



Assessment of Corrective Measures

**Consumers Energy Company
Former BC Cobb Power Plant Bottom Ash Pond & Ponds 0-8
Coal Combustion Residual Units
Muskegon, 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 BC Cobb Bottom Ash Pond and Ponds 0-8 (BCC Ponds). The CCR Rule 40 CFR §257.96(a) requires that an owner or operator initiate an assessment of corrective measures (ACM) to prevent further release, to remediate any releases, and to restore impacted areas to original conditions if any Appendix IV constituent has been detected at a statistically significant level exceeding a 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.

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 BCC Ponds, 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 federal rules and state rules promulgated under Michigan's Natural Resources and Environmental Protection Act (NREPA), Part 115, Solid Waste Management, as amended by Public Act 640 of 2018.

On January 14, 2019, Consumers Energy provided notification that lithium was present at statistically significant levels above the federal GWPS in one or more downgradient monitoring wells at the BCC Ponds. 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 necessitated the development and submittal of the ACM under the timeframes provided under the CCR Rule.

As documented in the March 30, 2018 Notification of Intent to Initiate Closure letter submitted in accordance with §257.102(g), Consumers Energy intends to close the BCC Ponds under the CCR Rule's closure by removal provisions in §257.102(c). Consumers Energy has also submitted a closure work plan to EGLE (Golder, May 2018) that included a multiple lines of

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).

evidence approach for verifying CCR removal. The closure work plan was reviewed and approved by EGLE on October 16, 2018. Field activities are scheduled to begin in 2020, and when complete, will be documented in a CCR removal documentation report.

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. The nature and extent data consist of data collected from the background and downgradient CCR monitoring well networks between February 2016 and April 2019. Based on this network, installation of additional downgradient monitoring wells was not necessary.

Nature and Extent (N&E) Evaluation Wells		
BCC Background Wells	BCC Ponds CCR Unit Wells	N&E Delineation Wells
BCC-MW-15002	BCC-MW-15009	BCC-MW-15001
BCC-MW-15003	BCC-MW-15010	
BCC-MW-15004	BCC-MW-15011	
BCC-MW-15005	BCC-MW-15012	
BCC-MW-15006	BCC-MW-15013	
BCC-MW-15007	BCC-MW-15014	
BCC-MW-15008	BCC-MW-15015	
	BCC-MW-15016	
	BCC-MW-15017	
	BCC-MW-15018	
	BCC-MW-15019	
	BCC-MW-15020	
	BCC-MW-15021	
	BCC-MW-15022	
	BCC-MW-15023	
	BCC-MW-17001	
	BCC-MW-17002	
	BCC-MW-17003	
	BCC-MW-17004	
	BCC-MW-17005	
	BCC-MW-17006	

Lithium concentrations exceed the GWPS in on-site groundwater. The property containing the site is owned and operated by Consumers Energy and on-site groundwater is not used for drinking water. There are no on-site drinking water wells, so the drinking water pathway on-site is not complete. The nearest off-site drinking water well is more than 2,000 feet away on the other side of the North Branch Muskegon River.

Several groundwater management alternatives evaluated in this ACM are considered technically feasible to reduce on-site 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 the BCC Ponds in coordination with the specified CCR source material management strategies. Under an adaptive management 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 site groundwater conditions and inform the remedy selection. The next semiannual assessment monitoring event is scheduled to occur in September 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 impacted groundwater at the BCC Ponds that, at a minimum, meets the federal standards of §257.97(b) and state standards of R299.4444(2). It is anticipated that the remedy selection process for addressing affected groundwater will proceed following implementation of the specified CCR source material management strategies. A public meeting with interested and affected parties will be scheduled in accordance with §257.96(e) and R299.4443(4) once one or more preferred remedial approach(es) for groundwater are identified. 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.

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 BC Cobb Bottom Ash Pond and Ponds 0-8 (BCC Ponds). The CCR Rule 40 CFR §257.96(a) requires that an owner or operator initiate an assessment of corrective measures (ACM) to prevent further release, to remediate any releases, and to restore impacted areas to original conditions if any Appendix IV constituent has been detected at a statistically significant level exceeding a 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 the BCC Ponds in satisfaction of the requirements of the CCR Rule §257.96 and the requirement to initiate an assessment of corrective measures pursuant to R 299.4443(1) of Michigan Part 115. TRC has prepared this ACM for the BCC Ponds, 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. This report also serves to document substantial progress towards the requirements for feasibility studies contained in Part 201 of the act.

Consumers Energy previously determined to utilize a dewatering and source removal strategy for closure of the BCC Ponds as documented in Section 3.1 of this ACM. Closure by removal was the method of closure selected and implemented for the BCC Ponds 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 ACM, especially with respect to addressing source control. Based on this strategy, this ACM focuses on the evaluation of viable alternatives for groundwater management in conjunction with the selected closure method – closure by removal - source

material control option without specifically evaluating construction of a final cover or other impermeable cap.

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, R299.4443 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 the alternative on a scale from ineffective to highly effective. The evaluation of each alternative is discussed in Section 4.

This ACM was initiated on April 14, 2019, following the January 14, 2019 *Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g)*, which documented that lithium was present at statistically significant levels above the federal GWPS in one or more downgradient monitoring wells at the BCC Ponds. Consumers Energy notified the Michigan Department of Environment, Great Lakes, and Energy (EGLE)¹ in the Response Action Plan submitted on March 15, 2019 that this ACM would be submitted by September 11, 2019. 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;

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).

- 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 measure approach tabulated for comparison in Table 1. Description of the potential remedy approaches are provided in Section 3 and then discussed in context of applicability at the BCC Ponds 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). In addition to providing notification to EGLE that the ACM has been placed in the facility's operating record, this report is being submitted in satisfaction of the timelines in the Response Action Plan.

1.2.2 State Requirements

On December 28, 2018, the State of Michigan enacted Public Act No. 640 of 2018 (PA 640) to amend the Natural Resources and Environmental Protection Act, also known as Part 115 of PA 451 of 1994, as amended (a.k.a., Michigan Part 115 Solid Waste Management). The December 2018 amendments to Part 115 were developed to provide the State of Michigan oversight of CCR impoundments and landfills and to better align existing state solid waste management rules and statutes with the CCR Rule. This alignment would ensure compliance with the CCR standards through a state-approved permitting program that would be deemed to be "equivalent to" or "as protective as" through an administrative application that would be reviewed and authorized by USEPA. It should be noted that the Michigan statute does not act in lieu of the federal standards until such a time as the USEPA authorizes the permit program.

Michigan's Part 115 references Michigan's Part 201 (Environmental Cleanup) which adopts by reference the requirements for feasibility studies. This ACM has been prepared in compliance with the requirements for feasibility studies contained in Part 201 and includes an analysis of the effectiveness of potential corrective measures in meeting the requirements and objectives of the remedy. Requirements for evaluating effectiveness of potential remedies under Michigan rules are the same as those under the CCR Rule with the exception that state rules allow cost to be a balancing consideration for selecting a remedy.

1.3 Program Summary

The CCR Rule applies to the BCC Ponds. In accordance with the schedule defined in §257.90(b)(1), a groundwater monitoring system was installed around the BCC Ponds 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 Standard per §257.95(g)*, lithium was present at statistically significant levels above the federal GWPSs in one or more downgradient monitoring wells at the BCC Ponds, 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

Prior to remedy selection, Consumers Energy will also collect a sufficient number of samples to evaluate Michigan state-specific constituents as follows:

Additional Monitoring Constituents (Michigan Part 115)	
Detection Monitoring	Assessment Monitoring
Iron	Copper Nickel Silver Vanadium Zinc

1.4 Bottom Ash Pond Closure

Consumers Energy evaluated source material management technologies and determined to close the BCC Ponds under the CCR Rule’s closure by removal provisions in §257.102(c) as referenced in Section 11519b(9)(a) in P.A. 640. Consumers Energy submitted the *B.C. Cobb Generating Facility Bottom Ash Pond and Ponds 0-8 Closure Work Plan*, (Golder, 2018) to EGLE for agreement on Consumers Energy’s plan to remove CCR on May 31, 2018 and clarified on August 13, 2018 (Golder, 2018b). EGLE provided written concurrence with the plan on October 16, 2018. Consumers Energy also provided formal Notification of Intent to Initiate Closure of the BCC Ponds on March 30, 2018, per §257.102(g).

Consumers Energy ceased hydraulic loading to the BCC Ponds in April 2016. Field activities for CCR removal are scheduled to begin in 2020 and will consist of dewatering to allow for excavation of the vertical and lateral extent of waste CCR. The reduction of hydraulic loading and recharge of the aquifer are expected to have changed groundwater redox conditions (e.g., from aerobic to anaerobic) and the physical removal of CCR is expected to further improve groundwater quality.

Section 2

Hydrogeology/Current Conditions

The former BC Cobb coal-fired power generation facility began generating electricity in 1948, and plant operations ceased in April 2016. The site is located east of Muskegon Lake, south of North Branch Muskegon River, northwest of the CSX rail line, and west of the Muskegon River marsh in Muskegon, Michigan.

2.1 Description of CCR Units

There are two RCRA CCR units associated with the site—the Bottom Ash Pond and Ponds 0-8 (collectively the BCC Ponds), both of which were wet ash dewatering areas. The locations of the Bottom Ash Pond and Ponds 0-8 are shown in Figure 1. From 1984 through plant closure in 2016, CCR have been deposited in the BCC Ponds by utilizing sluicing methods. Bottom ash slurry was directed into the Bottom Ash Pond, with Bottom Ash Pond overflow being directed into Ponds 5 or 6. Fly ash from the power plant was directed into Ponds 7 and 8. The ponded CCR was routed through the remaining ponds in series. Each pond allowed a portion of CCR particles to settle out before the overflow was transferred to the next pond. The overflow from Pond 4 was discharged to a National Pollutant Discharge Elimination System (NPDES) outfall located on the Discharge Channel.

CCR was periodically removed from the ponds and disposed or beneficially reused. During operation of the CCR units, the pond surface water elevations were at 588 feet. Since plant closure in 2016, the pond water elevation has been decreased through dewatering to the groundwater level of approximately 580 feet.

2.2 Geologic/Hydrogeologic Setting

The majority of the Ponds 0-8 is comprised of surficial CCR and sand fill. United States Geologic Survey (USGS) topographic maps and aerial photographs dating back to 1929, in addition to field descriptions of subsurface soil at the site, indicate that the area currently occupied by the ash ponds was originally marsh land.

The subsurface materials encountered in the pond area generally consist of CCR ranging from 3 to 28 feet below ground surface (ft bgs) overlying 10 to 20 feet of poorly graded, fine-grained sand. Discontinuous layers of organic materials (i.e., humus) and peat (on the order of 0.5 to 1.0 feet thick), and organic-rich zones or sand and silt are present within the fine-grained sand. Organic-rich silt was also encountered at depths ranging from 20 to 30 ft bgs, beneath the fine-grained sand, ranging in thickness from approximately 1 to 13 feet. The organic-rich silt deposits are thickest in the perimeter berms along the southernmost edge of the pond area (toward

Muskegon Lake). Thinner deposits of the organic-rich silt were encountered toward the northernmost edge of the pond area. Silty clay and/or poorly graded, fine- to medium-grained sand is generally observed within 30 to 40 ft bgs, beneath the organic-rich silt. An underlying gray clay was encountered throughout the pond area at approximately 40 ft bgs, beneath the fine to medium-grained sand.

Bedrock and quaternary geologic maps of Michigan and local water well records indicate that 120 to 190 feet of glacio-lacustrine sand, gravel, moraine and lacustrine clay deposits are present throughout Muskegon County. These lacustrine deposits are situated on top of the sandstone bedrock that is part of the Marshall Formation, typically encountered at approximately 200 to 250 ft bgs throughout Muskegon County. Glacial moraine deposits are more prevalent in the northern and eastern portions of the County, while glacio-lacustrine sands dominate in the western and southern areas surrounding Muskegon Lake, and the area approaching Lake Michigan. The site is located in the central area of the County.

The Ponds 0-8 is bound by several surface water features (Figure 1): The North Branch Muskegon River and former plant-associated discharge channel adjoin the northwestern and southernmost boundaries of the pond area, and Veterans Memorial Pond is located northeast of the pond area, approximately 100 feet northeast of Michigan Highway 120.

Groundwater flow within the uppermost aquifer varies between early CCR monitoring at the site before plant operations ceased in April 2016 and the post-shutdown period when sluicing operations had ended. While the ponds were actively receiving CCR and non-CCR wastewater, groundwater in the pond area was several feet higher than surrounding surface water and upgradient groundwater, creating a mound in the BCC Ponds. In general, groundwater is typically encountered at a similar or slightly higher elevation relative to the surrounding surface water features, generally within the range of 579 to 582 feet above mean sea level (ft AMSL), flowing outward toward the bounding surface water features.

2.3 Environmental Setting and Monitoring Network

In accordance with §257.91, Consumers Energy established a groundwater monitoring system for the BCC Ponds that consists of 29 monitoring wells that are screened in the uppermost aquifer. The monitoring well locations are shown on Figure 1.

Monitoring wells BCC-MW-15002 through BCC-MW-15008 are located southwest of the BCC Ponds and provide data on background groundwater quality that has not been impacted by the CCR Unit (total of 7 background wells). Monitoring wells BCC-MW-15009 through BCC-MW-15023 are located downgradient of the BCC Ponds (15 downgradient wells). As shown on Figure 1, monitoring well BCC-MW-15001 is used for water level measurements only.

Monitoring well BCC-MW-15001 was excluded from the background data set due to the presence of significant amounts of surficial CCR recorded in the boring log at that location.

CCR monitoring system wells along the North Branch Muskegon River (BCC-MW-15016 through BCC-MW-15020, in addition to BCC-MW-15021 along the northeast edge of the pond area) are screened in a deeper saturated sand, whereas the other CCR monitoring wells are screened closer to the water table, at or near the base of the CCR. The deeper wells are generally screened beneath an organic-rich silt unit, and the shallower wells are installed within the shallower saturated sand (above the organic-rich silt). The vertical well placement of the deeper wells is insufficient to fully assess groundwater venting to the Muskegon River and/or Veterans Memorial Pond in this area. Therefore, it was determined that additional wells were needed along the North Branch Muskegon River (adjacent to deeper screened monitoring wells BCC-MW-15016 through BCC-MW-15020, in addition to BCC-MW-15021 along the northeast edge of the pond area) to further characterize shallow groundwater quality. Six shallow monitoring wells are paired with the six deeper wells to characterize the potential for venting groundwater to surface water. Five shallow monitoring wells are paired with the deeper monitoring wells along the North Branch Muskegon River and one shallow monitoring well is located along the northeast edge of the pond area (between the pond area and the Veterans Memorial Pond).

2.4 On-Site Groundwater Flow Conditions

TRC evaluated both horizontal and vertical flow directions with the available data set to assess groundwater flow toward the adjacent surface water bodies over time. Significant changes occurred in the BCC Ponds starting with the first groundwater monitoring event in November 2015 through the present. The generating plant shut down in April 2016 and ceased sluicing ash to the BCC Ponds. Since then, the ponds have been allowed to passively dewater by gravity drainage. Veterans Memorial Pond to the north was mechanically dewatered for maintenance activities sometime during the period between August and December 2017. These operational changes around the ponds have had an effect on groundwater flow rate and direction at both the upgradient and downgradient monitoring wells in the groundwater monitoring system.

While the ponds were active, groundwater in the pond area was several feet higher than surrounding surface water and upgradient groundwater, creating a mound in the BCC Ponds, and groundwater flow was generally radial throughout the active CCR area. Groundwater flow immediately following cessation of sluicing activities in April 2016 showed slight groundwater flow radially outward toward the bounding surface water features from the BCC Ponds, with a low gradient and minimal discernible overall flow direction across the BCC Ponds.

At the time of the December 2017 sampling, Veterans Memorial Pond was separated from the Muskegon River by a weir, dewatered, and undergoing construction unrelated to site activities. When Veterans Memorial Pond was mechanically drained, a steeper gradient was established along the eastern side of the peninsula toward the Veterans Memorial Pond area. The groundwater flow at that time was predominantly to the northeast toward Veterans Memorial Pond. There may have been a slight outward flow component adjacent to the Muskegon River; however, given that the elevation of the Muskegon River is unknown at the time of the data collection, there is some uncertainty whether there is a slight outward or inward horizontal gradient between the pond area and the edge of the Muskegon River/Discharge Channel at that time. Currently, Veterans Memorial Pond is no longer drained and local groundwater elevations have trended towards equilibrium yielding gradients in the pond area that are essentially flat.

In general, groundwater is typically encountered at a similar or slightly higher elevation relative to the surrounding surface water features, generally within the range of 579 to 582 ft AMSL. Groundwater elevation data from the most recent assessment monitoring event (April 2019) were used to construct the contour map presented in Figure 2. The groundwater flow conditions observed in April 2019 were generally consistent with previous conditions observed during assessment monitoring where groundwater was typically encountered at a similar or slightly higher elevation relative to the surrounding surface water features, flowing outward toward the bounding surface water features. Groundwater elevation data from April 2019 continued to exhibit a low hydraulic gradient and had a slight, but discernable, flow direction compared to the previous rounds of assessment monitoring where no discernable flow direction was observed.

On December 7, 2017, a comprehensive round of static water level measurements was collected from the 29 CCR wells that demonstrates groundwater flow conditions while Veterans Memorial Pond was separated from the Muskegon River by a weir, dewatered, and undergoing construction. Based on CCR groundwater monitoring data collected before, during, and after Veterans Memorial Pond construction activities, the dewatering at Veterans Memorial Pond appears to have influenced groundwater flow across the pond area in both the shallow and deeper screened wells, suggesting that the underlying organic-rich silt is limited in horizontal extent. The groundwater flow at that time was predominantly to the east-northeast toward Veterans Memorial Pond. The average shallow hydraulic gradient throughout the pond area during the December 2017 event was estimated at 0.004 ft/ft. Using the mean hydraulic conductivity of 58 ft/day (ARCADIS, 2016) and an assumed effective porosity of 0.3, the estimated average seepage velocity ranges from approximately 0.77 ft/day or 280 ft/year for the December 2017 event. When the Veterans Memorial Pond was not being dewatered, average horizontal gradients have varied at the site and have ranged from as high as 0.006 ft/ft with an average seepage velocity on the order of 1.1 ft/day (402 ft/year) in November 2015 while

hydraulic loading was taking place, down to flat or very low gradients on the order of 0.0004 ft/ft and a seepage velocity on the order of 0.07 ft/day (26 ft/year) in April 2019 during post-Veterans Memorial Pond dewatering and post-hydraulic loading conditions.

Vertical gradients were calculated for the shallow/deep well pairs at the newly installed monitoring well locations. At the time of the December 2017 sampling event, downward vertical flow potential is observed along the south and west edge of the pond area, and upward vertical flow potential is apparent along the northern edge of the pond area, near the Veterans Memorial Pond. Similar to horizontal gradients, the dewatering at Veterans Memorial Pond likely influenced the observed vertical gradients along the northeast edge of the pond area. Vertical gradients observed at the shallow/deep paired wells since December 2017 show that the gradients are variable, shifting periodically from slightly upward to slightly downward, to essentially non-existent at each location. However, during periods where the water table is flat, slight upward gradients (0.001 to 0.01 ft/ft) are more prevalent across the site. Vertical hydraulic gradients indicate groundwater flow potential; however, the ability for groundwater to flow vertically is impeded by the presence of the silt-rich layer present between the shallow and deeper wells in the area of the BCC Ponds.

Horizontal gradients were also evaluated using the six wells screened in the deeper sand (BCC-MW-15016 through BCC-MW-15021). The average hydraulic gradients were calculated using well pairs BCC-MW-15016/BCC-MW-15017 and BCC-MW-15021/BCC-MW-15019. The November 2015 through April 2019 water level data indicate that horizontal flow in the deeper sand does not always mimic the shallow water table flow direction, and has a variable, or often indistinguishable, flow direction. The estimated horizontal gradient calculated using the aforementioned well pairs during times when flow potential is to the northwest (toward the North Branch Muskegon River) ranges from approximately 0.00007 ft/ft (August 2018) to 0.0005 ft/ft (April 2016). Using the mean hydraulic conductivity of 58 ft/day (ARCADIS, 2016) and an assumed effective porosity of 0.3, the estimated average seepage velocity ranges from approximately 0.01 ft/day or 5 ft/year (August 2018) to 0.09 ft/day or 32 ft/year (April 2016). However, as shown in water level data from July 2016 to April 2018, the flow direction in the deeper sand is to the southeast (away from the North Branch Muskegon River) before and after Veterans Memorial Pond dewatering activities (in addition, flow was to the east-southeast during dewatering activities as observed in July, September, and December 2017).

Groundwater flow at the BCC Ponds has undergone several changes over time due to permanent discontinuation of hydraulic loading in the BCC Ponds area and the dewatering of Veterans Memorial Pond in 2017 (as discussed below and in the January 31, 2018 *Annual Groundwater Report for the Former BC Cobb Power Plant Bottom Ash Pond and Ponds 0-8 CCR Unit*). Although the overall gradient has diminished compared to pre-2018 monitoring events due to the discontinued hydraulic loading and Veterans Memorial Pond dewatering, general

groundwater flow is still slightly outward toward the river, or equal to the river, with groundwater flowing toward the BCC Ponds from the area of the background wells.

2.5 Nature and Extent of Environmental Impacts

Since lithium was detected at the BCC Ponds at statistically significant levels above the GWPS, the nature and extent of the release is described below in accordance with §257.95(g)(1).

2.5.1 Potential Extent of CCR Source Materials

In addition to ongoing groundwater monitoring activities, characterization activities for the CCR and underlying materials at the BCC Ponds were completed in 2015 (Golder, 2015). This work included collecting and analyzing samples from 45 soil borings located between 0 and 43 feet below ground surface in and around the BCC Ponds for select metals and other potential indicator parameters. Compositional analysis showed that CCR present generally contained arsenic, boron, chromium, and selenium concentrations that exceeded Michigan Part 201 nonresidential drinking water protection or groundwater surface water interface (GSI) protection criteria for soils. Leaching analysis was also performed to spatially determine the solubility of various constituents. Subsequent characterizations were completed in 2017 to better define observed conditions near the bottom ash pond. These characterizations were 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 closure work plan submitted to EGLE (Golder, 2018).

Evaluation of the leachability and compositional data from the characterization work in combination with ongoing groundwater monitoring activities has provided observations relative to ponded CCR and historical sluice water as a potential source of groundwater impact. Native sand underlying the ponded CCR generally contained lower concentrations of metals; however, no significant vertical or lateral variability was noted within the CCR materials. Additionally, there was no apparent relationship between the depth of CCR and the general solubility of constituents that were being measured. Most of the compositional sampling was completed while active sluicing was occurring.

2.5.2 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	Primary Source Areas
GSI	Bottom Ash Pond, Ponds 0-8
Drinking Water	Bottom Ash Pond, Ponds 0-8

2.5.3 Characterization of Groundwater

Following the initial and subsequent assessment monitoring sampling events (April and June/August 2018³), the compliance well groundwater concentrations for Appendix IV parameters 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). The statistical evaluation of the June/August 2018 Appendix IV constituents showed lithium was present at statistically significant levels (i.e., lower confidence limit exceeded the GWPS). The remaining Appendix IV constituents were not present at statistically significant levels during the June/August 2018 assessment monitoring event. Therefore, for the purposes of this ACM, constituents of concern (COCs) include lithium.

	Constituent	GWPS	Units	GWPS Exceedance ⁴
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

³ The initial assessment monitoring event for the shallow monitoring wells installed in 2017 was held in August 2018 to allow the minimum of four independent samples to be collected for statistical evaluation.

⁴ An exceedance occurs when the lower confidence limit of the downgradient data is above the GWPS.

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.

The nature and extent characterization was performed using data collected from existing groundwater monitoring wells. The existing CCR monitoring network is located between the CCR units and surface water features; thus, the nature and extent of impacts are laterally delineated and installation of additional monitoring wells at locations downgradient of the CCR units was not necessary or feasible. In addition, Consumers Energy installed six shallow monitoring wells paired with six existing deeper wells along the North Branch Muskegon River in December 2017 to further characterize shallow groundwater quality, evaluate the GSI, and evaluate the vertical gradients. Vertical delineation is met at the underlying gray clay that was encountered throughout the pond area at approximately 40 ft bgs (about 545 ft AMSL), beneath the fine- to medium-grained sand. The nature and extent data consist of Appendix III and IV constituents collected from the background and downgradient CCR monitoring well networks.

Nature and Extent (N&E) Evaluation Wells		
BCC Ponds Background Wells	BCC Ponds CCR Unit Wells	N&E Delineation Wells
BCC-MW-15002	BCC-MW-15009	BCC-MW-15001
BCC-MW-15003	BCC-MW-15010	
BCC-MW-15004	BCC-MW-15011	
BCC-MW-15005	BCC-MW-15012	
BCC-MW-15006	BCC-MW-15013	
BCC-MW-15007	BCC-MW-15014	
BCC-MW-15008	BCC-MW-15015	
	BCC-MW-15016	
	BCC-MW-15017	
	BCC-MW-15018	
	BCC-MW-15019	
	BCC-MW-15020	
	BCC-MW-15021	
	BCC-MW-15022	
	BCC-MW-15023	
	BCC-MW-17001	
	BCC-MW-17002	
	BCC-MW-17003	
	BCC-MW-17004	

Nature and Extent (N&E) Evaluation Wells		
BCC Ponds Background Wells	BCC Ponds CCR Unit Wells	N&E Delineation Wells
	BCC-MW-17005	
	BCC-MW-17006	

Looking at impacted groundwater on a site-wide basis is more practical from a risk mitigation standpoint, given:

- 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 Appendix IV constituents in the shallow water-bearing unit at the site as compared to the GWPSs 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

Lithium

Lithium is present at statistically significant levels exceeding the GWPS in shallow groundwater along the discharge channel in BCC-MW-17001 and BCC-MW-17002. Although the lower confidence limit of lithium at BCC-MW-15010 does not currently exceed the GWPS, the upper confidence limit is above the GWPS. Concentrations of lithium are trending downward in the shallow wells.

Other Potential COCs

In addition to the aforementioned COCs that exceed GWPSs, 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
Boron	✓	✓
Chloride	✓	✓

Sulfate	✓	✓
Total Dissolved Solids (TDS)	✓	✓
pH	✓	✓
Arsenic	✓	✓
Barium		✓
Molybdenum	✓	
Selenium		✓

2.5.4 Risk Evaluation

Lithium has been identified in site groundwater at concentrations exceeding applicable federal criteria (i.e., GWPS). The property containing the site is owned and operated by Consumers Energy and on-site groundwater is not used for drinking water. There are no on-site drinking water wells, so the drinking water pathway on-site is not complete (Figure 4). In order to close the drinking water pathway at the site, a restrictive covenant prohibiting future withdrawal of groundwater for potable use would be appropriate, if deemed necessary, following source removal and CCR impacted groundwater recovery activities to mitigate this risk pathway.

The potential for off-site drinking water to be impacted by groundwater from the site is low. As discussed above, vertical gradients observed at the shallow/deep paired wells since December 2017 show that the gradients vary, shifting between slightly upward to downward, to essentially non-existent at each location. However, during periods where the water table is flat, very slight upward gradients are more prevalent across the site. While vertical hydraulic gradients indicate groundwater flow potential, the presence of the silt-rich layer between the shallow and deeper wells impedes the ability for groundwater to flow vertically. Without the silt layer, hydraulic gradients are likely upward throughout the uppermost saturated sand given that the North Branch Muskegon River and the nearby Muskegon Lake are regional discharge features. A review of the closest residential well logs indicates that the silt layer is not present. In addition, dewatering at Veterans Memorial Pond influenced the deeper wells, also suggesting that the silt is limited in horizontal extent. Also, Lake Muskegon and the North Branch Muskegon River to the northwest and the North Branch Muskegon River to the north separate the residential wells from the site.

Groundwater monitoring data indicate that horizontal flow in the deeper sand is variable, or often stagnant, ranging from 5 ft/year (August 2018) to 32 ft/year (April 2016) during times where groundwater flow is to the northwest (toward the North Branch Muskegon River). However, as discussed above, the flow direction in the deeper sand is periodically indistinguishable or to the southeast (away from the North Branch

Muskegon River and residential drinking wells). Off-site migration potential and risk to off-site drinking water in the deeper sand is very low given that groundwater in the deeper sand has a very low flow rate and at times flows away from the North Branch Muskegon River (away from the drinking water wells), and if groundwater were to flow toward the northwest for an extended period of time, flow would likely be upward toward the regional surface water discharge features that are present between the site and the nearest residential wells. In addition, the underlying clay unit prevents the downward vertical migration of groundwater. To further mitigate potential risk associated with groundwater at the site, CCR removal is planned, in addition to CCR impacted groundwater recovery/dewatering, as part of final closure.

The groundwater located beneath the BCC Ponds has the potential to vent to the adjacent surface water features, as discussed above. Therefore, in addition to the aforementioned drinking water use restriction, if active remediation does not address portions of the BCC Site or active remediation does not achieve generic GSI cleanup standards, it may be appropriate to mitigate those risks through establishing mixing-zone based GSI criteria.

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 the BCC Ponds under the RCRA Rule's closure by removal provisions in §257.102(c) as documented in the February 2018 Closure Plan that is available on Consumers Energy's 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.

3.1.2 BCC Ponds Closure by CCR Removal

A source material management strategy of closure by removal involves removing and decontaminating all areas impacted by releases from the CCR unit per the provisions in 257.102(c). CCR removal field activities are scheduled to begin in 2020.

The first phase of closure activities will be CCR removal and documentation. Excavation will be performed to remove CCR to elevations identified during site investigations with visual observations and field analyses made to confirm the CCR removal objective is met. Documentation of CCR removal will then be performed to provide lines of evidence that validate the extent of the excavation and visual observations made in the field.

Characterization data were compiled to form a subsurface excavation profile that determined the threshold depth of excavation before other lines of evidence were deployed to validate satisfaction with the limits of excavation based on the Quality Assurance protocol developed and detailed in the closure work plan submitted to EGLE (Golder, May 2018). This workplan was reviewed and approved by EGLE on October 16, 2018. The approved workplan provides additional details regarding the multiple lines of evidence approach to CCR removal. When the CCR removal is complete, Consumers Energy will prepare a documentation report of the removal activities, which will be submitted to EGLE, and placed in the operating record.

3.2 CCR – Impacted Groundwater Management Technologies

Several management technologies exist to reduce or 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 (No Source Removal);
- Post Source Removal Monitoring;
- Groundwater Capture/Control;
- Impermeable Barrier;
- Active Geochemical Sequestration; and
- Passive Geochemical Sequestration.

Each of these technology options for the site 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) and R299.4443.

3.2.1 Alternative 1: Groundwater Monitoring (No Source Removal)

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: Post Source Removal Monitoring

Post source 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 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: 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: Impermeable Barrier

Impermeable barriers can be installed below the ground surface to inhibit the 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 placed 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: 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 COCs. 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: 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 lithium. 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 BCC Ponds, government guidance documents, and previous activities. The extent and magnitude of COC-impacted groundwater will be considered for evaluation of the final remedy.

Balancing criteria were selected based on remedy selection criteria in §257.97 and R299.4444 described in Section 4.1. In addition, R299.4443 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).

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 drinking water and GSI exposure pathways, addressing the ACM factors required in §257.96 and R299.4443 of Part 115, and considering the following remedy selection balancing criteria specified in §257.97, R299.4444 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 closure by CCR removal as the source material control option as specified for the BCC Ponds. Source removal has been selected as the source control strategy for the BCC Ponds. Therefore, groundwater management alternatives will be considered in conjunction with source removal. Each alternative is discussed in the following sub-sections and are summarized in Table 1.

4.2 Alternative 1a: 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 at sites 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.

4.3 Alternative 2a: Source Removal with Post Remedy Monitoring

Source removal and post-remedy groundwater monitoring generally offers an advantage over other options considered since no remediation system requires installation or maintenance, thus reducing operating costs and long-term uncertainties. As discussed in Section 2.1, closure by removal was the method of closure selected for the BCC Ponds 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 the BCC Ponds since the contaminant source will be removed. Although groundwater chemistry already appears to be improving as a result of discontinuing the hydraulic loading to the BCC Ponds, and is expected to further improve following source removal, there still is some uncertainty surrounding how changes in redox conditions may affect contaminant transport, leading to a potentially reduced effectiveness in controlling COCs. 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, as there is a possibility that naturally occurring processes may not be able to meet the remedial goals. 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.

Consumers Energy is currently evaluating closure design options which include dewatering, the extent of which has not yet been defined but will likely be significant. The dewatering process will likely benefit groundwater quality in the BCC Ponds. Monitoring of groundwater quality improvements due to source removal and dewatering will be performed under this alternative.

4.4 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 the BCC Ponds.

Groundwater extraction can be accomplished using wells screened within water bearing zones 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 near surface water features and the BCC Ponds, 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 potential COCs (e.g. 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.

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. There are moderate long-term uncertainties associated with this alternative, as there is no proof of the effectiveness of groundwater extraction operation at the BCC Ponds. Additionally, there is uncertainty associated with the management of the extracted groundwater, which may need to be treated on site or transported off site for discharge. The effectiveness of a groundwater capture system would need to be monitored, and a routine system inspection and maintenance program would be required. Design and construction of a groundwater extraction system would take longer to implement than groundwater monitoring.

4.5 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 the BCC Ponds to surface water. The impermeable wall would need to be installed into the clay confining unit underlying the uppermost groundwater aquifer of the BCC Ponds. In order to evaluate this alternative further, groundwater modeling would be performed to assess the need for supplemental groundwater extraction.

An impermeable barrier would effectively minimize the movement of impacted groundwater, providing better protection than remediation relying on physical, chemical, or biological processes. However, due to the high capital cost of construction, the cost of remedial action is higher than other options considered. Installation of an impermeable barrier combined with

groundwater capture would have considerably longer construction duration when compared to other options considered.

4.6 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 (redox). Additionally, air sparging can increase pH in groundwater by stripping carbon dioxide (CO₂), which has the potential to immobilize other COCs (e.g., lithium).

Installing air sparge wells, potentially in a curtain configuration perpendicular to flow of groundwater, offers a remedial option for select COCs by creating a reactive zone in an attempt to buffer groundwater conditions and immobilize lithium by increasing pH and immobilizing this constituent. 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. The neutral pH conditions (6.6 to 8.0 S.U.) observed at monitoring wells near Ponds 0-8 may also limit the effectiveness of a pH buffering approach.

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. 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 addition of operating parameters makes this alternative more difficult to monitor performance than other options considered. Reliability of an active geochemical sequestration system is also considered lower when compared to other remedial alternatives due to the increased amount of operation, maintenance, and overall effectiveness. 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 COC and would increase the time needed to implement this alternative.

4.7 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.

Lithium, due to the chemical nature of this element, is not expected to be treated with a zero valent iron (ZVI) wall and therefore may pass through a permeable reactive barrier without treatment prior to discharging to surface water receptors. A geochemical sequestration treatment alternate approach (e.g., pH buffering) may be required to address lithium.

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

Consumers Energy determined to close the BCC Ponds under the CCR Rule's closure by removal provisions in §257.102(c) as referenced in Section 11519b(9)(a) in P.A. 640. Consumers Energy submitted the *B.C. Cobb Generating Facility Bottom Ash Pond and Ponds 0-8 Closure Work Plan*, (Golder, 2018) to the EGLE for agreement on Consumers Energy's plan to close by removing CCR on May 31, 2018 and clarified on August 13, 2018 (Golder, 2018b). EGLE provided written concurrence with the plan on October 16, 2018. Consumers Energy also provided formal Notification of Intent to Initiate Closure of the BCC Ponds to the EGLE on March 30, 2018, per §257.102(g).

Consumers Energy ceased hydraulic loading to the BCC Ponds in April 2016. Field activities for CCR removal are scheduled to begin in 2020 and will consist of dewatering to allow for excavation of the vertical and lateral extent of CCR, as described in the *B.C. Cobb Generating Facility Bottom Ash Pond and Pond 0-8 Closure Plan*, (Golder, 2018) and the Closure Work Plan. When CCR removal is complete, Consumers Energy will prepare a documentation report of the removal activities, which will be submitted to EGLE, and placed in the operating record.

5.2 Groundwater Management

This ACM Report provides a high-level assessment of groundwater remediation technologies that could potentially address site-specific COCs under known site groundwater conditions. Currently, the assessment of remedial technologies is based on the remediation of lithium. 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. Remaining alternatives evaluated in this ACM are considered technically feasible final groundwater management strategies to be evaluated following source removal.

Consumers Energy plans to proactively utilize an adaptive management strategy for selecting the final groundwater remedy for the BCC Ponds in coordination with the specified CCR source

material management strategy. 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 a remedy for the BCC Ponds that, at a minimum, meets the standards of §257.96(b) and R 299.4444(2) as outlined in Section 6. Lithium has been identified in site groundwater at concentrations exceeding applicable criteria. Consumers Energy will begin dewatering and source removal in 2020 while continuing to evaluate groundwater management alternatives, considering the assumptions and data limitations identified below.

5.3 Assumptions and Limitations

The groundwater monitoring system at the BCC Ponds has measured groundwater quality over a relatively short period of time (2015 to 2019). Baseline conditions for the BCC Ponds were established based on a minimum eight samples collected on a quarterly basis over two years. This short baseline period does not fully capture the potential variability in groundwater chemistry over time. Due to the significant operational changes that occurred within the ash management area and immediately adjacent to it during the CCR Rule baseline period, where groundwater flow rates and directions were changed drastically over relatively short periods of time, there is additional variability present in the BCC baseline data set. Hydraulic loading to the BCC Ponds was stopped in April 2016 and Veterans Memorial Pond was dewatered for maintenance activities sometime during the period between August and December 2017. These changes have the potential to influence the reported site conditions by including data that may have been biased low or high due to changing site conditions and may be inconsistent with the natural groundwater data distribution.

Since beginning CCR monitoring in 2015, Consumers Energy has ceased hydraulic loading to the BCC Ponds and began dewatering. Due to the operational changes of the BCC Ponds, the gradient between the pond area and the surrounding surface water bodies flattened out as compared to observations under hydraulic loading. 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 will likely be affected by this change in redox conditions.

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 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) and R299.4444(2), 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) and be able to attain groundwater protection standard specified in R299.4441;
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 and PA 640 Section 11511(a)(3) and Section 11519(b)(2) 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;
5. Control the source or sources of releases so as to reduce or eliminate, to the maximum extent practicable, further releases of PA 640 Section 11511(a)(3) and Section 11519(b)(2) constituents into the environment that may pose a threat to human health or the environment; and
6. Comply with standards for management of wastes as specified in §257.98(d) and R299.4445(4).

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 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) and R299.4443(4) 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).

Based on the results of the corrective measures assessment pursuant to R299.4443, Consumers Energy will propose to the EGLE director a remedy that, at a minimum, meets the standards specified in R299.4444(2). Consumers Energy will within 14 days of selecting a remedy, submit to the director a proposed remedial action plan which is in compliance with Part 201 of the act and which describes the selected remedy and how it also meets the standards of Part 201 of the act.

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 September 2019 with results summarized in the 2019 Annual Groundwater Monitoring Report issued in January 2020.

Section 7

References

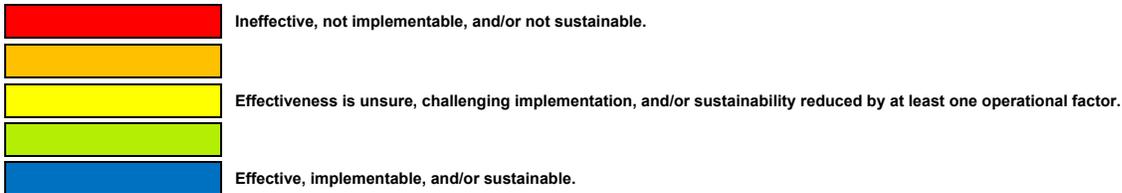
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- TRC. January 2019. Statistical Evaluation of Initial Assessment Monitoring Sampling Event, BC Cobb Bottom Ash Pond & Ponds 0-8 CCR Unit, Consumers Energy Company, Muskegon, Michigan. Prepared for Consumers Energy Company.
- U.S. Environmental Protection Agency (USEPA). 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance. Office of Conservation and Recovery. EPA 530/R-09-007.
- USEPA. April 2015. 40 CFR Parts 257 and 261. Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule. 80 Federal Register 74 (April 17, 2015), pp. 21301-21501 (80 FR 21301).
- USEPA. July 2018. 40 CFR Part 257. Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities; Amendments to the National Minimum Criteria (Phase One, Part One); Final Rule. 83 Federal Register 146 (July 30, 2018), pp. 36435-36456 (83 FR 36435).

Tables

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

Site/Impoundment Name: Former BC Cobb Power Plant, Bottom Ash Pond and Ponds 0-8

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) 1	Post Source Removal 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 concurrently close the Bottom Ash Pond and Ponds 0-8 CCR Unit under the RCRA Rule's closure by removal provisions in §257.102(C), as documented in the February 2018 Closure Plan.

Figures



LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRAIDENT MONITORING WELL
- NATURE AND EXTENT WELL
- APPROXIMATE POND BOUNDARY

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 9/22/2018.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
3. MONITORING WELLS BCC-MW-17001 THROUGH BCC-MW-17006 SURVEYED BY CONSUMERS ENERGY CO. ON 1/16/2018.
4. DEEP SCREENED WELLS (DEEP) ARE CHARACTERIZED BY WELL SCREENS SET BELOW 555 FEET MSL.

0 300 600
Feet

1" = 300'
1:3,600

PROJECT: **CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN**

TITLE: **SITE PLAN**

DRAWN BY: S. MAJOR	PROJ NO.: 322176
CHECKED BY: B. YELEN	FIGURE 1
APPROVED BY: S. HOLMSTROM	
DATE: SEPTEMBER 2019	

TRC

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

FILE NO.: 322176-001-008.mxd



LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRAIDENT MONITORING WELL
- NATURE AND EXTENT WELL
- APPROXIMATE POND BOUNDARY
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)
- GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)

- NOTES**
1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 9/22/2018.
 2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
 3. MONITORING WELLS BCC-MW-17001 THROUGH BCC-MW-17006 SURVEYED BY CONSUMERS ENERGY CO. ON 1/16/2018.
 4. DEEP SCREENED WELLS (DEEP) ARE CHARACTERIZED BY WELL SCREENS SET BELOW 555 FEET MSL.
 5. GROUNDWATER ELEVATION DATA RECORDED ON APRIL 8, 2019.

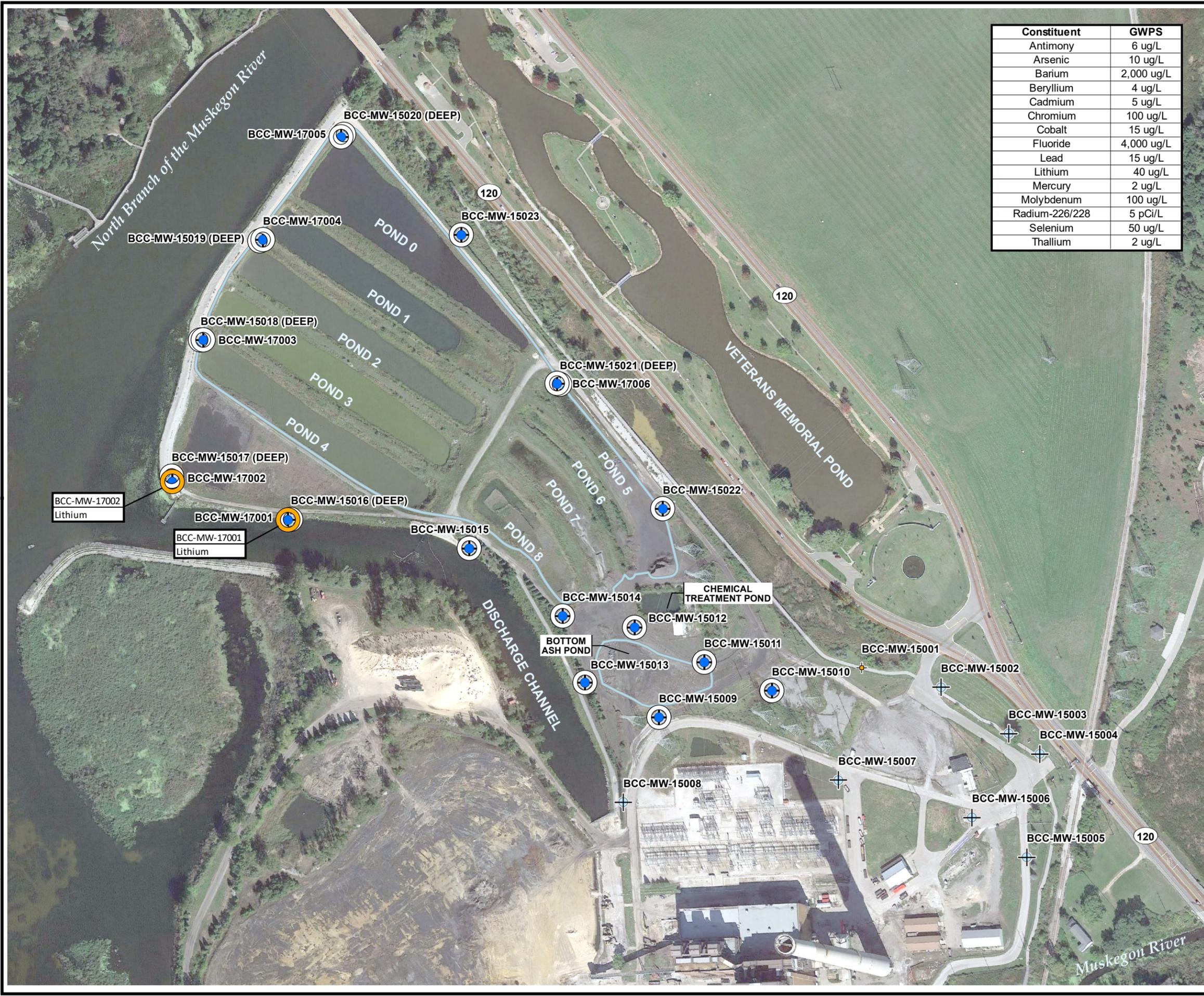
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Feet

1" = 300'
1:3,600

PROJECT:		CONSUMERS ENERGY COMPANY BC COBB POWER PLANT MUSKEGON, MICHIGAN	
TITLE:		SHALLOW GROUNDWATER CONTOUR MAP APRIL 8, 2019	
DRAWN BY:	S. MAJOR	PROJ NO.:	322176
CHECKED BY:	B. YELEN	FIGURE 2	
APPROVED BY:	S. HOLMSTROM		
DATE:	JULY 2019		

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FILE NO.: 322176-001-007.mxd



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

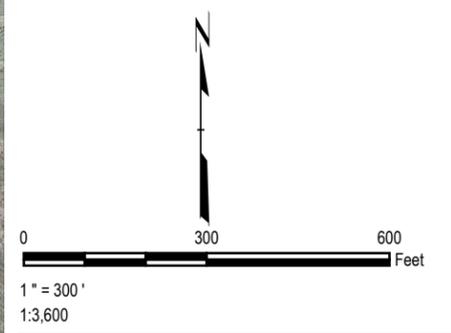
LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADE MONITORING WELL
- NATURE AND EXTENT WELL
- NO STATISTICALLY SIGNIFICANT EXCEEDANCES
- STATISTICALLY SIGNIFICANT GWPS EXCEEDANCE
- APPROXIMATE POND BOUNDARY

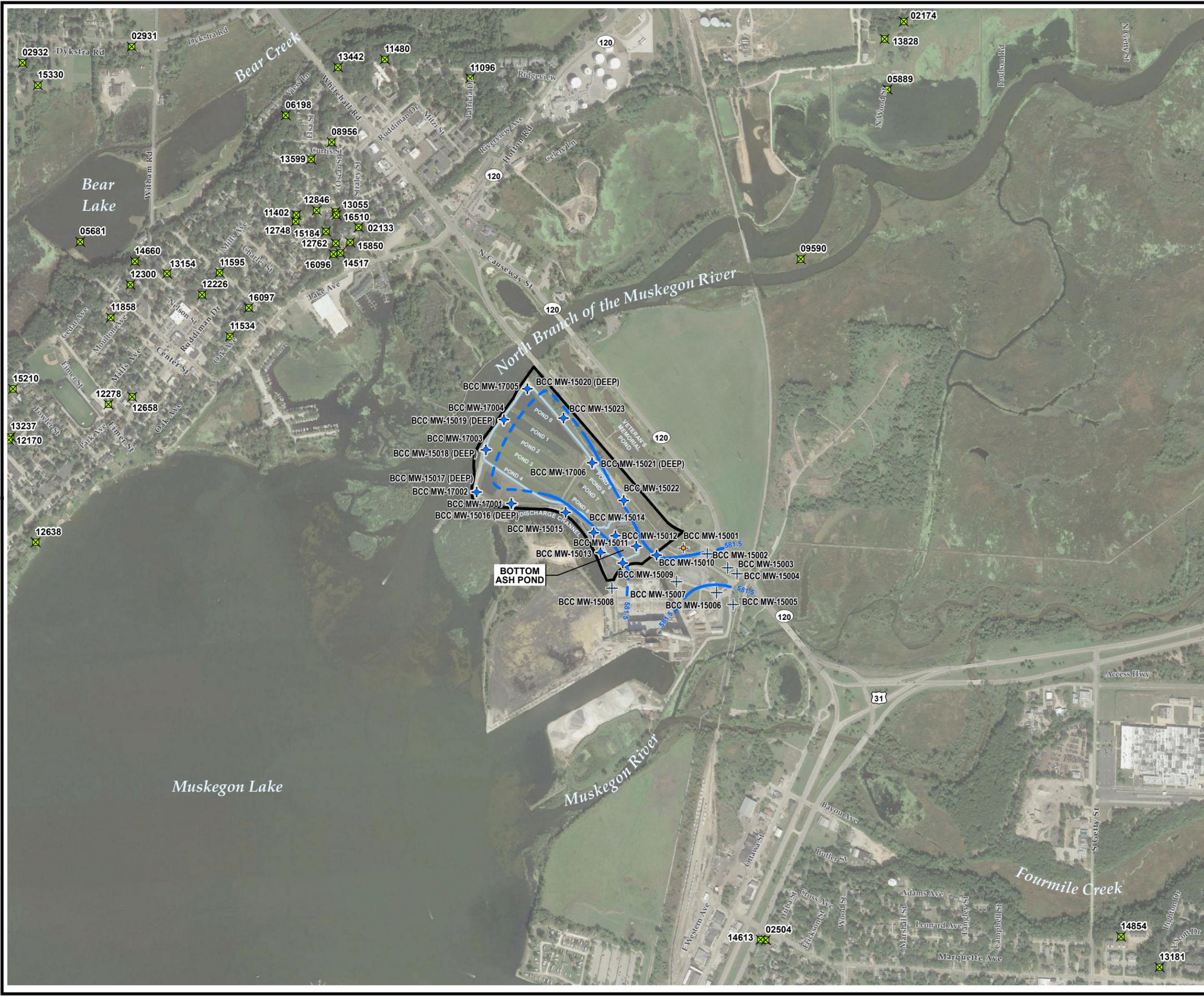
WELL ID
CONSTITUENT(S)
EXCEEDING GWPS

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
3. MONITORING WELLS BCC-MW-17001 THROUGH BCC-MW-17006 SURVEYED BY CONSUMERS ENERGY CO. ON 1/16/2018.
4. 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.
5. AN EXCEEDANCE OF THE GWPS OCCURS WHEN THE LOWER CONFIDENCE LIMIT OF THE DOWNGRADE DATA EXCEEDS THE GWPS.
6. DEEP SCREENED WELLS (DEEP) ARE CHARACTERIZED BY WELL SCREENS SET BELOW 555 FEET MSL.



PROJECT:		CONSUMERS ENERGY COMPANY BC COBB POWER PLANT MUSKEGON, MICHIGAN	
TITLE:		NATURE AND EXTENT SUMMARY GWPS EXCEEDANCES	
DRAWN BY:	S. MAJOR	PROJ NO.:	322176-001
CHECKED BY:	K. AMONETTE	FIGURE 3	
APPROVED BY:	S. HOLMSTROM		
DATE:	SEPTEMBER 2019		



LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- NATURE AND EXTENT WELL
- DRINKING WATER WELL
- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE POND BOUNDARY
- GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)

- ### NOTES
1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 9/22/2018.
 2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
 3. MONITORING WELLS BCC-MW-17001 THROUGH BCC-MW-17006 SURVEYED BY CONSUMERS ENERGY CO. ON 1/16/2018.
 4. DEEP SCREENED WELLS (DEEP) ARE CHARACTERIZED BY WELL SCREENS SET BELOW 555 FEET MSL.
 5. GROUNDWATER ELEVATION DATA RECORDED APRIL 8, 2019.
 6. DRINKING WATER WELL LOCATIONS FROM THE STATE OF MICHIGAN WELLOGIC DATABASE, 8/12/2019.

0 1,000 2,000
Feet

1" = 1,000'
1:12,000

PROJECT:		CONSUMERS ENERGY COMPANY BC COBB POWER PLANT MUSKEGON, MICHIGAN	
TITLE:		PROPERTY BOUNDARY AND SURROUNDING FEATURES	
DRAWN BY:	S. MAJOR	PROJ NO.:	322176
CHECKED BY:	K. AMONETTE	FIGURE 4	
APPROVED BY:	S. HOLMSTROM		
DATE:	JULY 2019		

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Appendix A

Demonstration for 60-Day Extension

A CMS Energy Company

Date: July 12, 2019

To: Operating Record

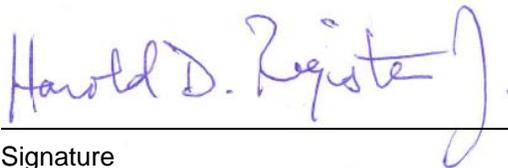
From: Harold D. Register, Jr., P.E. 

RE: Demonstration for 60-Day Extension for Assessment of Corrective Measures
Professional Engineer Certification
BC Cobb Bottom Ash Pond and BC Cobb Ponds 0-8

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 BC Cobb Bottom Ash Pond and BC Cobb Ponds 0-8 due to site-specific conditions that are changing based on initiating closure activities. Notification was made on March 30, 2018 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 BC Cobb Bottom Ash Pond and BC Cobb Ponds 0-8 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