e.g., oxidation of arsenic, its subsequent complexation with iron hydroxides, and precipitation). Aeration increases dissolved oxygen concentration in the groundwater and causes an accompanying increase in oxidation reduction potential.

Installing air sparge wells, potentially in a curtain configuration perpendicular to flow of groundwater, offers a remedial option creating a reactive (oxidizing) zone in an attempt to remove arsenic through precipitation with dissolved minerals and sorption on metal/iron oxyhydroxides. Similar to other *in situ* approaches, a limiting process with this *in-situ* remedial approach is the delivery of the compounds within the area of interest. Creating enough contact with target constituents can be difficult in heterogeneous and fine-grained materials.

Like the groundwater capture system alternative, design and operation of an active geochemical sequestration system also needs to consider COC migration control and potential changes in oxidation state within water bearing zones that could cause adverse effects such as unwanted scale formation (e.g., fouling) in well screens. The creation of an oxidizing zone may increase the mobility of other metals, such as selenium. System operation and maintenance would be required to monitor operational parameters (e.g., pressures, temperatures, flow rates, etc.), and conduct routine maintenance on the system (e.g., filter cleaning and change-out, blower valve, belt and oil maintenance, etc.). Reliability of an active geochemical sequestration system is also considered lower when compared to other remedial alternatives due to the increased amount of operation and maintenance considerations. Installation of an active geochemical sequestration system would take longer than implementing groundwater monitoring. Furthermore, the efficacy of using passive and active geochemical sequestration would need to be further

evaluated to determine if the act of sequestration has the potential to result in unanticipated consequences resulting in the mobilization of other metals that are currently not identified as constituents of concern.

4.2.6 Ponds 1-2 Alternative 2e: Source Removal with Passive Geochemical Sequestration

Passive geochemical sequestration, such as a permeable reactive barrier, offers a remediation option for select COCs with no active operational costs other than periodic performance monitoring once installed. However, remediation of other COCs may not be equally effective, and therefore such COCs may pass through the permeable reactive barrier without treatment prior to discharge. Although the permeable reactive barrier offers a relatively low-cost remedial alternative, long term performance cannot be guaranteed, and wall failure would not be easily repaired without considerable reconstruction efforts.

The pH and redox conditions in the subsurface environment will control the solubility of arsenic into groundwater. For example, in low pH and oxidized aquifer conditions, dissolved arsenic resides in a low solubility oxidized ionic state [As⁵⁺]. At high pH and reduced aquifer conditions, dissolved arsenic resides in a higher solubility reduced ionic state [As³⁺]. The presence of organic carbon and aerobic bacteria will also impact the concentration of arsenic in groundwater; both tend to create reduced groundwater conditions, thereby increasing the solubility/mobility of arsenic in the subsurface.

Ferric (oxidized) iron and zero-valent (reduced) iron (ZVI) have been demonstrated to be effective in the removal of arsenic in groundwater by way of adsorption onto the iron surfaces. Once adsorbed, the [As⁵⁺] and [As³⁺] ions will form complexes with iron corrosion products including ferrous hydroxide and ferric oxyhydroxides, and then become occluded by successive layers of corrosion products.

To address arsenic, in the uppermost aquifer, the permeable reactive barrier could be constructed using ZVI (with sulfide and organic carbon amendments to sustain the reduced environmental condition in this zone).

Arsenic removal by reactive *in situ* chemistry has been implemented in pilot and full-scale field installations; however, to be sure of its success and exact construction specifications, the proposed permeable reactive barrier would require an extensive bench treatability study, if a permeable reactive barrier wall was to be implemented. The uncertainty of this alternative results in a relatively high potential for future response activities if it fails or proves to be ineffective. The use of chemical additions may cause changes in groundwater chemistry that result in increases in the persistence, toxicity, or mobility of groundwater constituents that would not occur with only

monitoring, groundwater capture or control, or an impermeable barrier. Permeable Reactive Barrier wall construction would take a similar amount of time to implement as an impermeable barrier. Localized injections may be implemented slightly quicker but will still take longer to implement than groundwater. Furthermore, the efficacy of using passive and active geochemical sequestration would need to be further evaluated to determine if the act of sequestration has the potential to result in unanticipated consequences resulting in the mobilization of other metals that are currently not identified as constituents of concern.

4.3 Pond A Groundwater Management Alternatives

Closure in place has been selected as the source control strategy for Pond A. Therefore, groundwater management alternatives for Pond A will be considered in conjunction with closure in place. Each alternative is discussed in the following sub-sections and are summarized in Table 1b.

4.3.1 Pond A Alternative 1a: No Source Control Action with Long Term Groundwater Monitoring and Institutional Controls (Baseline)

A no action CCR source material management strategy with long-term groundwater monitoring is not considered viable due to its ineffectiveness of reducing potential exposures to the CCR material or potential migration of CCR material beyond the confines of the specified unit, nor is it a regulatory option. The no action CCR source material management strategy was included in the alternatives evaluation to provide a comparative baseline for other corrective measures alternatives.

4.3.2 Pond A Alternative 2a: Closure in Place with Post Remedy Monitoring

Groundwater chemistry is still equilibrating following operational changes, and there is still some uncertainty surrounding how changes in redox conditions may affect contaminant transport. Since this groundwater monitoring remedy with source control relies on naturally occurring processes that are hard to predict, there may be a potential for future response activities. Post-remedy monitoring could be initiated immediately following closure in place utilizing the existing monitoring well network and would continue for 30 years per the Post-Closure Plan.

4.3.3 Pond A Alternative 2b: Closure in Place with Groundwater Capture/Control

A groundwater extraction system is expected to be highly effective at capturing groundwater prior to venting to surface water, thus protecting potential receptors. However, this alternative has high capital and long-term costs due to the installation and ongoing operation and maintenance of the groundwater extraction system.

Reliability of a groundwater capture/control system is higher than active or passive geochemical sequestration, but is less reliable than an impermeable barrier due to operation, maintenance, and overall effectiveness. Design and construction of a groundwater extraction system would take longer to implement than groundwater monitoring.

4.3.4 Pond A Alternative 2c: Closure in Place with Impermeable Barrier with Groundwater Capture/Control

An impermeable barrier would effectively minimize the movement of affected groundwater, providing better protection than remediation relying on physical, chemical, or biological processes. However, due to the high seepage velocity and depth to the clay confining unit observed, the cost of the remedial action is higher than other options considered due to the high capital cost of construction for installing a relatively deep slurry wall with a robust groundwater extraction to prevent mounding or flow-around. Installation of an impermeable barrier combined with groundwater extraction would also have considerably longer construction duration when compared to other options considered.

4.3.5 Pond A Alternative 2d: Closure in Place with Active Geochemical Sequestration

Air Sparge could be an effective *in situ* groundwater treatment technology to either remove or transforms COCs. System operation and maintenance would be required to monitor operational parameters (e.g., pressures, temperatures, flow rates, etc.), and conduct routine maintenance on the system (e.g., filter cleaning and change-out, blower valve, belt and oil maintenance, etc.). The creation of an oxidizing zone may increase the mobility of other metals, such as selenium. Reliability of an active geochemical sequestration system is also considered lower when compared to other remedial alternatives due to increased operation and maintenance considerations. Design and installation of an active geochemical sequestration system would take longer than implementing groundwater monitoring. Furthermore, the efficacy of using passive and active geochemical sequestration would need to be further evaluated to determine if the act of sequestration has the potential to result in unanticipated consequences resulting in the mobilization of other metals that are currently not identified as constituents of concern.

4.3.6 Pond A Alternative 2e: Closure in Place with Passive Geochemical Sequestration

Arsenic removal by reactive *in situ* chemistry has been implemented in pilot and full-scale field installations; however, to be sure of its success and exact construction specifications, the proposed Permeable Reactive Barrier would require an extensive

bench treatability study for this site, if a Permeable Reactive Barrier wall was to be implemented. The effectiveness and reliability of passive geochemical sequestration is low compared to other options. The uncertainty of this alternative results in a relatively high potential for future response activities if it fails or proved to be ineffective. The use of chemical additions may cause changes in groundwater chemistry that result in increases in the persistence, toxicity, or mobility of groundwater constituents that would not occur with only monitoring, groundwater capture or control, or an impermeable barrier. Installation of a Permeable Reactive Barrier wall would have considerably longer construction duration when compared to other options considered. Furthermore, the efficacy of using passive and active geochemical sequestration would need to be further evaluated to determine if the act of sequestration has the potential to result in unanticipated consequences resulting in the mobilization of other metals that are currently not identified as constituents of concern.

Section 5

Remedy Selection Summary

This ACM has been completed to meet the requirements of §257.96 and to begin the process of selecting corrective measure(s) for groundwater. The CCR source material management strategy is summarized in Section 5.1. The results of the assessment of groundwater remediation technologies are summarized in Section 5.2.

5.1 CCR Source Material Management

As documented in the September 2018 Notification of Intent to Initiate Closure letters submitted in accordance with §257.102(g), Consumers Energy is in the process of closing Ponds 1-2 under the RCRA Rule's closure by removal provisions in §257.102(c) and Pond A under the RCRA Rule's closure in place provisions in §257.102(d) as documented in the January 2018 and October 2016 Closure Plans, respectively, available on the Consumers Energy CCR Rule Compliance Data and Information webpage.

5.1.1 Ponds 1-2 – Source Removal

As documented in the Closure Plan, Ponds 1-2 was dewatered, the hydraulic structures were abandoned, and CCR was removed as part of the CCR removal and unit decontamination procedures. Excavated CCR from Ponds 1-2 was consolidated into a smaller footprint in Pond A. CCR removal from Ponds 1-2 was complete in 2018 and final documentation for CCR removal has been submitted to EGLE.

5.1.2 Pond A – Closure in Place

As documented in the Closure Plan, closure activities began in second quarter 2019. In general, Pond A closure activities were conducted in the following sequence: dewatering and grading activities; subgrade preparation; geosynthetics deployment; protective cover/topsoil; and vegetative layer. Cover construction was completed in summer 2019 and the Closure Certification Report is being developed for submission to EGLE.

The protective cover, along with evidence showing a lack of vertical gradients, will serve to minimize or eliminate the post-closure infiltration of liquid into the CCR. Consumers Energy is in the process of implementing monitoring of Pond A in accordance with the EGLE-approved HMP.

5.2 Groundwater Management

This ACM Report provides a high-level assessment of groundwater remediation technologies that could potentially address COCs. Currently, the assessment of remedial technologies is based on the remediation of arsenic. Based on the evaluation discussed in Section 4, long term groundwater monitoring in coordination with a no action CCR source material management strategy (Alternative 1) is not viable, and as discussed above, is a non-regulatory option that was included only as a comparative baseline for the alternative evaluation process. The remaining alternatives evaluated in this ACM are considered technically feasible final groundwater management strategies to be evaluated following Ponds 1-2 source removal and Pond A closure in place.

Consumers Energy plans to utilize an adaptive management strategy for selecting the final groundwater remedies for Ponds 1-2 and Pond A in coordination with the specified CCR source material management strategies. Under this remedy selection strategy, corrective measures may be implemented to address existing conditions followed by monitoring and evaluation of the corrective measure performance. Adjustments will be made to the corrective measure remedy, as needed, to achieve the remedial goals.

Consumers Energy will, as soon as feasible, select groundwater management remedies for Ponds 1-2 and Pond A that, at a minimum, meet the standards of §257.96(b) as outlined in Section 6. Although arsenic has been identified at concentrations exceeding applicable criteria, an evaluation of risk demonstrates that there are **currently no adverse effects on human health or the environment** from either surface water or groundwater due to CCR management at Ponds 1-2 or Pond A. Consumers Energy will continue to evaluate groundwater management alternatives, considering the assumptions and data limitations identified below. The groundwater management strategy will be coalesced into a comprehensive site characterization and used to develop a site-wide response action strategy for the JHC Solid Waste Disposal facility under the revision to the RAP being developed by Consumers Energy.

5.3 Assumptions and Limitations

The CCR groundwater monitoring system at Ponds 1-2 and Pond A has measured groundwater quality over a relatively short period of time (2015 to 2019). Baseline conditions for the CCR units at the JHC site were established based on a minimum eight samples collected on a quarterly basis over two years. This short baseline period limits the confidence in assessing the potential variability in groundwater quality over time based on hydrological and groundwater chemistry changes.

Since the start of CCR monitoring in 2015, Consumers Energy has ceased hydraulic loading, dewatered, and removed CCR from Ponds 1-2, and ceased hydraulic loading, dewatered, and

placed final cover over Pond A. Due to the decommissioning of the wet ash ponds, groundwater mounding in the vicinity of the decommissioned CCR units is reduced. The reduction of hydraulic loading and recharge of the aquifer are expected to have changed groundwater conditions (e.g., from aerobic to anaerobic). Many of the Appendix III and IV constituents may be affected by this change in redox conditions. Groundwater flow in the vicinity of Pond A is also still equilibrating following dewatering, as shown by the slight mounding still observed.

Any remedial strategy depending on geochemical sequestration will need to implicitly include an analysis of the relative stability of groundwater chemistry, including an assessment of future uncertainty based on factors such as fluctuations in groundwater or surface elevations, redox indicators, etc. The efficacy of using passive and active geochemical sequestration methods would also need to be evaluated to determine if the act of sequestration has the potential to result in unanticipated consequences resulting in the mobilization of other metals that are currently not identified as constituents of concern.

Section 6

Next Steps

6.1 Selection of Remedy

The remedy selection process commences following the submittal of the ACM. Consumers Energy will, as soon as feasible, select a remedy that, at a minimum, meets the standards of §257.97(b), that specify that remedies must:

1. Be protective of human health and the environment;
2. Attain the groundwater protection standard as specified pursuant to §257.95(h);
3. Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in Appendix IV to this part into the environment;
4. Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems; and
5. Comply with standards for management of wastes as specified in §257.98(d).

Upon completion of the ACM leading up to the selection of remedy, Consumers Energy will prepare a semiannual report describing the progress in selecting and designing the remedy in accordance with §257.97. Preferred remedial technologies may be further evaluated as part of the remedy selection process to address site-specific conditions associated with long- and short-term effectiveness and protectiveness, implementability, the practicable capability of the Consumers Energy, including a consideration of the technical and economic capability, and other considerations, and the degree to which community concerns are addressed by a potential remedy or remedies.

6.2 Public Meeting Requirement

Consumers Energy will discuss the ACM results in a public meeting with interested and affected parties in accordance with §257.96(e) prior to selecting a remedy. The public meeting will be conducted at least 30 days prior to the selection of remedy in accordance with §257.96(e).

Consumers Energy will notify stakeholders when the public meeting has been scheduled.

6.3 Final Remedy Selection

A final report describing the selected remedy and how it meets the standards specified in §257.97 will be prepared following selection of a final remedy. Consumers Energy must obtain a certification from a qualified professional engineer that the remedy selected meets the

requirements of §257.97. The final report will be considered completed when it is placed in the facility's operating record as required by §257.105(h)(12).

As previously noted, Consumers Energy and the EGLE executed a Consent Agreement No. 115-01-2018. As outlined in Section 4.5 of the agreement, on or before October 1, 2021, Consumers Energy agrees to revise the existing RAP, which will address any exceedances of generic criteria in groundwater at the Site, including Ponds 1-2 and Pond A.

6.4 Continued Groundwater Monitoring

Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98, which includes semiannual assessment monitoring in accordance with §257.95 to monitor groundwater conditions and inform the remedy selection. The next semiannual assessment monitoring event is scheduled to occur in October 2019 with results summarized in the 2019 Annual Groundwater Monitoring Report issued in January 2020.

Section 7

References

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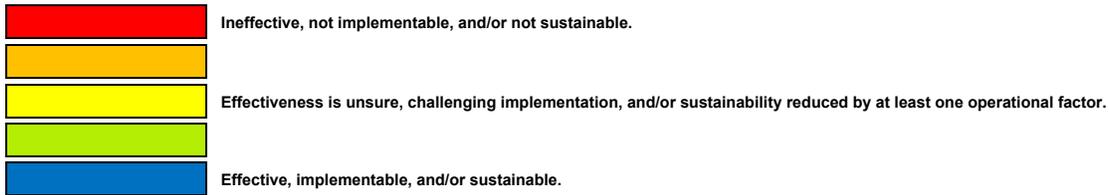
USEPA. April 2015. 40 CFR Parts 257 and 261. Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule. 80 Federal Register 74 (April 17, 2015), pp. 21301-21501 (80 FR 21301).

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

Tables

Table 1a
Summary of Remedial Action Selection Alternative Evaluation
Site/Impoundment Name: JH Campbell Bottom Ash Pond Units 1-2 North and 1-2 South

Option #		1	2				
CCR Source Management		None	CCR Removal				
Option #		a	a	b	c	d	e
Groundwater Management (all options will include ICs)		Long Term Groundwater Monitoring & Institutional Controls (ICs)	Post Source Removal Monitoring	Groundwater Capture/Control	Impermeable Barrier (e.g., slurry wall) with Groundwater Capture/Control	Active Geochemical Sequestration (e.g., Air Sparge)	Passive Geochemical Sequestration (e.g. PRB)
		1	2a	2b	2c	2d	2e
Balancing Criteria	Rule Reference						
i. Effectiveness in Protecting Health, Safety, Welfare, and the Environment	§257.96(c)(1) §257.97(b)(1) R 299.4444(2)(a) Section 20120(1)(a)						
ii. Long-Term Uncertainties	§257.96(c)(1) Section 20120(1)(b)						
iii. Persistence, Toxicity, Mobility, and Propensity to Bioaccumulate of the Hazardous Substances	§257.96(c)(1) Section 20120(1)(c)						
iv. Short- and Long-Term Adverse Health Effects from Exposure	§257.96(c)(1) §257.97(d)(4) R 299.4444(4)(e) Section 20120(1)(d)						
v. Cost of Remedial Action including Long-Term Maintenance	Section 20120(1)(e)						
vi. Reliability of the Alternatives	§257.96(c)(1) §257.97(c)(1)(vii) §257.97(c)(3)(ii) R 299.4444(3)(a)(vii) R 299.4444(3)(c)(ii) Section 20120(1)(f)						
vii. Potential for Future Response Activity Costs if Alternative Fails	§257.96(c)(1) §257.97(c)(1)(viii) R 299.4444(3)(a)(viii) Section 20120(1)(g)						
viii. Potential Threats associated with Excavation, Transportation, Redisposal, or Containment	§257.96(c)(1) §257.97(c)(1)(iv) R 299.4444(3)(a)(iv) Section 20120(1)(h)						
ix. Ability to Monitor Remedial Performance	Section 20120(1)(i)						
x. Public's Perspective about Extent to which the Proposed Remedial Action Effectively Addresses Requirements	§257.97(c)(4) R 299.4444(3)(e) Section 20120(1)(j)						
Relative Effectiveness							

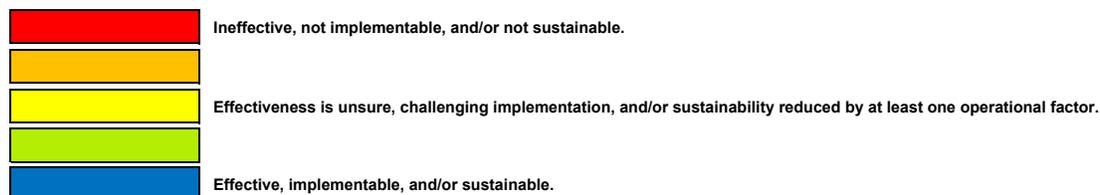


Notes:
 (1) Except as otherwise noted, balancing criteria encompass criteria in the CCR Rule §257.97, Michigan Part 115 R 299.4444, and Michigan Part 201, Section 20120 for remedy selection.
 (2) Consumers Energy performed source removal by excavation of CCR from Ponds 1-2 consistent with the Closure Plan and the December 2017 Closure Workplan. CCR removal from Ponds 1-2 was complete in 2018 and final documentation for CCR removal for Ponds 1-2 was submitted to EGLE in August 2019.

**Table 1b
Summary of Remedial Action Selection Alternative Evaluation**

Site/Impoundment Name: JH Campbell Pond A

Option #		1	2				
CCR Source Management		None	Close In Place - Low Permeability Cover				
Option #		a	a	b	c	d	e
Groundwater Management (all options will include ICs)		Long Term Groundwater Monitoring & Institutional Controls (ICs) 1	Post Source Management Monitoring 2a	Groundwater Capture/Control 2b	Impermeable Barrier (e.g., slurry wall) with Groundwater Capture/Control 2c	Active Geochemical Sequestration (e.g., Air Sparge) 2d	Passive Geochemical Sequestration (e.g. PRB) 2e
Balancing Criteria	Rule Reference						
i. Effectiveness in Protecting Health, Safety, Welfare, and the Environment	§257.96(c)(1) §257.97(b)(1) R 299.4444(2)(a) Section 20120(1)(a)						
ii. Long-Term Uncertainties	§257.96(c)(1) Section 20120(1)(b)						
iii. Persistence, Toxicity, Mobility, and Propensity to Bioaccumulate of the Hazardous Substances	§257.96(c)(1) Section 20120(1)(c)						
iv. Short- and Long-Term Adverse Health Effects from Exposure	§257.96(c)(1) §257.97(d)(4) R 299.4444(4)(e) Section 20120(1)(d)						
v. Cost of Remedial Action including Long-Term Maintenance	Section 20120(1)(e)						
vi. Reliability of the Alternatives	§257.96(c)(1) §257.97(c)(1)(vii) §257.97(c)(3)(ii) R 299.4444(3)(a)(vii) R 299.4444(3)(c)(ii) Section 20120(1)(f)						
vii. Potential for Future Response Activity Costs if Alternative Fails	§257.96(c)(1) §257.97(c)(1)(viii) R 299.4444(3)(a)(viii) Section 20120(1)(g)						
viii. Potential Threats associated with Excavation, Transportation, Redisposal, or Containment	§257.96(c)(1) §257.97(c)(1)(iv) R 299.4444(3)(a)(iv) Section 20120(1)(h)						
ix. Ability to Monitor Remedial Performance	Section 20120(1)(i)						
x. Public's Perspective about Extent to which the Proposed Remedial Action Effectively Addresses Requirements	§257.97(c)(4) R 299.4444(3)(e) Section 20120(1)(j)						
Relative Effectiveness							



Notes:
 (1) Except as otherwise noted, balancing criteria encompass criteria in the CCR Rule §257.97, Michigan Part 115 R 299.4444, and Michigan Part 201, Section 20120 for remedy selection.
 (2) Consumers Energy intends to close Pond A under the RCRA Rule's closure in place provisions in §257.102(d) as documented in the October 2016 Closure Plan.

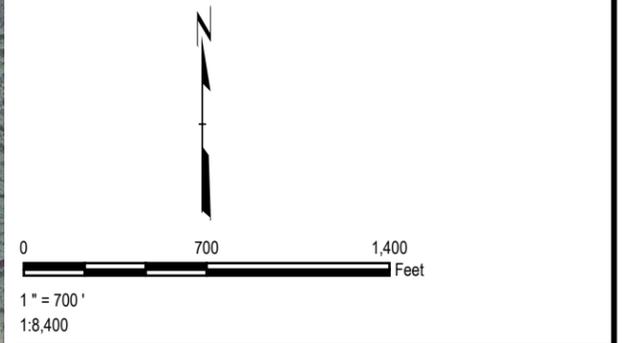
Figures



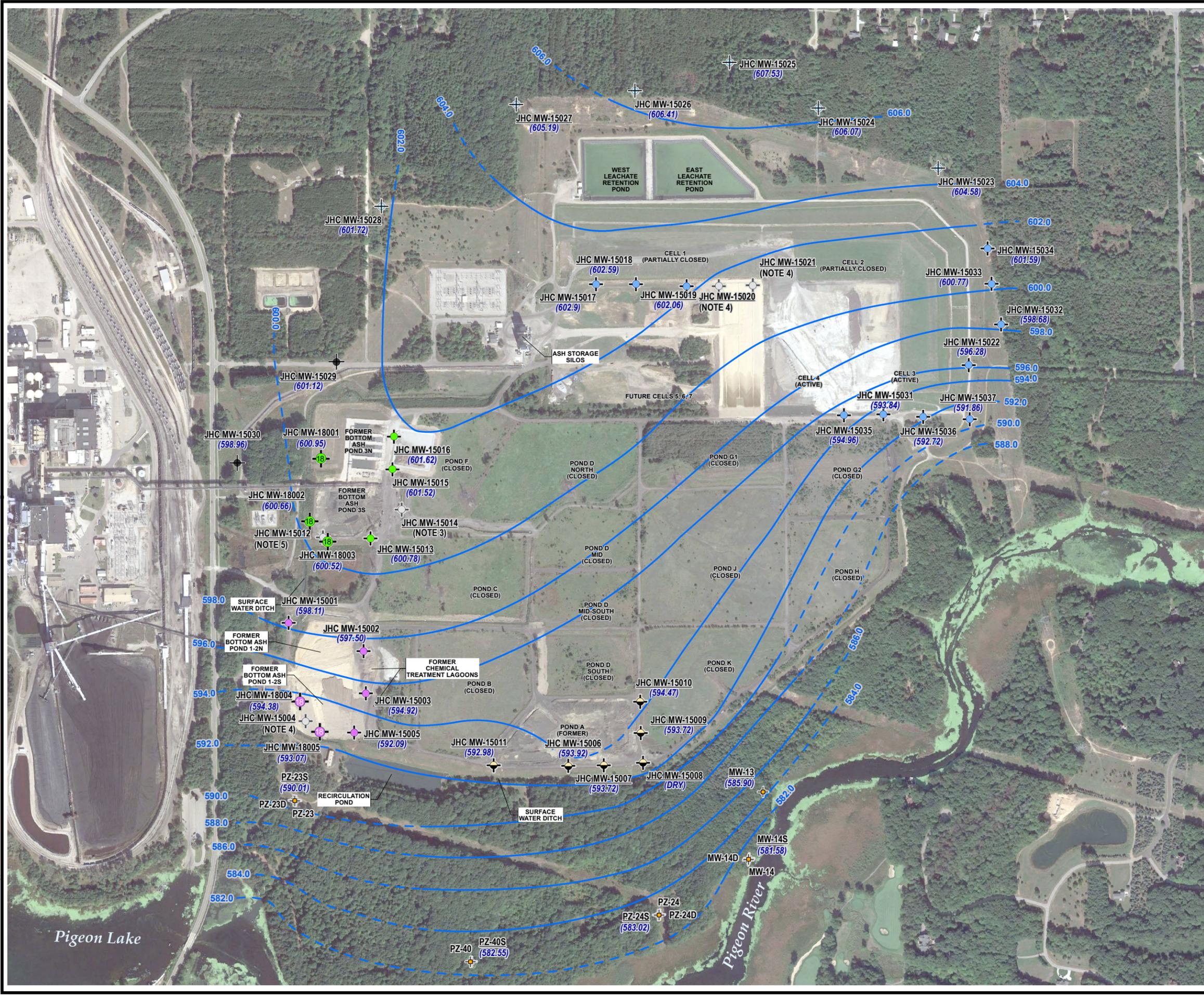
LEGEND

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

- NOTES**
1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
 2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH 12/07/2018.
 3. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
 4. MONITORING WELL DECOMMISSIONED JUNE 14, 2018.
 5. MONITORING WELL DECOMMISSIONED OCTOBER 10, 2018.
 6. JHC-MW-1800X MONITORING WELLS INSTALLED IN DECEMBER 2018.



PROJECT:		CONSUMERS ENERGY COMPANY JH CAMPBELL POWER PLANT WEST OLIVE, MICHIGAN	
TITLE:		SITE PLAN WITH CCR MONITORING WELL LOCATIONS	
DRAWN BY:	J. PAPEZ	PROJ NO.:	322174-001
CHECKED BY:	B. YELEN	FIGURE 1	
APPROVED BY:	S. HOLMSTROM		
DATE:	SEPTEMBER 2019		
FILE NO.:		322174-001-008.mxd	

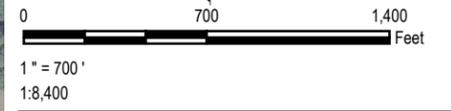


LEGEND

- 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 WELL
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- (600.97) GROUNDWATER ELEVATION (FEET)

NOTES

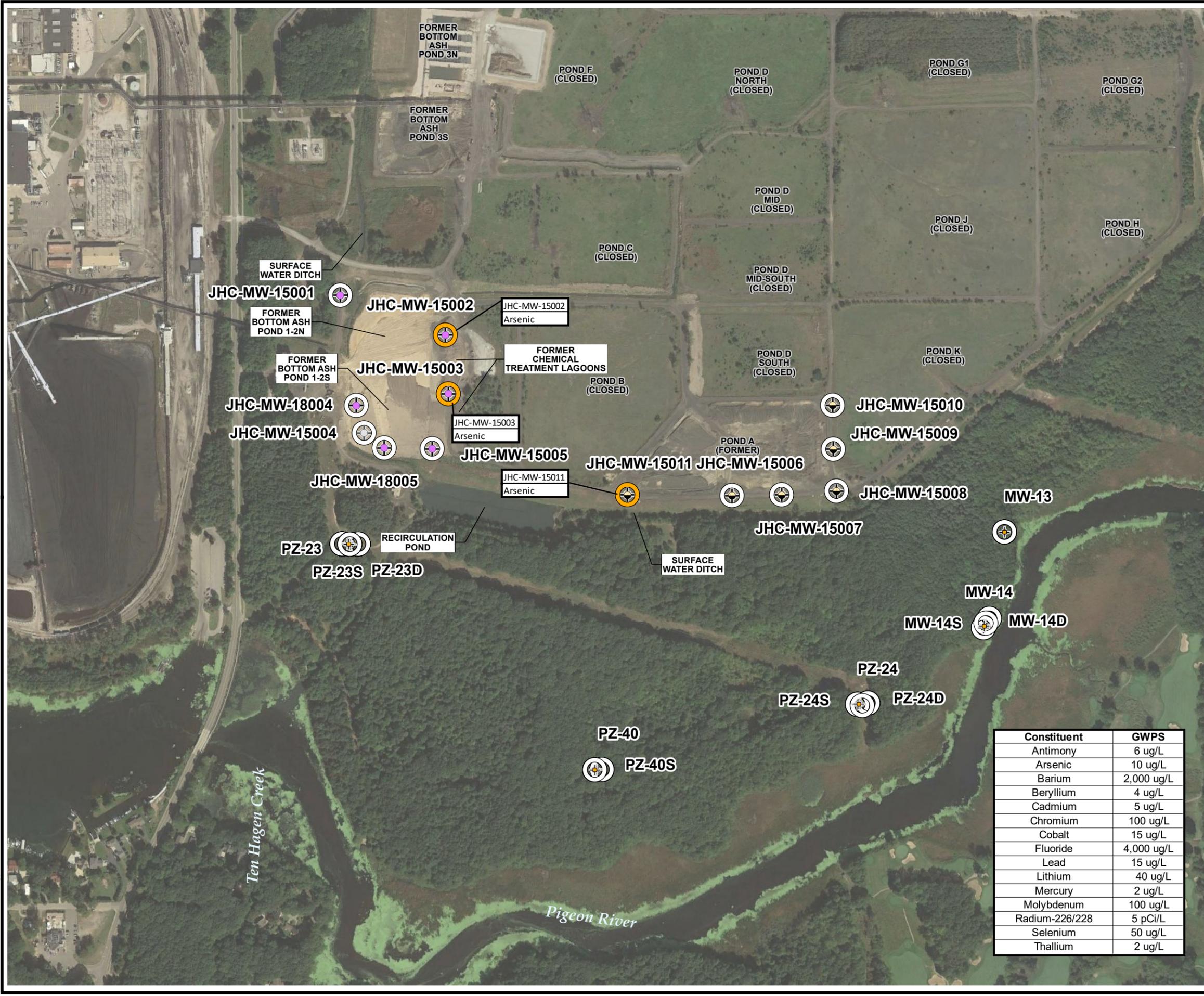
1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
2. WELL LOCATIONS SURVEYED BY NEDERVELD ON 11/25/2015.
3. MONITORING WELL DECOMMISSIONED NOVEMBER 13, 2017.
4. MONITORING WELL DECOMMISSIONED JUNE 14, 2018.
5. MONITORING WELL DECOMMISSIONED OCTOBER 10, 2018.
6. JHC-MW-1800X MONITORING WELLS INSTALLED IN DECEMBER 2018.
7. GROUNDWATER ELEVATIONS DISPLAYED IN FEET RELATIVE TO THE NORTH AMERICAN VERTICAL DATUM OF 1988.
8. GROUNDWATER ELEVATION DATA RECORDED APRIL 22, 2019.



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	FIGURE 2	
APPROVED BY:	S. HOLMSTROM		
DATE:	SEPTEMBER 2019		



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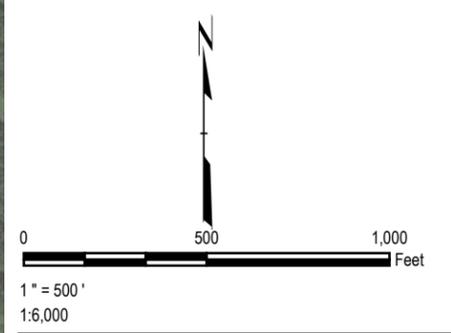
LEGEND

- DECOMMISSIONED MONITORING WELL
- DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- POND A MONITORING WELL
- NATURE AND EXTENT WELL
- NO STATISTICALLY SIGNIFICANT EXCEEDANCES
- STATISTICALLY SIGNIFICANT GWPS EXCEEDANCE

WELL ID
CONSTITUENT(S)
EXCEEDING GWPS

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
2. WELL LOCATIONS BASED ON SURVEY DATA THROUGH 12/07/2018.
3. GWPS (GROUNDWATER PROTECTION STANDARD) IS THE HIGHER OF THE MAXIMUM CONTAMINANT LEVEL (MCL)/REGIONAL SCREENING LEVEL FROM 83 FR 36435 (RSL) AND UPPER TOLERANCE LIMIT (UTL) AS ESTABLISHED IN TRC'S TECHNICAL MEMORANDUM DATED OCTOBER 15, 2018.
4. AN EXCEEDANCE OF THE GWPS OCCURS WHEN THE LOWER CONFIDENCE LIMIT OF THE DOWNGRADIENT DATA EXCEEDS THE GWPS.

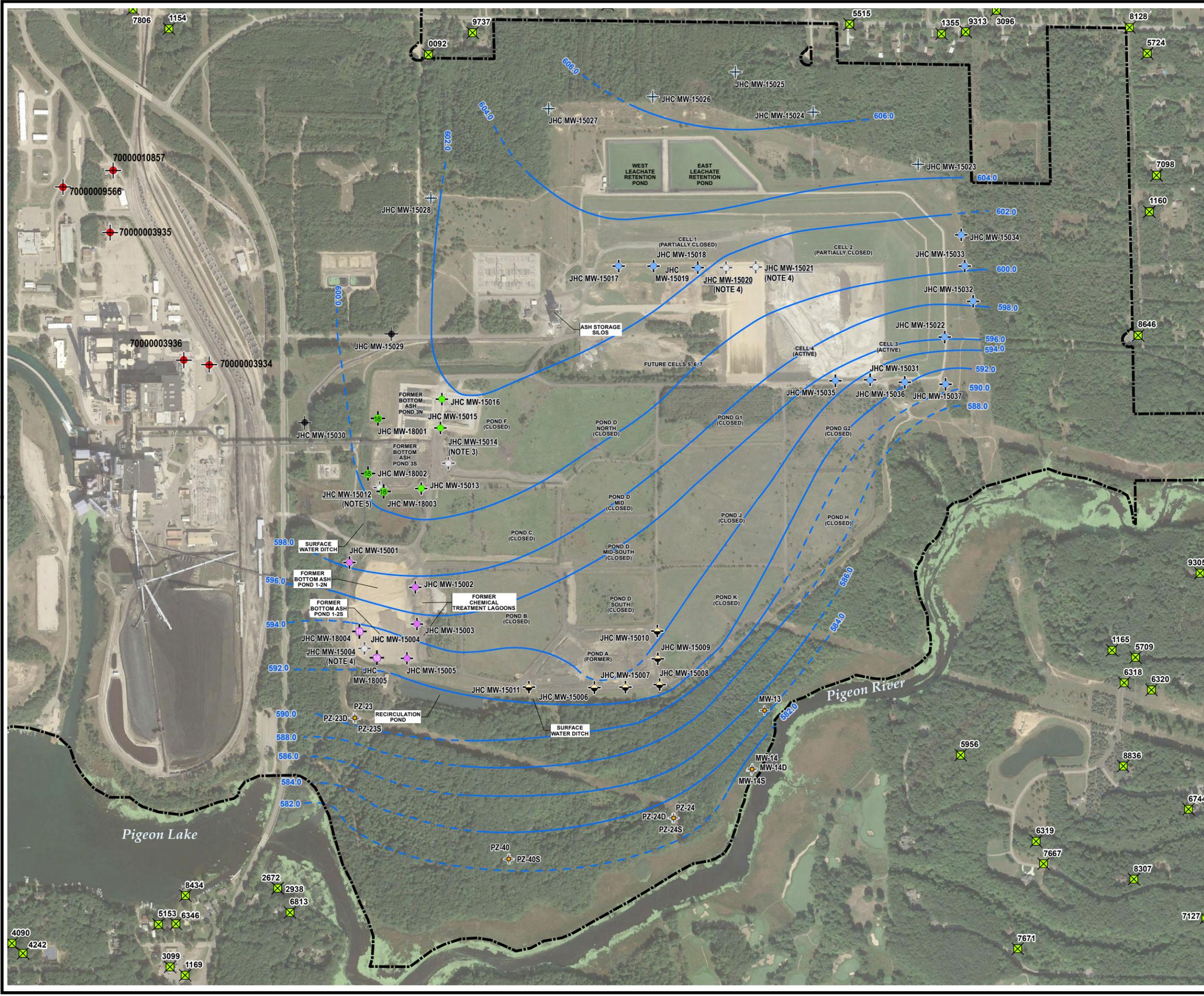


Constituent	GWPS
Antimony	6 ug/L
Arsenic	10 ug/L
Barium	2,000 ug/L
Beryllium	4 ug/L
Cadmium	5 ug/L
Chromium	100 ug/L
Cobalt	15 ug/L
Fluoride	4,000 ug/L
Lead	15 ug/L
Lithium	40 ug/L
Mercury	2 ug/L
Molybdenum	100 ug/L
Radium-226/228	5 pCi/L
Selenium	50 ug/L
Thallium	2 ug/L

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

TITLE: **NATURE AND EXTENT SUMMARY
GWPS EXCEEDANCES**

DRAWN BY: S. MAJOR	PROJ NO.: 322174-001
CHECKED BY: K. AMONETTE	
APPROVED BY: S. HOLMSTROM	FIGURE 3
DATE: SEPTEMBER 2019	



LEGEND

- BACKGROUND MONITORING WELL
- DECOMMISSIONED MONITORING WELL
- DOWNGRADEMENT BOTTOM ASH POND
- 1/2 N/S MONITORING WELL
- DOWNGRADEMENT BOTTOM ASH POND
- 3 N/S MONITORING WELL
- DOWNGRADEMENT LANDFILL MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- POND A MONITORING WELL
- NEW DOWNGRADEMENT BOTTOM ASH POND
- 1/2 N/S MONITORING WELL (2018)
- NEW DOWNGRADEMENT BOTTOM ASH POND
- 3 N/S MONITORING WELL (2018)
- NATURE AND EXTENT WELL
- DRINKING WATER WELL
- TYPE II WATER WELLS (NON-RESIDENTIAL)
- PROPERTY BOUNDARY
- 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.
8. DRINKING WATER AND TYPE II WATER WELL LOCATIONS FROM STATE OF MICHIGAN WELLOGIC DATABASE, 8/19/2019.
9. GROUNDWATER ELEVATION DATA RECORDED APRIL 22, 2019.

0 800 1,600
Feet

1" = 800'
1:9,600

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

TITLE: **PROPERTY BOUNDARY
AND
SURROUNDING FEATURES**

DRAWN BY: S. MAJOR	PROJ NO.: 322174-001
CHECKED BY: K. AMONETTE	
APPROVED BY: S. HOLMSTROM	
DATE: SEPTEMBER 2019	

FIGURE 4

TRC

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

FILE NO.: 322174-001-011.mxd

Appendix A

Demonstration for 60-Day Extension

A CMS Energy Company

Date: July 12, 2019

To: Operating Record

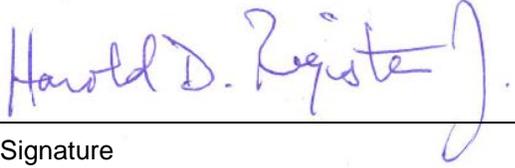
From: Harold D. Register, Jr., P.E. 

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

Professional Engineer Certification Statement [§257.96(a)]

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

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



Signature

July 12, 2019

Date of Certification

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

Name

6201056266

Professional Engineer Certification Number



07/12/2019