Hydrogeologic Monitoring Plan

for Compliance with the Michigan Part 115 Solid Waste Management

Former BC Cobb Power Plant

Muskegon, Michigan

Muskegon Environmental Redevelopment Group, LLC

December 10, 2020

Revised October 25, 2024

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Table of Abbreviations and Acronyms

Abbreviation	Definition
ACM	Assessment of Corrective Measures
AMSL	Above Main Sea Level
ASD	Alternative Source Demonstration
BTOC	Below Top of Casing
BTV	Background Threshold Values
CC	Contracted consultant
CCR	Coal Combustion Residuals
CEC	Consumers Energy Company
CFR	Code of Federal Regulations
COC	Chain of Custody
COI	Constituents of Interest
DO	Dissolved Oxygen
EDD	Electronic Data Deliverable
EGLE	Michigan Department of Environment, Great Lakes & Energy
EPA	U.S. Environmental Protection Agency
EFT	Environmental Field Technician
GPS	Groundwater Protection Standards
HMP	Hydrogeologic Monitoring Plan
ICP	Inductively Coupled Plasma
LCS	Laboratory Control Sample
MERG	Muskegon Environmental Redevelopment Group, LLC
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Unit
ORP	Oxidation Reduction Potential
PC	Project Chemist
ES	Environmental Specialist
PVC	Poly Vinyl Chloride
RPD	Relative Percentage Differences
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
TDS	Total Dissolved Solids
TOC	Top of Casing

Abbreviation	Definition
TSS	Total Suspended Solids
USGS	U.S. Geologic Survey
UTL	Upper Tolerance Limit

Geologist Certification

Hydrogeologic Monitoring Plan

Former B.C. Cobb Power Station, Michigan

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Certified Professional Geologist

American Institute of Professional Geologist

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1.0 Introduction

This Hydrogeologic Monitoring Plan (HMP) was prepared for the former BC Cobb Power Plant (BCC or Site) to support the application to the Michigan Department of Environment, Great Lakes & Energy (EGLE) for a Solid Waste Operating License under Michigan Statute Part 115. BCC is the site of a former coal-fired power generation facility located in Muskegon, Michigan (Figure 1). During operations, coal combustion residuals (CCR) were deposited in Ponds 0-8 and the Bottom Ash Pond (Figure 2).

This HMP sets forth the requirements and procedures of the CCR groundwater monitoring program at BCC. The HMP was developed in accordance with the EGLE Hydrogeologic Monitoring Plan Checklist (Appendix A).

1.1 Background

Consumers Energy Company (CEC) operated BCC between 1948 and 2016. The Site has ten CCR ponds subject to the U.S. Environmental Protection Agency's (EPA) CCR Rule (40 CFR Part 257): a bottom ash pond and Ponds 0-8 (collectively referred to as the BCC Ponds) (Figure 2). In accordance with §257.91, CEC installed a groundwater monitoring network around the bottom ash pond as one CCR unit; and a monitoring network around Ponds 0-8 as a second CCR unit. Background groundwater monitoring was completed as required by §257.93. As documented in the CEC January 14, 2019 *Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g),* lithium was observed present at statistically significant levels above the Groundwater Protection Standard (GPS) developed for the CCR Rule compliance program in two downgradient monitoring wells at the Ponds 0-8 CCR unit, thus necessitating CEC develop the September 2019 *Assessment of Corrective Measures*.

The Muskegon Environmental Redevelopment Group, LLC (MERG) has since acquired the BCC property and has completed removal of CCR material from the ponds as part of pond remediation and closure efforts. CCR excavation efforts were completed in April of 2022 and dewatering efforts ceased on June 15, 2022 (HDR, 2022). MERG has continued implementation of the federal CCR Rule groundwater monitoring program, as required by §257.90-95, as a continuation of the CEC monitoring program.

1.2 Purpose

The State of Michigan has adopted recent legislation requiring that CCR impoundments be permitted under Part 115 Solid Waste Management. MERG was required to obtain a solid waste operating license from EGLE no later than December 28, 2020. The BCC surface impoundments, Ponds 0-8 and the Bottom Ash Pond, will be regulated under Part 115 until closure is achieved. Part 115 permitting application requirements include submittal of an HMP. This HMP was developed to comply with Part 115 solid waste rules, specifically the Coal Ash Landfill and Coal Ash Impoundments HMP Checklist and the Assessment Monitoring Program Checklist in Appendix A. Once permitted by the State, MERG will implement both the federal and state groundwater monitoring programs concurrently to comply with both the federal CCR Rule and Part 115 operating license.

Figure 1. General Location

Figure 2. BC Cobb – CCR Units and Well Location Map - 2020 Condition

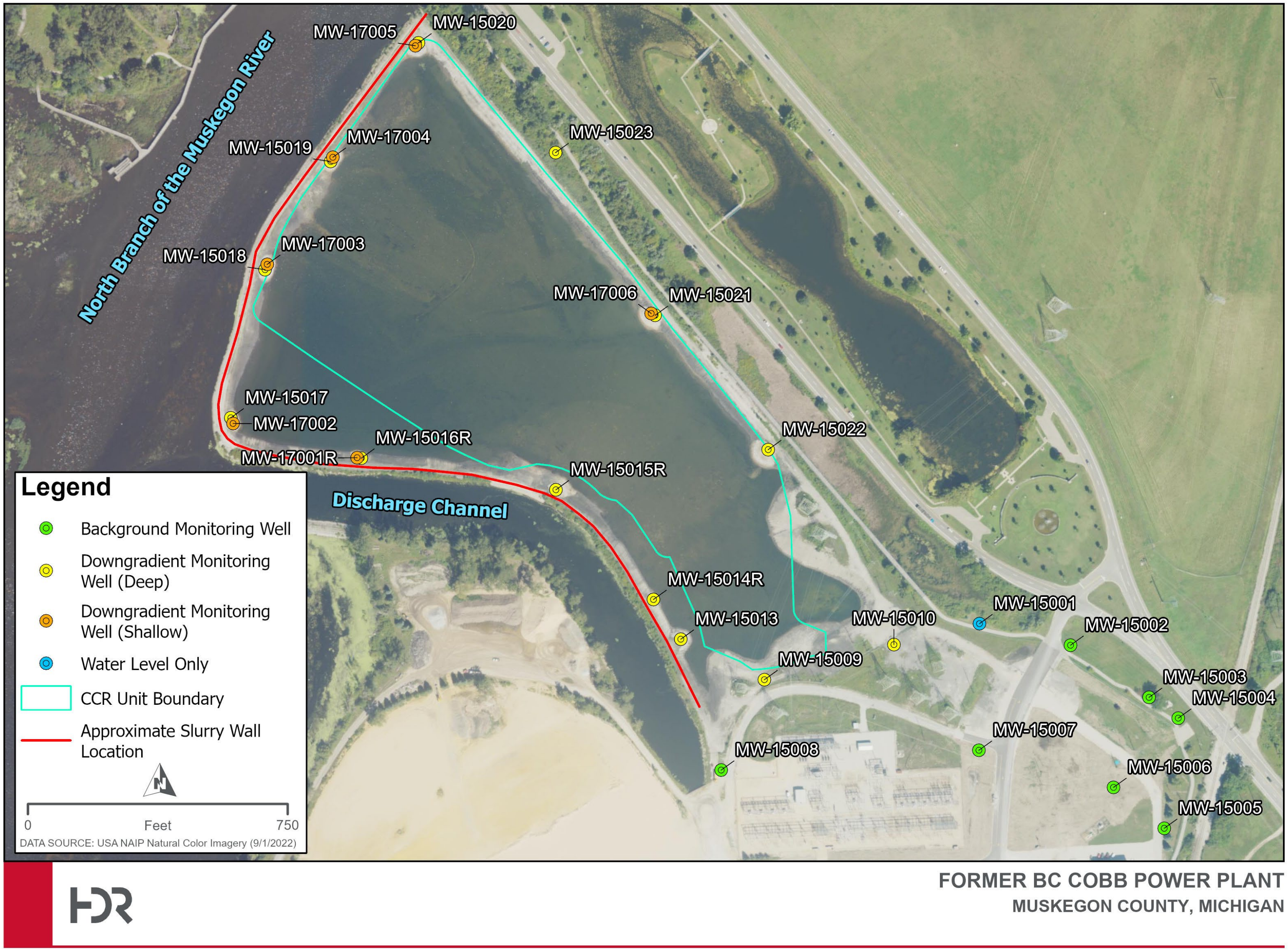


Figure 3. CCR Unit and Monitoring Wells

1.3 Site Description

The Site is in close proximity with several water bodies. Muskegon Lake is located to the east, Muskegon River to the northwest, and the Veterans Memorial Park to the northeast. The Discharge Channel is along the southern border of the Site and discharges into Muskegon Lake. The two CCR units associated with the Site, the Bottom Ash Pond and Ponds 0-8, were wet ash wastewater treatment units (Figure 2). From 1984 through plant closure in 2016, CCR have been deposited in the 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 lowered and appears to be approximately below that of the adjacent Muskegon River.

1.4 Hydrogeologic Conceptual Model

Ponds 0-8 are primarily comprised of CCR and sand fill. According to historic U.S. Geologic Survey (USGS) topographic maps and aerial photographs dating back to 1929, the area currently occupied by the ash ponds was originally marsh land. The subsurface materials 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) 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 clay was encountered throughout the pond area at approximately 40 ft bgs, beneath the fine to medium-grained sand. Geologic cross sections are provided in Appendix B.

Geologic maps of Michigan and local 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. Glacio-lacustrine sands dominate in the western and southern areas surrounding Muskegon Lake. The site is located in the central area of the County.

Ponds 0-8 are bound by surface water features (Figure 3): The North Branch Muskegon River and former plant-associated discharge channel adjoin the western and southernmost boundaries of the pond area, and Veterans Memorial Park is located north and northeast of the pond area. MERG understands that there is surface water pumping at the Veterans Memorial Park on an occasional basis to limit the flooding in some areas of the park. Pumping performed at the park has the potential to have an effect on the groundwater flow conditions at BCC. Therefore, changes over time in groundwater flow conditions at the Site boundary will need to give consideration to that potential for impact.

Groundwater flow within the uppermost aquifer has varied during plant operations and the post-shutdown period. While the ponds were actively receiving CCR and non-CCR wastewater, groundwater in the pond area was several feet higher than the surrounding surface water in Muskegon River and upgradient groundwater, creating a mound under the BCC surface impoundments, with groundwater flowing outward toward the surface water features. Since the power plant shut down in April 2016, groundwater is encountered at a similar elevation to the surrounding surface water, generally within the range of 579 to 583 feet above mean sea level (ft AMSL).

During the most recent monitoring event in March 2024, groundwater elevations varied little across the site, ranging between 579.63 and 580.40 AMSL, with a flow direction generally northeast (Figure 4 and Figure 5). The gradient across the site in March 2024 was 0.0009 ft/ft. Using the average hydraulic conductivity measured at the Ponds 0-8 monitoring wells of 58 feet/day (ARCADIS, 2016), and an assumed effective porosity of 0.3, this results in groundwater flow rate of approximately 0.31 feet/day (approximately 113 feet/year).

2.0 Groundwater Monitoring

2.1 Monitoring Well Network

The CCR Rule requires, at a minimum, one upgradient and three downgradient monitoring wells per CCR unit to be completed in the uppermost aquifer. Section § 257.90 of the Rule states that the operator: *"…may install a multiunit groundwater monitoring system instead of separate groundwater monitoring systems for each CCR unit."* In addition, the Rule states that downgradient monitoring wells should be installed to: *"accurately represent the quality of groundwater passing the waste boundary of the CCR unit. The downgradient monitoring system must be installed at the waste boundary that ensures detection of groundwater contamination in the uppermost aquifer."*

The certified monitoring network at BC Cobb includes seven background wells on the southeast end of the Site to evaluate groundwater conditions unaffected by the CCR units. Ponds 0-8 were separated by narrow embankments that were not recommended for well installation (Figure 2). To install downgradient wells at the waste boundary, wells would need to be installed on the embankments. The CEC federal CCR Rule compliance monitoring program was developed for two CCR units (Ponds 0-8 as a multiunit and the Bottom Ash Pond). However, due to the proximity of the CCR ponds, the ash removal excavation area planned for the BCC ponds, the water quality results from CEC (described in Section 3.1), and the existing well network that complies with federal and state monitoring well location guidelines, MERG monitors the BCC ponds as one CCR unit, including the Ponds 0-8 and the Bottom Ash Pond as a single CCR multiunit. The groundwater monitoring network is composed of 19 wells at the waste boundary of the one CCR unit. The CCR unit boundary and the monitoring well locations are shown on Figure 3.

2.1.1 Background Monitoring Locations

Seven wells (MW-15002 through MW-15008) were installed in the southeast area of the Site to evaluate water quality unaffected by the CCR unit. Figure 4 illustrates that these background wells are still upgradient or at a side gradient to the CCR unit and therefore, even with groundwater flow changes at the site, these wells remain appropriate background wells. MW-15001 was sampled during the background monitoring phase of the CCR Rule compliance program but now serves as a nature and extent well with only static water level measurement required.

2.1.2 Point of Compliance Monitoring Locations

The following 21 wells were installed in 2015 and 2017 and form the MERG multiunit monitoring well network around the CCR unit (Ponds 0-8 and the Bottom Ash Pond):

• MW-15009	• MW-15015R	• MW-15021	• MW-17004
• MW-15010	• MW-15016R	• MW-15022	• MW-17005
• MW-15011	• MW-15017	• MW-15023	• MW-17006
• MW-15012	• MW-15018	• MW-17001R	
• MW-15013	• MW-15019	• MW-17002	
• MW-15014R	• MW-15020	• MW-17003	

Shallow wells (identified as MW-17001 through MW-17006) were installed in 2017 and were paired with existing wells MW-15016 through MW-15021 to better characterize shallow groundwater quality and flow direction (Figure 3). MW-15016R through MW-15021 now provide data on deeper groundwater while MW-17001R through MW-17006 provide shallow groundwater data.

To accommodate pond closure construction in 2020, MW-15012 was abandoned, and wells MW-15015, MW-15016, and MW-17001 were relocated to within 10 feet of the original location. In February 2022, monitoring wells MW-15014 and MW-15011 were abandoned to accommodate continued CCR removal efforts. Well MW-15014 was relocated approximately 100 feet south. Relocated wells are distinguished with an “R” following the well identifier (MW-15014R, MW-15015R, MW-15016R and MW-17001R).

2.2 Well Construction

All of the monitoring wells proposed as part of the MERG groundwater monitoring network were constructed by CEC for compliance with the federal CCR Rule, except for the four replacement wells described above in Section 2.1 that were installed by MERG (MW-15015R, MW-15016R and MW-17001R) (Arcadis, 2016), and MW-15014R installed by Stearns Drilling under the supervision of HDR in February 2022. Monitoring wells were constructed as 2-inch diameter polyvinyl chloride (PVC) wells completed in 6-inch diameter boreholes. The screen depths were targeted for placement at or below the top of the water table. Boreholes were drilled to a depth of approximately 10 to 15 feet below the uppermost saturated zone. The length of screen intervals was determined based on observations of each location during the soil boring. This resulted in borehole depths between 19 and 50 feet below ground surface (bgs). Once the target drilling depth was reached at each borehole, the 2-inch diameter, Schedule 40 PVC casing and 3-10 foot well screen (0.010-inch slots) were assembled and installed. After well placement in the borehole, the filter pack sand and the bentonite pellet seal were placed via gravity feed from the surface into the annular space. The medium-grained sand filter pack was placed around each well screen to a minimum of 2 feet above the well screen. A 2-foot thick bentonite grout seal was placed on top of the well screen. A cement-bentonite grout of approximately 1.5 feet sealed the remainder of the annular space. All original wells (installed in 2015 and 2017) were finished with a 3-foot stickup well cover set in a 2-feet by 2-feet concrete pad. Each well is accompanied by two yellow bollards for protection. Relocated wells MW-15015R, MW-15016R, and MW-17001R are flush mount and installed with manhole covers instead of a locking stickup cover. At the same time the relocated wells were installed in May 2020, wells MW-15017, MW-15018, MW-15019, MW-15020, MW-17002, MW-17003, MW-17004, and MW-17005 were converted to flush mount to accommodate construction. Monitoring well MW-15014R was finished with a stick-up protective cover surrounded by a 2-foot by 2-foot cement pad and four bollards. Well construction details for all wells are included in Table 1. Boring logs and well construction logs are provided in Appendix C. Each well was developed by surging and purging until turbidity readings were below 10 NTUs.

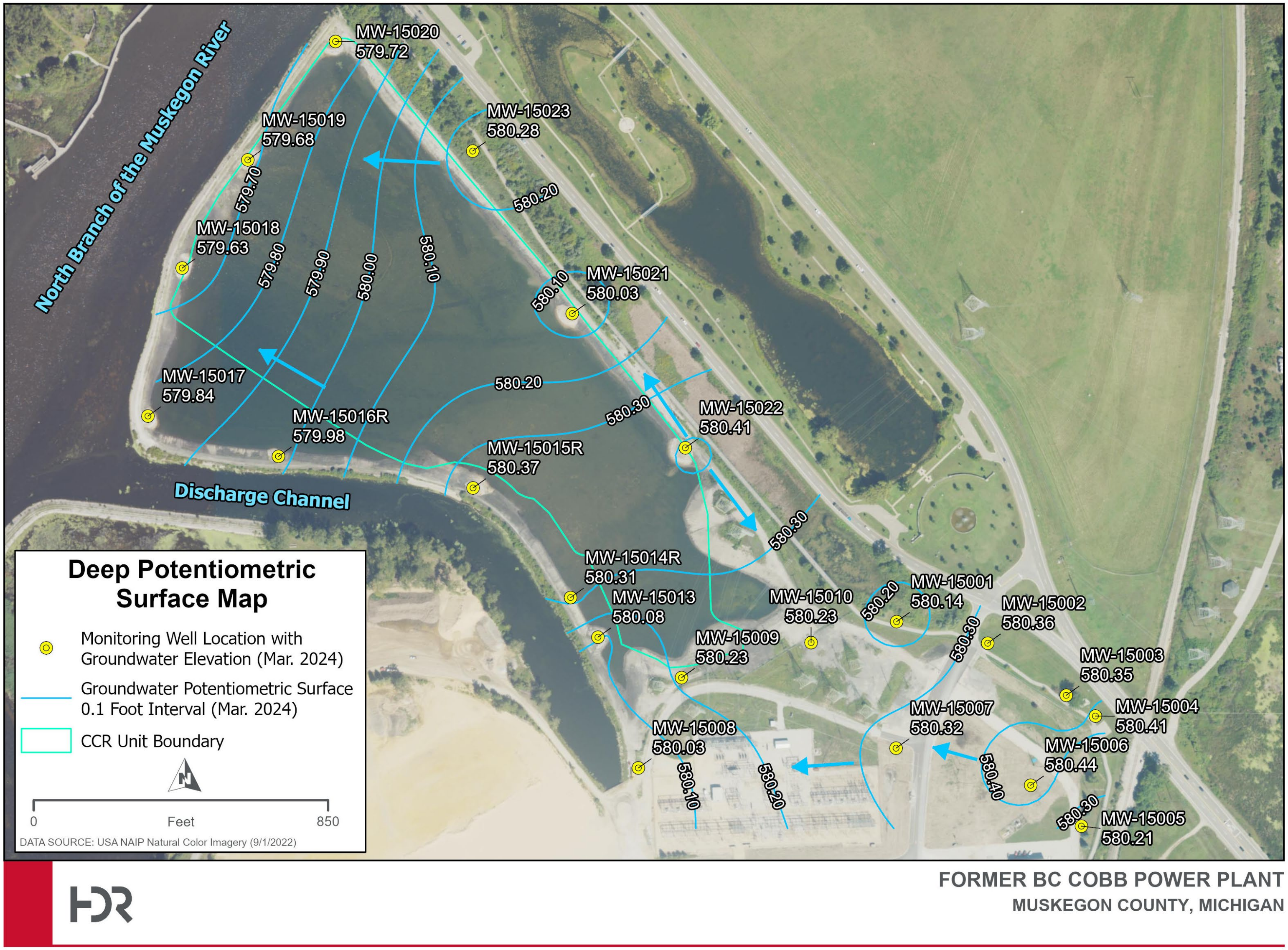


Figure 4. Groundwater Elevation Contours from March 2024 - Deep Wells

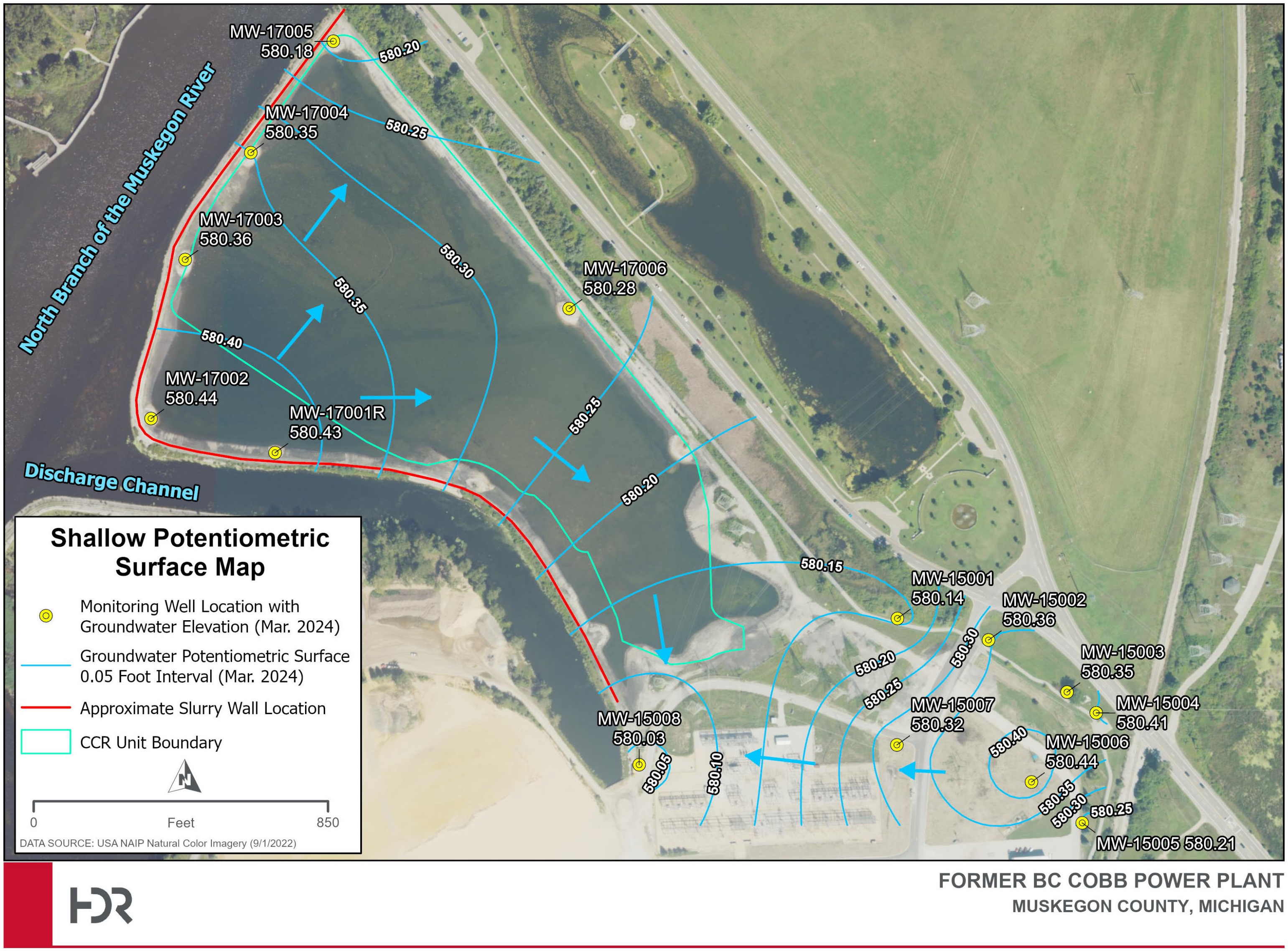


Figure 5. Groundwater Elevation Contours from March 2024 - Shallow Wells

Table 1. Well Construction Details for Groundwater Monitoring at Former BCC

Well ID	Easting NAD83 State Plane, Michigan South 2113 (feet)	Northing NAD83 State Plane, Michigan South 2113 (feet)	Elevation TOC (feet) NAVD88	Depth of Screen Interval (feet bgs)	Well Total Depth (feet bgs)	Well Stickup[3] (feet)	Casing Type	Static Depth to Water[2] (feet BTOC)	Static Water Elevation (feet)
MW-15001 Water Level Only	12624262.18	645763.32	586.52	10-20	20	2.92	2-inch Sch. 40 PVC	6.38	580.14
MW-15002	12624512.86	645701.73	586.87	15-20	20	3.07	2-inch Sch. 40 PVC	6.51	580.36
MW-15003	12624726.22	645555.93	587.12	13-18	18	3.02	2-inch Sch. 40 PVC	6.77	580.35
MW-15004	12624824.48	645491.68	590.57	5-15	15	2.87	2-inch Sch. 40 PVC	10.16	580.41
MW-15005	12624783.15	645166.74	587.77	5-15	15	2.97	2-inch Sch. 40 PVC	7.56	580.21
MW-15006	12624610.52	645291.65	587.81	5-15	15	2.91	2-inch Sch. 40 PVC	7.37	580.44
MW-15007	12624188.85	645409.39	587.43	4-10	10	2.93	2-inch Sch. 40 PVC	7.11	580.32
MW-15008	12623510.47	645340.01	587.76	4-9	9	2.96	2-inch Sch. 40 PVC	7.73	580.03
MW-15009	12623622.98	645606.92	589.27	14-24	24	2.97	2-inch Sch. 40 PVC	9.04	580.23

Table 1. Well Construction Details for Groundwater Monitoring at Former BCC

Well ID	Easting NAD83 State Plane, Michigan South 2113 (feet)	Northing NAD83 State Plane, Michigan South 2113 (feet)	Elevation TOC (feet) NAVD88	Depth of Screen Interval (feet bgs)	Well Total Depth (feet bgs)	Well Stickup[3] (feet)	Casing Type	Static Depth to Water[2] (feet BTOC)	Static Water Elevation (feet)
MW-15010	12623979.47	645690.69	588.11	12-22	22	2.91	2-inch Sch. 40 PVC	7.88	580.23
MW-15011[6]	12623765.87	645780.29	595.22	21-31	31	2.92	2-inch Sch. 40 PVC	22.58	572.64
MW-15012[5]	12623545.99	645889.92	597.39	21-31	31	2.89	2-inch Sch. 40 PVC	15.05	582.34
MW-15013	12623389.21	645716.41	598.50	30-40	40	2.60	2-inch Sch. 40 PVC	9.92	580.08
MW-15014[6]	12623318.73	645925.93	599.04	23-31	31	2.84	2-inch Sch. 40 PVC	16.50	573.02
MW-15014R	12323293.80	645827.80	589.7	27-32	32	2.8	2-inch Sch. 40 PVC	9.39	580.31
MW-15015[1] Abandoned	12623024.09	646138.93	596.75	20-30	30	2.85	2-inch Sch. 40 PVC	14.19	582.56
MW-15015R	12623028.78	646150.02	586.52	13-23	23	-0.27	2-inch Sch. 40 PVC	6.15	580.37
MW-15016[1] Abandoned	12622459.26	646227.56	589.05	35-40	45	2.85	2-inch Sch. 40 PVC	6.65	582.40

Table 1. Well Construction Details for Groundwater Monitoring at Former BCC

Well ID	Easting NAD83 State Plane, Michigan South 2113 (feet)	Northing NAD83 State Plane, Michigan South 2113 (feet)	Elevation TOC (feet) NAVD88	Depth of Screen Interval (feet bgs)	Well Total Depth (feet bgs)	Well Stickup[3] (feet)	Casing Type	Static Depth to Water[2] (feet BTOC)	Static Water Elevation (feet)
MW-15016R	12622458.17	646237.39	586.62	40-44	44	-0.20	2-inch Sch. 40 PVC	6.64	579.98
MW-15017	12622085.55	646354.69	588.61 586.33[4]	35-40	40	2.91 -0.29[4]	2-inch Sch. 40 PVC	6.49	579.84
MW-15018	12622179.74	646789.54	592.43 586.33[4]	37.5-42.5	42.5	3.03 -0.26[4]	2-inch Sch. 40 PVC	6.70	579.63
MW-15019	12622369.93	647103.13	592.42 586.32[4]	37-42	42	3.02 -0.29[4]	2-inch Sch. 40 PVC	6.64	579.68
MW-15020	12622626.85	647436.97	592.23 586.26[4]	35-40	40	2.73 -0.41[4]	2-inch Sch. 40 PVC	6.54	579.72
MW-15021	12623310.03	646654.84	593.73	39.5-42.5	42.5	3.03	2-inch Sch. 40 PVC	13.70	580.03
MW-15022	12623634.96	646263.16	595.82	24-30	30	3.22	2-inch Sch. 40 PVC	15.41	580.41
MW-15023	12622999.24	647125.15	588.08	12-19.5	19.5	2.68	2-inch Sch. 40 PVC	7.80	580.28
MW-17001[1] Abandoned	12622452.1	646228.0	589.29	15-20	20	3.19	2-inch Sch. 40 PVC	6.75	582.54

Table 1. Well Construction Details for Groundwater Monitoring at Former BCC

Well ID	Easting NAD83 State Plane, Michigan South 2113 (feet)	Northing NAD83 State Plane, Michigan South 2113 (feet)	Elevation TOC (feet) NAVD88	Depth of Screen Interval (feet bgs)	Well Total Depth (feet bgs)	Well Stickup[3] (feet)	Casing Type	Static Depth to Water[2] (feet BTOC)	Static Water Elevation (feet)
MW-17001R	12622452.13	646239.58	586.61	15-20	20	-0.22	2-inch Sch. 40 PVC	6.18	580.43
MW-17002	12622087.2	646348.8	588.79 586.26[4]	13.5-18.5	18.5	2.99 -0.28[4]	2-inch Sch. 40 PVC	5.82	580.44
MW-17003	12622184.8	646794.9	592.37 586.31[4]	17-22	22	3.07 -0.26[4]	2-inch Sch. 40 PVC	5.95	580.36
MW-17004	12622373.4	647110.1	591.84 586.27[4]	17.5-22.5	22.5	2.74 -0.32[4]	2-inch Sch. 40 PVC	5.92	580.35
MW-17005	12622619.7	647433.9	592.42 586.33[4]	20-25	25	3.12 -0.24[4]	2-inch Sch. 40 PVC	6.15	580.18
MW-17006	12623301.6	646657.7	593.78	24.5-29.5	29.5	3.33	2-inch Sch. 40 PVC	13.33	580.28

[1] Wells were removed in May 2020 during the construction of a soil bentonite wall (SBW) and relocated within 10 feet of previous location. Relocated wells denoted with “R” after original well ID number. Easting/Northing location data obtained from MERG survey May 21, 2020.

[2] Static water level for wells were measured March 27, 2024. The static water levels shown for abandoned wells MW-15011 and MW-15014 were measured the week of October 19, 2021. The static water levels shown for abandoned wells MW-15012, MW-15015, MW-15016, and MW-17001 were measured the week of May 7, 2020.

[3] Location and construction data (Easting/Northing, Elevation TOC, Screen Interval, Well Stickup, and Casing Type) for wells MW-15001 – MW-15023 was obtained from *Summary of Monitoring Well Design, Installation, and Development* report by Arcadis 2016. Location and construction data for wells MW-17001 – MW-17006 was obtained from the *2019 Annual Groundwater Monitoring Report* prepared by TRC (TRC, 2020). Construction data was obtained for MW-15015R, MW-15016R, and MW-17001R from Final Boring-Well Logs prepared by SME May 12, 2020. These can be found in Appendix C.

[4] Well elevations changed from stick up to flush mount for construction activities May 12, 2020.

[5] Well was abandoned in June 2020 to accommodate construction activities.

[6] Well was abandoned in February 2022, MW-15014 was replaced with MW-15014R to accommodate construction activities.

3.0 Groundwater Sampling and Analysis

3.1 Ongoing CCR Rule Compliance Monitoring Program

3.1.1 Background Monitoring

The BC Cobb groundwater monitoring program was implemented by CEC after the CCR Rule was initiated on October 19, 2015. The CCR Rule Part §257.93 requires a minimum of eight background samples to be collected before October 17, 2017 for the 40 CFR Part 257 Appendix III and IV constituents (Table 2). CEC conducted quarterly CCR Rule compliance background monitoring between November 2015 and September 2017.

Table 2. Groundwater Quality Parameters in Compliance with the CCR Rule Part 257

Appendix III Constituents for Detection Monitoring	Analytical Reporting Limit of CEC Federal Monitoring Compliance Program (2015-2019)	Units
Boron	5.0	ug/L
Calcium	5.0	mg/L
Chloride	25.0	mg/L
Fluoride	100	ug/L
pH	0.1	SU
Sulfate	0.25	mg/L
Total Dissolved Solids (TDS)	20.0	mg/L
Appendix IV Constituents for Assessment Monitoring		
Antimony	1.0	ug/L
Arsenic	1.0	ug/L
Barium	10	ug/L
Beryllium	0.20	ug/L
Cadmium	0.20	ug/L
Chromium	1.0	ug/L
Cobalt	1.0	ug/L
Fluoride	100	ug/L
Lead	1.0	ug/L
Lithium	10.0	ug/L

Table 2. Groundwater Quality Parameters in Compliance with the CCR Rule Part 257

Mercury	0.20	ug/L
Molybdenum	1.0	ug/L
Selenium	1.0	ug/L
Thallium	1.0	ug/L
Radium 226 and 228 combined	1.0	pCi/L
Additional Parameters		
Total Suspended Solids (TSS)	25	mg/L

3.1.2 Detection Monitoring

The eight rounds of background water quality data for the background/upgradient wells (MW-15002 – MW-15008) were used to develop background threshold values (BTVs) for each Appendix III and IV constituent of interest (COI). CEC used the upper tolerance limit (UTL) of the background wells (lumped) for each COI to develop the BTVs. Detection monitoring analyzed Appendix III COIs and identified a statistically significant increase (SSI) of boron, fluoride, and pH in at least one of the downgradient wells. CEC's contracted consultant, TRC, performed an Alternative Source Demonstration (ASD) but did not find evidence of a source other than the Ponds. Therefore, CEC initiated assessment monitoring.

3.1.3 Assessment Monitoring

The first CCR Rule compliance assessment monitoring sampling event took place in April 2018. Per CCR Rule, CEC sampled and analyze the groundwater in each well for all COIs in Appendix IV of Part §257, for the purposes of determining detected COIs. Within 90 days of obtaining results from the initial assessment monitoring sample event, and on a semiannual basis thereafter, CEC initiated a program to sample all wells for Appendix III and detected Appendix IV COIs. CEC sampled semiannually between June 2018 and September 2019 as part of the assessment monitoring program. MERG acquired the property in April 2020 and continued CCR Rule assessment monitoring by monitoring beginning in May 2020.

Under the assessment monitoring program and in accordance with 40 CFR § 257.95(e-g), Appendix III and IV monitoring results must be compared to BTVs and the groundwater protection standards (GPS). In accordance with 40 CFR § 257.95(g-h), CEC developed GPS for each Appendix IV COI and identified concentrations of lithium at statistically significant levels (SSLs) above the GPS at two downgradient wells, MW-17001 and MW-17002 on the first semiannual assessment monitoring event (June 2018). The notification to the operating record of the SSLs was followed up with a Response Action Plan submitted to the EGLE on March 15, 2019 laying out the preliminary understanding of water quality and actions that were underway to mitigate unacceptable risk associated with the identified release from the CCR unit. The Assessment of Corrective Measures (ACM) was initiated on April 15, 2019 and was certified and submitted to the EGLE on September 11, 2019 and provided in the Response Action Plan.

MERG acquired the Site and initiated the source removal corrective measure by installing a slurry wall and dewatering pumps. CCR excavation efforts were completed in April of 2022 and dewatering efforts ceased on June 15, 2022. MERG will continue the CCR Rule compliance semiannual groundwater assessment monitoring along with annual and semiannual reporting until closure groundwater conditions are observed.

Attachment 1 provides the 2018 and 2017 Groundwater Monitoring Reports for the Site to provide prior statistical evaluations completed, including the development of background values and assessment monitoring statistical evaluations.

3.2 Part 115 Compliance Monitoring Program

3.2.1 Background Monitoring

The BC Cobb CCR Rule compliance groundwater monitoring program has BTVs developed for Appendix III and IV COIs. The Michigan Statute 324.11511a(3)(c) provides the list of detection monitoring parameters, which are the same as the detection monitoring parameters for the CCR Rule compliance (Appendix III, Table 2), with the exception that the State Statute also includes total iron. The Michigan Statute 324.11519b(2) provides the list of assessment monitoring parameters, which are the same as the assessment monitoring parameters for the CCR Rule compliance (Appendix III and IV, Table 2), with the exception that the State Statute also includes total copper, nickel, silver, vanadium, and zinc. The existing groundwater dataset for the Site does not include iron, copper, nickel, silver, vanadium, or zinc. The current groundwater monitoring status by MERG is semiannual Assessment Monitoring at the site. Because the source removal corrective measure for the Site is currently underway, and future findings for these six new concentrations at the site will not change the corrective measure approach (ash removal for Ponds 0-8 and the Bottom Ash Ponds), additional site visits (more frequent or earlier in time) to collect these new COI data were not warranted. Instead, to develop BTVs for total iron, copper, nickel, silver, vanadium, and zinc, MERG has added these six additional State COIs to the existing COI list for each monitoring event moving forward, from both background wells and downgradient wells. MERG completed the eighth sample event that included the additional six COIs in March 2024. MERG has developed a BTV for each of these six COIs by lumping the eight sets of background well data and calculating the 95 UTL for iron, copper, nickel, silver, vanadium, and zinc to be consistent with the existing statistical program. BTVs for the other CCR COIs were also updated to include the additional data collected since the BTVs were initially developed.

3.2.2 Detection Monitoring

According to Michigan Statute 324.11511a(3), 11512a(1), and 11519a(1)(h), semiannual detection monitoring for CCR surface impoundments is required. Detection monitoring was completed by CEC under the BC Cobb CCR Rule compliance program, which identified SSIs for boron, fluoride, and pH in downgradient wells. As described in 3.2.1, total iron is the only new COI required in Part 11511a(3)(c) for the State compliance groundwater monitoring program not already monitored at BC Cobb under the CCR Rule compliance program. The BTV for iron has been developed following the eighth sample event collected in March 2024. Moving forward, as described above in 3.2.1, the concentrations of iron from each downgradient well during each semiannual assessment monitoring event will be compared to the BTV for iron. Should an SSI be detected for iron, a notice will be placed in the operating record within 14 days of the determination and notify the director that the notice was placed in the operating record. However, the Site is already in Assessment Monitoring, therefore no additional monitoring program status change will be required. Alternatively, MERG may document that the SSI resulted from an error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

3.2.3 Assessment Monitoring Program

According to Michigan Statute 324.11519b(2), if the detection monitoring confirms a statistically significant increase over background for one or more of the constituents listed in section 11511a(3), the owner shall conduct assessment monitoring. The constituents to be monitored in the assessment monitoring program shall include those listed in section 11519b(2). Detection monitoring performed by CEC identified SSIs of boron, fluoride, and pH in at least one of the downgradient wells; therefore, Assessment Monitoring was initiated by CEC at the Site in 2018 under the federal monitoring program.

Under the CCR Rule compliance groundwater program, MERG is currently in Assessment Monitoring, performing semiannual groundwater monitoring. MERG proposes to initiate State Part 115 compliance groundwater monitoring by starting within Assessment Monitoring status. The list of COIs required in Part 11519b(2) for assessment monitoring compliance has five COIs not previously analyzed at the Site under the existing CCR Rule compliance Assessment Monitoring Program, these include copper, nickel, silver, vanadium, and zinc. Therefore, background data collection will be required for those five parameters (plus iron from the detection monitoring Part 115 COI list). The BTVs for copper, nickel, silver, vanadium, and zinc were developed after the eighth sample event took place in March 2024. A GPS was developed for each of these new COIs.

MERG will continue to perform semiannual assessment monitoring, sampling from background wells and downgradient wells around the CCR unit. MERG will analyze samples for the COIs in Part 11511a(3) and 11519b(2).

After each semiannual sample event, MERG will update the statistics for each downgradient well to determine:

- If the concentrations of all constituents listed in 11519b(2) are shown to be at or below background values for 2 consecutive sampling events, then MERG will notify the director of the finding and may return to detection monitoring (R 299.4441(5)).
- If there are detections of concentrations of one or more constituents listed in Michigan Statute 324.11511a(3) and 324.11519b(2) at statistically significant levels above the GPS, the State will be notified within 14 days. In addition, the Assessment of Corrective Measures semiannual updates will include the addition of the additional SSLs as well as any description if the identification of the new SSL COIs would be reason to evaluate additional corrective measures not previously described. The Response Action Plan will also be assessed to determine if it requires edits to reflect the newly identified SSLs. Typically, identification of SSLs would also trigger ceasing acceptance of coal ash at the impoundment and a requirement to begin implementation of closure; however, BC Cobb has already completed those steps.

- As described above, CEC previously identified SSLs for lithium at two shallow wells based on the federal CCR Rule compliance groundwater program GPS values; the concentrations of lithium (lower confidence limits from each downgradient well) are above the GPS values developed for lithium under this State Part 115 compliance groundwater program (GPS values provided in the Statistical Procedures Plan in Appendix E). The SSL test was completed for copper, nickel, silver, vanadium, and zinc, for the first time after BTVs were developed following the March 2024 assessment monitoring event. SSLs have been identified for iron in five deep wells: MW-15016R, MW-15017, MW-15019, MW-15020, and MW-15021.

3.3 Monitoring Schedule and Frequency

Semiannual Assessment Monitoring will continue until the CCR units are closed, as approved by EGLE. See Table 3 and Table 4 below for the sample locations and frequencies, respectively.

Table 3. Groundwater Sample Locations

Background Monitoring Wells	MW-15002 MW-15003 MW-15004 MW-15005 MW-15006 MW-15007 MW-15008
Downgradient Monitoring Wells	MW-15009 MW-15010 MW-15013 MW-15014R MW-15015R MW-15016R MW-15017 MW-15018 MW-15019 MW-15020 MW-15021 MW-15022 MW-15023 MW-17001R MW-17002 MW-17003 MW-17004 MW-17005 MW-17006
Total Monitoring Wells to be Sampled	26
QC Samples to be collected per sample event (Field Duplicate 1 per 10 sampled wells)	2
Total samples submitted to lab for analysis for each sample event	28
Water Level Only Monitoring Wells	MW-15001

Table 4. CCR Groundwater Sample Collection Frequency

Type of Monitoring	Wells	Year	Frequency	Water Quality Constituents of Interest
Assessment Monitoring*	Background and Downgradient	Nov 2020- until Clean Closure	Semiannual	Michigan Statute 324.11511a(3) and 324.11519b(2)

3.4 Sampling Procedures

Appendix D provides the proposed sample collection and safety procedures. Procedures are consistent with EPA guidelines and the CCR Rule. MERG or a Contracted Consultant will collect all samples.

3.4.1 Quality Control

Quality Control (QC) checks of both the field procedures and laboratory analyses will be used to assess and document data quality and to identify discrepancies in the measurement process that need correction. Quality control samples will be used to assess various data quality parameters such as representativeness of the environmental samples, the precision of sample collection and handling procedures, and the accuracy of laboratory analyses. In addition, all sample containers, preservation methods, and holding times will be in accordance with QC requirements.

The analytical laboratory will use a series of QC samples, as identified in the laboratory's Quality Assurance Plan and specified in the standard analytical methods. The types of samples include method blanks, surrogate spikes, laboratory control samples, laboratory control sample duplicates, matrix spikes, and matrix spike duplicates. Analyses of QC samples will be performed for samples of similar matrix type and concentration and for each sample batch. Laboratory accuracy is assessed through the analysis of matrix spike/matrix spike duplicate (MS/MSD) samples. The number of MS/MSD analyses is based on laboratory quality control standards. MERG approved contract laboratory will run MS/MSD samples at a rate of 5 percent, or one for every 20 samples analyzed. MS/MSD analysis results reflect the ability of the laboratory and method to accurately determine the quantity of an analyte in a particular sample. The measurement of "standards", or materials of accepted reference values, provides an assessment of the accuracy of laboratory instruments and analytical methods. Accuracy will be evaluated through the use of EPA Quality Control Samples or Standard Reference Materials. Accuracy at the laboratory is expressed as percent recovery of the control sample. Laboratory MS recovery requirement is 80 to 120 percent, and MSD maximum difference is 20 percent.

The precision of field sampling procedures will be evaluated by collection and analysis of field duplicate samples. Duplicate samples are two or more samples collected or processed so that the samples are considered to be essentially identical in composition. Duplicate samples will be used to evaluate the reproducibility (precision) of analyte concentration values reported by the laboratory. Although two replicates are not adequate to assess precision, they can be used to show whether variability of results for the samples is within the range of expected precision.

The number of duplicate samples to be collected would typically be at a rate of ten percent (approximately one for every ten samples). Sample identification for duplicates will be the same as the sample identification with the addition of a "Duplicate" (e.g. MW-15018 and MW-15018D). The precision will be measured through the evaluation of relative percentage differences (RPDs) between sample and duplicate sample and between matrix spike and matrix spike duplicates and calculated as follows:

Relative Percentage Difference (%) = $\left[\frac{|SA\ concentration - SB\ concentration|}{\underline{Average\ concentration\ of\ SA+SB}}\right]\ x\ 100$

Where SA denotes Sample A; SB denotes the duplicate, sample B.

Duplicate RPD requirement is 20 percent. Accuracy is measured by the difference between the measured or observed value and the true or assigned value. Accuracy in the field is assessed through the adherence to all sample handling, preservation, and holding times.

Calibration of field equipment is completed by the rental equipment company prior to each rental, and calibration records are included with the equipment. Therefore, calibration of field equipment measuring field parameters (YSI or similar) will be calibrated at the beginning of each sample event. The calibration record from the equipment company will be reviewed to ensure accurate calibration. The sample crew will photograph the calibration documentation provided with the equipment. The field equipment will be calibration checked at the end of each sample day.

Laboratory data will be reviewed, validated and qualified, if necessary, prior to use. The laboratory data validation procedure is described in Section 3.6.

3.5 Monitoring Parameters and Analytical Methods

3.5.1 Sample Parameters

Parameters to be analyzed for each semiannual assessment monitoring event are shown on Table 5. These parameters include all of the constituents required for groundwater sampling by the Part 115 Solid Waste Regulations. Analytical testing of water samples will be performed by Trace Analytical, a contract laboratory in Muskegon, Michigan. Field measurements will be collected by the sampling team during the purging process. The field measurements are specific conductance, temperature, dissolved oxygen, pH, turbidity, and oxidation/reduction potential (ORP).

Table 5. Groundwater Quality Parameters to be Analyzed
Constituents for Assessment Monitoring*
Boron
Calcium
Chloride
Iron
Fluoride
pH
Sulfate
Total Dissolved Solids (TDS)
Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Copper
Fluoride
Lead
Lithium
Mercury
Molybdenum
Nickel
Selenium
Silver
Thallium
Vanadium
Zinc
Radium 226 and 228 combined
Additional Constituents
Total Suspended Solids

*All metals are to be analyzed as total metals.

3.5.2 Sample Analysis

Table 6 lists the constituents of interest that will be analyzed by the contract laboratory and the analytical methods, preservation, and sample holding times.

Table 6. Water Quality Parameters to be Analyzed

Parameter		Sample Bottle	Units to be reported	Preservation	Method	Holding Time	Laboratory Reporting Limits
Sb, total	Antimony	250 mL plastic	mg/L	Nitric Acid	200.8	6 mos	0.005
As, total	Arsenic		mg/L	Nitric Acid	200.8	6 mos	0.002
Ba, total	Barium		mg/L	Nitric Acid	200.8	6 mos	0.150
Be, total	Beryllium		mg/L	Nitric Acid	200.8	6 mos	0.001
B, total	Boron		mg/L	Nitric Acid	200.7	6 mos	0.04
Cd, total	Cadmium		mg/L	Nitric Acid	200.8	6 mos	0.0005
Cr, total	Chromium		mg/L	Nitric Acid	200.8	6 mos	0.005
Co, total	Cobalt		mg/L	Nitric Acid	200.8	6 mos	0.005
Cu, total	Copper		mg/L	Nitric Acid	200.8	6 mos	0.005
Fe, total	Iron		mg/L	Nitric Acid	200.7	6 mos	0.02
Pb, total	Lead		mg/L	Nitric Acid	200.8	6 mos	0.003
Li, total	Lithium		mg/L	Nitric Acid	200.7	6 mos	0.005
Hg, total	Mercury		mg/L	Nitric Acid	7470A	28 d	0.0002
Mo, total	Molybdenum		mg/L	Nitric Acid	200.8	6 mos	0.005
Ni, total	Nickel		mg/L	Nitric Acid	200.8	6 mos	0.005
Se, total	Selenium		mg/L	Nitric Acid	200.8	6 mos	0.005
Ag, total	Silver		mg/L	Nitric Acid	200.8	6 mos	0.0005
Tl, total	Thallium		mg/L	Nitric Acid	200.8	6 mos	0.002
V, total	Vanadium		mg/L	Nitric Acid	200.8	6 mos	0.005
Zn, total	Zinc		mg/L	Nitric Acid	200.8	6 mos	0.005
Ca	Calcium	250 mL plastic 1 L Plastic	mg/L	Nitric Acid	6010D	6 mos	2.5
F	Fluoride		mg/L	Chill	300.0	28 d	1.0
Cl	Chloride		mg/L	Chill	300.0	28 d	10
SO_4	Sulfate		mg/L	Chill	300.0	28 d	10

Table 6. Water Quality Parameters to be Analyzed

TDS	Total Dissolved Solids	1 L plastic	mg/L	Chill	SM 2540C	7 d	20
TSS	Total Suspended Solids	1 L plastic	mg/L	Chill	SM 2540D	7 d	3
RA226/228	Radium 226 and 228 combined	(2) 1 L plastic	pCi/L	HNO_3	903.0/904.0	6 mos	2.0 combined

3.6 Data Validation

This section describes the processes for data review and validation. MERG or it's Contracted Consultant (CC) will perform the data validation, statistical analysis, interpretation, and reporting. The scanned field forms, the laboratory reports (pdf and EDD), and the chain of custody (COC) will be used to complete the process.

3.6.1 Field Data Review

The field data review will be performed by MERG or it's CC and include verification that QC checks and calibrations are recorded properly in the field data sheets and that any necessary and appropriate corrective actions were implemented and recorded. Such data will be written into field data sheets immediately after measurements are taken. If errors are made, results will be legibly crossed out and corrected in a space adjacent to the original (erroneous) entry. If transcription errors have been made, the LS and EFT will address the errors to provide resolution.

Field measurement data will be entered by the CC into electronic files for data validation and data interpretation. Table 7 lists the field records that will be validated and verified and who is responsible.

3.6.2 Laboratory Data Review

External laboratory data-reduction procedures will be performed according to the laboratory's Quality Assurance Manual. Paper and electronic data files will be maintained by the laboratory to document the sample identification number and the sample tag number with sample results and other details, such as analytical method used, name of analyst, date of analysis, matrix sampled, reagent concentrations, instrument settings, and raw data.

The laboratory review process will include a review by the analyst, a second-level review by a supervisor or designee, and a completeness review by the laboratory's Project Manager prior to final data reporting. QC data (for example, laboratory duplicates, LCSs, MSs, and MSDs) will be compared to the acceptance criteria. The laboratory will appropriately flag unacceptable data in the data package.

Table 7 lists the analytical data package records that will be validated and verified and who is responsible.

Table 7. Data Verification and Validation Inputs

Item	Description	Verification (Completeness)	Validation (Conformance to Specifications)	Who Will Verify or Validate
Field Records				
1	Field equipment calibration records	X	X	CC
2	Chain-of-Custody forms	X	X	CC
3	Field decontamination documentation	X	X	CC
4	Sample collection field forms	X	X	CC
5	Drilling logs	X		CC
6	Well construction logs	X		CC
7	Well development field forms	X		CC
Analytical Data Package				
9	Cover sheet (laboratory identifying information)	X	X	CC
10	Case narrative	X	X	CC
11	Internal laboratory Chain-of-Custody forms	X	X	CC
12	Sample chronology and consistency (that is, dates and times of receipt, preparation, and analysis)	X	X	CC
13	Communication records with laboratory	X	X	CC
14	EDD format consistency	X		CC
15	Sample identification, results nomenclature, and data qualifier consistency	X		CC
16	Method detection limit consistency	X	X	CC
17	Instrument calibration records	X	X	CC
18	Laboratory Report	X	X	CC
19	Field QC sample results and calculation of accuracy and precision	X	X	CC

3.6.3 Verification

Verification is a completeness check that is performed before the data review process continues in order to determine whether the required information was collected and is available. Verification is not designed for use in qualitative review but ensures the availability of sufficient information for subsequent steps of the data review process. Example inputs for conducting the completeness check are listed in Table 7 above.

The following procedures will be completed by the CC for data verification:

- COC forms and shipping documents will be reviewed and verified for completeness and accuracy against the actual contents of the laboratory report and EDD.
- Field notes will be reviewed for completeness and accuracy.

The CC will verify that the following QC procedures were performed by the laboratory:

- COC and sample receipt documentation
- Sample index (correlation of field sample identifier [ID] to laboratory sample ID)
- Laboratory case narrative (method deviations and QC anomalies)
- Analytical holding times
- LCS recoveries
- MS and/or MSD recoveries
- MS/MSD relative percent difference (RPD) values
- Field duplicate RPD values
- Method blank
- Laboratory duplicate RPD values
- Summaries of initial and continuing calibration
- Summaries of instrument blanks (for example, initial calibration blank [ICB] and continuous calibration blank, if specified in the method)
- Interference check samples (ICP and ICP–mass spectrophotometry [ICP-MS])
- Serial dilutions (ICP and ICP-MS)
- Post-digestion spikes
- Summaries of internal standards

3.6.4 Data Validation

The purposes of data validation are to minimize suspect analytical data, designate a data qualifier for any data quality limitation discovered, and eliminate analytical data that do not pass validation acceptance criteria. A formal data validation will be performed by CC and will include a review of field QC sample analyses and laboratory data. The CC will determine whether the measurement performance criteria have been met and will calculate the data completeness for the project.

EVALUATING FIELD DATA

The results of field QC sample analyses associated with each laboratory data package will be reviewed by the CC to evaluate field QC samples and further indications of the data quality. If a problem is identified through reviewing field QC data, all related field samples will be identified by the CC, and, if possible, corrective actions will be instituted and documented. If data are compromised because of a problem identified via field QC sample review, appropriate data qualifications will be used by the CC to identify the data for future data users.

The handling, preservation, and storage of samples collected during the sampling program will be monitored by the CC on an ongoing basis. The sample receipt records (a required data package deliverable) as well as the COC documentation will also be assessed by the CC during data validation. Sample handling, storage, or preservation problems identified during data validation will result in appropriate qualification of data.

EVALUATING LABORATORY DATA

Data verification will be performed by the CC on 100 percent of the data to ensure completeness of the data packages. The purpose of chemistry data validation is to verify that the data are of known quality, are technically valid, are defensible, and are usable for their intended purpose. The objectives of the data validation process are to:

- Verify completeness of data packages and corresponding EDDs.
- Assess compliance with project-specific procedures and programs.
- Evaluate system process control to ensure that no systematic errors exist within the data sets.
- Assess field QC samples to determine whether sampling has adversely affected the reported results and, therefore, usability.
- Assess both method and laboratory performance through tabulation of QC outliers.
- Provide measures of data quality in terms of precision, accuracy, and completeness so that overall usability can be determined.

Data validation will be performed by CC using the general protocols and processes described in the following documents, as applicable:

- Guidance on Environmental Data Verification and Data Validation QA/G-8 (USEPA, 2002)
- Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA, 2010) (as a general guidance and using professional judgment for the validation in support of or in the absence of method-specific direction)
- Guidance for Labeling Externally Validated Laboratory Analytical Data (USEPA, 2009a)
- EPA SOP HW-3b (USEPA, 2015)

The following specific QC elements will be validated by the CC for conformance to project specifications and acceptance criteria:

- COC and sample receipt documentation
- Sample index (correlation of field sample identifier [ID] to laboratory sample ID)

- Laboratory case narrative (method deviations and QC anomalies)
- Analytical holding times
- Methods used
- Analysis performed within required holding times
- LCS recoveries
- MS and/or MSD recoveries
- MS/MSD relative percent difference (RPD) values
- Field duplicate RPD values

Each data package will be accompanied by an EDD prepared by the laboratory. Additional laboratory QC data can be included in the EDD as long as the data fields specified in the EDD are also maintained. EDDs will be cross checked by the CC against corresponding data reports to confirm consistency in the results reported in these two separate formats. The following data qualifiers will be applied during data validation by the CC:

U	The analyte was analyzed for, but was not detected at, a level greater than or equal to the level of the adjusted reporting limit (RL) for the sample and method.
J	The analyte was positively identified, and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain QC criteria were not met, or to the concentration of the analyte being below the RL).
J+	Same as J, and the reported concentration is potentially biased high.
J–	Same as J, and the reported concentration is potentially biased low.
UJ	The analyte was not detected at a level greater than or equal to the adjusted method detection limit (MDL). However, the reported adjusted MDL is approximate and might be inaccurate or imprecise.
R	The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte might or might not be present in the sample.

The above definitions are consistent with those described in the EPA SOP HW-2b (USEPA, 2015). See Table 9 for details on how data will be qualified if QC limits are not met.

After the fieldwork and the final analytical data have been completed and reviewed by the CC for each sampling event, a Data Quality Summary Report will be prepared by the CC for the project. The report will summarize quality assurance and audit information, including the results of the data review; will evaluate field QC sample data, such as field duplicates; and will describe any corrective actions taken. The Data Quality Summary Reports will be appended to the project reports in which sampling data was used.

3.6.5 Data Usability Assessment

Data collected from the field activities will be evaluated against the following data quality parameters.

PRECISION

Precision refers to the degree to which repeated measurements are similar to one another when obtained under prescribed conditions. Precision will be assessed by evaluating the results of field duplicates to determine RPD. QC procedures and acceptance criteria are summarized in Table 8.

For precision:

RPD for field duplicates percent RPD = $\left[\frac{|Amount\ in\ sample\ 1 - Amount\ in\ Sample\ 2|}{Amount\ in\ Sample\ 1 + Amount\ in\ sample\ 2}\right]\ x\ 100$

ACCURACY

Accuracy is defined as the measure of the closeness of an individual measurement or the average of a number of measurements to the actual or “true” value. Laboratory accuracy will be assessed by evaluating LCSs and MSs and calculating the percent recovery (percentR). QC procedures and acceptance criteria are summarized in Table 8.

For accuracy:

Percent recovery for MS percentR = $\left(\frac{Spike\ conc. - Sample\ conc.}{Amount\ of\ spike\ added}\right)\ x\ 100$

Percent recovery for LCS percentR = $\left(\frac{Spike\ conc.}{Amount\ of\ spike\ added}\right)\ x\ 100$

COMPLETENESS

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount of data that was expected or planned for. A qualified datum will be considered unless it has been rejected (R), in which case it is unusable. The goal for completeness is 100 percent; however, a rejected (unusable) datum will be evaluated to determine whether data gaps exist or whether the project objectives were met without it.

For completeness:

Percent completeness = $\left(\frac{Number\ of\ usable\ measurements}{Number\ of\ planned\ measurements}\right)\ x\ 100$

A brief Data Quality Summary Report will be developed for each semiannual sample event and will document the results of the data verification and validation. This report will describe the conclusions made during the data assessment regarding data usability. Any limitations on the usability of the data will be explained, including the reasons for data qualifiers, the definitions of the qualifiers, and a summary of the specific acceptance criteria that were assessed and found to be outside control limits.

Table 8. Minimum QC Procedures for Project Parameters

Quality Check	Minimum Frequency	Acceptance Criteria	Corrective Action(s)
Metals by ICP-MS			
Laboratory control sample (percent recovery)*	One per analytical batch	75–125	Correct the problem, then reanalyze. If still out, reprep and reanalyze the LCS and all samples in the affected batch.
Laboratory matrix spike/matrix spike duplicate (percent recovery)*	One per analytical batch	75–125	Assess data to determine whether there is a matrix effect or analytical error. Analyze LCS for failed target analytes. Communicate matrix effects to the prime contractor so an evaluation can be made by the PC with respect to the project quality objectives.
Laboratory matrix spike/matrix spike duplicate (RPD)	One per analytical batch	<20% RPD	Flag data.
Field duplicate relative percent difference	One per 10 sampled wells	20	Upon repeated nonconformance, field sampling personnel will be contacted to investigate proper sampling procedure.
Total Suspended Solids and Total Dissolved Solids			
Laboratory control sample (percent recovery)*	One per analytical batch	75–125	Correct the problem, then reanalyze. If still out, reprep and reanalyze the LCS and all samples in the affected batch.
Laboratory matrix spike/matrix spike duplicate (percent recovery)*	One per analytical batch	Not applicable	Not applicable.
Field duplicate relative percent difference	One per 10 sampled wells	20	Field duplicates are collected to provide information about overall precision and the ability of sampling techniques to produce a representative sample. Upon repeated nonconformance, field sampling personnel will be contacted to investigate proper sampling procedure.
Anions			
Laboratory control sample (percent recovery)*	One per analytical batch	75–125	Correct the problem, then reanalyze. If still out, reprep and reanalyze the LCS and all samples in the affected batch.
Laboratory matrix spike/matrix spike duplicate (percent recovery)*	One per analytical batch	75–125	Assess data to determine whether there is a matrix effect or analytical error. Analyze LCS for failed target analytes. Communicate matrix effects to the prime contractor so an evaluation can be made by the PC with respect to the project quality objectives.
Laboratory matrix spike/matrix spike duplicate (RPD)	One per analytical batch	<20% RPD	Flag data.

Table 8. Minimum QC Procedures for Project Parameters

Quality Check	Minimum Frequency	Acceptance Criteria	Corrective Action(s)
Field duplicate relative percent difference	One per 10 sampled wells	20	None. Field duplicates are collected to provide information about overall precision and the ability of sampling techniques to produce a representative sample.
Radium 226/228			
Laboratory control sample (percent recovery)*	One per analytical batch	75–125	Correct the problem, then reanalyze If still out, reprep and reanalyze the LCS and all samples in the affected batch.
Laboratory matrix spike/matrix spike duplicate (percent recovery)*	One per analytical batch	75–125	Assess data to determine whether there is a matrix effect or analytical error. Analyze LCS for failed target analytes. Communicate matrix effects to the prime contractor so an evaluation can be made by the PC with respect to the project quality objectives.
Laboratory matrix spike/matrix spike duplicate (RPD)	One per analytical batch	<20% RPD	Flag data.
Field duplicate relative percent difference	One per 10 sampled wells	20	Upon repeated nonconformance, field sampling personnel will be contacted to investigate proper sampling procedure.

* Other laboratory quality controls (for example, method blanks) will be completed following the laboratory quality assurance plan. The laboratory will be responsible for reporting the data verification codes on reports.

Table 9. Qualification Process

Quality Check	Nonconformance	Qualification	Affected Samples
Holding Time	Holding time exceeded	Qualify results ≥ MDL as estimated low (J-) Qualify non-detects as estimated (UJ)	Apply to each sample for which the holding time criteria was not met
LCS Recovery	%R < acceptable	Qualify results that are ≥ MDL as estimated low (J-). Qualify non-detects as estimated (UJ)	Apply to all samples in the same preparation batch.
	%R > acceptable	Qualify results that are ≥ MDL as estimated high (J+)	
MS Recovery	%R < acceptable	Qualify results that are ≥ MDL as estimated low (J-) Qualify non-detects as estimated (UJ)	Apply to the parent field sample used to prepare the matrix spike sample.
	%R > acceptable	Qualify results that are ≥ MDL as estimated high (J+)	

Table 9. Qualification Process

Quality Check	Nonconformance	Qualification	Affected Samples
MS/MSD RPD	RPD allowance exceeded	Qualify results that are ≥ MDL as estimated (J) Qualify non-detects as estimated (UJ)	Apply to the parent field sample used to prepare the matrix spike sample.
Field Duplicate RPD	RPD allowance exceeded	Qualify results that are ≥ MDL as estimated (J) Qualify non-detects as estimated (UJ)	Apply to the parent field sample and its duplicate.
Field equipment blank	Detected > RL	Qualify results that are ≥ MDL as estimated (J)	Use professional judgment to determine whether qualification is required for associated sample data. For example, qualification of samples collected on the same date as the field blank with detectable results.

3.7 Data Management

All project data and information must be documented in a format that is usable by project personnel. This section describes how project data and information will be documented, tracked, and managed, from generation in the field to final use and storage, in a manner that ensures data integrity and retrieval.

3.7.1 Data Package Deliverables

Data package deliverables for off-site analyses are listed below.

SAMPLE COLLECTION AND FIELD MEASUREMENTS DATA PACKAGE DELIVERABLES

Sample collection documentation will include field form entries, field measurements, and COC forms.

Field measurements will be taken by the sampling team for groundwater samples collected by low-flow sampling. The measurements are specific conductance, temperature, dissolved oxygen, pH, turbidity, and ORP. All field and QC sample results, calibrations, and calibration verifications will be recorded by the sampling team on field forms. The hard-copy versions of the field data will be scanned by the sampling team and filed with other project data.

OFF-SITE LABORATORY DATA PACKAGE DELIVERABLES

The contract laboratory will provide laboratory data packages for each set of samples analyzed. Data and summary sufficient for the data validator to perform verification and data usability assessment are to be sent by email to the CC within 15 business days of receiving the sample. Delivery of a hard-copy data package will not be required.

The laboratory will email the CC an analytical report and an electronic data deliverable (EDD).

The information provided by the laboratory will be sufficient to review the data with respect to:

- Holding times and sample conditions

- Calibrations and instrument performance
- Detection/quantitation limits
- Spike and surrogate recoveries
- Duplicate analyses (laboratory duplicates and matrix spike [MS]/MS duplicates [MSD])
- Laboratory control sample (LCS)
- Blank contamination
- Target compound identification and quantitation

A laboratory report will be provided that includes the following hard-copy information for each analytical data package:

- Cover sheet listing the name and number of samples included in the report.
- Narrative comments describing problems encountered in analysis; identification of any analyses not meeting QC criteria, including holding times; and cautions regarding unusable data due to QC results that are outside the control limit.
- COC forms.
- Documentation of extraction, clean-up, and analytical methods used.
- Tabulated results of inorganic compounds identified and quantified, with analyte-specific detection limits. Analytes will be reported for each sample as a detected concentration or as not detected above the specific limits of quantitation, which must be stated. The laboratory will also report dilution factors, date of analysis, surrogate percent recoveries, batch run logs, and analytical batch number for each sample, with corresponding sample results.
- Analytical results for QC sample spikes, laboratory duplicates, initial and continuing calibration, verifications of standards and laboratory blanks, standard procedural blanks, LCSs, laboratory reference materials, inductively coupled plasma (ICP) interference check samples, and detection limit check samples.
- Documentation of rationale for the use of method of standard addition, if required.

Corresponding to each individual laboratory report, an EDD will be prepared and submitted along with the laboratory data package.

3.7.2 Data Handling and Management

This section describes computerized and manual procedures that trace the paths of all data from generation to final use and storage, as well as the associated quality checks for error detection that are performed to ensure data integrity.

DATA RECORDING

Data recording in the field will be performed as described herein and using the forms and formats in Appendix D.

3.7.3 Data Tracking and Control

The project quality records will be maintained by the CC. These records, either electronic or hard copy in form, will include the following:

1. Project work plans with any approved modifications, updates, and/or addendums
2. Project Sampling SOP and Statistical Method Certification, with any approved modifications, updates, and/or addendums
3. Field documentation
4. COC records
5. Laboratory documentation (results received from the laboratory will be documented in an electronic format)
6. Data validation and verification reports
7. Final project reports and deliverables

Hard-copy field and laboratory records will be maintained in the project's central data file, where original field and laboratory documents are filed chronologically for future reference. These records are also scanned to produce electronic copies in portable document format (PDF). The electronic versions of these records will be maintained in the CC network and has a routine backup schedule.

All project records listed above will be provided to MERG and maintained on file by MERG for a minimum of three years after completion of the work. Besides acting as a central data repository, the database will further facilitate data analysis and reporting. The information stored in the database will consist of sampling information (for example, sample identification, location, and sampling date and time), and analytical chemistry data specified in different fields of the EDD format selected for the project. Field data previously transferred from hard-copy documents into electronic files and laboratory EDDs will be reviewed for completeness and accuracy by the CC.

RECORDKEEPING

MERG will place the following groundwater monitoring information, as it becomes available, in the facility's operating record:

- Annual groundwater monitoring and corrective action report
- Semiannual Remedy Selection Progress Report
- Documentation of the design, installation, development, and decommissioning of any monitoring wells
- Groundwater monitoring system certification
- Selection of a statistical method certification

4.0 Statistical Approach

The statistical procedures use for the groundwater monitoring program will be in accordance with Part 115 Rule 908. These statistical procedures will be consistent with those used for CCR Rule compliance monitoring program in accordance with 40 CFR §257.93(f and g). Appendix E provides the Statistical Procedures Plan, including components for preliminary data analysis (outliers, distributions, serial correlation, trend analysis, seasonality); approach to computing background threshold values; the test for statistically significant levels above groundwater protection standards for assessment monitoring; and test for closure.

5.0 Groundwater Reporting

MERG will submit annual groundwater monitoring reports to EGLE not later than 30 days after the end of the calendar year. Annual reports will summarize key monitoring actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year. The annual groundwater monitoring report will contain the following information, to the extent available:

1. A map showing the CCR units, background and downgradient monitoring wells;
2. Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken;
3. Determine rate and direction of groundwater flow each time groundwater is sampled; and
4. In addition to all the monitoring data, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs. Also, determine rate and direction of groundwater flow each time groundwater is sampled.

MERG will notify the EGLE prior to undertaking well abandonment, plugging, replacement, or repair at the Site. MERG will notify EGLE when sampling and analysis program documentation has been placed in the operating record.

6.0 Response Action Plan

According to Michigan Statutes 324.11519b(2), if detection monitoring confirms a statistically significant increase over background, the owner shall prepare a response action plan in compliance with R 299.4442 of the part 115 rules. Consumers Energy first provided EGLE a Response Action Plan for the Site prepared in accordance with R 299.4442 of the part 115 rules on March 15, 2019 after calculating a potential SSL for lithium at BCC Ponds (CEC, 2019a). That report documented sources of contamination, interim response activities taken to control possible sources of contamination, and a schedule for terminating receipt of waste and initiating closure of the BCC Ponds. That report was approved by EGLE on May 14, 2019. Should additional SSLs be identified, or MERG propose any changes to the Action Plan, MERG will submit a revised Response Action Plan to EGLE.

7.0 Assessment of Corrective Measures

The CEC completed the ACM for the Site, which was submitted to EGLE on September 11, 2019. The ACM complied with all required components of the §257.96. The ACM stated that an adaptive management strategy would be implemented at the Site that includes measures to remove source material, reduce infiltration, and/or minimize the potential future migration. MERG is adopting the ACM as written and has implemented source removal.

8.0 Remedy Selection and Remedial Action Plan

The CEC prepared a Semiannual Progress Report for the Site as a requirement of §257.97(a) of the CCR Rule, which described progress toward selecting and designing the final remedy for the CCR unit. In accordance with the CCR Rule, MERG will prepare a remedy selection progress report semiannually until the final remedy is selected.

The CEC first reported the potential for SSLs over GPS in the *Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g)* (CEC, 2019b). Subsequently, the Assessment of Corrective Measures Report (TRC, 2019) was completed on September 11, 2019.

In 2018, CEC developed the February 2018 Closure Plan and placed it in the Operating Record, which confirmed the CEC plan to close the BCC Ponds in accordance with the CCR Rule §257.102(c). The CEC also submitted a Closure Work Plan to EGLE, who approved it on October 16, 2018 (clarifications of the Work Plan on August 13, 2018 and September 20, 2019). Excavation of CCR removal commenced in 2020; with elements of construction such as design, permitting, and procurement having commenced in 2019. CCR excavation efforts were completed in April of 2022 as documented in the CCR Removal Report dated September 19, 2022 (HDR, 2022).

The CEC first provided EGLE a Response Action Plan prepared in accordance with Part 115 on March 15, 2019 after calculating a potential SSL for lithium at BCC Ponds. That report documented sources of contamination, interim response activities taken to control possible sources of contamination, and a schedule for terminating receipt of waste and initiating closure of the BCC Ponds. That report was approved by EGLE on May 14, 2019. CEC also completed the ACM for the Site, which was submitted to EGLE on September 11, 2019. The ACM stated that an adaptive management strategy would be implemented that includes measures to remove source material, reduce infiltration, and/or minimize the potential future migration.

Construction associated with source removal was initiated in June 2020, including installation of a slurry wall and dewatering pumps. Dewatering commenced in July 2020, allowing for excavation of the vertical and lateral extent of waste CCR. The removal of CCR ash began in August 2020. CCR excavation efforts were completed in April of 2022 and dewatering efforts ceased on June 15, 2022. It is anticipated that the remedy selection process for addressing affected groundwater will proceed following the implementation of the CCR source material removal. Additionally, MERG will continue semiannual assessment monitoring that will inform the remedy selection. The final remedy will be formally selected per §257.97 and R 299.4445 once the selected option is reviewed and commented on by EGLE and a public meeting is conducted at least 30-days prior to the final selection as required under §257.96(e). At the time of remedy selection, MERG will prepare a Remedial Action Plan in compliance with R 299.4445.

9.0 References

ARCADIS. May 13, 2016. Summary of Monitoring Well Design, Installation, and Development. BC Cobb Electric Generation Facility – Muskegon, Michigan. Prepared for Consumers Energy Company.

Consumer Energy Company. March 30, 2018. Notification of Intent to Close Two CCR Units. B.C. Cobb Generating Facility Bottom Ash Pond and Ponds 0-8 Closure Plan, Muskegon, Michigan. Prepared for Consumers Energy Company.

Consumer Energy Company, March 15, 2019a. Response Action Plan B.C. Cobb Generating Facility Bottom Ash Pond and Ponds 0-8 Closure Plan, Muskegon, Michigan.

Consumer Energy Company. January 15, 2019b. Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g). B.C. Cobb Generating Facility Bottom Ash Pond and Ponds 0-8, Muskegon, Michigan. Prepared for Consumers Energy Company.

HDR, Inc. September 19, 2022. CCR Removal Report. Prepared for Muskegon Environmental Redevelopment Group, LLC.

TRC Environmental Corporation. September 11, 2019. Assessment of Corrective Measures, Consumers Energy, Former BC Cobb Power Plant, Bottom Ash Pond & Ponds 0-8, Muskegon, Michigan. Prepared for Consumers Energy Company.

TRC Environmental Corporation. January 2020. 2019 Annual Groundwater Monitoring and Corrective Action Report, Consumers Energy, Former BC Cobb Power Plant, Bottom Ash Pond & Ponds 0-8, Muskegon, Michigan. Prepared for Consumers Energy Company.

Appendix A

EGLE Hydrogeologic Monitoring Plan Checklist

2019

PART 115 RULES CHECKLIST
COAL ASH LANDFILL AND COAL ASH IMPOUNDMENTS
HYDROGEOLOGICAL MONITORING PLAN

Facility Name BC Cobb Date 8/14/2020 Initials

Report Name BC Cobb Hydrogeologic Monitoring Plan Report Date

ITEM	HMP Section where Item may be Reviewed
1. <u>Design and siting</u> ensure groundwater will not exceed: R306(1)	N/A – CCR Unit in Closure
MCLs in 40 CFR Part 257 and Appendix I. (Note: if the design and siting ensure GW will not exceed MCLs identified in appendix I, they will likely ensure that Michigan's cleanup criteria are not exceeded)	
Existing concentrations, where these already exceed 40 CFR Part 257 and Appendix I, unless groundwater has greater than 10,000 mg/L TDS.	
2. Design and siting ensure that requirements of Part 31 and its rules will be met. R306(2)	N/A – CCR Unit in Closure
3. Hydrogeologic monitoring plan for the coal ash landfill or coal ash impoundment includes the following components:	
A monitoring well system which complies with R906. R905(1)a	2.1
Leachate and SCS monitoring programs as specified in R432, <u>if required</u>. R905(1)b	N/A – Impoundments
Surface water monitoring program for surface waters that may receive runoff from the "active work area" (see R101(g)). R905(1)c	N/A
4. Contains the following specific information: R905(2)	
All GW sampling locations. R905(2)a	2.1
Sampling constituents/parameters and frequency. R905(2)b	3.2-3.3
Sampling and analysis procedures for each parameter including: R905(2)c	
Sample collection.	Appendix D
Sample preservation and shipment.	Appendix D
Analytical procedures, including detection limits.	3.5
Chain of custody control.	Appendix D
Laboratory and field quality assurance and quality control procedures.	3.6, Appendix D

ITEM	HMP Section where Item may be Reviewed
Procedures for prevention of cross contamination in wells during well installation, purging and sampling.	Appendix D
Statistical procedures for data evaluation in compliance with R908.	Appendix E
5. Sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that represent the quality of: R906(1)	2.1
Background water quality not affected by leakage from a unit. R906(1)a	2.1.1
Meets conditions for use of wells other than true upgradient. R906(1)(a)i or ii	2.1.1
Downgradient groundwater and ensures detection of groundwater contamination in the uppermost aquifer, and other groundwater specified by the Director. R906(1)b	2.1.2
Meets conditions for downgradient monitor well installation at locations other than the solid waste boundary.	2.1.2
Wells installed at the closest practicable distance from the solid waste boundary.	2.1.2
6. Meets conditions for a multi-unit groundwater monitoring system instead of separate monitoring systems for each landfill unit when the facility has several discrete units. R906(2)	2.1
Monitoring wells not more than 150 meters from the solid waste boundary of each unit, located on land owned by the owner of the unit R906(2)a	2.1
Sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer. R906(2)b	2.1, 2.2
Is as protective of human health and environment as individual monitoring systems for each unit, based on the following: R906(2)b	
Number, spacing and orientation of the units.	1.0
Hydrogeologic setting.	1.4
Site history.	1.1
Engineering design of the units.	2.2
Type of waste accepted at the units.	1.1

ITEM	HMP Section where Item may be Reviewed
7. Monitoring wells cased in a manner that maintains the integrity of the well borehole. R 906(3)	2.2
8. Well casings screened or perforated and packed with gravel or sand, where necessary, to enable the collection of groundwater samples. R906(3)	2.2
9. Annular space in each monitoring well sealed to prevent contamination of the samples and groundwater. R906(3)	2.2
10. Notified the Director that the design, installation, development, and decommission of any monitoring wells, piezometers, and other measurement, sampling, and analytical devises documentation have been placed in the operating record. R906(4)	Will be done as part of 6.0 Reporting
11. All monitoring wells, piezometers, and other measurement, sampling, and analytical devices designed, operated and maintained to perform to design specifications throughout the life of the monitoring program. R906(5)	2.2
12. Monitoring wells designed to minimize the time necessary to recharge well, given hydraulic conductivity of the aquifer. R906(6)	2.2
13. Number, spacing, and depths of monitoring systems in compliance with the following conditions: R906(7)	
Site-specific technical information that includes thorough characterization of both of the following: R906(7)(a)	
The uppermost aquifer, including all of the following information: R906(7)(a)i	1.4, 2.0
Aquifer thickness.	
Groundwater flow rate.	
Groundwater flow direction including seasonal and temporal fluctuations in groundwater flow.	
Saturated and unsaturated geologic units and fill materials overlying the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer, including all of the following: R906(7)(a)ii	1.4, 2.0
Thickness.	
Stratigraphy.	
Lithology.	
Hydraulic conductivities.	

ITEM	HMP Section where Item may be Reviewed
Porosities.	
Effective Porosities.	
Certified by a Geologist. R906(7)b	v
Approved by the Director. Within 14 days of this approval, the owner or operator shall notify the Director that the certification and approval have been placed in the operating record. R906(7)c	
14. All wells clearly labeled, properly vented, capped, and locked when not in use. R906(8)	2.2
15. All wells visible throughout the year. R906(8)	2.2
16. Owner or operator to notify the Director or designee prior to undertaking well abandonment, plugging, replacement, or repair. R906(9)	5.0
17. Groundwater monitoring program includes sampling and analysis procedures designed to ensure monitoring results that provide an accurate representation of groundwater quality at the background and downgradient wells installed in compliance with R906. R907(1)	3.0
18. Owner or operator has notified Director that sampling and analysis program documentation has been placed in the operating record. R907(1)	5.0
19. The sampling and analysis program shall include all of the following:	
Sample collection. R907(1)a	Appendix D
Sample preservation and shipment. R907(1)b	Appendix D
Analytical procedures. R907(1)c	3.5
Chain of custody control. R907(1)d	Appendix D
Quality assurance and quality control. R907(1)e	Appendix D
20. Sampling and analysis programs include sampling and analytical methods appropriate for groundwater sampling and accurately measure hazardous constituents and other monitoring parameters in groundwater samples. R907(2)	Appendix D
21. Groundwater samples shall not be field filtered. 324.11511a(3)e	Appendix D
22. Sampling procedures and frequency are protective of human health and the environment. R907(3)	Appendix D
23. Analytical methods and practical quantitation limits for groundwater monitoring are approved by the Director. R907(4)	

ITEM			HMP Section where Item may be Reviewed
24.	Groundwater elevations measured immediately prior to purging each time groundwater is sampled.	R907(5)	Appendix D
25.	Owner or operator to determine rate and direction of groundwater flow each time groundwater is sampled.	R907(5)	5.0
26.	Facility to measure groundwater elevations within a period of time short enough to avoid temporal variations in groundwater flow which could preclude accurate determination of groundwater flow rate and direction.	R907(5)	1.4
27.	Groundwater elevations measured by methods giving precision to 1/8 inch or 0.01 foot, measured from the top of the well reference point using a determined USGS datum point.	R907(6)	Appendix D
28.	Facility has established background water quality in a hydraulically upgradient or background well or wells for each of the monitoring parameters or constituents required in groundwater monitoring program. (Background groundwater quality may be established at wells not located hydraulically upgradient from the unit if the well meets R906(1)(a)).	R907(7)	2.1
29.	Number of samples to establish groundwater quality data consistent with statistical procedures determined per R908. The sampling procedures are those specified pursuant to the provisions of the following:	R907(8)	
	For detection monitoring	R440	3.1.2, 3.2.2
	For assessment monitoring	R441	3.1.3, 3.2.3
	For remedial action	R444	3.1.3, 3.2.3
30.	All samples obtained shall be representative of the site's groundwater quality.	R907(9)	Appendix A
	Each well will be purged until dry or until not less than 3 times the amount of water in the well casing has been removed.		Appendix D
	Monitoring wells will be sampled immediately after purging where recovery rates allow.		Appendix D
	If well pumped dry during purging, samples will be taken within 24 hours.		Appendix D
31.	If nondedicated pumps or mobile sampling equipment is used, facility will use the following procedures to minimize the potential for cross-contamination:	R907(10)	Appendix D
	Sample wells from upgradient to downgradient, except areas of known contamination will be sampled from least contaminated to most contaminated well.	R907(10)a	Appendix D

ITEM		HMP Section where Item may be Reviewed
	Each piece of equipment will be thoroughly cleaned and rinsed with distilled water before use in each well. R907(10)b	Appendix D
	Other decontamination procedures approved by the Department. R907(10)c	AppendixD
32	The owner and operator shall submit all monitoring results to the director or designee not later than 30 days after the end of the calendar quarter. R907(11)	5.0 – Annual reporting since semi-annual monitoring
33.	The owner and operator of a landfill will sample and analyze groundwater by methods specified in “Standard Methods for the Examination of Water and Wastewater…. Or other methods approved by the director or his or her designee. (we would accept SW-846 methods). 324.11511a(4)	3.5.2
34.	Detection monitoring parameter list includes: 324.11511a(3)(c)	3.5.1
	Boron 324.11511a(3)(c)i	
	Calcium 324.11511a(3)(c)ii	
	Chloride 324.11511a(3)(c)iii	
	Fluoride 324.11511a(3)(c)iv	
	Iron 324.11511a(3)(c)v	
	pH 324.11511a(3)(c)vi	
	Sulfate 324.11511a(3)(c)vii	
	Total Dissolved Solids 324.11511a(3)(c)viii	
35.	Contains a statistics plan or statistical procedures that meets the requirements of Rule 908. (Use Part 115 Rules Checklist – Landfill Groundwater Monitoring Statistical Procedures). R908	4.0
36.	Detection monitoring is conducted quarterly during the active life and semiannually during the post-closure period, except as provided for in R440(5). R440(1)(a)	3.1.2
37.	Meets conditions for deletion of R452 to R454 parameters.	

ITEM		HMP Section where Item may be Reviewed
	Parameters and breakdown products are not in leachate for not less than 2 consecutive and historic samplings. R440(4)	N/A
38.	Meets conditions for alternative monitoring frequency for R450-451 parameters (at least semiannually) or for R452-454 parameters (at least annually) based on following factors: R440(5)	N/A
	Lithology of aquifer and unsaturated zone. R440(5)a	
	Hydraulic conductivity of aquifer and unsaturated zone. R440(5)b	
	Groundwater flow rates. R440(5)c	
	Minimum distance from the waste and the closest downgradient well screen, or presence of SCS. R440(5)d	
	Resource value of aquifer. R440(5)e	
39.	First sampling event includes 4 independent samples from each well. Subsequent events include minimum of 1 sample from each well. R440(7)	3.1-3.2
40.	In case of statistically significant increase over background:	
	Place notice in operating record within 14 days. R440(8)a	3.2.3
	Prepare assessment monitoring plan per R441 and a response action plan within 45 days. R440(8)b	3.2.3
41.	If statistically significant increase over background due to other source or is due to an error, has owner:	3.1-3.2
	Documented a demonstration of this and placed notice in operating record within 30 days. R440(9)	
	If a successful demonstration is made,	
	Continue detection monitoring. R440(9)(a)	
	Determined if the unit remains monitorable R440(9)(b)	
	If a successful demonstration is not made, then 15 days after notification by the director, prepare an assessment monitoring plan and a response action plan. R440(10)	

ITEM		HMP Section where Item may be Reviewed
42.	Text in the HMP indicates an assessment monitoring program will be developed if required under R441 or the Assessment Monitoring Program is included with the HMP. (use the assessment monitoring program checklist if the program is provided) or the Assessment Monitoring program has already been approved and is referenced in the HMP. R441 Or a schedule, approved by the department, that leads to compliance by no later than December 28, 2020 has been provided. 324.11511a(3)(f)ii	3.2
43.	Text in the HMP indicates a response action plan will be developed if required under R442 or the Response Action Plan is included. (use the response action plan checklist if a plan is provided) or the Response Action Plan has already been approved and is referenced in the HMP. R442 Or a schedule, approved by the department, that leads to compliance by no later than December 28, 2020 has been provided. 324.11511a(3)(f)ii	3.1.3, 6.0
44.	Text in the HMP indicates that corrective measures will be assessed if required under R443 or the assessment of corrective measures is included in the HMP or the assessment of corrective measures has already been approved and is referenced in the HMP. R443 Or a schedule, approved by the department, that leads to compliance by no later than December 28, 2020 has been provided. 324.11511a(3)(f)ii	3.2.3, 7.0
45.	Text in the HMP indicates that a remedy will be selected, if required, in compliance with R444 or the remedy selection and remedial action plan is included with the HMP or the remedy selection and remedial action plan has already been approved and is referenced in the HMP. R444 Or a schedule, approved by the department, that leads to compliance by no later than December 28, 2020 has been provided. 324.11511a(3)(f)ii	8.0
46.	Text in the HMP indicates that a remedial action plan will be implemented, if required, in compliance with R445 or the remedial action plan implementation details are included with the HMP or the remedial action plan has already been implemented and is referenced in the HMP. R445 Or a schedule, approved by the department, that leads to compliance by no later than December 28, 2020 has been provided. 324.11511a(3)(f)ii	8.0
COMMENTS:		

ITEM	HMP Section where Item may be Reviewed

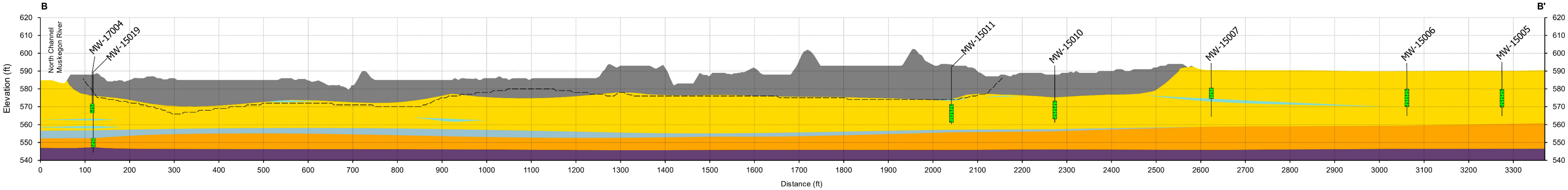
Appendix B

Cross Sections through the Ponds

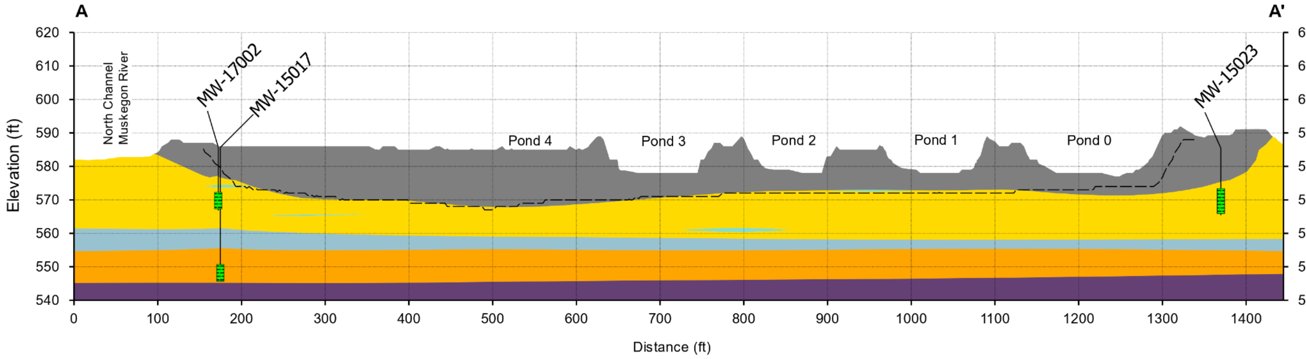
BC COBB POWER PLANT
MUSKEGON COUNTY, MICHIGAN

PATH: J:\2020\20-038_CHARAH_BC_COBB_ASH POND_(SYROCKI)\7.2_WORK_IN_PROGRESS\MAP_DOCS\DRAFT\CHARAH_BC_COBB_MW_CROSSSECTIONS.MXD - USER: AKAPLE - DATE: 12/8/2020

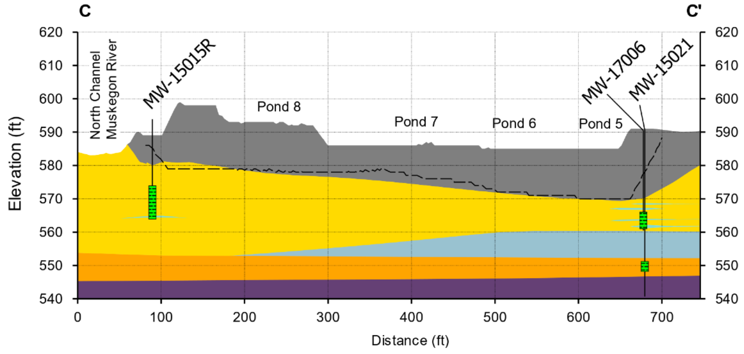
Profile B-B'



Profile A-A'



Profile C-C'



- ▇ Coal Combustion Residuals (CCR)
- 🟨 Sand - Upper
- ▇ Peat, Organic Clay, Organic Silt - Interbeds
- ▇ Peat, Organic Clay, Organic Silt
- 🟧 Sand - Lower
- 🟪 Basal Clay
- ---- Closure Excavation Grade
- 🟩 Screen

Vertical exaggeration: 4x

0ft 250ft

Appendix C

Monitoring Well Boring Logs and Well Construction Logs

Date Start: 10/12/15
Date Finish: 10/12/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Hand Auger/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 3.8
Water Level Finish (ft. btoc.): 5.96

Northing: 645763.32
Easting: 12624262.15
Casing Elevation: 586.52

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 583.6

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15001**

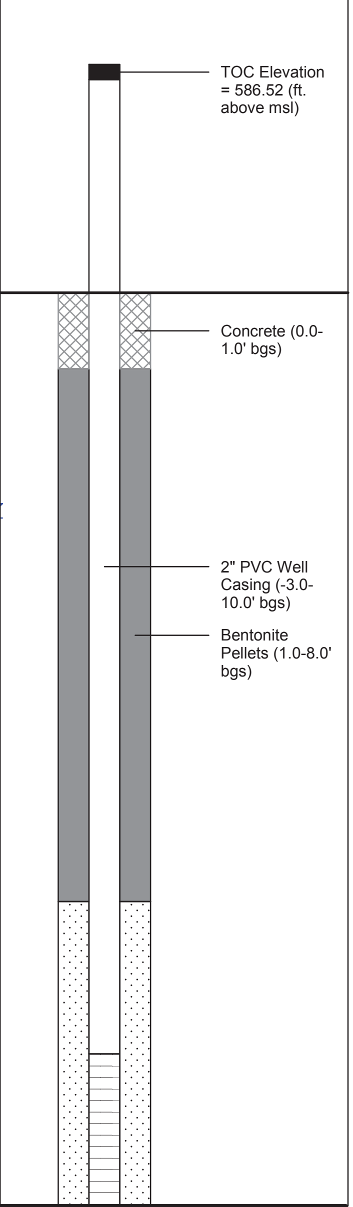
Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Cloudy, Windy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
	585								
0								(0.0 - 0.1') GRASS and TOPSOIL.	
								(0.1 - 1.0') SAND, fine to very fine, subround; little silt; well sorted; dry to moist; dark brown (10YR 3/3).	
								(1.0 - 3.8') ASH, some fine to very fine sand, subround; little silt; poorly sorted; moist to wet; dark grayish brown (10YR 4/2). NOTE: Fill material.	▼
	580	1	0.0-6.0'	6.0	NA			(3.8 - 4.0') SAND, fine, little very fine, subround; trace to little silt; well sorted; wet; grayish brown (10YR 5/2). NOTE: trace organic matter, trace ash.	
5								(4.0 - 7.0') CLAY, some silt, high plasticity, no dilatancy; trace very fine sand; subround; medium stiff to soft; moist; gray (10YR 5/1) to grayish brown (10YR 5/2). NOTE: very soft, gray (10Yr 5/1) to gray (10YR 6/1) from 6.0-7.0' bgs.	
								(7.0 - 7.5') CLAY, some silt, medium plasticity, slow dilatancy; trace very fine sand, subround; soft; moist to wet; very dark gray (10YR 3/1). NOTE: little to some organic matter.	
								(7.5 - 8.0') WOOD, dark gray (10YR 4/1).	
	575	2	6.0-10.0'	3.0	NA			(8.0 - 9.0') CLAY and SILT, low plasticity, slow dilatancy; little very fine to fine sand, subround; medium stiff; moist to wet; brown (10YR 4/3). NOTE: some organic matter, trace to little wood.	
								(9.0 - 9.1') SAND, very fine, subround; trace silt; well sorted; wet; light gray (10Yr 7/2).	
10								(9.1 - 9.6') CLAY and SILT, high plasticity, no dilatancy; little to some very fine sand, subround; medium stiff; moist; brown (10YR 4/3).	
								(9.6 - 20.0') SAND, fine to medium; trace to little very fine sand, subround; trace to little silt; well sorted; wet; light brownish gray (10YR 6/2).	

Well/Boring Construction



ARCADIS Design & Consultancy for natural and built assets

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

Hand Auger to 6.0' bgs.
Groundwater encountered at 3.8' bgs during drilling.
Water level at development was 5.96' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.84 feet

Date Start: 10/12/15
Date Finish: 10/12/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Hand Auger/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 3.8
Water Level Finish (ft. btoc.): 5.96

Northing: 645763.32
Easting: 12624262.15
Casing Elevation: 586.52

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 583.6

Descriptions By: A. Westhuis

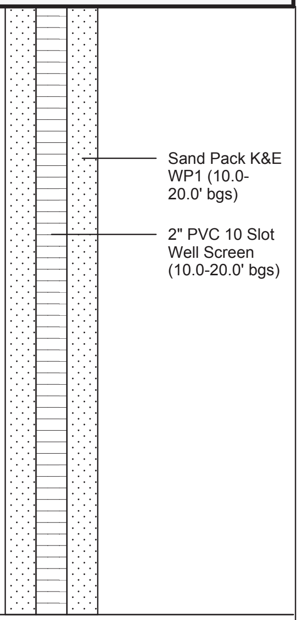
Well/Boring ID: **BCC MW-15001**

Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Cloudy, Windy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	570									
15		3	10.0-20.0'	9.0	NA					
	565							NOTE: organic matter, roots, from 18.8 to 18.9' bgs.		
20								End of boring 20.0' bgs.		
	560									
25										



ARCADIS Design & Consultancy for natural and built assets

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

Hand Auger to 6.0' bgs.
Groundwater encountered at 3.8' bgs during drilling.
Water level at development was 5.96' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.84 feet

Date Start: 10/12/15
Date Finish: 10/12/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 5.0
Water Level Finish (ft. btoc.): 6.45

Northing: 645701.73
Easting: 12624512.86
Casing Elevation: 586.87

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 583.8

Descriptions By: A. Westhuis

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

Client: Consumers Energy

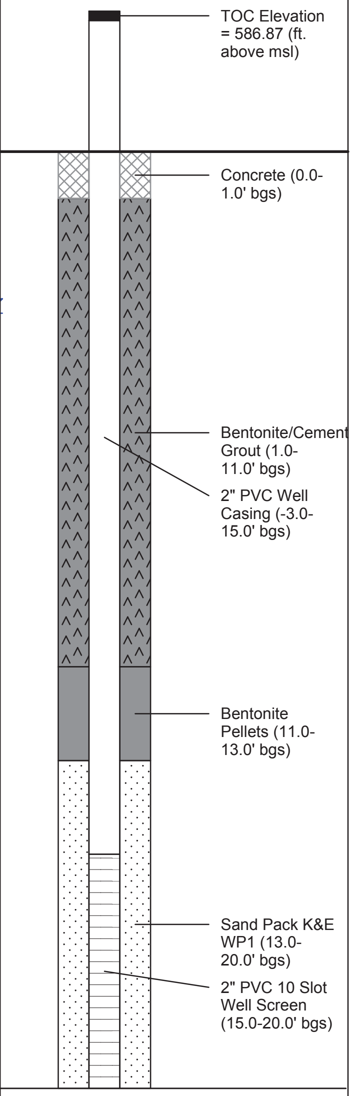
Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Cloudy, Windy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
0	583.8							(0.0 - 0.1') GRASS and TOPSOIL.	
0.1		1	0.0-8.0'	4.0	NA			(0.1 - 12.0') SAND, fine to medium; trace to little very fine sand, subround; well sorted; moist to wet; dark brown (10YR 3/3).	▼
5								NOTE: Wet at 5.0' bgs.	
8		2	8.0-10.0'	1.0	NA				
10		3	10.0-20.0'	7.0	NA				
12								(12.0 - 13.0') SAND, fine to medium, subround; trace silt; well sorted; wet; brown (10YR 5/3).	
13								(13.0 - 13.5') CLAY and SILT, medium plasticity, no dilatancy; little to some very fine to fine sand, subround; medium stiff; moist; brown (10YR 4/3).	
13.5								(13.5 - 20.0') SAND, fine to medium; trace to little very fine sand, subround; trace silt; well sorted; wet; light brownish gray (10YR 6/2).	
20								End of boring 20.0' bgs.	

Elevation scale: 585, 580, 575, 570, 565. Depth scale: 0, 5, 10, 15, 20.

Well/Boring Construction



ARCADIS Design & Consultancy for natural and built assets

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

Air Knife to 8.0' bgs.
Groundwater encountered at 5.0' bgs during drilling.
Water level at development was 6.45' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.86 feet

Date Start: 10/12/15
Date Finish: 10/12/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 11.0
Water Level Finish (ft. btoc.): 6.77

Northing: 645555.93
Easting: 12624726.22
Casing Elevation: 587.12

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 584.1

Descriptions By: A. Westhuis

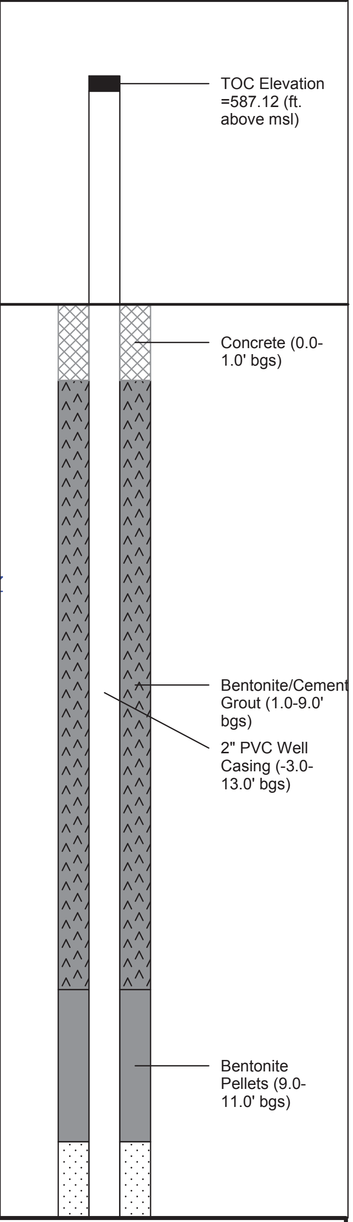
Well/Boring ID: **BCC MW-15003**

Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Cloudy, Windy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	585									
0								(0.0 - 0.1') GRASS and TOPSOIL.		
								(0.1 - 10.0') SAND, fine to medium; trace to little very fine sand, subround; well sorted; moist to wet; dark brown (10YR 3/3).	▼	
	580	1	0.0-8.0'	3.5	NA					
5										
	575	2	8.0-10.0'	1.0	NA					
10								(10.0 - 11.0') CLAY and SILT, medium plasticity, no dilatancy; little to some very fine to fine sand, subround; medium stiff; moist; brown (10YR 4/3). NOTE: little to some organic matter; roots, wood.		
								(11.0 - 18.0') SAND, fine to medium; trace to little very fine sand, subround; trace silt; well sorted; wet; light brownish gray (10YR 6/2).		



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

Air Knife to 8.0' bgs.
Groundwater encountered at 11.0' bgs during drilling.
Water level at development was 6.77' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.84 feet

Date Start: 10/12/15
Date Finish: 10/12/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 11.0
Water Level Finish (ft. btoc.): 6.77

Northing: 645555.93
Easting: 12624726.22
Casing Elevation: 587.12

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 584.1

Descriptions By: A. Westhuis

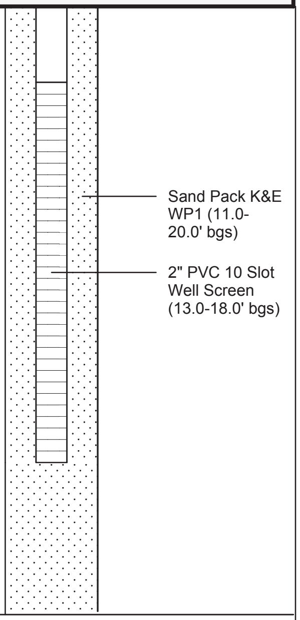
Well/Boring ID: **BCC MW-15003**

Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Cloudy, Windy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	570									
15		3	10.0-20.0'	9.0	NA					
								(18.0 - 20.0') SAND, very fine to fine, subround; little to trace silt; well sorted; wet; grayish brown (10YR 5/2) to gray (10YR 6/1). NOTE: Organic matter; roots, leaves, wood from 18.0 to 18.3' bgs and 19.0 to 19.1' bgs.		
	565									
20								End of boring 20.0' bgs.		
	560									
25										



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

Air Knife to 8.0' bgs.
Groundwater encountered at 11.0' bgs during drilling.
Water level at development was 6.77' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.84 feet

Date Start: 10/13/15
Date Finish: 10/13/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 7.0
Water Level Finish (ft. btoc.): 10.27

Northing: 645491.68
Easting: 12624824.48
Casing Elevation: 590.57

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 587.7

Descriptions By: A. Westhuis

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

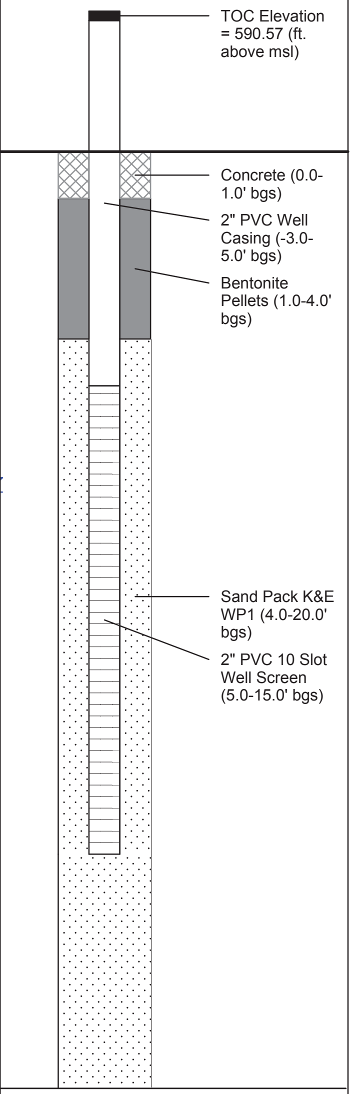
Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 50 F Cloudy, Windy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
	590								
0								(0.0 - 0.1') GRASS and TOPSOIL.	
5	585	1	0.0-8.0'	3.5	NA			(0.1 - 10.0') SAND, fine; little very fine sand, subround; trace granules, subround; trace silt; well sorted; dry to moist; light yellowish brown (10YR 6/4).	
	580							NOTE: Wet at 7.0' bgs.	▼
10	575							(10.0 - 14.0') SAND, fine; little medium, subround; trace to little silt; well sorted; wet; grayish brown (10YR 5/2).	
								NOTE: Trace organice material; wood at 13.5' bgs.	
15		2	8.0-20.0'	10.0	NA			(14.0 - 17.0') SAND, medium; little coarse sand, subround; trace granules, subround; little silt; well sorted; wet; grayish brown (10YR 5/2).	
								NOTE: Organic matter, wood; dark brown (10YR 3/3) from 16.5 to 17.0' bgs.	
	570							(17.0 - 20.0') SAND, very fine to fine, subround; little silt; well sorted; wet; grayish brown (10YR 5/2).	
20								End of boring 20.0' bgs.	

Well/Boring Construction



ARCADIS Design & Consultancy for natural and built assets

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

Air Knife to 8.0' bgs.
Groundwater encountered at 7.0' bgs during drilling.
Water level at development was 10.27' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.82 feet

Date Start: 10/13/15
Date Finish: 10/13/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 6.0
Water Level Finish (ft. btoc.): 7.61

Northing: 645166.74
Easting: 12624783.15
Casing Elevation: 587.77

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 584.8

Descriptions By: A. Westhuis

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

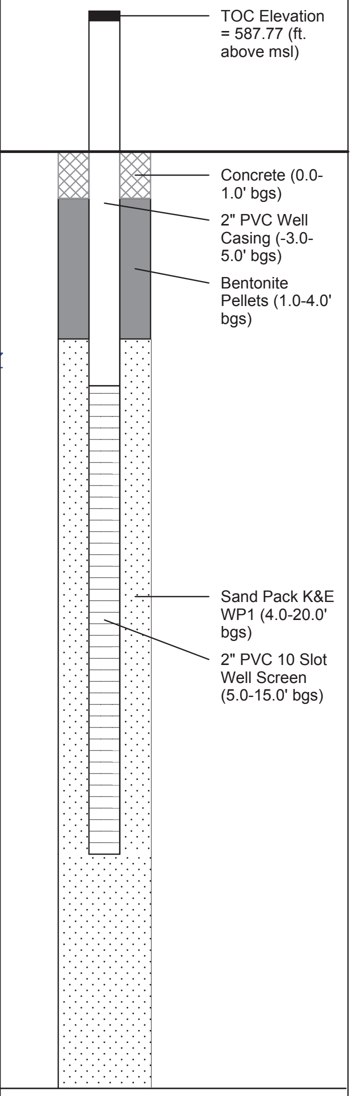
Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 50 F Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
0	585							(0.0 - 0.1') GRASS and TOPSOIL.	
		1	0.0-6.0'	6.0	NA			(0.1 - 10.0') SAND, fine; little very fine sand, subround; trace granules, subround; little to trace silt; well sorted; moist to wet; pale brown (10YR 6/3).	
5	580								▼
		2	6.0-10.0'	4.0	NA			NOTE: Wet at 6.0' bgs.	
10	575							(10.0 - 10.5') SAND, fine, subround; little silt; well sorted; wet; very dark gray (10YR 3/1). NOTE: trace organic matter, large wood fragments.	
		3	10.0-20.0'	8.0	NA			(10.5 - 20.0') SAND, fine to medium; trace coarse sand, subround; little to trace silt; well sorted; wet; grayish brown (10YR 5/2).	
15	570								
20	565							End of boring 20.0' bgs.	

Well/Boring Construction



ARCADIS Design & Consultancy for natural and built assets

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

Air Knife to 6.0' bgs.
Groundwater encountered at 6.0' bgs during drilling.
Water level at development was 7.61' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.54 feet

Date Start: 10/13/15
Date Finish: 10/13/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 5.0
Water Level Finish (ft. btoc.): 7.45

Northing: 645291.65
Easting: 12624610.52
Casing Elevation: 587.81

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 584.9

Descriptions By: A. Westhuis

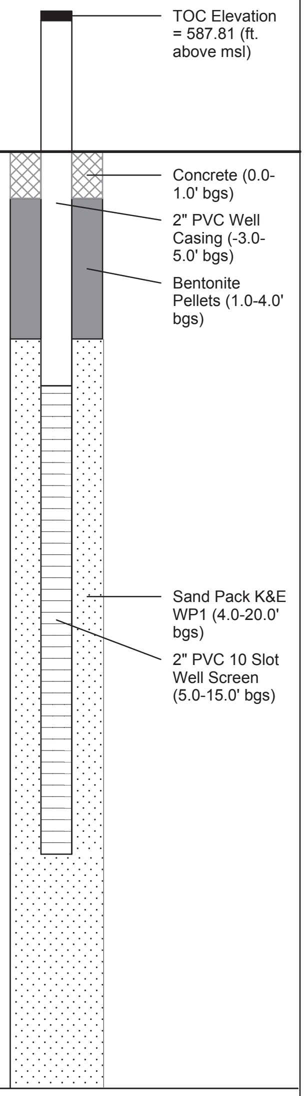
Well/Boring ID: **BCC MW-15006**

Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 50 F Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
0	585							(0.0 - 0.1') LANDSCAPING STONE. (0.1 - 9.0') SAND, fine, subround; trace granules, subround; trace silt; well sorted; moist to wet; light yellowish brown (10YR 6/4).		
5	580	1	0.0-10.0'	4.0	NA			NOTE: Wet at 5.0' bgs.	▼	
10	575							(9.0 - 20.0') SAND, fine to medium, subround; trace granules, subround; well sorted; wet; light brownish gray (10YR 6/2).		
15	570	2	10.0-20.0'	8.0	NA					
20	565							End of boring 20.0' bgs.		



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

Air Knife to 6.0' bgs.
Groundwater encountered at 5.0' bgs during drilling.
Water level at development was 7.45' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 581.14 feet

Date Start: 10/14/15
Date Finish: 10/14/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 5.0
Water Level Finish (ft. btoc.): 6.78

Northing: 645409.39
Easting: 12624188.85
Casing Elevation: 587.43

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 584.5

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15007**

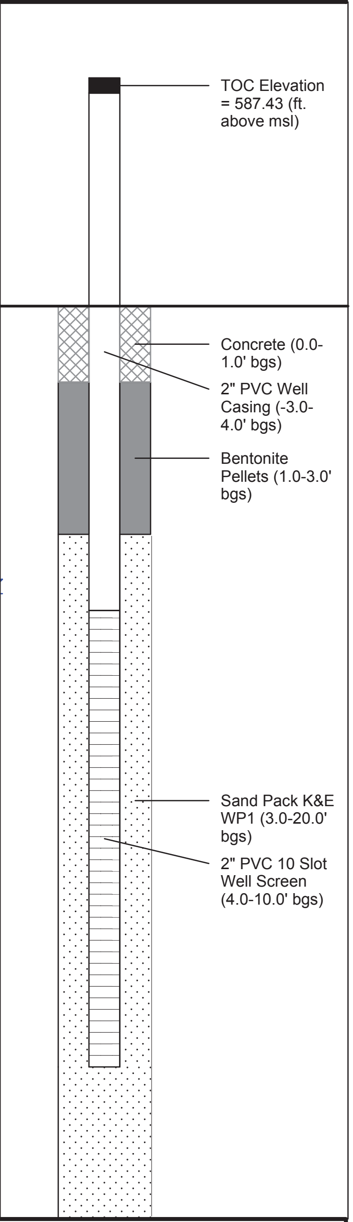
Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 50 F Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
	585								
0								(0.0 - 0.1') GRASS and TOPSOIL.	
								(0.1 - 10.0') SAND, very fine to fine, subround; trace granules to samll pebble, subround; little to trace silt; well sorted; moist to wet; brown (10YR 5/3).	
									▼
	580								
5		1	0.0- 10.0'	2.0	NA			NOTE: Wet at 5.0' bgs.	
	575								
10								(10.0 - 10.5') CLAY and SILT, medium to high plasticity, no dilatancy; trace very fine sand, subround; soft to very soft; dark brown (10YR 3/3). NOTE: little organic matter; roots.	
								(10.5 - 11.2') SAND, very fine, subround; trace granules, subround; little silt; poorly sorted; wet; grayish brown (10YR 5/2). NOTE: trace to little organic matter; roots and wood (dark brown (10YR 3/3).	
								(11.2 - 11.7') CLAY and SILT, high plasticity, no dilatancy; soft; dark brown (10YR 3/3).	

Well/Boring Construction



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

Air Knife to 9.0' bgs.
Groundwater encountered at 5.0' bgs during drilling.
Water level at development was 6.78' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 581.13 feet

Date Start: 10/14/15
Date Finish: 10/14/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 5.0
Water Level Finish (ft. btoc.): 6.78

Northing: 645409.39
Easting: 12624188.85
Casing Elevation: 587.43

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 584.5

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15007**

Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 50 F Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
								(11.7 - 12.5') SAND, very fine to fine, subround; little silt; poorly sorted; wet; pale brown (10YR 6/3). NOTE: Organic rich matter roots and wood; dark brown (10YR 3/3) from 12.0 to 12.5' bgs.		
								(12.5 - 20.0') SAND, fine to medium; little very fine sand, subround; trace silt; well sorted; wet; light brownish gray (10YR 6/2).		
	570									
15		2	10.0- 20.0'	8.0	NA					
	565							NOTE: Organic matter wood; dark brown (10YR 3/3) from 19.5 to 20.0' bgs.		
20								End of boring 20.0' bgs.		
	560									
25										

ARCADIS Design & Consultancy for natural and built assets

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

Air Knife to 9.0' bgs.
Groundwater encountered at 5.0' bgs during drilling.
Water level at development was 6.78' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 581.13 feet

Date Start: 10/14/15
Date Finish: 10/14/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 4.5
Water Level Finish (ft. btoc.): 7.11

Northing: 645340.01
Easting: 12623510.47
Casing Elevation: 587.76

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 584.8

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15008**

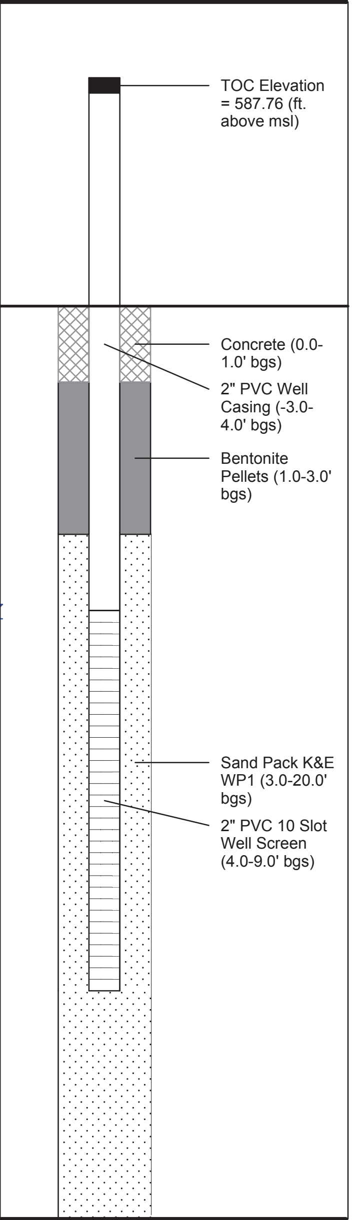
Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
	585								
0								(0.0 - 0.1') LANDSCAPING STONE.	
								(0.1 - 9.5') SAND, fine to very fine, subround; trace granules to small pebble, subround; little silt; well sorted; moist to wet; brown (10YR 5/3).	
								NOTE: Wet at 4.5' bgs.	▼
5	580	1	0.0-10.0'	3.0	NA				
	575							(9.5 - 12.0') SAND, fine, little medium sand, subround; little to trace silt; well sorted; wet; grayish brown (10YR 5/2).	
10									

Well/Boring Construction



ARCADIS Design & Consultancy for natural and built assets

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

Air Knife to 8.0' bgs.
Groundwater encountered at 4.5' bgs during drilling.
Water level at development was 7.11' btoc.
No staining observed.
Groundwater elevation measured on November 30, 2015 was 580.99 feet

Date Start: 10/14/15
Date Finish: 10/14/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 4.5
Water Level Finish (ft. btoc.): 7.11

Northing: 645340.01
Easting: 12623510.47
Casing Elevation: 587.76

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 584.8

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15008**

Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
								(12.0 - 13.0') SAND, fine, little medium sand, subround; little to some silt; poorly sorted; wet; dark grayish brown (10YR 4/2). NOTE: wood fragments; very dark gray (10YR 3/1), slight odor at 12.0' bgs.		
								(13.0 - 13.5') CLAY and SILT, low plasticity, no dilatancy; little to trace very fine to fine sand, subround; soft; dark brown (10YR 3/3). NOTE: little organic matter, roots.		
								(13.5 - 15.5') SAND, fine, subround; some silt; poorly sorted; wet; brown (10YR 4/3). NOTE: trace organics.		
15	570	2	10.0-20.0'	9.0	NA					
								(15.5 - 20.0') SAND, fine to medium; trace silt; well sorted; wet; grayish brown (10YR 5/2).		
20	565							End of boring 20.0' bgs.		
25	560									

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

Air Knife to 8.0' bgs.
Groundwater encountered at 4.5' bgs during drilling.
Water level at development was 7.11' btoc.
No staining observed.
Groundwater elevation measured on November 30, 2015 was 580.99 feet

Date Start: 10/14/15
Date Finish: 10/14/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 0.5
Water Level Finish (ft. btoc.): 7.51

Northing: 645606.92
Easting: 12623622.98
Casing Elevation: 589.27

Borehole Depth (ft. bgs.): 24.0
Surface Elevation: 586.3

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15009**

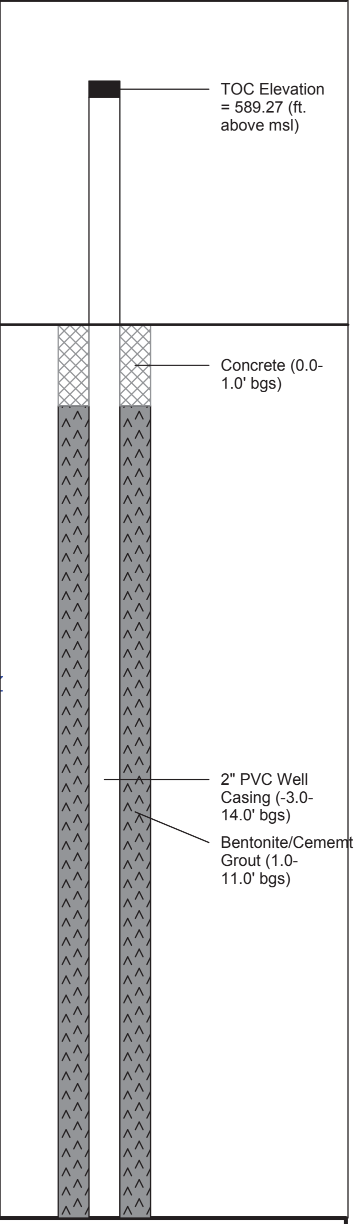
Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
	590								
0	585 580	1	0.0-8.0'	0.0	NA			(0.0 - 8.0') NO RECOVERY, soils not logged, air knife soil cuttings disposed in CE approved area. NOTE: Wet at 4.5' bgs.	▼
5		2	8.0-10.0'	2.0	NA		☒	(8.0 - 10.0') ASH, rapid dilatancy; wet; soft; very dark gray (10YR 3/1). NOTE: Fill material. Little to trace organic matter; roots and wood fragments.	
10							▦	(10.0 - 12.0') CLAY and SILT, low plasticity, no dilatancy; some to little very fine to fine sand, subround; soft; dark brown (10YR 3/3).	

Well/Boring Construction



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

Air Knife to 8.0' bgs.
Groundwater encountered at 0.5' bgs during drilling.
Water level at deveopment was 7.51' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 581.88 feet

Date Start: 10/14/15
Date Finish: 10/14/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 0.5
Water Level Finish (ft. btoc.): 7.51

Northing: 645606.92
Easting: 12623622.98
Casing Elevation: 589.27

Borehole Depth (ft. bgs.): 24.0
Surface Elevation: 586.3

Descriptions By: A. Westhuis

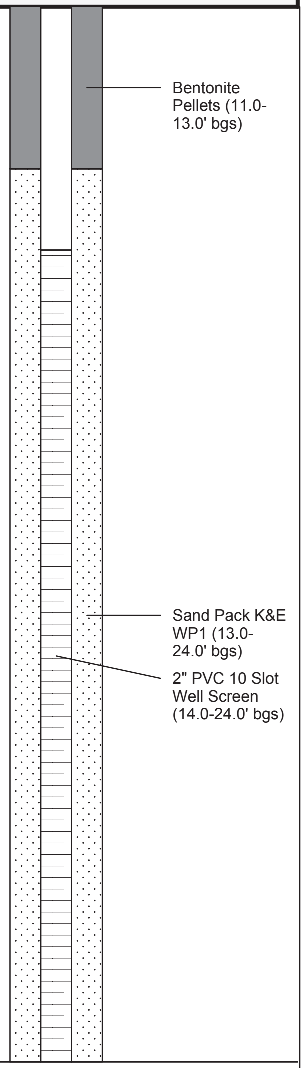
Well/Boring ID: **BCC MW-15009**

Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	575									
		3	10.0-15.0'	4.0	NA			(12.0 - 17.2') SAND, fine, subround; litle silt; well sorted; wet; brown (10YR 4/3). NOTE: Some clay, low plasticity, no dilatancy; soft; dark brown (10YR 3/3).		
15										
	570									
								NOTE: Some organic rich matter, roots and wood; wet; very dark brown (10YR 2/2) from 17.0 to 17.2' bgs.		
		4	15.0-20.0'	5.0	NA			(17.2 - 24.0') CLAY and SILT, low plasticity, no dilatancy; little to trace very fine to fine sand, subround; soft; dark brown (10YR 3/3). NOTE: little organic matter, roots.		
20										
	565									
		5	20.0-24.0'	4.0	NA					
								End of boring 24.0' bgs.		
25										



ARCADIS Design & Consultancy for natural and built assets

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

Air Knife to 8.0' bgs.
Groundwater encountered at 0.5' bgs during drilling.
Water level at deveopment was 7.51' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 581.88 feet

Date Start: 10/14/15
Date Finish: 10/15/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 0.3
Water Level Finish (ft. btoc.): 6.93

Northing: 645690.69
Easting: 12623979.47
Casing Elevation: 588.11

Borehole Depth (ft. bgs.): 24.0
Surface Elevation: 585.2

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15010**

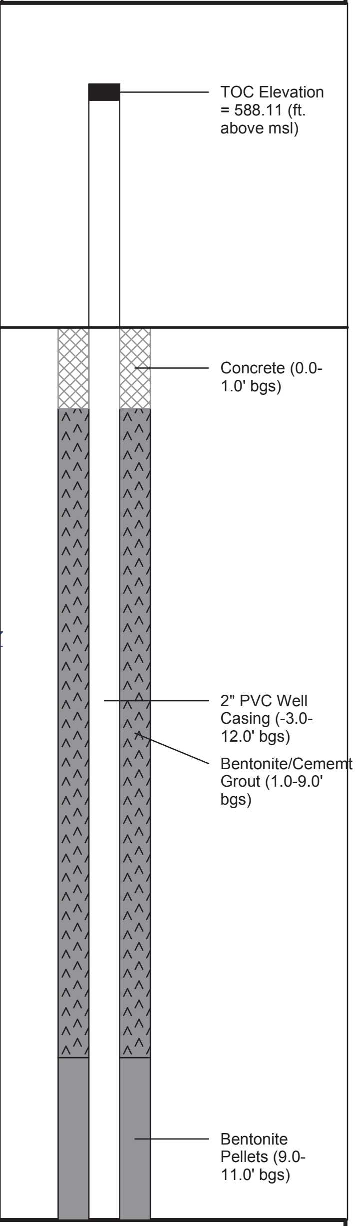
Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
0	585							(0.0 - 0.3') STONE, parking lot aggregate.	
								(0.3 - 10.0') ASH, some fine sand, subround; little granules to small pebble subround; wet; soft; very dark gray (10YR 3/1). NOTE: Fill material.	
5	580	1	0.0- 10.0'	3.0	NA				
10	575							(10.0 - 24.0') SAND, very fine to fine; trace to little medium sand, subround; trace silt; well sorted; wet; grayish brown (10YR 5/2).	

Well/Boring Construction



Design & Consultancy for natural and built assets

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

Air Knife to 8.0' bgs.
Groundwater encountered at 0.3' bgs during drilling.
Water level at development was 6.93' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 581.42 feet

Date Start: 10/14/15
Date Finish: 10/15/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 0.3
Water Level Finish (ft. btoc.): 6.93

Northing: 645690.69
Easting: 12623979.47
Casing Elevation: 588.11

Borehole Depth (ft. bgs.): 24.0
Surface Elevation: 585.2

Descriptions By: A. Westhuis

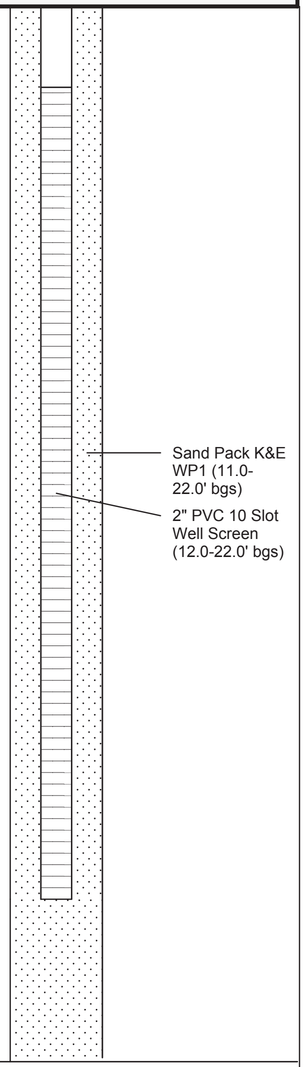
Well/Boring ID: **BCC MW-15010**

Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
15	570	2	10.0-20.0'	8.0	NA					
								NOTE: Little silt and organic matter near 17.0' bgs.		
20	565									
		3	20.0-24.0'	4.0	NA					
								End of boring 24.0' bgs.		
25	560									



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

Air Knife to 8.0' bgs.
Groundwater encountered at 0.3' bgs during drilling.
Water level at development was 6.93' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 581.42 feet

Date Start: 10/15/15
Date Finish: 10/15/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 6.5
Water Level Finish (ft. btoc.): 13.03

Northing: 64578029
Easting: 12623765.87
Casing Elevation: 595.22

Borehole Depth (ft. bgs.): 32.0
Surface Elevation: 592.3

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15011**

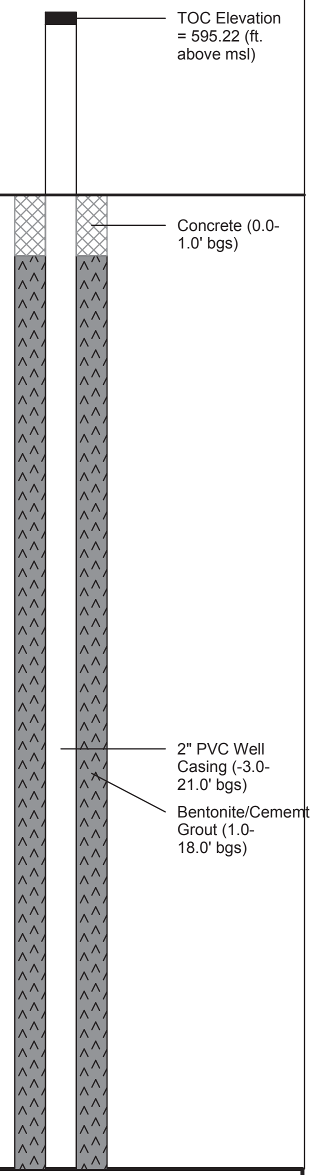
Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
	595								
0								(0.0 - 0.1') GRASS, ROOTS and ASH.	
								(0.1 - 18.0') ASH, non-plastic, rapid dilatancy, little fine sand, subround; poorly sorted; soft; wet; gray (10YR 5/1) to dark gray (10YR 4/1). NOTE: Fill material.	
	590								
5		1	0.0-10.0'	3.0	NA				
								NOTE: Wet at 6.5' bgs.	
	585								
10									▼
	580								
								NOTE: Laminated from 13.5 to 15.0' bgs.	
15		2	10.0-20.0'	9.0	NA				

Well/Boring Construction



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

Air Knife to 9.0' bgs.
Groundwater encountered at 6.5' bgs during drilling.
Water level at development was 13.03' btoc.
No staining observed.
Groundwater elevation measured on November 30, 2015 was 582.13 feet

Date Start: 10/15/15
Date Finish: 10/15/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 6.5
Water Level Finish (ft. btoc.): 13.03

Northing: 64578029
Easting: 12623765.87
Casing Elevation: 595.22

Borehole Depth (ft. bgs.): 32.0
Surface Elevation: 592.3

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15011**

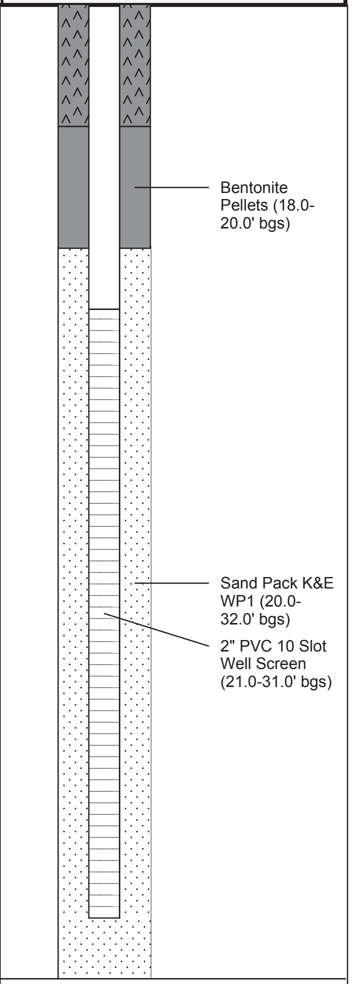
Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
	575								
								(18.0 - 19.0') CLAY and SILT, medium to high plasticity, no dilatancy; medium stiff to soft; moist; dark brown (10YR 3/3). NOTE: organic rich, some wood and roots; slight odor.	
								(19.0 - 26.0') SAND, fine, subround; some to little silt; well sorted; wet; light brownish gray (10YR 6/2).	
20									
	570								
25									
		3	20.0-32.0'	9.0	NA			(26.0 - 27.0') SAND, fine, little medium sand, subround; little silt; poorly sorted; wet; dark grayish brown (10YR 4/2). NOTE: organic rich, some roots and wood.	
	565							(27.0 - 32.0') SAND, fine, little very fine sand, subround; trace silt; well sorted; wet; light brownish gray (10YR 6/2).	
30									
	560							End of boring 32.0' bgs.	
35									

Well/Boring Construction



ARCADIS Design & Consultancy for natural and built assets

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

Air Knife to 9.0' bgs.
Groundwater encountered at 6.5' bgs during drilling.
Water level at development was 13.03' btoc.
No staining observed.
Groundwater elevation measured on November 30, 2015 was 582.13 feet

Date Start: 10/15/15
Date Finish: 10/15/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 8.0
Water Level Finish (ft. btoc.): 13.79

Northing: 645889.92
Easting: 12623545.99
Casing Elevation: 597.39

Borehole Depth (ft. bgs.): 35.0
Surface Elevation: 594.5

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15012**

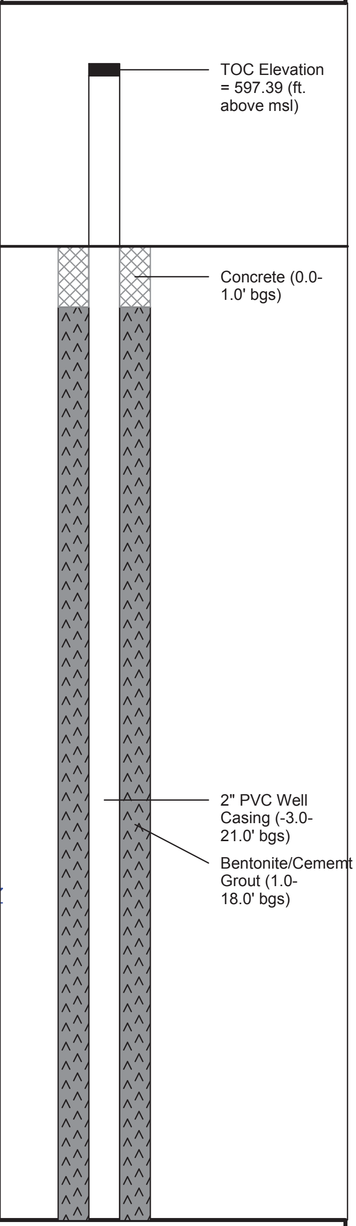
Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
	595								
0								(0.0 - 0.1') GRASS, ROOTS and ASH.	
								(0.1 - 9.0') SAND, fine, subround, and ASH; little silt; poorly sorted; wet; soft; dark grayish brown (10YR 4/2).	
	590								
5		1	0.0-10.0'	3.0	NA				
								NOTE: Wet at 8.0' bgs.	
	585							(9.0 - 18.0') ASH, little fine sand, subround; non-plastic, rapid dilatancy; poorly sorted; wet; soft; gray (10YR 5/1). NOTE: Fill material.	
10									
									▼
								NOTE: Laminated from 13.0-15.0' bgs.	
	580								
15		2	10.0-20.0'	9.0	NA				

Well/Boring Construction



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

Air Knife to 9.0' bgs.
Groundwater encountered at 8.0' bgs during drilling.
Water level at development was 13.79' btoc.
No staining observed.
Groundwater elevation measured on November 30, 2015 was 583.46 feet

Date Start: 10/15/15
Date Finish: 10/15/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 8.0
Water Level Finish (ft. btoc.): 13.79

Northing: 645889.92
Easting: 12623545.99
Casing Elevation: 597.39

Borehole Depth (ft. bgs.): 35.0
Surface Elevation: 594.5

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15012**

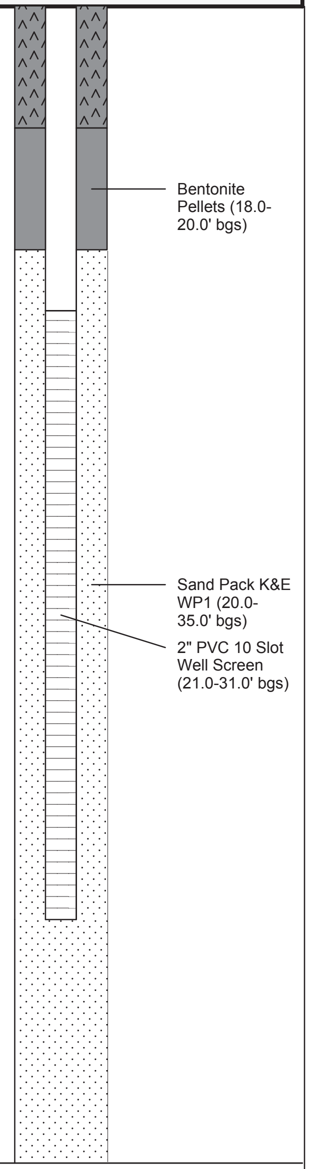
Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
20	575							(18.0 - 19.0') CLAY and SILT, medium plasticity, no dilatancy; moist; medium stiff to soft; dark brown (10YR 3/3). NOTE: organic rich; some wood and roots; slight odor. (19.0 - 30.0') SAND, fine, subround; little silt; well sorted; wet; light brownish gray (10YR 6/2). NOTE: trace organics; dark brown (10YR 3/3).	
25	570		20.0-25.0'	5.0	NA				
30	565	3	25.0-30.0	5.0	NA				
35	560		30.0-35.0	5.0	NA			(30.0 - 35.0') SAND, fine, subround; little silt; well sorted; wet; light brownish gray (10YR 6/2).	
								End of boring 35.0' bgs.	

Well/Boring Construction



ARCADIS Design & Consultancy for natural and built assets

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

Air Knife to 9.0' bgs.
Groundwater encountered at 8.0' bgs during drilling.
Water level at development was 13.79' btoc.
No staining observed.
Groundwater elevation measured on November 30, 2015 was 583.46 feet

Date Start: 10/15/15
Date Finish: 10/16/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 9.5
Water Level Finish (ft. btoc.): 16.38

Northing: 645716.41
Easting: 12623389.21
Casing Elevation: 598.5

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 595.9

Descriptions By: A. Westhuis

Well/Boring ID: BCC MW-15013

Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample
0.0-10.0	595.9-585.9	1	0.0- 10.0'	5.0	NA	
10.0-20.0	585.9-575.9	2	10.0- 20.0'	9.0	NA	

Stratigraphic Description

(0.0 - 0.1') GRASS, ROOTS and ASH.

(0.1 - 9.5') SAND, fine, subround, and ASH; poorly sorted; moist; yellowish brown (10YR 5/6) to dark yellowish brown (10YR 3/6).

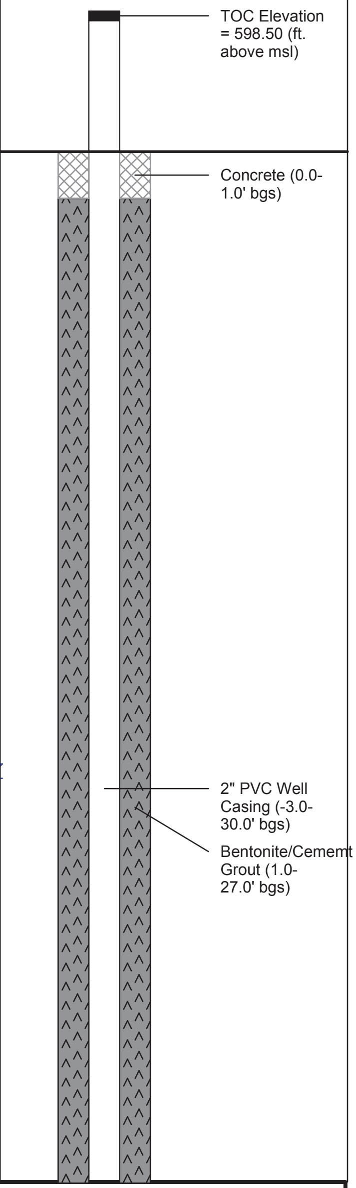
NOTE: Wet at 9.5' bgs.

(9.5 - 10.5') ASH, little fine sand, subround; non-plastic, rapid dilatancy; poorly sorted; wet; soft; gray (10YR 5/1) to dark gray (10YR 4/1). NOTE: Fill material.

(10.5 - 13.5') SAND, fine to medium, and ASH; trace coarse sand, subround; poorly sorted; moist to wet; dark yellowish brown (10YR 4/4) to brown (10YR 4/3).

(13.5 - 28.0') ASH; little fine sand, subround; non-plastic, rapid dilatancy; poorly sorted; wet; very soft; gray (10YR 5/1) to grayish brown (10YR 5/2).

Water Level (ft. bgs.)



Remarks: bgs = below ground surface

Air Knife to 9.0' bgs.
Groundwater encountered at 9.5' bgs during drilling.
Water level at development was 16.38' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 582.33 feet above mean sea level.

Date Start: 10/15/15
Date Finish: 10/16/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 9.5
Water Level Finish (ft. btoc.): 16.38

Northing: 645716.41
Easting: 12623389.21
Casing Elevation: 598.5

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 595.9

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15013**

Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample
			20.0-25.0'	4.0	NA	
25	570	3	25.0-30.0	5.0	NA	
30	565		30.0-35.0	5.0	NA	
35	560		35.0-40.0	4.0	NA	
40	555					
45	550					

Stratigraphic Description

(28.0 - 36.0') SAND, fine, trace medium sand, subround; trace silt; well sorted; wet; light gray (10YR 7/2) to very pale brown (10YR 7/3).

(36.0 - 36.5') SAND, fine, subround; trace silt and organics; light gray (10YR 7/1) to dark yellowish brown (10YR 4/4). NOTE: some leaves and small sticks.

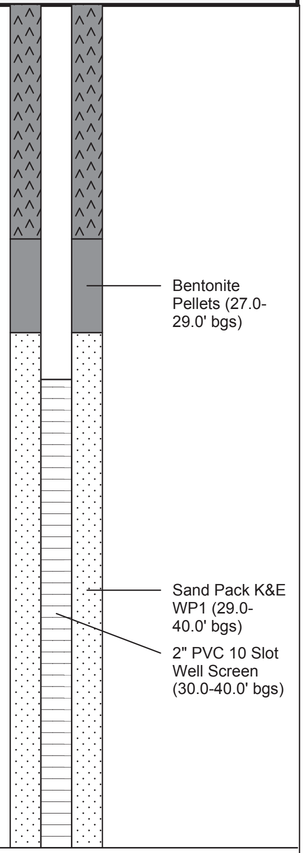
(36.5 - 37.5') CLAY and SILT, low plasticity to non-plastic, no dilatancy; moist; medium stiff; dark brown (10YR 3/3). NOTE: some organics, leaves, roots and wood.

(37.5 - 40.0') SAND, fine, subround; trace silt; well sorted; wet; light gray (10YR 7/2).

End of boring 40.0' bgs.

Water Level (ft. bgs.)

Well/Boring Construction



Remarks: bgs = below ground surface

Air Knife to 9.0' bgs.
Groundwater encountered at 9.5' bgs during drilling.
Water level at development was 16.38' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 582.33 feet above mean sea level.

Date Start: 10/16/15
Date Finish: 10/16/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 14.0
Water Level Finish (ft. btoc.): 15.50

Northing: 645925.93
Easting: 12623318.73
Casing Elevation: 599.04

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 596.2

Descriptions By: A. Westhuis

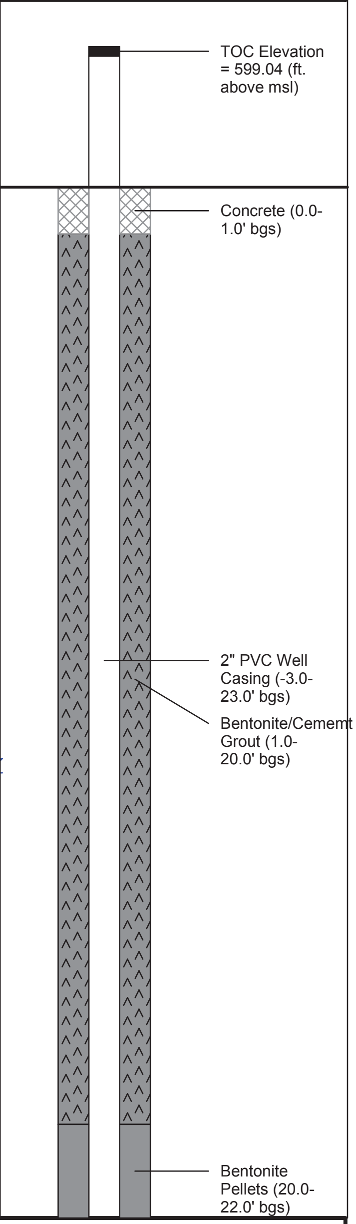
Well/Boring ID: **BCC MW-15014**

Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	600									
0	595							(0.0 - 0.1') GRASS, ROOTS and ASH.		
								(0.1 - 14.0') SAND, fine to medium, subround, and ASH; poorly sorted; soft; moist to wet; brown (10YR 5/3) to dark grayish brown (10YR 4/2). NOTE: Fill material.		
5	590	1	0.0-10.0'	3.0	NA					
10	585									
								(14.0 - 14.5') ASH, little fine sand, subround; non-plastic, rapid dilatancy; poorly sorted; wet; soft; very dark grayish brown (10YR 5/2) to dark gray (10YR 4/1). NOTE: Fill material. Little to trace organics; roots.	▼	
15	580	2	10.0-20.0'	9.0	NA			(14.5 - 17.5') ASH, non-plastic, rapid dilatancy; poorly sorted; wet; soft; dark gray (10YR 4/1). NOTE: Fill material.		
								(17.5 - 20.0') ASH, non-plastic, rapid dilatancy; poorly sorted; wet; soft; grayish brown (10YR 5/2) to dark gray (10YR 4/1). NOTE: Fill material, laminated.		
20	575							(20.0 - 27.0') SAND, fine, subround; trace silt; well sorted; wet; light brownish gray (10YR 6/2). NOTE: Organic rich matter, roots, leaves; dark brown (10YR 3/3) from 20.0 to 20.5' bgs.		



ARCADIS Design & Consultancy for natural and built assets

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

Air Knife to 9.25' bgs.
Groundwater encountered at 14.0' bgs during drilling.
Water level at development was 15.50' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 583.19 feet

Date Start: 10/16/15
Date Finish: 10/16/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 14.0
Water Level Finish (ft. btoc.): 15.50

Northing: 645925.93
Easting: 12623318.73
Casing Elevation: 599.04

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 596.2

Descriptions By: A. Westhuis

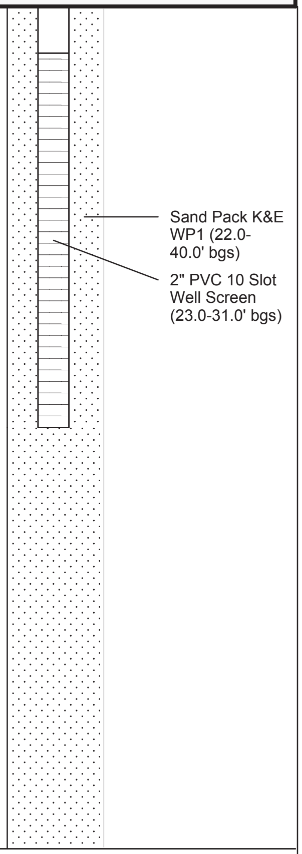
Well/Boring ID: **BCC MW-15014**

Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
25	570	3	20.0-30.0'	8.0	NA					
30								(27.0 - 31.0') SAND, fine, subround; some silt; little clay; poorly sorted; wet; light brownish gray (10YR 6/2). NOTE: little to some organics, roots and wood from 27.0 to 27.1' bgs and at 30.0' bgs.		
	565							(31.0 - 34.0') SAND and SILT; trace clay; non-plastic, rapid dilatancy; wet; poorly sorted; soft; dark grayish brown (10YR 4/2). NOTE: rich organic layer; some roots and wood.		
35		4	30.0-40.0	9.0	NA			(34.0 - 36.0') SAND, fine, subround; little silt; well sorted; wet; light brownish gray (10YR 6/2).		
	560							(36.0 - 37.5') SAND, fine, and ORGANICS; poorly sorted; wet; dark brown (10YR 3/3) to light gray (10YR 7/2).		
								(37.5 - 39.0') SAND, fine, subround; well sorted; wet; light brownish gray (10YR 6/2).		
								(39.0 - 40.0') CLAY and SILT, low plasticity to non-plastic, no dilatancy; moist; medium stiff; dark brown (10YR 3/3).		
40	555							End of boring 40.0' bgs.		
45	550									



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

Air Knife to 9.25' bgs.
Groundwater encountered at 14.0' bgs during drilling.
Water level at development was 15.50' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 583.19 feet

Date Start: 10/16/15
Date Finish: 10/19/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 8.5
Water Level Finish (ft. btoc.): 12.16

Northing: 646138.93
Easting: 12623024.09
Casing Elevation: 596.75

Borehole Depth (ft. bgs.): 30.0
Surface Elevation: 593.9

Descriptions By: A. Westhuis

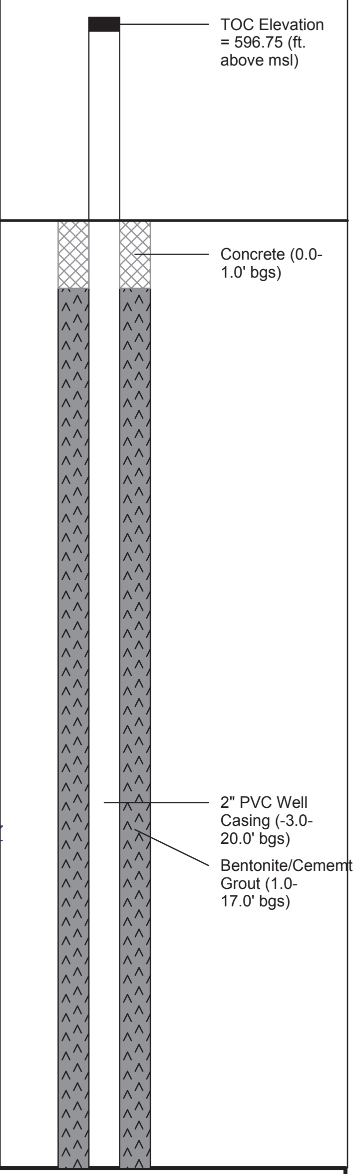
Well/Boring ID: **BCC MW-15015**

Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	595									
0								(0.0 - 8.5') SAND, fine to medium, and ASH, subangular; poorly sorted; moist; dark grayish brown (4/2). NOTE: Fill material.		
	590									
5		1	0.0-10.0'	2.0	NA					
	585							(8.5 - 14.0') ASH, non-plastic, rapid dilatancy; wet; soft; very dark grayish brown (10YR 3/2). NOTE: Fill material.	▼	
10										
	580							NOTE: Wood fragments at 14.0' bgs.		



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

Air Knife to 8.5' bgs.
Groundwater encountered at 8.5' bgs during drilling.
Water level at development was 12.16' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.81 feet

Date Start: 10/16/15
Date Finish: 10/19/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 8.5
Water Level Finish (ft. btoc.): 12.16

Northing: 646138.93
Easting: 12623024.09
Casing Elevation: 596.75

Borehole Depth (ft. bgs.): 30.0
Surface Elevation: 593.9

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15015**

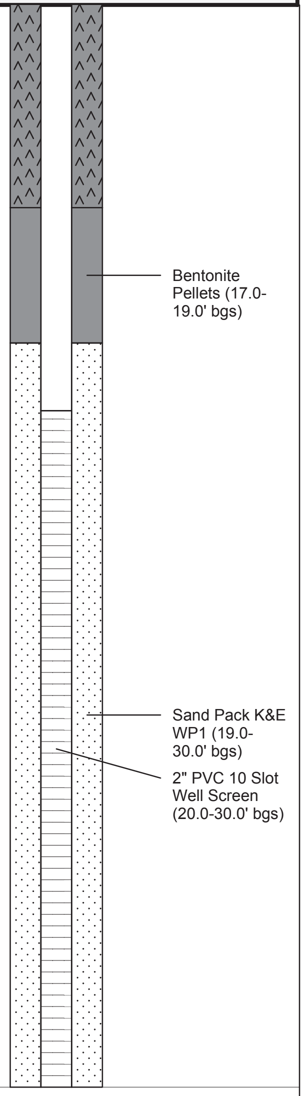
Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
15		2	10.0-20.0'	9.0	NA			(14.0 - 17.0') SAND, fine, subround; well sorted; wet; light brownish gray (10YR 6/4). NOTE: light yellowish brown (10YR 6/4) from 14.0-16.0' bgs; pale brown (10YR 6/3) from 16.-17.0' bgs.	
								(17.0 - 19.0') FILL material, wood fragments; brown (10YR 4/3) to very dark brown (10YR 2/2).	
	575							(19.0 - 29.0') SAND, fine, subround; trace silt; well sorted; wet; light brownish gray (10YR 6/4).	
20									
	570								
25		3	20.0-30.0'	10.0	NA				
								NOTE: Little clay and silt at 27.0' bgs.	
	565							(29.0 - 29.5') CLAY and SILT, low to medium plasticity, no dilatancy; little fine sand, subround; moist; medium stiff; brown (10YR 4/3). NOTE: organic rich, wood near 29.5' bgs.	
								(29.5 - 30.0') SAND, fine, subround; trace silt; well sorted; wet; light brownish gray (10YR 6/4).	
30								End of boring 30.0' bgs.	

Well/Boring Construction



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

Air Knife to 8.5' bgs.
Groundwater encountered at 8.5' bgs during drilling.
Water level at development was 12.16' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.81 feet

Date Start: 10/19/15
Date Finish: 10/19/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 8.5
Water Level Finish (ft. btoc.): 8.65

Northing: 646227.56
Easting: 12622459.26
Casing Elevation: 589.05

Borehole Depth (ft. bgs.): 45.0
Surface Elevation: 586.2

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15016**

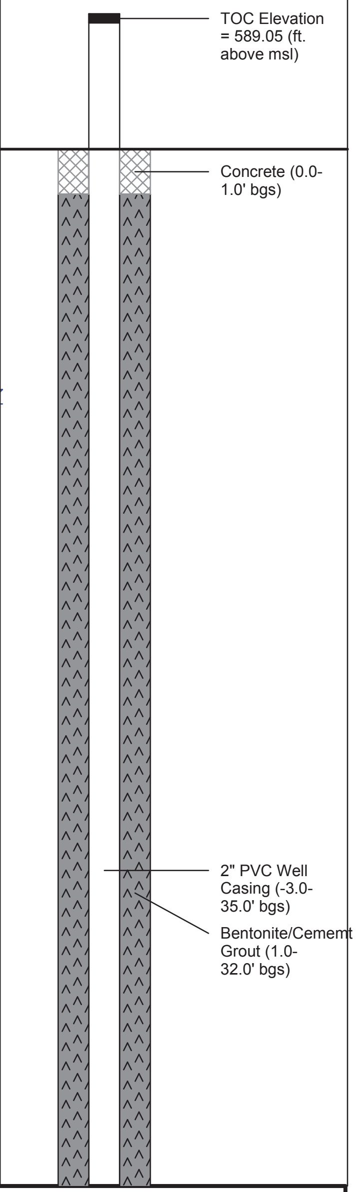
Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
	590								
0								(0.0 - 15.0') SAND, fine to medium, and ASH; little coarse, subround; poorly sorted; moist to wet; dark grayish brown (10YR 4/2). NOTE: Fill material, trace coal fragments.	
	585								
5		1	0.0-10.0'	3.0	NA				
	580								
10								NOTE: Wet at 9.0' bgs.	
	575								
15		2	10.0-20.0'	10.0	NA			(15.0 - 17.0') SAND, fine, subround; little silt; well sorted; wet; light brownish gray (10YR 6/4).	
	570							(17.0 - 19.0') FILL material, wood fragments; some fine sand, subround; brown (10YR 4/3) to very dark brown (10YR 2/2).	
20								(19.0 - 25.0') SAND, fine, subround; some clay; some to trace silt, non-plastic, no dilatancy; medium stiff; well sorted; wet; light brownish gray (10YR 6/4).	
	565							NOTE: organic rich matter, leaves, sticks, wood; moist; dark brown (10YR 3/3) from 21.0 to 25.0' bgs.	

Well/Boring Construction



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

Air Knife to 8.5' bgs.
Groundwater encountered at 8.5' bgs during drilling.
Water level at development was 8.65' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.08 feet

Date Start: 10/19/15
Date Finish: 10/19/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 8.5
Water Level Finish (ft. btoc.): 8.65

Northing: 646227.56
Easting: 12622459.26
Casing Elevation: 589.05

Borehole Depth (ft. bgs.): 45.0
Surface Elevation: 586.2

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15016**

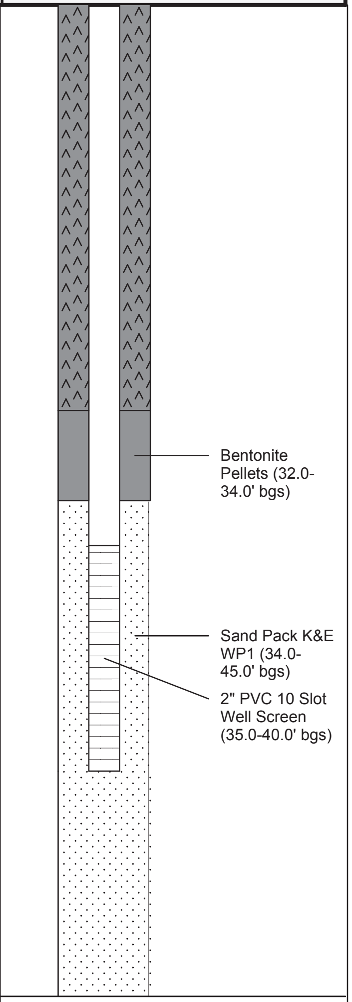
Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
25	560	3	20.0-30.0'	10.0	NA			(25.0 - 27.0') SAND, fine, subround; trace silt; well sorted; wet; light brownish gray (10YR 6/4).	
								(27.0 - 28.5') CLAY and SILT, low plasticity to non-plastic, no dilatancy; little fine sand, subround; moist; soft; dark brown (10YR 3/3). NOTE: organic rich, trace roots.	
								(28.5 - 28.8') SAND, fine, subround; trace silt; well sorted; wet; light brownish gray (10YR 6/4).	
30	555							(28.8 - 35.0') CLAY and SILT, low plasticity to non-plastic, no dilatancy; little fine sand, subround; moist; soft; dark brown (10YR 3/3). NOTE: Organic rich; trace roots from 28.8 to 30.0' bgs. NOTE: Trace shell fragments at 34.0' bgs.	
35	550	4	30.0-40.0'	9.0	NA			(35.0 - 37.0') SAND, fine, subround; little silt; well sorted; wet; yellowish brown (10YR 5/4).	
								(37.0 - 40.5') SAND, fine, subround; trace silt; well sorted; wet; pale brown (10YR 6/3). NOTE: Trace small pebble, subround at 39.0' bgs.	
40	545	5	40.0-45.0'	5.0	NA			(40.5 - 45.0') CLAY, high plasticity, no dilatancy; trace silt; moist; medium stiff to soft; gray (10YR 7/1).	
45	540							End of boring 45.0' bgs.	
50									

Well/Boring Construction



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

Air Knife to 8.5' bgs.
Groundwater encountered at 8.5' bgs during drilling.
Water level at development was 8.65' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.08 feet

Date Start: 10/19/15
Date Finish: 10/20/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 8.0
Water Level Finish (ft. btoc.): 8.53

Northing: 646354.69
Easting: 12622085.55
Casing Elevation: 588.61

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 585.7

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15017**

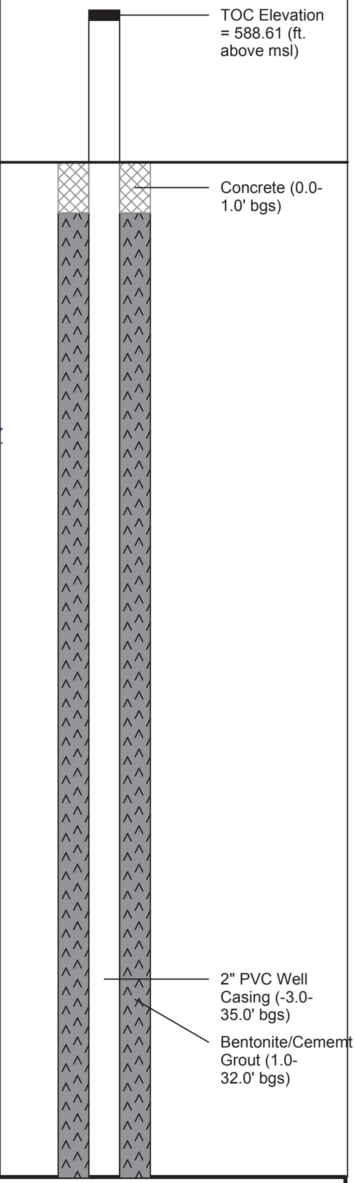
Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy, Windy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
0								(0.0 - 11.0') SAND, fine to medium, subround, and ASH; little coarse sand, subround; poorly sorted; moist to wet; very dark grayish brown (10YR 3/2). NOTE: Fill material.	
	585								
5	580	1	0.0-10.0'	3.0	NA				▼
								NOTE: Wet at 9.0' bgs; trace coal fragments.	
10	575								
								(11.0 - 14.0') SAND, fine, subround, and SILT; trace clay, non-plastic, no dilatancy; moist to wet; poorly sorted; soft; dark brown (10YR 3/3) to light brownish gray (10YR 6/2). NOTE: little to trace organic matter, sticks, wood, and leaves.	
								(14.0 - 15.0') CLAY and SILT, low plasticity to non-plastic, no dilatancy; little fine sand subround; moist; soft; dark brown (10YR 3/3).	
15	570	2	10.0-20.0'	9.0	NA			(15.0 - 18.5') SAND, fine, subround; little to trace silt; well sorted; wet; light brownish gray (10YR 6/4).	
								(18.5 - 20.0') FILL material, wood fragments; some fine sand, subround; brown (10YR 4/3) to dark brown (10YR 3/3). NOTE: Trace sticks and leaves.	
20								(20.0 - 20.5') SAND, fine, subround; trace silt; well sorted; wet; pale brown (10YR	

Well/Boring Construction



ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface

Air Knife to 8.0' bgs.
Groundwater encountered at 8.0' bgs during drilling.
Water level at development was 8.53' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 579.99 feet above mean sea level.

Date Start: 10/19/15
Date Finish: 10/20/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 8.0
Water Level Finish (ft. btoc.): 8.53

Northing: 646354.69
Easting: 12622085.55
Casing Elevation: 588.61

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 585.7

Descriptions By: A. Westhuis

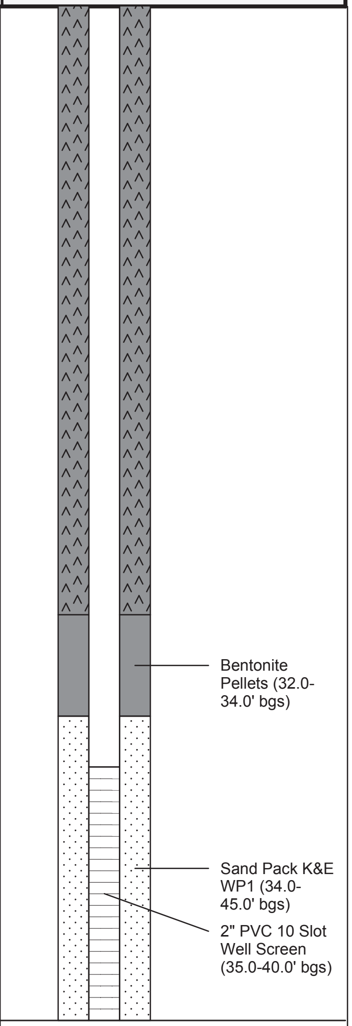
Well/Boring ID: **BCC MW-15017**

Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy, Windy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
								6/3).		
	565							(20.5 - 21.5') SAND, fine, subround; trace silt; trace wood; poorly sorted; wet; pale brown (10YR 6/3) to dark brown (10YR 3/3). NOTE: Organic rich matter, wood, sticks; dark brown (10YR 3/3) from 21.0 to 21.5' bgs.		
								(21.5 - 22.0') SAND, fine subround; trace silt; well sorted; wet; pale brown (10YR 6/3).		
								(22.0 - 23.5') CLAY and SILT, non-plastic, no dilatancy; little fine sand, subround; moist; soft; brown (10YR 3/3).		
25	560	3	20.0-30.0'	9.0	NA			(23.5 - 33.0') CLAY and SILT, non-plastic, no dilatancy; some fine sand, subround; moist; soft; brown (10YR 3/3).		
30	555									
								NOTE: Some wood and sticks; trace shell fragments at 33.0' bgs. (33.0 - 35.0') SAND, fine, subround; trace silt; well sorted; wet; yellow (10YR 7/6).		
35	550	4	30.0-40.0'	9.0	NA			(35.0 - 40.0') SAND, fine, subround; trace silt; well sorted; wet; pale brown (10YR 6/3).		
40	545							End of boring 40.0' bgs.		



ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface

Air Knife to 8.0' bgs.
Groundwater encountered at 8.0' bgs during drilling.
Water level at development was 8.53' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 579.99 feet above mean sea level.

Date Start: 10/20/15
Date Finish: 10/20/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 8.0
Water Level Finish (ft. btoc.): 11.78

Northing: 646789.54
Easting: 12622179.74
Casing Elevation: 592.43

Borehole Depth (ft. bgs.): 45.0
Surface Elevation: 589.4

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15018**

Client: Consumers Energy

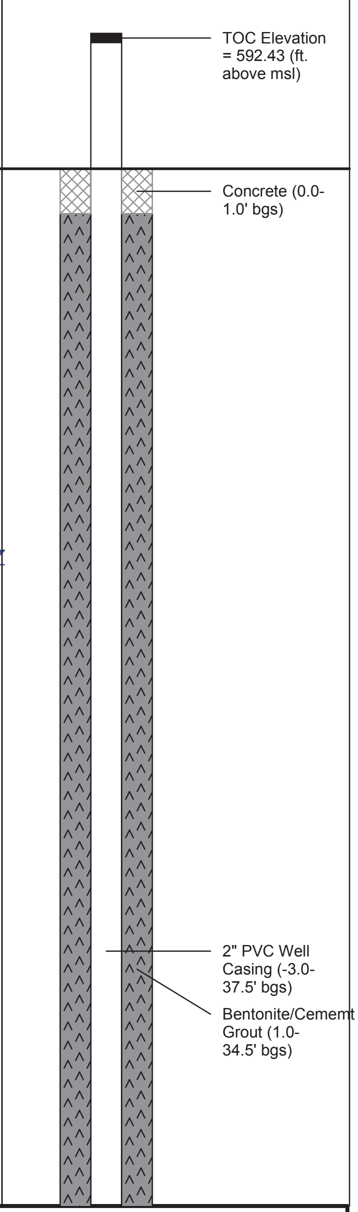
Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Stratigraphic Description
0	589.4						(0.0 - 0.3') STONE, aggregate for road base.
0.3		1	0.0-10.0'	3.0	NA		(0.3 - 14.0') ASH, trace to little fine sand, subround; non-plastic; slow dilatancy; moist to wet; soft; very dark gray (10YR 3/1). NOTE: Fill material.
8							NOTE: Wet at 8.0' bgs.
10		2	10.0-20.0'	9.0	NA		
14							(14.0 - 23.0') SAND, fine, subround; some silt; trace granules; trace clay; poorly sorted; wet; light brownish gray (10YR 6/4). NOTE: Some large wood fragments at 17.5' and 20.0' bgs.
20							NOTE: Increase in silt at 20.0' bgs
22							NOTE: Organic Rich Matter, wood, sticks, leaves; dark brown (10YR 3/3) from 22.0 to 23.0' bgs.

Water Level (ft. bgs.): ▼ 8.0

Well/Boring Construction



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

Air Knife to 8.5' bgs.
Groundwater encountered at 8.0' bgs during drilling.
Water level at development was 11.78' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.08 feet

Date Start: 10/20/15
Date Finish: 10/20/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 8.0
Water Level Finish (ft. btoc.): 11.78

Northing: 646789.54
Easting: 12622179.74
Casing Elevation: 592.43

Borehole Depth (ft. bgs.): 45.0
Surface Elevation: 589.4

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15018**

Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample
25	565	3	20.0-30.0'	10.0	NA	
30	560					
35	555	4	30.0-40.0'	10.0	NA	
40	550					
45	545	5	40.0-45.0'	5.0	NA	
50	540					

Stratigraphic Description

(23.0 - 25.5') SAND, fine, subround; some silt; poorly sorted; wet; light brownish gray (10YR 6/4). NOTE: wood debris from 24.0 to 24.3' bgs.

NOTE: Organic rich matter, wood, sticks, leaves; dark brown (10YR 3/3) from 25.0 to 25.5' bgs.

(25.5 - 27.5') SAND, fine, subround; little to some silt; well sorted; wet; light brownish gray (10YR 6/4). NOTE: wood debris, sticks; brown (10YR 3/3) from 26.0 to 26.3' bgs.

(27.5 - 28.0') CLAY and SILT, low plasticity to non-plastic, no dilatancy; little fine sand, subround; moist; soft; dark brown (10YR 3/3).

(28.0 - 30.0') SAND, fine, subround, and SILT; wet; poorly sorted; soft; light browish gray (10YR 6/4) to dark brown (10YR 3/3). NOTE: little wood debris, organic rich near 29.0' bgs.

(30.0 - 37.0') CLAY and SILT, low plasticity to non-plastic, no dilatancy; trace fine sand, subround; moist; medium stiff to soft; dark brown (10YR 3/3) to very dark brown (10YR 2/2). NOTE: organic rich, large sticks at 31.0' bgs; white shell fragments from 35.0 to 37.0' bgs.

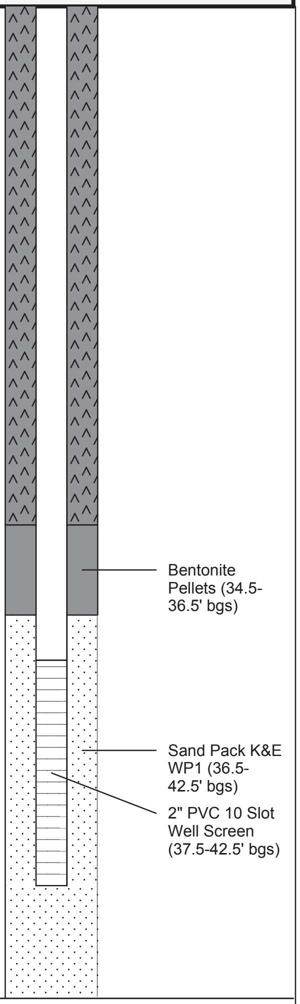
(37.0 - 42.5') SAND, fine, subround; well sorted; wet; very pale brown (10YR 7/3).

(42.5 - 45.0') CLAY, high plasticity, no dilatancy; trace silt; moist; medium stiff to soft; gray (10YR 7/1).

End of boring 45.0' bgs.

Water Level (ft. bgs.)

Well/Boring Construction



ARCADIS Design & Consultancy for natural and built assets

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

Air Knife to 8.5' bgs.
Groundwater encountered at 8.0' bgs during drilling.
Water level at development was 11.78' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.08 feet

Date Start: 10/20/15
Date Finish: 10/20/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 7.0
Water Level Finish (ft. btoc.): 12.22

Northing: 647103.13
Easting: 12622369.93
Casing Elevation: 592.42

Borehole Depth (ft. bgs.): 45.0
Surface Elevation: 589.4

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15019**

Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample
0–10	589.4–579.4	1	0.0-10.0'	4.0	NA	
10–20	579.4–569.4	2	10.0-20.0'	9.0	NA	

Stratigraphic Description

(0.0 - 0.3') STONE, aggregate for road base.

(0.3 - 13.0') ASH, little fine sand, subround; trace granules, subangular; non-plastic, slow to rapid dilatancy; moist to wet; soft; very dark gray (10YR 3/1). NOTE: Fill material.

NOTE: Wet at 7.0' bgs.

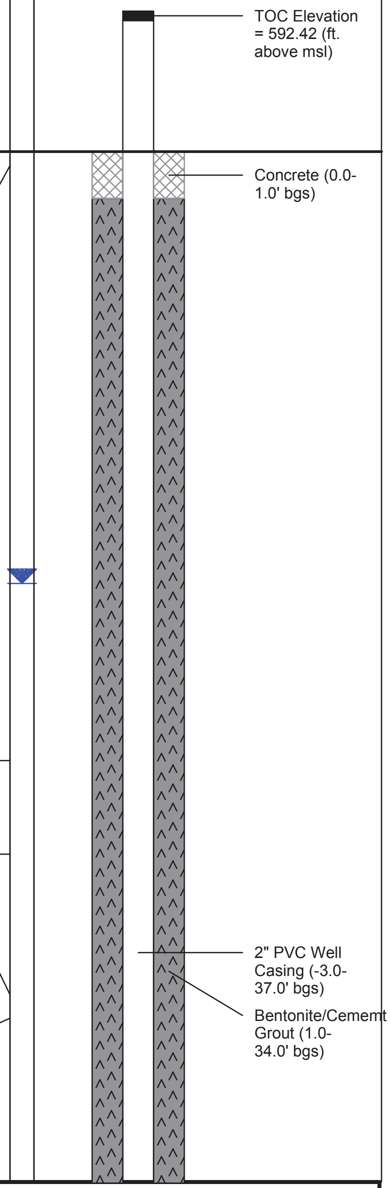
(13.0 - 15.0') SAND, fine, subround; little to some silt; well sorted; wet; pale brown (10YR 6/3).

(15.0 - 18.0') SAND, fine, subround; some silt; well sorted; wet; grayish brown (10YR 5/2).

NOTE: Large wood fragments at 17.0' bgs.

(18.0 - 18.5') SAND, fine, subround; and SILT; poorly sorted; wet; dark brown (10YR 3/3). NOTE: some organic matter; sticks; wood.

(18.5 - 26.0') SAND, fine; little silt; trace medium sand, subround; well sorted; wet; light brownish gray (10YR 6/2).



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

Air Knife to 8.5' bgs.
Groundwater encountered at 7.0' bgs during drilling.
Water level at development was 12.22' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.11 feet

Date Start: 10/20/15
Date Finish: 10/20/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 7.0
Water Level Finish (ft. btoc.): 12.22

Northing: 647103.13
Easting: 12622369.93
Casing Elevation: 592.42

Borehole Depth (ft. bgs.): 45.0
Surface Elevation: 589.4

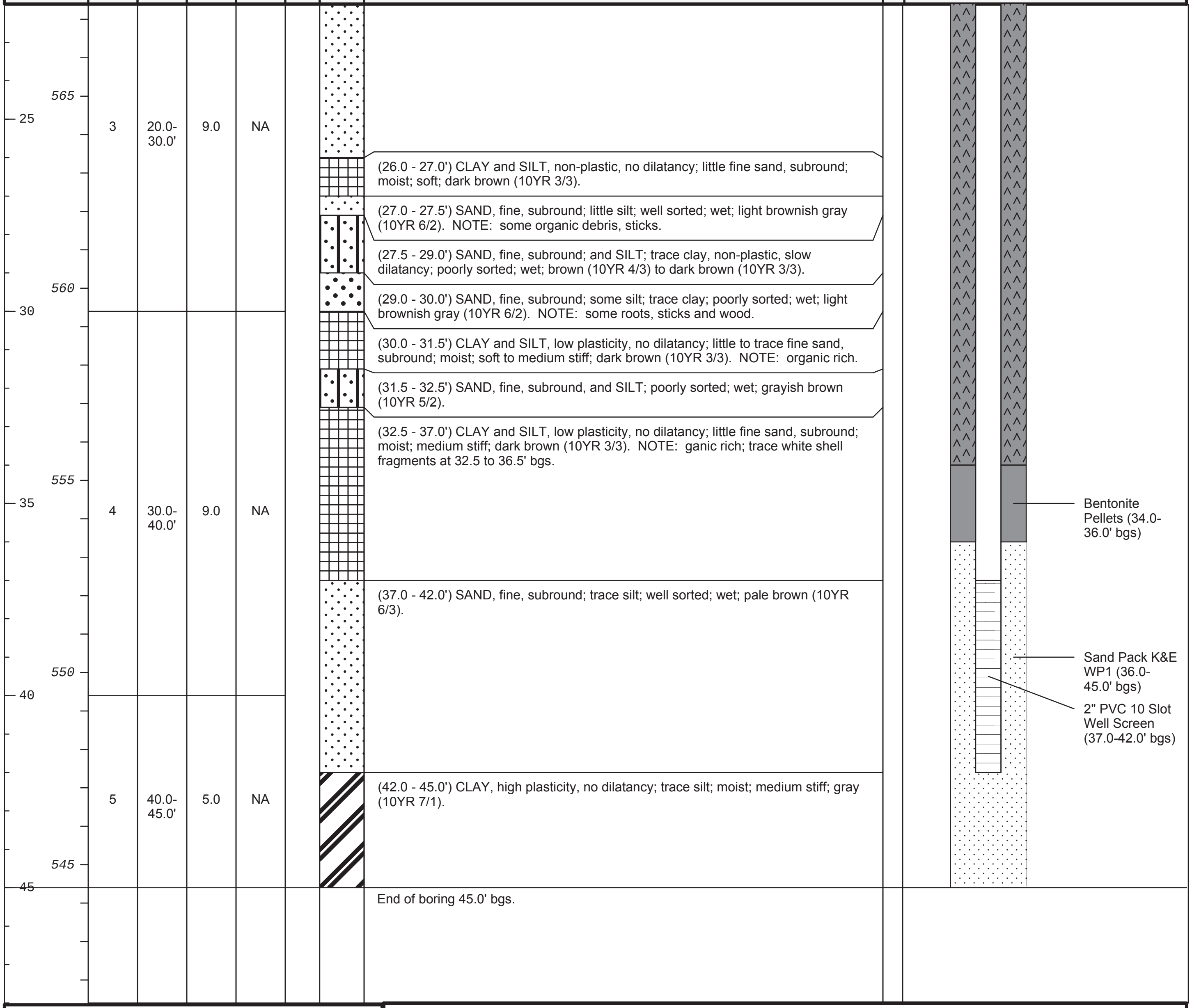
Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15019**

Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Cloudy



Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample
3	20.0-30.0'	9.0	NA	
4	30.0-40.0'	9.0	NA	
5	40.0-45.0'	5.0	NA	

Stratigraphic Description

(26.0 - 27.0') CLAY and SILT, non-plastic, no dilatancy; little fine sand, subround; moist; soft; dark brown (10YR 3/3).

(27.0 - 27.5') SAND, fine, subround; little silt; well sorted; wet; light brownish gray (10YR 6/2). NOTE: some organic debris, sticks.

(27.5 - 29.0') SAND, fine, subround; and SILT; trace clay, non-plastic, slow dilatancy; poorly sorted; wet; brown (10YR 4/3) to dark brown (10YR 3/3).

(29.0 - 30.0') SAND, fine, subround; some silt; trace clay; poorly sorted; wet; light brownish gray (10YR 6/2). NOTE: some roots, sticks and wood.

(30.0 - 31.5') CLAY and SILT, low plasticity, no dilatancy; little to trace fine sand, subround; moist; soft to medium stiff; dark brown (10YR 3/3). NOTE: organic rich.

(31.5 - 32.5') SAND, fine, subround, and SILT; poorly sorted; wet; grayish brown (10YR 5/2).

(32.5 - 37.0') CLAY and SILT, low plasticity, no dilatancy; little fine sand, subround; moist; medium stiff; dark brown (10YR 3/3). NOTE: ganic rich; trace white shell fragments at 32.5 to 36.5' bgs.

(37.0 - 42.0') SAND, fine, subround; trace silt; well sorted; wet; pale brown (10YR 6/3).

(42.0 - 45.0') CLAY, high plasticity, no dilatancy; trace silt; moist; medium stiff; gray (10YR 7/1).

End of boring 45.0' bgs.

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

Air Knife to 8.5' bgs.
Groundwater encountered at 7.0' bgs during drilling.
Water level at development was 12.22' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.11 feet

ARCADIS Design & Consultancy for natural and built assets

Date Start: 10/21/15
Date Finish: 10/21/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 7.0
Water Level Finish (ft. btoc.): 12.19

Northing: 647436.97
Easting: 12622626.85
Casing Elevation: 592.23

Borehole Depth (ft. bgs.): 45.0
Surface Elevation: 589.5

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15020**

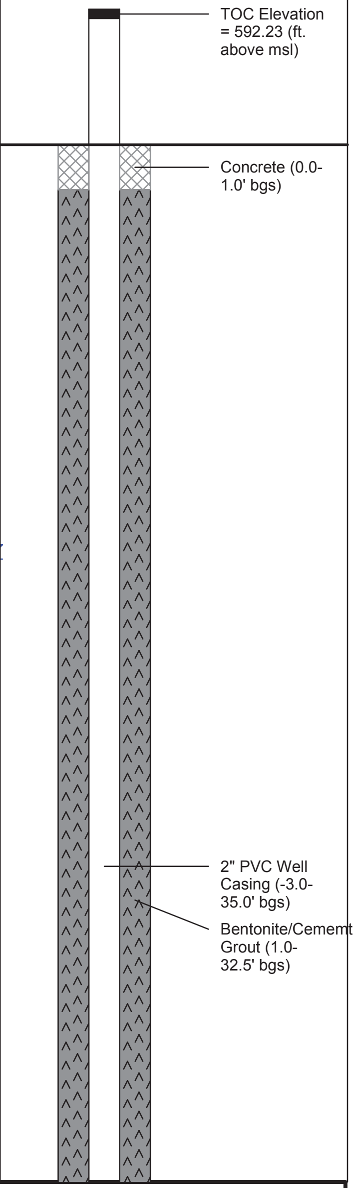
Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
	590								
0								(0.0 - 10.0') NO RECOVERY; most soil cuttings from air knife were not placed back int the hole.	
5	585	1	0.0-10.0'	0.0	NA				
	580								▼
10							∴	(10.0 - 18.0') SAND, fine, subround; some ash; little medium sand; trace granules to small pebble, subangular; moist to wet; poorly sorted; very dark grayish brown (10YR 3/2). NOTE: little large stones; road base fill material.	
15	575	2	10.0-20.0'	5.0	NA		∴		
							×	(18.0 - 20.0') ASH, trace fine sand, subround; non-plastic, rapid dilatancy; wet; soft; very dark gray (10YR 4/1). NOTE: Fill material.	
20	570						∴	(20.0 - 31.0') SAND fine, subround; little silt; well sorted; wet; light brownish gray (10YR 6/2).	

Well/Boring Construction



ARCADIS Design & Consultancy for natural and built assets

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

Air Knife to 8.5' bgs.
Groundwater encountered at 7.0' bgs during drilling.
Water level at development was 12.19' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.14 feet

Date Start: 10/21/15
Date Finish: 10/21/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 7.0
Water Level Finish (ft. btoc.): 12.19

Northing: 647436.97
Easting: 12622626.85
Casing Elevation: 592.23

Borehole Depth (ft. bgs.): 45.0
Surface Elevation: 589.5

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15020**

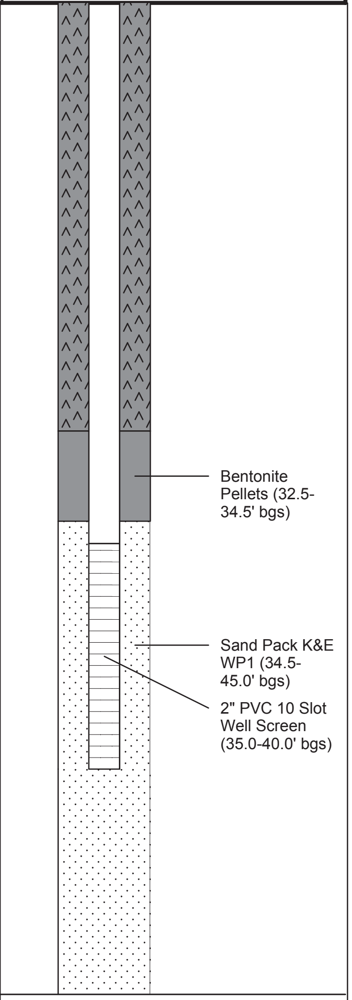
Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
25	565	3	20.0-30.0'	5.0	NA				
30	560								
								(31.0 - 32.5') CLAY and SILT, medium plasticity, no dilatancy; trace fine sand, subround; moist; medium stiff; dark brown (10YR 3/3). NOTE: trace white shell fragments.	
								(32.5 - 34.0') SAND, fine, subround; some to little silt; well sorted; wet; brown (10YR 5/3).	
								(34.0 - 35.0') CLAY and SILT, low plasticity to non-plastic; some fine sand, subround; wet; soft to very soft; brown (10YR 4/3).	
35	555	4	30.0-40.0'	10.0	NA			(35.0 - 40.0') SAND, fine, subround; trace silt; well sorted; wet; light gray (10YR 7/2). NOTE: large cobble at 35.0' bgs.	
40	550							(40.0 - 45.0') CLAY, high plasticity, no dilatancy; trace silt; moist; medium stiff to soft; gray (10YR 5/1).	
		5	40.0-45.0'	4.0	NA				
45	545							End of boring 45.0' bgs.	
50	540								

Well/Boring Construction



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

Air Knife to 8.5' bgs.
Groundwater encountered at 7.0' bgs during drilling.
Water level at development was 12.19' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.14 feet

Date Start: 10/21/15
Date Finish: 10/21/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 5.0
Water Level Finish (ft. btoc.): 14.00

Northing: 646654.84
Easting: 12623310.03
Casing Elevation: 593.73

Borehole Depth (ft. bgs.): 50.0
Surface Elevation: 590.7

Descriptions By: A. Westhuis

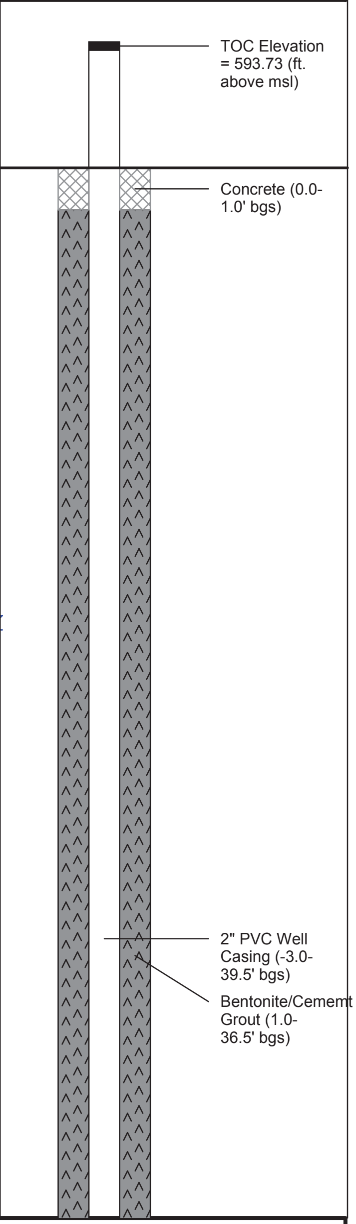
Well/Boring ID: **BCC MW-15021**

Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Stratigraphic Description
0							(0.0 - 20.5') ASH, trace fine sand, subround; non-plastic, rapid dilatancy; well sorted; moist to wet; very soft; dark gray (10YR 4/1). NOTE: Fill material.
	590						
5	585	1	0.0-10.0'	5.5	NA		
10	580						
15	575	2	10.0-20.0'	10.0	NA		
20	570						(20.5 - 22.0') SANd, fine, subround; some silt; trace granules, subround; poorly sorted; wet; gray (10YR 5/1) to pale brown (10YR 6/3).
							(21.5 - 22.0') NOTE: Organic rich matter, wood, sticks, leaves; dark yellowish brown (10YR 3/6) from 21.5 to 22.0' bgs.
							(22.0 - 23.5') SAND, fine, subround; some silt; poorly sorted; wet; grayish brown (10YR 5/2). NOTE: Some organic rich debris, wood and sticks; dark brown (10YR 3/3).



Remarks: bgs = below ground surface

Air Knife to 8.0' bgs.
Groundwater encountered at 5.0' bgs during drilling.
Water level at development was 14.00' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.1 feet above mean sea level.

Date Start: 10/21/15
Date Finish: 10/21/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 5.0
Water Level Finish (ft. btoc.): 14.00

Northing: 646654.84
Easting: 12623310.03
Casing Elevation: 593.73

Borehole Depth (ft. bgs.): 50.0
Surface Elevation: 590.7

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15021**

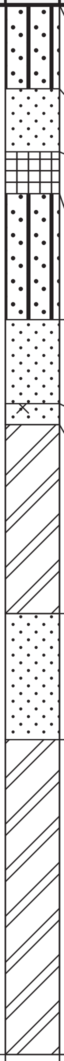
Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 60 F Partly Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample
	565	3	20.0-30.0'	10.0	NA	
30	560					
35	555	4	30.0-40.0'	10.0	NA	
40	550					
45	545	5	40.0-50.0'	10.0	NA	
50	540					

Geologic Column



Stratigraphic Description

(23.5 - 25.0') SAND, fine, subround; little silt; well sorted; wet; light gray (10YR 7/2).

(25.0 - 27.0') SAND, fine, subround, and SILT; poorly sorted; moist to wet; brown (10YR 4/3) to dark gray (10YR 4/1). NOTE: some organic debris, sticks, wood, leaves.

(27.0 - 28.5') SAND, fine, subround; little to some silt; well sorted; wet; light gray (10YR 7/2).

(28.5 - 29.5') CLAY and SILT, non-plastic, no dilatancy; little fine sand, subround; medium stiff; moist; dark brown (10YR 3/3). NOTE: some organic debris, wood from 29.0 to 29.5' bgs.

(29.5 - 32.5') SAND, fine, subround, and SILT; poorly sorted; moist; dark brown (10YR 3/3). NOTE: wood, sticks and leaves from 29.5 to 30.0' and 32.0 to 32.5' bgs.

(32.5 - 35.0') SAND, fine, subround; little silt; well sorted; wet; pale brown (10YR 6/3).

(34.5 - 35.0') NOTE: Organics, wood, sticks.

(35.0 - 39.5') CLAY, medium to high plasticity, no dilatancy; little to some silt; medium stiff; very dark brown (10YR 2/2).

NOTE: White shell fragments at 37.5' and 38.0' bgs.

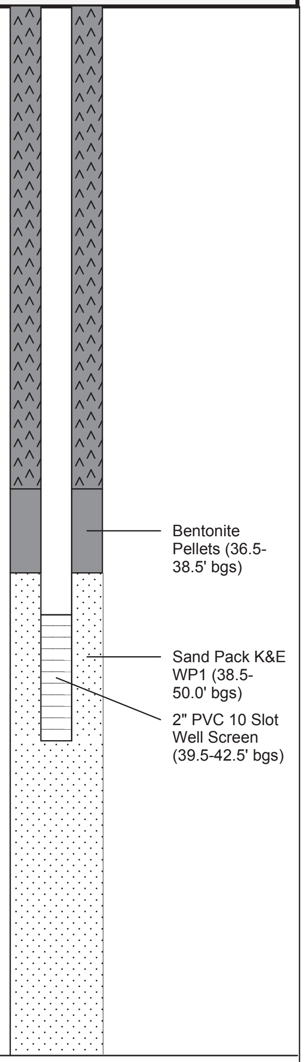
(39.5 - 42.5') SAND, fine, subround; trace silt; well sorted; wet; light gray (10YR 7/2).

(42.5 - 50.0') CLAY, high plasticity, no dilatancy; trace silt; moist; medium stiff; gray (10YR 5/1).

End of boring 50.0' bgs.

Water Level (ft. bgs.)

Well/Boring Construction



ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface

Air Knife to 8.0' bgs.
Groundwater encountered at 5.0' bgs during drilling.
Water level at development was 14.00' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 580.1 feet above mean sea level.

Date Start: 10/23/15
Date Finish: 10/23/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 7.0
Water Level Finish (ft. btoc.): 12.28

Northing: 646263.16
Easting: 12623634.96
Casing Elevation: 595.82

Borehole Depth (ft. bgs.): 45.0
Surface Elevation: 592.6

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15022**

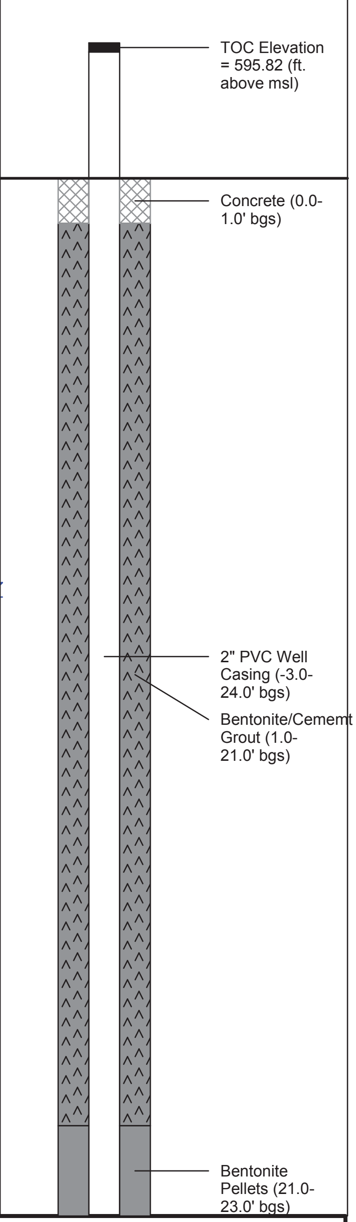
Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 40 F Sunny

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
0	595							(0.0 - 22.0') ASH, trace fine sand, subround; non-plastic, rapid dilatancy; well sorted; moist to wet; gray (10YR 5/1). NOTE: Fill material.	
5	590	1	0.0-10.0'	4.5	NA			NOTE: Wet at 7.0' bgs.	
10	585								
15	580	2	10.0-20.0'	9.0	NA				
20	575							(22.0 - 30.0') SAND, fine, subround; trace silt; well sorted; wet; light brownish gray (10YR 6/2).	

Well/Boring Construction



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

Air Knife to 9.0' bgs.
Groundwater encountered at 7.0' bgs during drilling.
Water level at development was 12.28' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 583.42 feet

Date Start: 10/23/15
Date Finish: 10/23/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 7.0
Water Level Finish (ft. btoc.): 12.28

Northing: 646263.16
Easting: 12623634.96
Casing Elevation: 595.82

Borehole Depth (ft. bgs.): 45.0
Surface Elevation: 592.6

Descriptions By: A. Westhuis

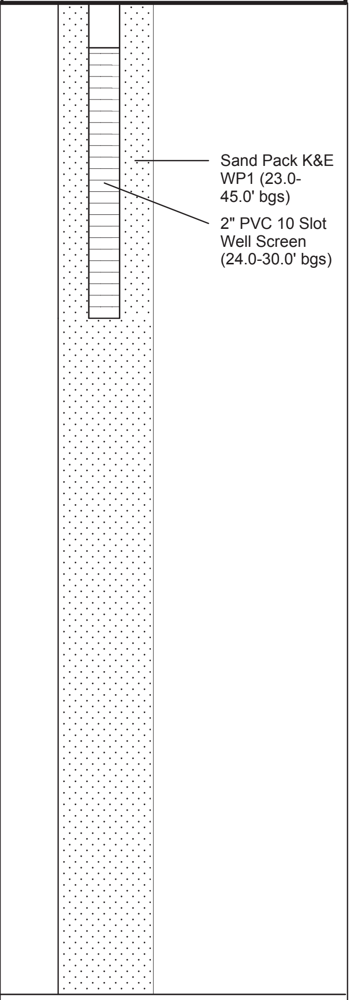
Well/Boring ID: **BCC MW-15022**

Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 40 F Sunny

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
25	570	3	20.0-30.0'	8.0	NA					
30	565	4	30.0-40.0'	9.0	NA			(30.0 - 33.0') SAND, fine, subround, and SILT, non-plastic, no dilatancy to slow dilatancy; moist to wet; poorly sorted; light brownish gray (10YR 6/2) to grayish brown (10YR 5/2). NOTE: little to some organic debris.		
35	560							(33.0 - 37.0') SILT, non-plastic, no dilatancy; some fine sand, subround; little clay; poorly sorted; moist to wet; grayish brown (10YR 5/2) to dark brown (10YR 3/3). NOTE: Organic rich debris, sitcks and wood from 36.0 to 37.0' bgs.		
								(37.0 - 40.5') SAND, fine, subround; little silt; well sorted; wet; light brownish gray (10YR 6/2).		
40	555	5	40.0-45.0'	5.0	NA			(40.5 - 43.0') CLAY and SILT, non-plastic, no dilatancy; some to little fine sand, subround; poorly sorted; moist; dark brown (10YR 3/3). NOTE: white shell fragments at 41.0' bgs; organic rich.		
								(43.0 - 44.0') SAND, fine, subround; well sorted; light grayish brown (10YR 6/2).		
								(44.0 - 45.0') CLAY and SILT, non-plastic to low plasticity, no dilatancy; little to trace fine sand, subround; moist; dark gray (10YR 3/3).		
45	550							End of boring 45.0' bgs.		
50										



ARCADIS Design & Consultancy for natural and built assets

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

Air Knife to 9.0' bgs.
Groundwater encountered at 7.0' bgs during drilling.
Water level at development was 12.28' btoc.
No odor or staining observed.
Groundwater elevation measured on November 30, 2015 was 583.42 feet

Date Start: 10/23/15
Date Finish: 10/23/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Hand Auger/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 0.0
Water Level Finish (ft. btoc.): 3.81

Northing: 647125.15
Easting: 12622999.24
Casing Elevation: 588.08

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 585.4

Descriptions By: A. Westhuis

Well/Boring ID: **BCC MW-15023**

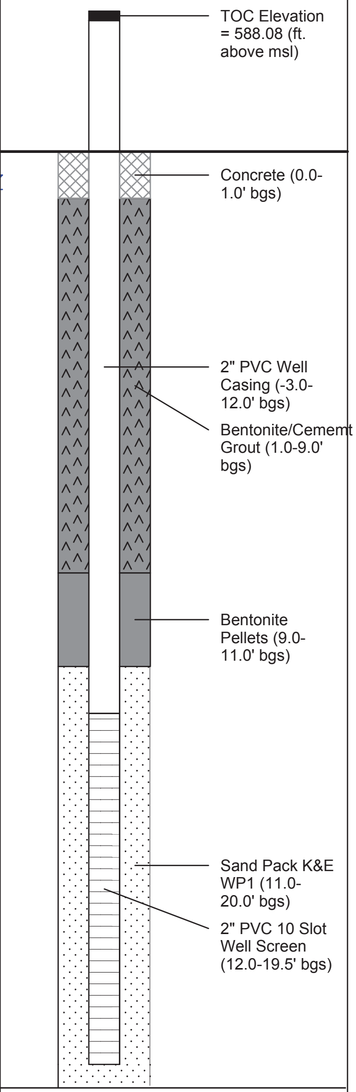
Client: Consumers Energy

Location: BC Cobb Facility
151 N Causeway St.
Muskegon, MI

Weather Conditions: 55 F Cloudy

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
0 5	585 580	1	0.0-10.0'	10.0	NA		× × ×	(0.0 - 10.0') ASH, non-plastic, rapid dilatancy; well sorted; wet; dark gray (10YR 4/1). NOTE: Fill material. Wet at 0.0' bgs. NOTE: Organic debris, leaves, sticks; dark brown (10YR 2/2) from 9.5 to 10.0' bgs; slight odor.	▼
10	575	2	10.0-20.0'	10.0	NA		⋰	(10.0 - 13.0') SAND, fine to medium, subround; trace silt; well sorted; wet; pale brown (10YR 6/3).	
							⋰	(13.0 - 16.0') SAND, very fine to fine, subround; some to little silt; well sorted; wet; gayish brown (10YR 5/2).	
15	570						⋰	(16.0 - 19.5') SAND, fine, subround; little to trace silt; well sorted; wet; pale brown (10YR 6/3).	
							▦	(19.5 - 20.0') SILT, some clay, non-plastic, no dilatancy; some to little fine sand, subround; poorly sorted; wet; dark brown (10YR 3/3). NOTE: little organic debris, wood.	
20	565							End of boring 20.0' bgs.	

Well/Boring Construction

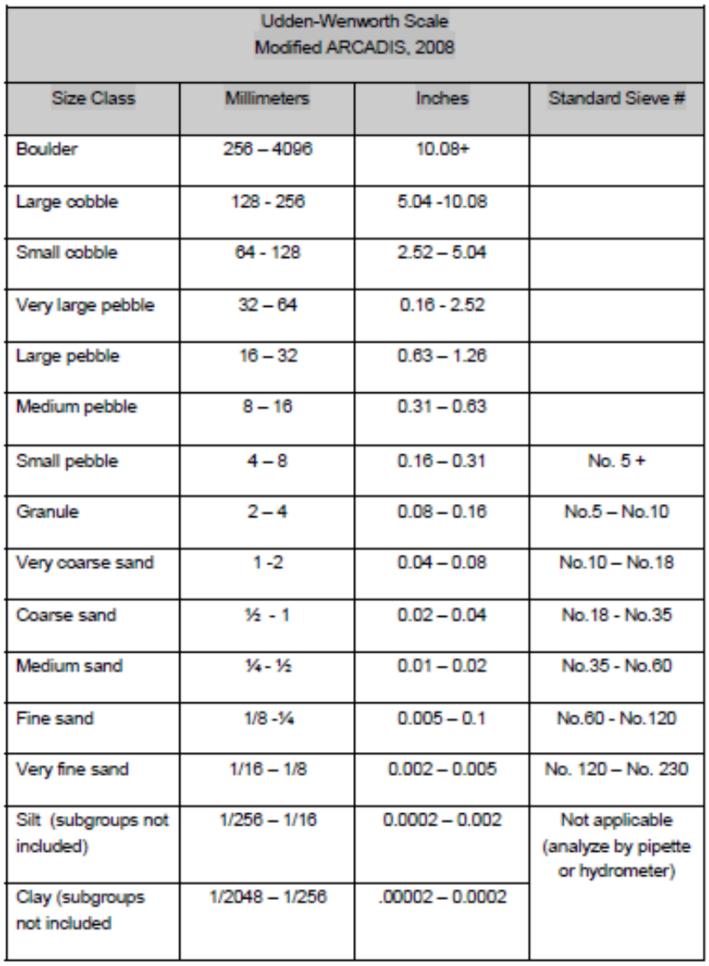


ARCADIS Design & Consultancy for natural and built assets

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

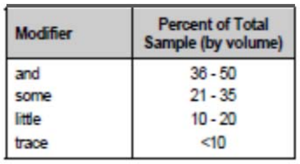
Hand Auger to 7.0' bgs.
Groundwater encountered at 0.0' bgs during drilling.
Water level at development was 3.81' btoc.
No staining observed.
Groundwater elevation measured on November 30, 2015 was 584.06 feet

SOIL DESCRIPTION

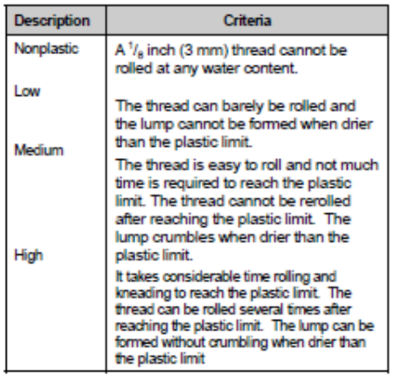


Udden-Wenworth Scale
Modified ARCADIS, 2008

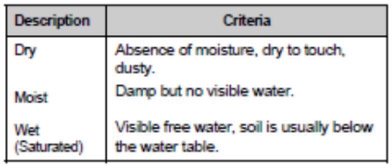
Size Class	Millimeters	Inches	Standard Sieve #
Boulder	256 – 4096	10.08+	
Large cobble	128 - 256	5.04 -10.08	
Small cobble	64 - 128	2.52 – 5.04	
Very large pebble	32 – 64	0.16 - 2.52	
Large pebble	16 – 32	0.63 – 1.26	
Medium pebble	8 – 16	0.31 – 0.63	
Small pebble	4 – 8	0.16 – 0.31	No. 5 +
Granule	2 – 4	0.08 – 0.16	No.5 – No.10
Very coarse sand	1 -2	0.04 – 0.08	No.10 – No.18
Coarse sand	½ - 1	0.02 – 0.04	No.18 - No.35
Medium sand	¼ - ½	0.01 – 0.02	No.35 - No.60
Fine sand	1/8 -¼	0.005 – 0.1	No.60 - No.120
Very fine sand	1/16 – 1/8	0.002 – 0.005	No. 120 – No. 230
Silt (subgroups not included)	1/256 – 1/16	0.0002 – 0.002	Not applicable (analyze by pipette or hydrometer)
Clay (subgroups not included	1/2048 – 1/256	.00002 – 0.0002	



Modifier	Percent of Total Sample (by volume)
and	36 - 50
some	21 - 35
little	10 - 20
trace	<10

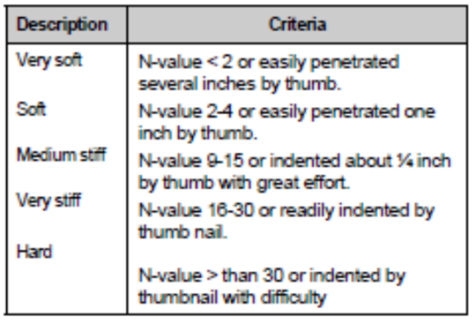


Description	Criteria
Nonplastic	A $^1/_8$ inch (3 mm) thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit

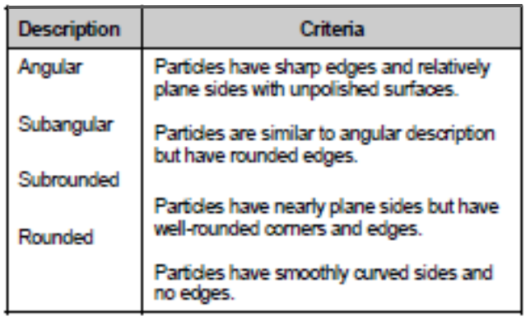


Description	Criteria
Dry	Absence of moisture, dry to touch, dusty.
Moist	Damp but no visible water.
Wet (Saturated)	Visible free water, soil is usually below the water table.

Fine-grained soil – Consistency

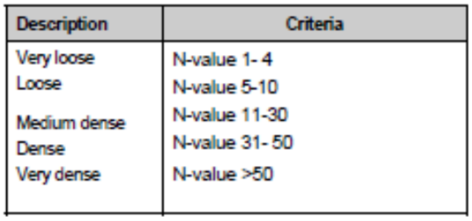


Description	Criteria
Very soft	N-value < 2 or easily penetrated several inches by thumb.
Soft	N-value 2-4 or easily penetrated one inch by thumb.
Medium stiff	N-value 9-15 or indented about ¼ inch by thumb with great effort.
Very stiff	N-value 16-30 or readily indented by thumb nail.
Hard	N-value > than 30 or indented by thumbnail with difficulty



Description	Criteria
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Particles are similar to angular description but have rounded edges.
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges.
Rounded	Particles have smoothly curved sides and no edges.

Coarse-grained soil – Density



Description	Criteria
Very loose	N-value 1- 4
Loose	N-value 5-10
Medium dense	N-value 11-30
Dense	N-value 31- 50
Very dense	N-value >50

WELL CONSTRUCTION LOG

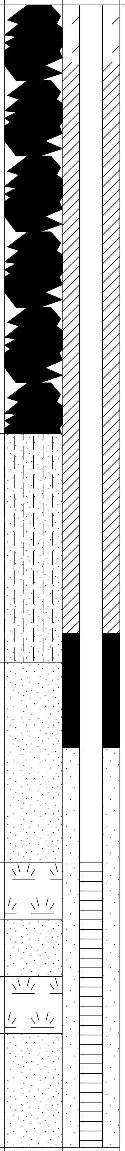
WELL NO. BCC-MW-17001

Page 1 of 1

Facility/Project Name: CEC: BC Cobb		Date Drilling Started: 12/6/17	Date Drilling Completed: 12/6/17	Project Number: 269767.0000.0000
Drilling Firm: Stearns	Drilling Method: Sonic	Surface Elev. (ft) 586.1 TOC Elevation (ft) 589.29	Total Depth (ft bgs) 20.0	Borehole Dia. (in) 6
Boring Location: 7 feet west of BCC-MW-15016. N: 646228.0 E: 12622452.1		Personnel Logged By - T. Hess Driller - B. Marshal	Drilling Equipment: Geoprobe 8140 LS	
Civil Town/City/or Village: Muskegon	County: Muskegon State: MI	Water Level Observations: While Drilling: Date/Time 12/6/17 00:00 ▽ Depth (ft bgs) 10.0 After Drilling: Date/Time 12/7/17 11:35 ▼ Depth (ft bgs) 5.81		

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS
1 HA	100	
2 CS	100	
3 CS	100	

DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
	SANDY COAL ASH mostly coal ash, some fine to medium sand, dark gray (10YR 4/1), loose, dry.		
	Change to some woody material at 5.0 feet.		
▼			
	SILTY SAND WITH ASH mostly fine to medium sand, some silt and ash, few to little woody material, light brownish gray (10YR 6/2), loose, moist.	SM	
10 ▽	Change to saturated at 10.0 feet.		
	SAND mostly fine to medium sand, light brownish gray (10YR 6/2), loose, moist.	SP	
	PEAT dark organic woody material (10YR 2/1), brittle, saturated.		
	SAND mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP	
	PEAT dark organic woody material (10YR 2/1), brittle, saturated.		
	SAND mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP	
20	End of boring at 20.0 feet below ground surface.		



Signature: For Tanner Hess

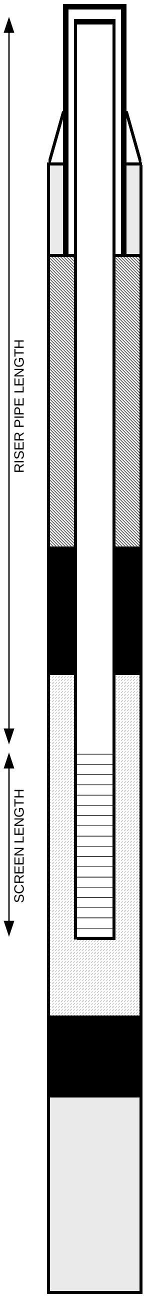
Firm: TRC Environmental Corporation (734) 971-7080
1540 Eisenhower Place Ann Arbor, MI 48108 Fax (734) 971-9022

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb
WELL ID: **BCC-MW-17001**
PROJ. NO: 269767.0000
DATE INSTALLED: 12/6/2017
INSTALLED BY: Tanner Hess
CHECKED BY: CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
589.29	3.1	TOP OF CASING
586.1	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
18.1		GROUT/BACKFILL MATERIAL: BENTONITE SLURRY GROUT/BACKFILL METHOD: TREMIE
	11.0	GROUT
		BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	13.0	BENTONITE SEAL
571.1	15.0	TOP OF SCREEN
5.00		FILTER PACK MATERIAL: MEDIUM, WASHED SAND
566.1	20.0	BOTTOM OF SCREEN
	20.0	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NA
566.1	20.0	HOLE BOTTOM



NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC
PIPE SCHEDULE: 40
PIPE JOINTS: THREADED O-RINGS
SCREEN TYPE: 2-INCH PVC
SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 20 FT.
IN. FROM TO FT.

SURF. CASING DIAMETER: IN. FROM TO FT.
IN. FROM TO FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP
TIME DEVELOPING: 0.5 HOURS
WATER REMOVED: 9.5 GALLONS
WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY
COLOR BEFORE: BROWN
CLARITY AFTER: CLEAR
COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	23.36	T/PVC	12/6/2017	1653
DTB AFTER DEVELOPING:	23.36	T/PVC	12/6/2017	1727
SWL BEFORE DEVELOPING:	8.99	T/PVC	12/6/2017	1653
SWL AFTER DEVELOPING:	9.59	T/PVC	12/6/2017	1727
OTHER SWL:	8.91	T/PVC	12/7/2017	1135
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO
PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO
LOCK KEY NUMBER: Consumers

REVISED 11/2013

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17002

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
CEC: BC Cobb	12/6/17	12/6/17	269767.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns	Sonic	585.8	588.79	19.0	6

Boring Location: 6 feet southeast of BCC-MW-15017.
N: 646348.8 E: 12622087.2

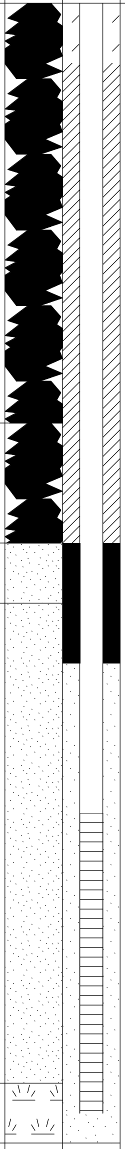
Personnel
Logged By - T. Hess
Driller - B. Marshal

Drilling Equipment: Geoprobe 8140 LS

Civil Town/City/or Village:	County:	State:
Muskegon	Muskegon	MI

Water Level Observations:
While Drilling: Date/Time 12/6/17 00:00 ▽ Depth (ft bgs) 10.0
After Drilling: Date/Time 12/7/17 11:28 ▼ Depth (ft bgs) 5.43

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
1 HA	100		0–5 2 4 ▼	**SANDY COAL ASH** mostly coal ash, some fine to medium sand, trace gravel, dark gray (10YR 4/1), loose, dry.		
2 CS	100		5–9 6 8	**COAL ASH** mostly coal ash, dark gray (10YR 4/1), loose, dry.		
3 CS	100		9–10	**SAND WITH COAL ASH** mostly fine to medium sand, little coal ash, dark gray (10YR 4/1), loose, dry.	SP	
			▽ 10 12 14 16	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP	
			18	**PEAT** mostly organic material, some silt and woody material, black (10YR 2/1), saturated.		
				End of boring at 19.0 feet below ground surface.		



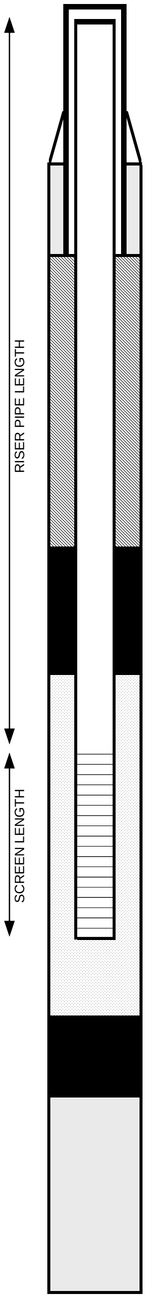
Signature: For Tanner Hess

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

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb		WELL ID:	**BCC-MW-17002**
PROJ. NO: 269767.0000	DATE INSTALLED: 12/6/2017	INSTALLED BY: Tanner Hess	CHECKED BY: CS



ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
588.79	3.0	TOP OF CASING
585.8	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL BENTONITE SLURRY
16.5		GROUT/BACKFILL METHOD TREMIE
	9.0	GROUT
		BENTONITE SEAL MATERIAL MEDIUM CHIPS
	11.0	BENTONITE SEAL
572.3	13.5	TOP OF SCREEN
5.00		FILTER PACK MATERIAL MEDIUM, WASHED SAND
567.3	18.5	BOTTOM OF SCREEN
	18.5	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL NATURAL COLLAPSE
566.8	19.0	HOLE BOTTOM

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 18 FT.
IN. FROM TO FT.

SURF. CASING DIAMETER: IN. FROM TO FT.
IN. FROM TO FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS
WATER REMOVED: 9.5 GALLONS
WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY
COLOR BEFORE: LIGHT BROWN
CLARITY AFTER: CLEAR
COLOR AFTER: CLEAR

ODOR (IF PRESENT): SLIGHT SULFUR

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	21.49	T/PVC	12/6/2017	1533
DTB AFTER DEVELOPING:	21.49	T/PVC	12/6/2017	1615
SWL BEFORE DEVELOPING:	8.49	T/PVC	12/6/2017	1533
SWL AFTER DEVELOPING:	8.58	T/PVC	12/6/2017	1615
OTHER SWL:	8.43	T/PVC	12/7/2017	1128
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO
PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO
LOCK KEY NUMBER: Consumers

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17003

Page 1 of 1

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
CEC: BC Cobb	12/5/17	12/5/17	269767.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns	Sonic	589.3	592.37	22.0	6

Boring Location: 7.5 feet northeast of BCC-MW-15018.
N: 646794.9 E: 12622184.8

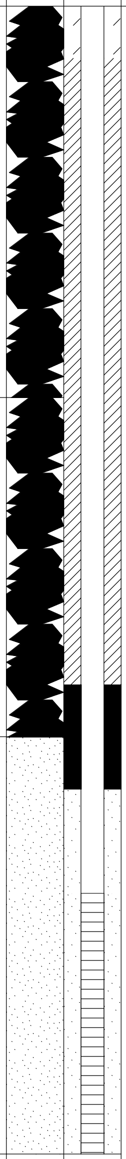
Personnel
Logged By - T. Hess
Driller - B. Marshal

Drilling Equipment: Geoprobe 8140 LS

Civil Town/City/or Village:	County:	State:
Muskegon	Muskegon	MI

Water Level Observations:
While Drilling: Date/Time 12/5/17 00:00 ▽ Depth (ft bgs) 11.0
After Drilling: Date/Time 12/7/17 11:24 ▼ Depth (ft bgs) 9.07

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100			**SANDY COAL ASH** mostly coal ash, some fine to medium sand, trace gravel, brown (10YR 4/3), loose, dry.				
2 CS	100		8	**COAL ASH** mostly coal ash, dark gray (10YR 4/1), loose, dry.				
			▼					
3 CS	100		▽	Change to saturated at 11.0 feet.				
			14	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
4 CS	100							
			22	End of boring at 22.0 feet below ground surface.				



Signature: For Tanner Hess

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

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb

WELL ID: **BCC-MW-17003**

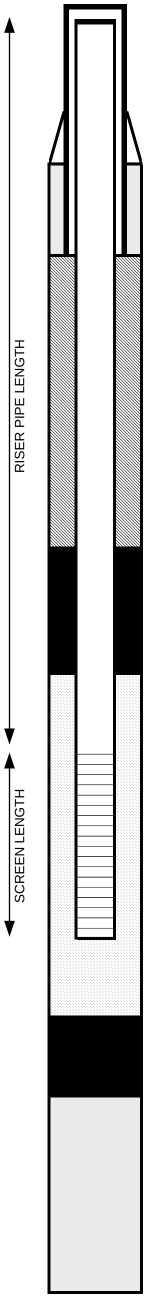
PROJ. NO: 269767.0000

DATE INSTALLED: 12/6/2017

INSTALLED BY: Tanner Hess

CHECKED BY: CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
592.37	2.9	TOP OF CASING
589.3	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL BENTONITE SLURRY
19.9		GROUT/BACKFILL METHOD TREMIE
	13.0	GROUT
		BENTONITE SEAL MATERIAL MEDIUM CHIPS
	15.0	BENTONITE SEAL
572.3	17.0	TOP OF SCREEN
5.00		FILTER PACK MATERIAL MEDIUM, WASHED SAND
567.3	22.0	BOTTOM OF SCREEN
	22.0	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL NA
567.3	22.0	HOLE BOTTOM



NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 22 FT.

IN. FROM TO FT.

SURF. CASING DIAMETER: IN. FROM TO FT.

IN. FROM TO FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS

WATER REMOVED: 9.5 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	25.25	T/PVC	12/6/2017	1258
DTB AFTER DEVELOPING:	25.25	T/PVC	12/6/2017	1337
SWL BEFORE DEVELOPING:	12.05	T/PVC	12/6/2017	1258
SWL AFTER DEVELOPING:	12.10	T/PVC	12/6/2017	1337
OTHER SWL:	11.97	T/PVC	12/7/2017	1124
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17004

Page 1 of 1

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
CEC: BC Cobb	12/5/17	12/5/17	269767.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns	Sonic	589.1	591.84	22.5	6

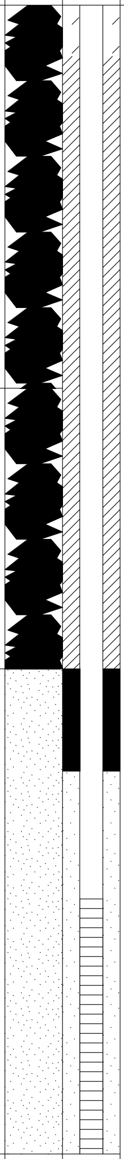
Boring Location: 8 feet northeast of BCC-MW-15019.
N: 647110.1 E: 12622373.4

Personnel
Logged By - T. Hess
Driller - B. Marshal

Drilling Equipment: Geoprobe 8140 LS

Civil Town/City/or Village:	County:	State:
Muskegon	Muskegon	MI

Water Level Observations:
While Drilling: Date/Time 12/5/17 00:00 ▽ Depth (ft bgs) 10.0
After Drilling: Date/Time 12/7/17 11:20 ▼ Depth (ft bgs) 9.03



SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
1 HA	100		0–5 (2, 4)	**SANDY COAL ASH** mostly coal ash, some fine to medium sand, trace gravel, brown (10YR 4/3), loose, dry.		
2 CS	0		5–10 (6, 8)	**COAL ASH** mostly coal ash, dark gray (10YR 4/1), loose. ▼ (9.03) ▽ (10.0)		No recovery from 5.0 to 10.0 feet.
3 CS	100		10–20 (10, 12, 14, 16, 18)	Change to saturated at 10.0 feet. **SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP	
4 CS	80		20–22.5 (20, 22)			
				End of boring at 22.5 feet below ground surface.		

Signature: For Tanner Hess

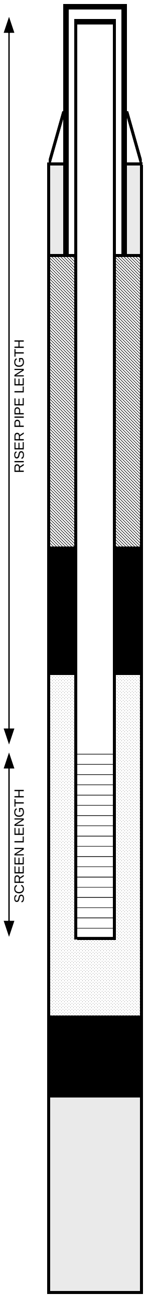
Firm: TRC Environmental Corporation (734) 971-7080
1540 Eisenhower Place Ann Arbor, MI 48108 Fax (734) 971-9022

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb		WELL ID:	**BCC-MW-17004**
PROJ. NO: 269767.0000	DATE INSTALLED: 12/5/2017 INSTALLED BY: Tanner Hess		CHECKED BY: CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
591.84	2.6	TOP OF CASING
589.1	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL BENTONITE SLURRY
		GROUT/BACKFILL METHOD TREMIE
20.1		
	13.0	GROUT
		BENTONITE SEAL MATERIAL MEDIUM CHIPS
	15.0	BENTONITE SEAL
571.6	17.5	TOP OF SCREEN
		FILTER PACK MATERIAL MEDIUM, WASHED SAND
5.00		
566.6	22.5	BOTTOM OF SCREEN
	22.5	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL NA
566.6	22.5	HOLE BOTTOM



NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 22 FT.
IN. FROM ____ TO ____ FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS
WATER REMOVED: 9.5 GALLONS
WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY
COLOR BEFORE: BROWN
CLARITY AFTER: CLEAR
COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	25.27	T/PVC	12/5/2017	1544
DTB AFTER DEVELOPING:	25.27	T/PVC	12/5/2017	1625
SWL BEFORE DEVELOPING:	11.20	T/PVC	12/5/2017	1544
SWL AFTER DEVELOPING:	11.30	T/PVC	12/5/2017	1625
OTHER SWL:	11.63	T/PVC	12/7/2017	1120
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO
PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO
LOCK KEY NUMBER: Consumers

REVISED 11/2013

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17005

Page 1 of 1

Facility/Project Name: CEC: BC Cobb	Date Drilling Started: 12/4/17	Date Drilling Completed: 12/5/17	Project Number: 269767.0000.0000

Drilling Firm: Stearns	Drilling Method: Sonic	Surface Elev. (ft) 589.3	TOC Elevation (ft) 592.42	Total Depth (ft bgs) 30.0	Borehole Dia. (in) 6

Boring Location: 8 feet southwest of BCC-MW-15020.
N: 647433.9 E: 12622619.7

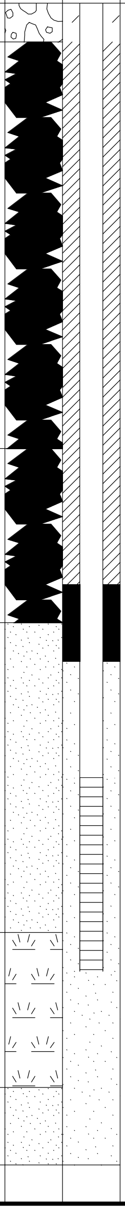
Personnel
Logged By - T. Hess
Driller - B. Marshal

Drilling Equipment: Geoprobe 8140 LS

Civil Town/City/or Village: Muskegon
County: Muskegon
State: MI

Water Level Observations:
While Drilling: Date/Time 12/4/17 00:00 ▽ Depth (ft bgs) 11.5
After Drilling: Date/Time 12/7/17 11:17 ▼ Depth (ft bgs) 9.96

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
1 HA	100			**GRAVEL** mostly gravel, white (10YR 8/1), road base.	GP	
				SANDY COAL ASH mostly coal ash, some fine to medium sand, trace gravel, brown (10YR 4/3), loose, dry.		
			5			
2 CS	50			Change to very dark gray (10YR 3/1) at 8.0 feet.		
			10	▼		
				▽		
3 CS	100			**COAL ASH** mostly coal ash, dark gray (10YR 4/1), loose, saturated.		
			15			
				SAND mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.		
			20		SP	
4 CS	100			**PEAT** mostly organic material, some silt and woody material, black (10YR 2/1), saturated.		
			25			
				SAND mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP	
			30	End of boring at 30.0 feet below ground surface.		



Signature: Saul B. Holmstrom
For Tanner Hess

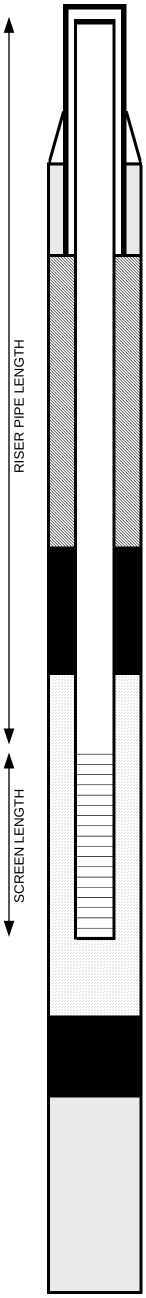
Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, MI 48108
(734) 971-7080
Fax (734) 971-9022

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME:	CEC: BC Cobb	WELL ID:	**BCC-MW-17005**
PROJ. NO: 269767.0000	DATE INSTALLED: 12/5/2017	INSTALLED BY: Tanner Hess	CHECKED BY: CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)
592.42	3.1 TOP OF CASING
589.3	0.0 GROUND SURFACE
	1.0 CEMENT SURFACE PLUG
	GROUT/BACKFILL MATERIAL BENTONITE SLURRY
	GROUT/BACKFILL METHOD TREMIE
23.1	
	15.0 GROUT
	BENTONITE SEAL MATERIAL MEDIUM CHIPS
	17.0 BENTONITE SEAL
569.3	20.0 TOP OF SCREEN
	FILTER PACK MATERIAL MEDIUM, WASHED SAND
5.00	
564.3	25.0 BOTTOM OF SCREEN
	25.0 BOTTOM OF FILTER PACK
	NA BENTONITE PLUG
	BACKFILL MATERIAL NATURAL COLLAPSE
559.3	30.0 HOLE BOTTOM



NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 24 FT.
IN. FROM TO FT.

SURF. CASING DIAMETER: IN. FROM TO FT.
IN. FROM TO FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS

WATER REMOVED: 9.5 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	27.89	T/PVC	12/5/2017	1400
DTB AFTER DEVELOPING:	27.89	T/PVC	12/5/2017	1445
SWL BEFORE DEVELOPING:	12.73	T/PVC	12/5/2017	1400
SWL AFTER DEVELOPING:	12.80	T/PVC	12/5/2017	1445
OTHER SWL:	13.06	T/PVC	12/7/2017	1117
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

REVISED 11/2013

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17006

Page 1 of 1

Facility/Project Name: CEC: BC Cobb	Date Drilling Started: 12/4/17	Date Drilling Completed: 12/4/17	Project Number: 269767.0000.0000

Drilling Firm: Stearns	Drilling Method: Sonic	Surface Elev. (ft) 590.5	TOC Elevation (ft) 593.78	Total Depth (ft bgs) 30.0	Borehole Dia. (in) 6

Boring Location: 9 feet west of BCC-MW-15021.
N: 646657.7 E: 12623301.3

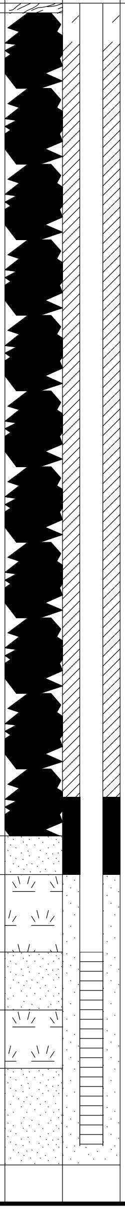
Personnel
Logged By - T. Hess
Driller - B. Marshal

Drilling Equipment: Geoprobe 8140 LS

Civil Town/City/or Village: Muskegon
County: Muskegon
State: MI

Water Level Observations:
While Drilling: Date/Time 12/4/17 00:00 ▽ Depth (ft bgs) 11.5
After Drilling: Date/Time 12/7/17 11:11 ▼ Depth (ft bgs) 13.5

SAMPLE							
NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG / WELL DIAGRAM	COMMENTS
1 HA	100			**TOPSOIL** black (10YR 2/1).			
				COAL ASH mostly coal ash, dark gray (10YR 4/1), fine, soft, loose.			
			5				
2 CS	100						
				Change to moist at 9.0 feet.			
			10	Change to dry at 10.0 feet.			
			▽	Change to saturated at 11.5 feet.			
			▼				
3 CS	100		15				
			20				
				SAND mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP		
				PEAT mostly organic material, some silt and woody material, black (10YR 2/1), saturated.			
4 CS	100		25	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP		
				PEAT mostly organic material, some silt and woody material, black (10YR 2/1), saturated.			
				SAND mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP		
			30	End of boring at 30.0 feet below ground surface.			



Signature: For Tanner Hess

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

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb

WELL ID: **BCC-MW-17006**

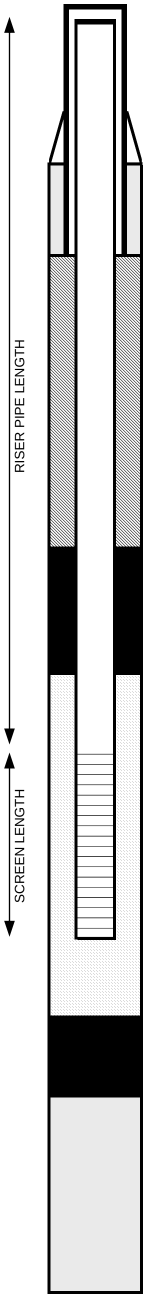
PROJ. NO: 269767.0000

DATE INSTALLED: 12/4/2017

INSTALLED BY: Tanner Hess

CHECKED BY: CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
593.78	3.3	TOP OF CASING
590.5	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL BENTONITE SLURRY
		GROUT/BACKFILL METHOD TREMIE
27.8		
	20.5	GROUT
		BENTONITE SEAL MATERIAL MEDIUM CHIPS
	22.5	BENTONITE SEAL
566.0	24.5	TOP OF SCREEN
		FILTER PACK MATERIAL MEDIUM, WASHED SAND
5.00		
561.0	29.5	BOTTOM OF SCREEN
	29.5	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL NATURAL COLLAPSE
560.5	30.0	HOLE BOTTOM



NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 30 FT.
IN. FROM TO FT.

SURF. CASING DIAMETER: IN. FROM TO FT.
IN. FROM TO FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.75 HOURS

WATER REMOVED: 14.25 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	32.69	T/PVC	12/5/2017	1153
DTB AFTER DEVELOPING:	32.69	T/PVC	12/5/2017	1315
SWL BEFORE DEVELOPING:	16.60	T/PVC	12/5/2017	1153
SWL AFTER DEVELOPING:	16.90	T/PVC	12/5/2017	1315
OTHER SWL:	16.80	T/PVC	12/7/2017	1111
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

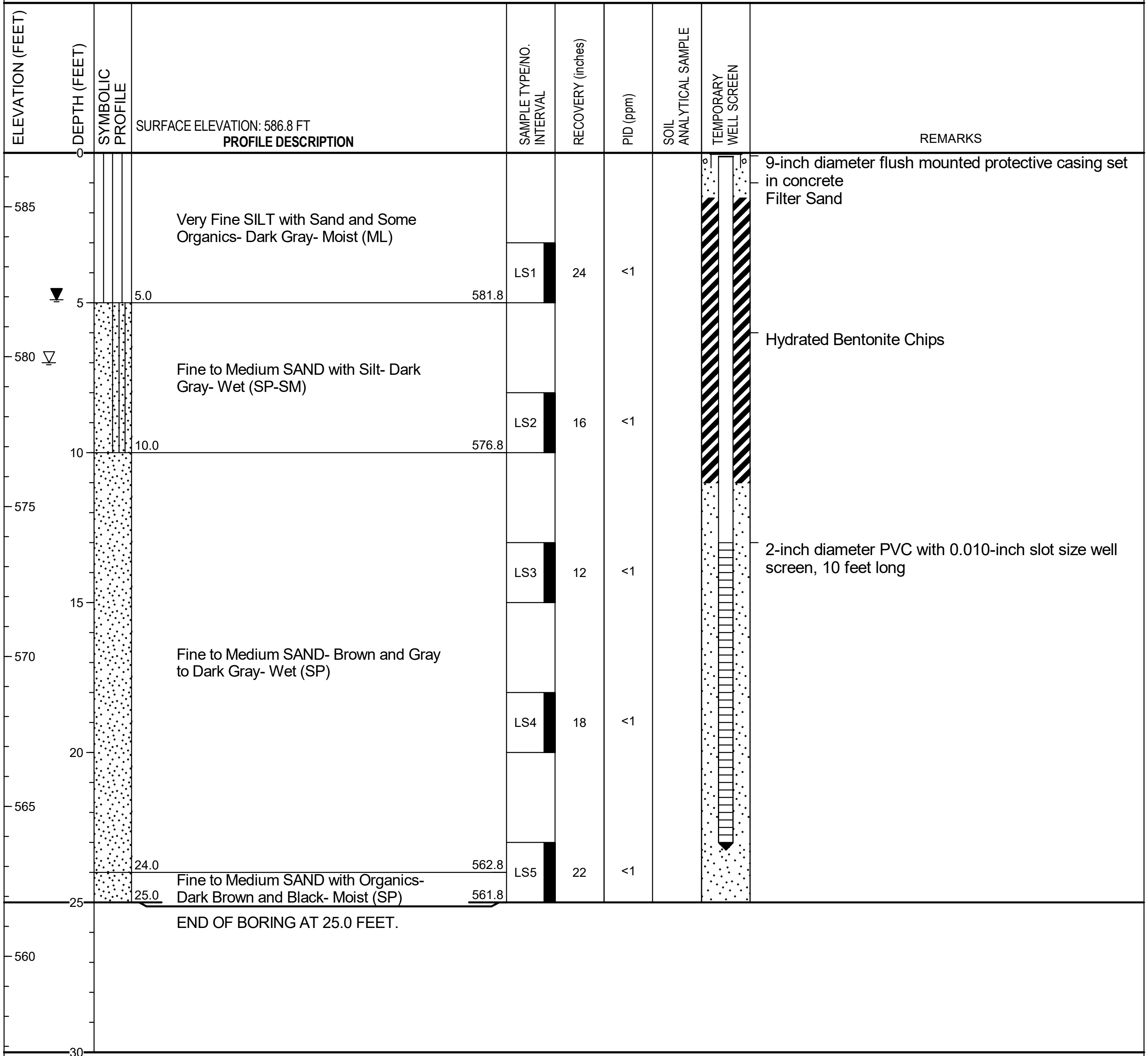
LOCK KEY NUMBER: Consumers

REVISED 11/2013

BORING MW-15015R

PAGE 1 OF 1

PROJECT NAME: BC Cobb
PROJECT NUMBER: 083742.02
CLIENT: HDR Michigan Inc
PROJECT LOCATION: Muskegon, Michigan
DATE STARTED: 5/12/20
COMPLETED: 5/12/20
BORING METHOD: Hollow-stem Augers
OPERATOR: BG (Stearns Drilling)
RIG NO.: ATV
LOGGED BY: MLS
CHECKED BY: CES



SURFACE ELEVATION: 586.8 FT

PROFILE DESCRIPTION

Depth (ft)	Profile description	Elevation (ft)
5.0	Very Fine SILT with Sand and Some Organics- Dark Gray- Moist (ML)	581.8
10.0	Fine to Medium SAND with Silt- Dark Gray- Wet (SP-SM)	576.8
24.0	Fine to Medium SAND- Brown and Gray to Dark Gray- Wet (SP)	562.8
25.0	Fine to Medium SAND with Organics- Dark Brown and Black- Moist (SP)	561.8

END OF BORING AT 25.0 FEET.

SAMPLE TYPE/NO.	RECOVERY (inches)	PID (ppm)
LS1	24	<1
LS2	16	<1
LS3	12	<1
LS4	18	<1
LS5	22	<1

REMARKS

9-inch diameter flush mounted protective casing set in concrete

Filter Sand

Hydrated Bentonite Chips

2-inch diameter PVC with 0.010-inch slot size well screen, 10 feet long

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ **DURING BORING:**	7.0	579.8
▼ **AT END OF BORING:**	4.9	581.9

BACKFILL METHOD: Well

NOTES:
1. Soil samples were classified according to ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) for environmental purposes only. Therefore, the boring logs and associated report(s) should not be used for geotechnical evaluation or design.
2. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.
3. Listed depths under the profile description are rounded to the nearest tenth of a foot (e.g. 5.75 = 5.8). Refer to the report and attachments for actual sample depths and/or intervals (where applicable).
4. No odors noted and no staining observed.

BORING MW-15016R

PAGE 1 OF 2

PROJECT NAME: BC Cobb | **PROJECT NUMBER:** 083742.02

CLIENT: HDR Michigan Inc | **PROJECT LOCATION:** Muskegon, Michigan

DATE STARTED: 5/12/20 | **COMPLETED:** 5/12/20 | **BORING METHOD:** Hollow-stem Augers

OPERATOR: BG (Stearns Drilling) | **RIG NO.:** ATV | **LOGGED BY:** MLS | **CHECKED BY:** CES

SURFACE ELEVATION: 586.8 FT

DEPTH (FEET)	PROFILE DESCRIPTION	ELEVATION (FEET)	SAMPLE TYPE/NO. INTERVAL	RECOVERY (inches)	PID (ppm)	SOIL ANALYTICAL SAMPLE	REMARKS
1.0	FILL- Fine to Medium SAND with Silt- Dark Brown- Moist (SP-SM)	585.8					9-inch diameter flush mounted protective casing set in concrete Filter Sand
8.0	FILL- Fine to Medium Sandy COAL ASH- Silt from 4 to 4.25 Feet- Black and Gray- Moist	578.8	LS1	24	<1		Bentonite Grout
15.0	FILL- Fine to Medium SAND- Some Ash, Wood Pieces and Organics- Dark Brown- Wet (SP)	571.8	LS2 LS3	24 15	<1 <1		
23.0	Fine to Medium SAND- Dark Gray- Wet (SP)	563.8	LS4	11	<1		
24.5	Fine to Medium SAND with Silt- Wood Pieces- Dark Gray- Wet (SP-SM)	562.3	LS5	18	<1		
28.5	Fine to Medium SAND- Wood Pieces from 28 to 28.5 Feet- Gray- Wet (SP)	558.3					
29.5	Fine to Medium SANDY SILT- Dark Gray- Wet (ML/SM)	557.3	LS6	19	<1		

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
∇ **DURING BORING:**	8.0	578.8
▼ **AT END OF BORING:**	4.8	582.0

BACKFILL METHOD: Well

NOTES:
1. Soil samples were classified according to ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) for environmental purposes only. Therefore, the boring logs and associated report(s) should not be used for geotechnical evaluation or design.
2. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.
3. Listed depths under the profile description are rounded to the nearest tenth of a foot (e.g. 5.75 = 5.8). Refer to the report and attachments for actual sample depths and/or intervals (where applicable).
4. No odors noted and no staining observed.

(Continued Next Page)

BORING MW-15016R

PAGE 2 OF 2

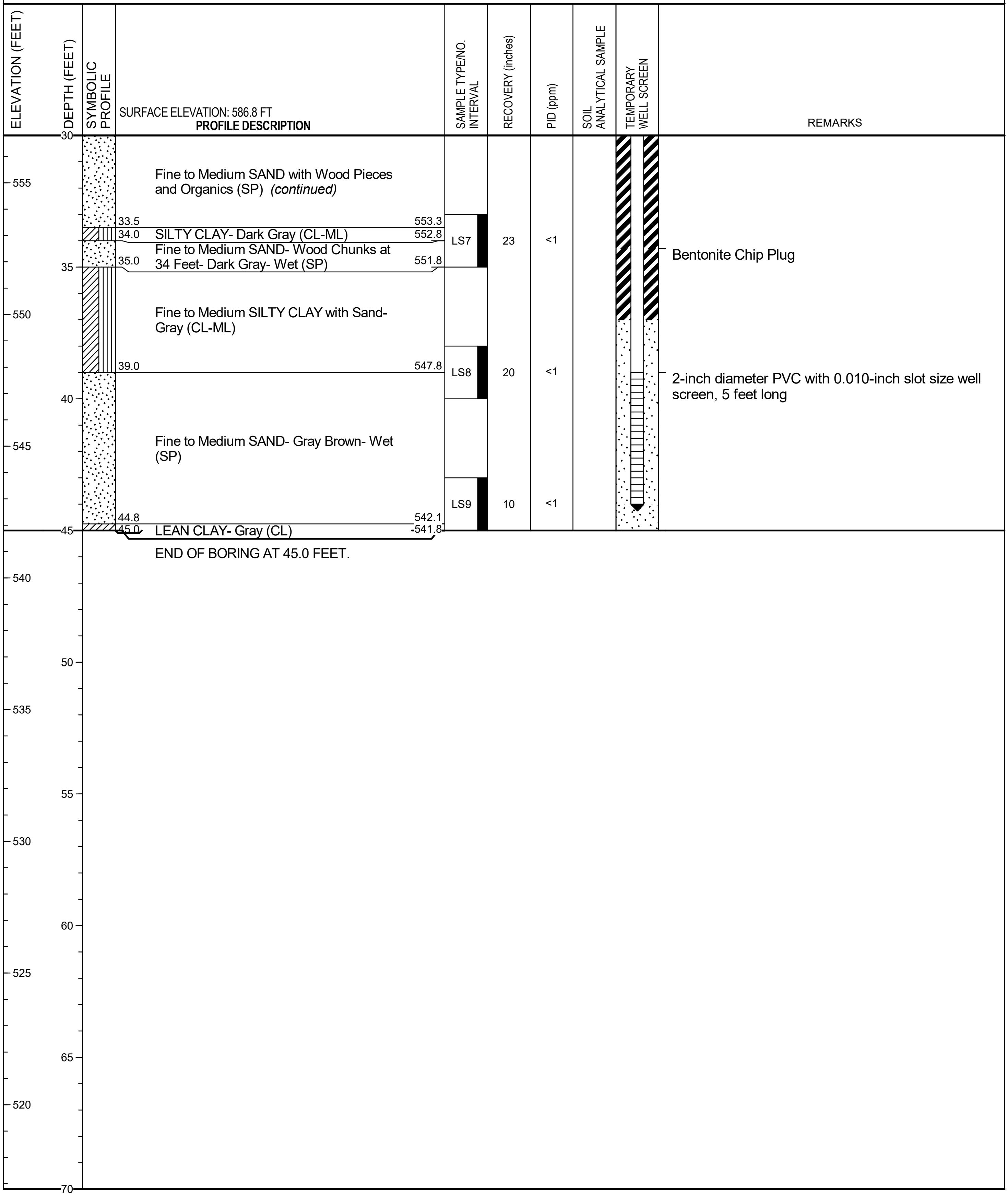
PROJECT NAME: BC Cobb

PROJECT NUMBER: 083742.02

CLIENT: HDR Michigan Inc

PROJECT LOCATION: Muskegon, Michigan

SURFACE ELEVATION: 586.8 FT



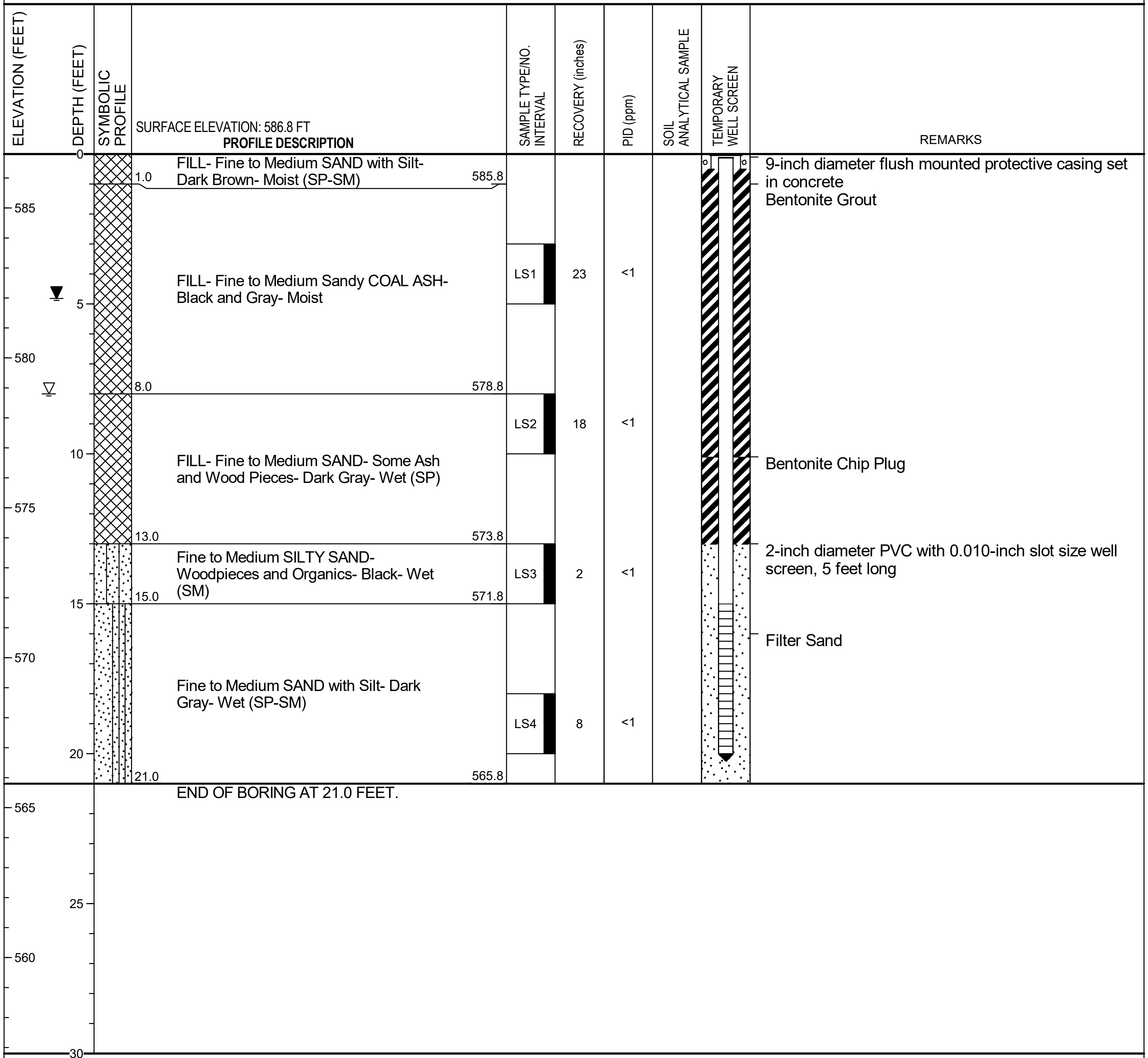
DEPTH (FEET)	PROFILE DESCRIPTION	ELEVATION (FEET)	SAMPLE TYPE/NO. INTERVAL	RECOVERY (inches)	PID (ppm)	REMARKS
33.5	Fine to Medium SAND with Wood Pieces and Organics (SP) *(continued)*	553.3				
34.0	SILTY CLAY- Dark Gray (CL-ML)	552.8	LS7	23	<1	Bentonite Chip Plug
35.0	Fine to Medium SAND- Wood Chunks at 34 Feet- Dark Gray- Wet (SP)	551.8				
39.0	Fine to Medium SILTY CLAY with Sand- Gray (CL-ML)	547.8	LS8	20	<1	2-inch diameter PVC with 0.010-inch slot size well screen, 5 feet long
44.8	Fine to Medium SAND- Gray Brown- Wet (SP)	542.1	LS9	10	<1	
45.0	LEAN CLAY- Gray (CL)	541.8				

END OF BORING AT 45.0 FEET.

BORING MW-17001R

PAGE 1 OF 1

PROJECT NAME: BC Cobb
PROJECT NUMBER: 083742.02
CLIENT: HDR Michigan Inc
PROJECT LOCATION: Muskegon, Michigan
DATE STARTED: 5/12/20
COMPLETED: 5/12/20
BORING METHOD: Hollow-stem Augers
OPERATOR: BG (Stearns Drilling)
RIG NO.: ATV
LOGGED BY: MLS
CHECKED BY: CES



SURFACE ELEVATION: 586.8 FT

DEPTH (FEET)	PROFILE DESCRIPTION	ELEVATION (FEET)	SAMPLE TYPE/NO. INTERVAL	RECOVERY (inches)	PID (ppm)	SOIL ANALYTICAL SAMPLE	REMARKS
1.0	FILL- Fine to Medium SAND with Silt- Dark Brown- Moist (SP-SM)	585.8					9-inch diameter flush mounted protective casing set in concrete Bentonite Grout
8.0	FILL- Fine to Medium Sandy COAL ASH- Black and Gray- Moist	578.8	LS1	23	<1		
13.0	FILL- Fine to Medium SAND- Some Ash and Wood Pieces- Dark Gray- Wet (SP)	573.8	LS2	18	<1		Bentonite Chip Plug
15.0	Fine to Medium SILTY SAND- Woodpieces and Organics- Black- Wet (SM)	571.8	LS3	2	<1		2-inch diameter PVC with 0.010-inch slot size well screen, 5 feet long
21.0	Fine to Medium SAND with Silt- Dark Gray- Wet (SP-SM)	565.8	LS4	8	<1		Filter Sand

END OF BORING AT 21.0 FEET.

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ **DURING BORING:**	8.0	578.8
▼ **AT END OF BORING:**	4.8	582.0

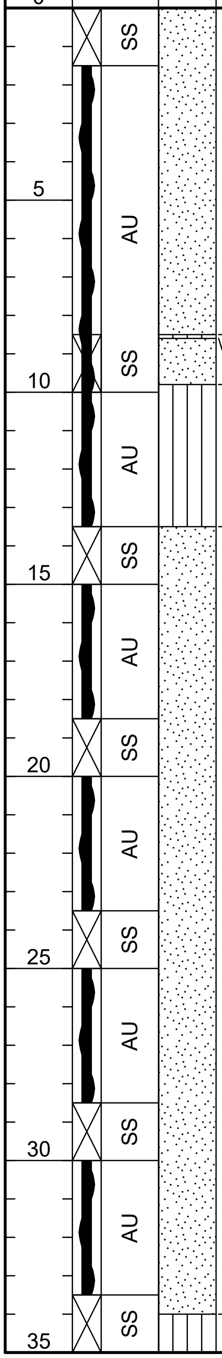
BACKFILL METHOD: Well

NOTES:
1. Soil samples were classified according to ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) for environmental purposes only. Therefore, the boring logs and associated report(s) should not be used for geotechnical evaluation or design.
2. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.
3. Listed depths under the profile description are rounded to the nearest tenth of a foot (e.g. 5.75 = 5.8). Refer to the report and attachments for actual sample depths and/or intervals (where applicable).
4. No staining observed.
5. Sulfur-type odor noted during drilling.

MW-15014R
PAGE 1 OF 1

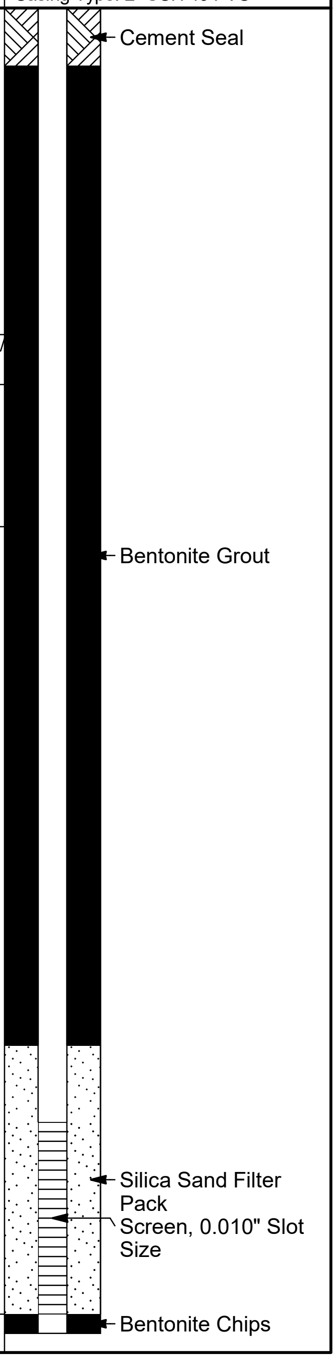
CLIENT Muskegon Environmental Redevelopment Group
PROJECT NAME Former BC Cobb Power Plant
PROJECT NUMBER 10220433
PROJECT LOCATION Muskegon, MI
DATE STARTED 01/31/22 10:15 **COMPLETED** 01/31/22 12:15
GROUND ELEVATION 586.9 ft MSL **HOLE DIAMETER** 8
DRILLING CONTRACTOR Stearns **DRILLER** Gary Greerlings
GROUND WATER LEVELS:
DRILLING METHOD HSA **EQUIPMENT** CME 55
▽ **AT TIME OF DRILLING** 15.00 ft / Elev 571.90 ft
LOGGED BY Tanten Buszka **CHECKED BY**
▼ **20 HRS AFTER DRILLING** 13.69 ft / Elev 573.21 ft
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM



	POORLY GRADED SAND WITH SILT AND GRAVEL, (SP) brown (10YR 6/6), poorly graded, subrounded, fine to medium grained, moist, dense, iron oxide staining	
8.5		578.4
	SILT WITH SAND, (ML) gray (10YR 5/1), poorly graded, fine grained, moist, loose, Organic fragments observed (Fly Ash)	
8.6		578.3
	POORLY GRADED SAND WITH SILT, (SP) gray (10YR 5/1), poorly graded, rounded, fine to medium grained, moist, loose	
9.8		577.1
	SILT WITH SAND, (ML) gray (10YR 5/1), fine grained, moist, loose, (Fly Ash)	
13.5	▼ ▽	573.4
	POORLY GRADED SAND, (SP) gray (10YR 3/1), poorly graded, rounded, fine to medium grained, saturated, loose, Silt (ML) lenses observed at 24.5-24.7 ft bgs, 29.9-30.0 ft bgs, and 34.4-35.0 ft bgs.	
34.0		552.9
	SILT, (ML) gray (10YR 3/1), fine grained, saturated, loose, (Fly Ash)	
35.0		551.9

Casing Top Elev: 589.7 (ft)
Casing Type: 2" SCH 40 PVC



Bottom of borehole at 35.0 feet.

Appendix D

Groundwater Sampling Collection Standard Operating Procedure

Groundwater Sample Collection Standard Operating Procedure

BC Cobb Facility

Muskegon Environmental Redevelopment Group, LLC.

July 8, 2020

1.0 Introduction

This Standard Operating Procedure (SOP) provides guidance for groundwater sample collection at the B.C. Cobb Facility (BCC or Site) located in Muskegon, Michigan. BCC is the site of a former coal-fired power generation facility. During operations, coal combustion residuals (CCR) were deposited in Ponds 0-8 and the Bottom Ash Pond. Groundwater monitoring will support compliance with the federal CCR Rule and the Michigan Part 115 Solid Waste Regulations for CCR ash impoundments. This SOP addresses procedures for the groundwater monitoring requirement.

1.1 Method Applicability

The following sections outline the general method for collecting low stress/low flow groundwater samples from monitoring wells. The low flow method is the preferred technique for groundwater monitoring. This technique is appropriate for this Site due to the following characteristics:

- Casing diameter is greater than 1.0 inch
- Screen interval is ten feet or less
- Samples are analyzed for total metals
- Low turbidity is desired in sample containers
- Purge water requiring disposal is minimized, and
- Analytes are repeatable.

The proposed sample collection and safety procedures below are consistent with EPA guidelines and CCR Rule. Muskegon Environmental Redevelopment Group, LLC (MERG) or their Consultant will collect all samples.

1.2 Summary of Method

Depth to water is measured prior to purging. After depth to water is measured, tubing is placed approximately mid-screen in the well. A peristaltic pump is used to purge water from the well at a rate of approximately 100-500 mL/minute. The purged water moves through a flow cell that contains probes to measure stabilization parameters such as pH and conductivity. Once parameters have stabilized, the purged water stream is disconnected from the flow cell and used to fill sample containers for lab analysis. A detailed explanation of this procedure is in Section 5.0.

2.0 Health and Safety

2.1 Safety Documentation

Job Hazard Analyses (JHAs) must be developed prior to arriving on Site. JHAs identify potential hazards that may be present on the Site or while executing the work. JHAs are used to provide methods to minimize hazards.

The site-specific Health and Safety Plan (H&SP) is used to identify actions and precautions to prevent injury. The H&SP also includes essential emergency service contacts in case of incident.

Each individual is required to have read and understood the Health and Safety Plan (HASP) for the specific project activity and signed the acknowledgement sheet confirming their review.

2.2 Safety Procedures

A safety briefing must be conducted between Site personnel and the sampling team before the start of the work each day. No sampling shall commence until all personnel have completed site specific safety training.

Complete equipment and supply checklists and verify that required documentation and equipment for field activities are on site.

Review locations for planned field activities for hazards. Each sampling site will be characterized by the following factors:

- Location of work
- Weather conditions: rainfall, temperature, and wind direction
- Ongoing activities that may influence or disrupt sampling efforts
- Accessibility to the sampling locations (e.g. road maintenance, rough terrain, fallen trees, flooding, etc.)

View monitoring well locations and confirm the monitoring wells are accessible and well identifications are clearly marked. Select location for disposal of decontamination and purge waters.

3.0 Equipment and Supplies

A complete list of equipment and supplies for groundwater sampling at the BCC site are provided as Appendix A. Primary equipment needs are detailed below:

- YSI water quality meter, or similar, with flow cell and hand-held monitor. In-line probes calibrated to measure dissolved oxygen, oxidation-reduction potential (ORP), conductivity, pH, and temperature are required. Turbidity may be included as an additional probe or a separate turbidity meter may be used.
- Peristaltic pump with pump head and external power source. Bladder pump may be used if water levels are >25 feet below top of casing.
- Water level measurement tape. Must have a minimum of 0.01-foot accuracy.
- Pump head tubing (silicone) and well tubing (polyethylene). Each well is equipped with dedicated tubing; extra tubing on hand is recommended if replacement is deemed necessary.
- Large SUV. An initial safety check should be performed at the start of each shift to confirm the vehicle is in good working condition. The vehicle should then be checked daily for damage or required maintenance.
- Decontamination supplies.
- Sample containers with appropriate preservatives.
- Personal protective equipment.
- Tools and materials as listed in Appendix A.

All equipment must be calibrated according to manufacturer's instructions. Periodic or daily checks are recommended to ensure accurate calibration. Written documentation is required for all calibrations and periodic checks.

4.0 Quality Control Documents and Records

The following documentation and records must be taken to the jobsite and maintained for every sampling event:

- Historical documentation, including:
    - Well construction data,
    - Well location map
    - Field data from the previous sampling event
- Material Safety Data Sheets (MSDSs) for any reagents taken to the Site
- Field log book/field worksheet to document:
    - Field instrument calibration data
    - Monitoring well identification number and condition
    - Well depth and depth to water, including date and time of measurement
    - Sample tubing material, diameter, length, placement, and pump type
    - Pumping rate, water level, water quality indicator values, and date and time of measurement
    - Identification and explanation of any unacceptable water quality indicator values
    - Time and date of sample collection
    - Sample ID
    - Field observations
    - Sampler's name or initials

  See Appendix B for the Field Data Sheet to be used to record the above information.
- Chain of Custody (COC) form must include:
    - Analytical parameters requested
    - Sample time and date
    - Sampler's name or initials
    - Site location
    - Sample ID
    - Preservatives added

  See Appendix C for a sample COC form.
- Sample labels must include:
    - Sample ID
    - Sample time and date
    - Sampler's initials
    - Preservatives
    - Analysis requested

Sample bottle labels, COC form data, and information on Field Data Sheets must match *exactly*.

5.0 Sampling Procedures

5.1 Determination of Depth-to-Groundwater (DTW)

The following initial steps will be followed before purging each monitoring well and collecting groundwater samples in the field.

1. Orient the equipment upwind of the monitoring wells if possible.
2. Begin with the well that has the least contaminated groundwater (if known) and proceed in increasing order of contamination such that the well with the highest contamination is sampled last.
3. Locate the monitoring well to be sampled, confirm monitoring well ID and record the condition of the monitoring well (casing protector, lock, locking cap, and well casing). Record any abnormal observations or evidence of damage or tampering.
4. A sheet of plastic or tarp may be laid around the casing protector to provide a clean area for equipment and minimizing contamination from the ground.
5. Remove the well cap.
6. If the well casing does not have a reference point, make one. The reference point is typically a V-cut or a mark on the top of the PVC well casing.
7. Hold the water level measuring tape against the reference point to measure the DTW to 0.01 feet. Duplicate the reading. Every measurement should be taken from the same reference point. Minimize disturbance of the water column while measuring.
8. Record the DTW on the Field Data Sheet (Appendix B).
9. Decontaminate the water-level indicator and tape prior to each use. The decontamination procedure for the water level indicator is: Hand wash the calibrated tape and probe that contacted groundwater with Alconox solution (or equivalent) and rinse with deionized water.
10. Monitoring well depth can be obtained from monitoring well construction logs. Measuring total depth of monitoring wells prior to sampling should be avoided; measuring to the bottom of the monitoring well casing may cause re-suspension of settled solids.
11. Continue on to purging if sampling is to occur on the same day. Lock well casing and pack up equipment if sampling is to occur at a later date.

5.2 Purging Procedure

The type of pump used for sampling is dependent upon the casing diameter, depth to groundwater, depth of the monitoring well screen, and anticipated volume required for purge. A peristaltic pump is recommended for the BC Cobb Site. A bladder pump may be used if groundwater levels are greater than 25 feet below the top of the casing. Decontamination of portable pumps is required prior to each use.

A peristaltic pump is appropriate for monitoring wells with groundwater depths less than 25 feet below the top of the casing. The sampling protocol will be as follows for the collection of groundwater samples using a peristaltic pump (such as the Geopump-2or similar):

1. Use historical well data to cut polyethylene tubing to the appropriate length such that the tubing end can be lowered to the middle of the screen, and there is at least three to four feet of tubing at the surface to run through the pump and run into a bucket.
2. Slowly and carefully lower the tubing to the mid-point of the screened interval. In cases where the entire screen is not saturated, place the tubing inlet near the middle of the saturated screen. Take care not to allow the tubing to touch the ground and introduce contamination into the well.
3. Do not place the tubing less than two feet above the bottom of the well, as this may cause the mobilization of bottom sediments. If saturated screen length is two feet or less, collect sample using disposable bailer.
4. Allow at least one foot of water above the inlet so there is little risk of entrainment or air in the sample.
5. Attach an in-line multi-probe flow-through cell. The flow-cell will be used to monitor the indicator parameters so as not to expose the water to the atmosphere prior to measurement. During purging, water quality indicator parameters (pH, ORP, turbidity, specific conductivity, and DO) will be measured every 3-5 minutes until the parameters have stabilized. Measurement should be recorded on Appendix B. A minimum of 5 sets of water quality indicator parameters should be recorded.
6. Begin purging the monitoring well at a rate of approximately 100 mL/minute. Flow rate can range from 100 to 500 mL/min. All purge water will be put in a bucket. The buckets will be disposed of on the ground surface at least 100 feet from the well. Record the pumping rate on the Field Data Sheet (Appendix B).
7. Stabilization is achieved after three successive readings are within ± 0.1 for pH, ± 10 mV for ORP, ± 3% for specific conductance, ± 10% for DO and turbidity. Temperature will also be measured and recorded, but will not be used as a stabilization parameter. Sampling may begin once the well has stabilized.
8. Turbidity and DO usually take the longest to stabilize. Up to 2 hours of purging may be required to reach stabilization. Stabilized purge indicator trends are generally obvious and follow either an exponential or asymptotic change to stable parameter values during purging. If stabilization does not occur or turbidity is >10 NTU after two hours of purging, the ES should be contacted for direction.

5.3 Sample Collection Procedure

Sample bottles will be labeled prior to collecting water in the bottles. Bottle labels will be completed for each sample container collected for analysis, using ink or permanent marker. Each label will include the following:

- Site Location
- Well identification number (MW-#);
- Sample collection date: month, day, year;
- Sample collection time;
- Sample preservation method (e.g. nitric acid); and
- Initials of personnel collecting the sample.

It is critical that both the sample bottle monitoring well identification and sample times match exactly the sample name and collection time written on both the Field Data Sheet and the Chain of Custody.

Use clean nitrile gloves for each well prior to handling any sample bottles. When collecting a sample:

1. The pump will not be turned off between the purging and sampling processes.
2. Disconnect the flow cell.
3. Samples will be collected in sample containers described in Section ##.##. Remove the sample bottle from the plastic bag and remove the cap.
4. Rinse the bottle with the sample stream, holding the tubing approximately 1/8" outside of the open bottle. Do not place the sample tubing within the bottle or allow it to dip into the collected sample.
5. Collect samples at the same flow rate as the purging rate. Minimize potential contamination by shielding the open bottles as needed. Minimize aeration by allowing the water to flow down the side of the bottle instead of against the bottom.
6. Fill to approximately ¼" below the bottle threads. Cap the bottle and store in a plastic bag. Place the plastic bag(s) in a cooler filled with ice.
7. If recharge is low, the drawdown in the well may approach the pump depth. Purge the well to within one foot of the pump depth, and remove the pump, close the well, and determine the time to let the well recharge prior to returning to collect the sample.
8. Sampling will be performed no less than 48 hours after well development is completed. Observations made during sample collection will be recorded on the water quality sample collection form in Appendix B.
9. After all samples from a monitoring well are collected, remove the tubing unless the tubing is dedicated to the well and remains in place. Tuck any extra length of tubing down into the well casing with care not to permanently pinch the tubing.
10. Cap and lock the monitoring well protective casing.
11. Pour collected purge water on the ground, away from any wells that are to be sampled next.
12. Repeat procedure for remaining monitoring wells.

Samples will be stored in a cooler with ice. The coolers from the field will be delivered back to the lab each day that samples are collected.

5.4 Decontamination Procedure

The purpose of decontamination is: (1) to eliminate the transfer of contaminants from one groundwater monitor well to another, and (2) to protect the health and safety of personnel who may come in contact with contaminated equipment. Decontamination procedures described in this section will be performed at the beginning of each day of field work and between each monitor point, and whenever the equipment is suspected of having been contaminated.

All non-dedicated sampling equipment must be decontaminated before its reuse. All disposable tubing will be properly discarded and new tubing used in its place. The peristaltic pump tubing will be replaced and discarded before each sample location, or dedicated tubing will remain in each well.

BC Cobb wells are equipped with dedicated tubing; however, if decontamination is required due to insufficient supply or suspected contamination, the steps are as follows:

1. Place the tubing into a bucket containing approximately 5 gallons of an Alconox / tap water solution. Run the pump within the solution for approximately 2 minutes, allowing for the soapy water to run through the tubing. Use a scrub brush if necessary.
2. Place the tubing into a bucket containing approximately 5 gallons of clean tap water. Run the pump within the water for approximately 2 minutes to rinse the pump and tubing.
3. Place the tubing into a bucket containing approximately 5 gallons of distilled water. Run the pump within the water for approximately 2 minutes.
4. Finally place the tubing into a bucket containing approximately 1 gallon (or as little volume as possible to accomplish a quick single rinse) of distilled water. Run the pump within the water for approximately 10 seconds.
5. Wrap the pump and tubing to maintain cleanliness during transport.
6. Replace water and water solutions daily.

The above steps also apply if a bladder pump is required for wells with water levels greater than 25 feet below the top of the casing.

Flow cell shall be rinsed with deionized water if debris is not flushed out during purging. If the probes are not fouled, no further action is necessary since the flow cell does not contact the sample. The cell must be filled with tap water and stored overnight.

5.5 Quality Control

Quality Control (QC) checks of both the field procedures and laboratory analyses will be used to assess and document data quality and to identify discrepancies in the measurement process that need correction. Quality control samples will be used to assess various data quality parameters such as representativeness of the environmental samples, the precision of sample collection and handling procedures, the thoroughness of the field equipment decontamination procedures, and the accuracy of laboratory analyses. In addition, all sample containers, preservation methods, and holding times will be in accordance with QC requirements.

The analytical laboratory will use a series of QC samples, as identified in the laboratory's Quality Assurance Plan and specified in the standard analytical methods. The types of samples include method blanks, surrogate spikes, laboratory control samples, laboratory control sample duplicates, matrix spikes, and matrix spike duplicates. The primary type used for BC Cobb is a sample duplicate. One monitoring well for every 20 will be selected to collect a duplicate sample. It requires an additional sample to be collected in the same manner as the original sample. This sample type is used by the laboratory to determine precision. Sample identification for duplicates will be the same as the sample identification with the addition of a "Duplicate" (e.g. MW-15018 and MW-15018D).

If the tubing is not dedicated per well, the sampler will have to execute an equipment blank to test decontamination effectiveness. Equipment blanks are used to determine if decontamination procedures for non-dedicated equipment are performed properly and there is no "carryover" from one aqueous sample to another. One equipment blank will be collected for each sample event that non-dedicated sampling equipment is used. Deionized water will be provided by the laboratory. The deionized water will be run through a decontaminated pump and tubing and collected in a sample bottle. Sample identification for equipment blanks will be the same as the next well to be sampled with the addition of an “EB” (e.g. MW-15019 and MW-15019EB). Detection of any of the analyzed constituents in an equipment blank will require a review of decontamination methods and analysis. Equipment blank requirement is no analytes detected above the reporting limit. Refer to Section 3.7 of the HMP for additional information regarding data quality objectives.

The precision will be measured through the evaluation of relative percentage differences (RPDs) between sample and duplicate samples and calculated as follows:

$$\text{Relative Percentage Difference (\%)} = \frac{\text{concentration SA-concentration SB}}{\text{Average concentration of SA+SB}} \text{ x } 100$$

Where SA denotes Sample A; SB denotes the duplicate, sample B.

Duplicate RPD requirement is 20 percent. Refer to Section 3.7 of the HMP for additional information regarding data quality objectives.

Accuracy is measured by the difference between the measured or observed value and the true or assigned value. Accuracy in the field is assessed through the adherence to all sample handling, preservation, and holding times.

Laboratory data will be reviewed, validated and qualified if necessary prior to use. The laboratory data validation procedure is described in Section 3.7 of the HMP.

5.6 Sample Preservation and Handling

The sample team shall be provided with COC forms prior to sampling. The Chain of Custody (COC) form should be completed in the field as the sampling progresses and signed upon transfer of custody at the laboratory. Chain of custody procedures comprise the following elements: (1) maintaining custody of samples, and (2) documentation of the requested analysis. To document chain of custody, an accurate record must be maintained to trace the possession of each sample from the moment of collection through analysis and reporting. The field chain of custody record is used to record the custody of all samples collected and maintained by investigators. All sample sets will be accompanied by a chain of custody record. It also serves as a sample logging mechanism for the laboratory sample custodian. The following rules apply to chain of custody records:

- All information must be supplied in the indicated spaces to complete the field chain of custody record. It is critical that the proper contact information is provided to the laboratory. This should always be the sampler or ES.
- Every person who maintained custody of the samples must sign in the designated signature block.
- The sample ID, date, and time on the chain of custody must match the sample bottle exactly.
- The total number of sample containers for each sample must be listed in the appropriate column. Total sample bottles need to be counted and double checked. Required analyses should be circled or entered in the appropriate location on the form and double checked.
- If expedited turnaround is requested, this needs to be noted clearly.
- Electronic results are required as EDDs and PDF files of the laboratory report.
- The last person receiving the samples should be the laboratory sample custodian or their designee(s).

- The chain of custody record is an accountability document and should be filled out thoughtfully.
- In cases where the samples leave the sampler's custody into an intermediate carrier, such as shipment, a seal should be placed on the container to detect unauthorized entry to the samples. Containers that arrive at the laboratory with compromised seals must be evaluated to determine if the chain of custody has been invalidated.
- If samples arrive at the laboratory without the COC document, it shall be completed by the laboratory under the supervision of the laboratory project manager. The person completing the COC at the lab shall enter the statement "COC completed by the laboratory upon receipt of sample(s)" in the remarks section of the COC and initial the entry.

A sample COC is included as Appendix C.

5.7 Closeout

Upon the completion of groundwater sampling activities, the sampler will perform the following activities:

- Check condition of field equipment.
- Review field documentation.
- Record field data sheet information into electronic project database.
- Make arrangements for shipment of samples (if applicable).
- Confirm logged analyses with the laboratory.

Appendix A

Groundwater Sampling Equipment Checklist

Groundwater Sampling Equipment Checklist

- Monitoring well keys
- Map of wells
- List of well names, well construction logs, water level data
- Field data forms
- Field logbook
- YSI (or similar) water quality meter
- Water level indicator tape (check that the depth is in feet and length is adequate for the site conditions)
- Nitrile gloves
- Trash bags
- Watch/timer
- Camera
- Purge water bucket
- Toolbox/wrenches (for well access)
- Hose or extra tubing (may be useful for purge water for certain submersible pump/reel rental setups)
- Knife/boxcutter for slicing tubing
- Graduated cylinder or graduated bucket (for flow measurement)
- Sample bottles
- Permanent Marker
- Cooler
- Ice/Ice packs
- Black electrical tape
- Decontamination bucket(s)
- Tap water source for decontamination
- Distilled water
- Deionized water
- Alconox
- Scrub brush
- Peristaltic Pump, such as the Geotech Geopump (groundwater <25 feet below top of casing)

- Modular battery and clips for vehicle battery and power cord
- Tubing, sufficient footage for disposal after each well or decontamination between wells (polyethylene well tubing, silicone pump head tubing)

Appendix B

Groundwater Sampling Field Data Sheet

Water Sample Collection Field Data Sheet

Site Name:______________________________ Well ID.:___________________

Sample I.D.(match bottle and COC form exactly):_______________________________

Personnel:_________________

Date: _____________________ Static Depth to Water (ft, btoc) _______________

Date/Time Sample Collected (match bottle and COC form exactly):____________________

Sample Method: _________________

Water level meter, pump, and tubing decontaminated prior: Yes No

Sample QC: Duplicate Yes No Duplicate Sample ID: ___________

Sample QC: Equipment Blank Yes No Equip Blank Sample ID: ___________

Well Purging Data (Fill In All Blanks)

Depth of Sample Collection (pump depth) (ft, btoc) _________________

Time Completed: _____________________ Total Purge _________ Units______

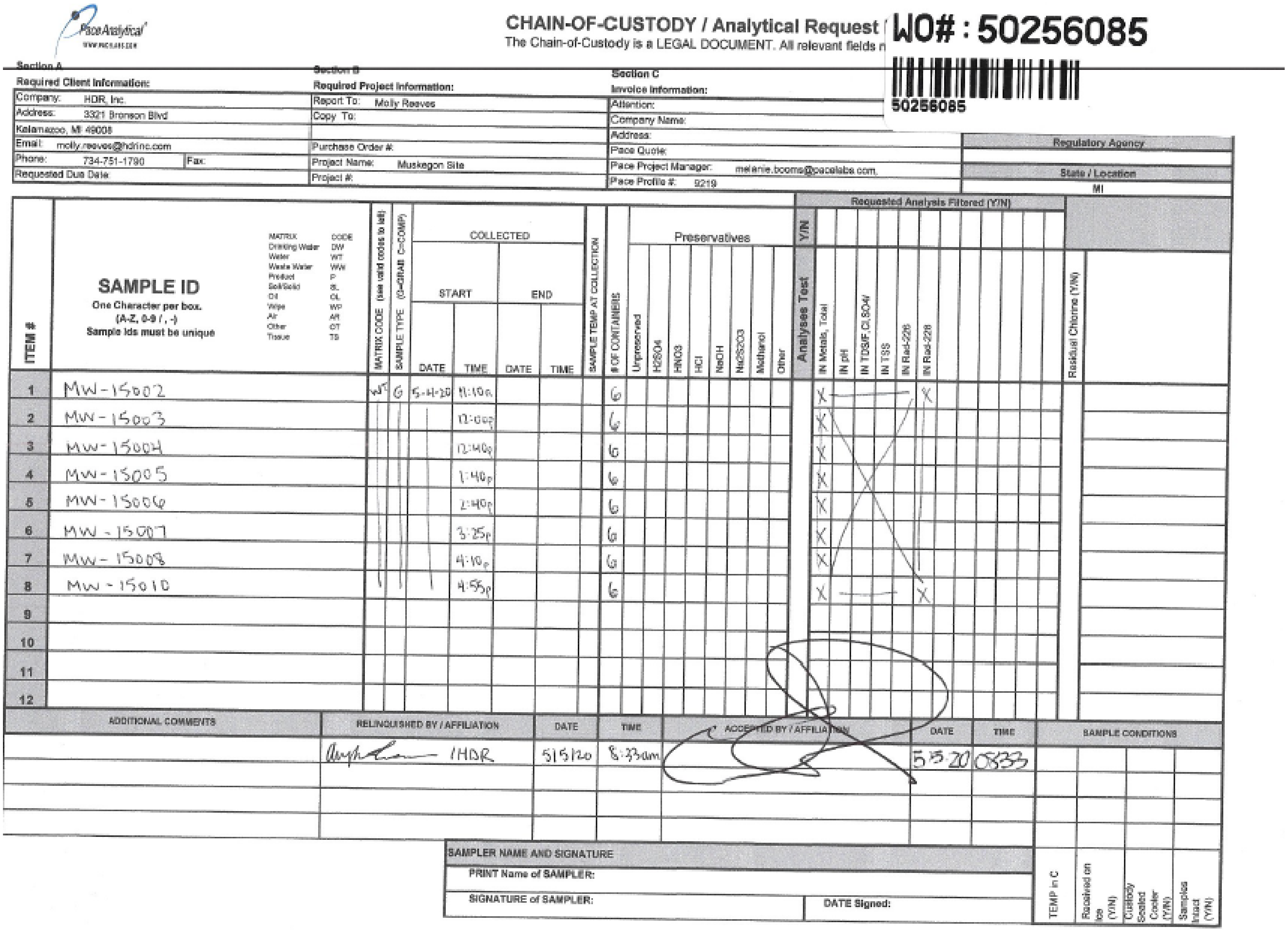
Field Measurements:

Time (24 hour)	Amount purged (ml)	pH	COND (mS/m)	TURB (NTU)	DO (mg/L)	TEMP (Cº)	ORP (mV)	Water Depth (ft, btoc)

Flow Rate_____________
Pump controller setting_____________
General Comments:

Appendix C

Example Chain of Custody Form



Pace Analytical
www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields n

WO# : 50256085

50256085

Section A
Required Client Information:

Company: HDR, Inc.
Address: 3321 Bronson Blvd
Kalamazoo, MI 49008
Email: molly.reeves@hdrinc.com
Phone: 734-751-1790 Fax:
Requested Due Date:

Section B
Required Project Information:

Report To: Molly Reeves
Copy To:
Purchase Order #:
Project Name: Muskegon Site
Project #:

Section C
Invoice Information:

Attention:
Company Name:
Address:
Pace Quote:
Pace Project Manager: melanie.booms@pacelabs.com,
Pace Profile #: 9219

Regulatory Agency:

State / Location: MI

SAMPLE ID
One Character per box.
(A-Z, 0-9 / , -)
Sample Ids must be unique

MATRIX	CODE
Drinking Water	DW
Water	WT
Waste Water	WW
Product	P
Soil/Solid	SL
Oil	OL
Wipe	WP
Air	AR
Other	OT
Tissue	TS

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED START DATE	COLLECTED START TIME	COLLECTED END DATE	COLLECTED END TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H2SO4	HNO3	HCl	NaOH	Na2S2O3	Methanol	Other
1	MW-15002	WT	G	5-11-20	11:10a				6								
2	MW-15003				12:00p				6								
3	MW-15004				12:40p				6								
4	MW-15005				1:40p				6								
5	MW-15006				2:40p				6								
6	MW-15007				3:25p				6								
7	MW-15008				4:10p				6								
8	MW-15010				4:55p				6								
9																	
10																	
11																	
12																	

Requested Analysis Filtered (Y/N)

ITEM #	Analyses Test Y/N	IN Metals, Total	IN pH	IN TDS/F,Cl,SO4/	IN TSS	IN Rad-226	IN Rad-228							Residual Chlorine (Y/N)
1		X					X							
2		X												
3		X												
4		X												
5		X												
6		X												
7		X												
8		X					X							
9														
10														
11														
12														

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
	/HDR	5/5/20	8:33am		5.5.20	0833				
							TEMP in C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER:
SIGNATURE of SAMPLER: DATE Signed:

Addendum to Groundwater Sample Collection Standard Operating Procedure

BC Cobb Facility

Muskegon Environmental Redevelopment Group, LLC.

June 28, 2024

This document serves as an addendum to the B.C. Cobb Facility (BCC or Site) Groundwater Sample Collection Standard Operating Procedure (SOP). This addendum provides additional guidance for preventing the contamination of monitoring well casings while conducting groundwater sampling. This addendum is in response to the observation that coal combustion residual (CCR) material was airborne because of onsite construction activities. The airborne particles could settle on the inside edge of the well casing and subject the groundwater and sampling to contamination. The procedure outlined below is designed to prevent contamination from airborne material and precipitation.

Additional steps:

- After removing the well cap and prior to inserting the water level measuring tape, use a clean paper towel or cloth to wipe the bottom of the well cap and the inside of the well casing to remove any debris. Wet the towel or cloth with tap water if necessary. Dispose of the towel/cloth in a trash bag when finished. See SOP Section 5.1 for the complete procedure for determining the depth-to-groundwater.
- Prior to inserting the sample tubing, cover the top of the casing with a wide-mouthed plastic bottle or plastic bag to prevent wind-blown sediment from collecting around the inside of the upper casing while sampling. Cut a hole only large enough for the tubing to pass through. See SOP Section 5.2 for the complete procedure for purging.

Equipment needed:

- Paper towels/clean cloth
- Trash bags
- Tap water
- Ziploc bags or wide-mouthed plastic bottle to cover casing while sampling
- Utility knife

Appendix E

Statistical Procedures Plan

Statistical Procedures Plan

1.0 Project Management

This Statistical Procedures Plan provides the procedures for analysis for the data generated during groundwater monitoring at the former B.C. Cobb Power Plant (Site). The Muskegon Environmental Redevelopment Group, LLC (MERG) must comply with the U.S. Environmental Protection Agency's (USEPA) Coal Combustion Residuals Rule and the Michigan Part 115 Solid Waste Regulations for CCR units. Groundwater monitoring of the CCR unit is an integral part of compliance with the federal CCR Rule and State solid waste permit.

This document addresses the statistical procedures for evaluating data to select statistical method(s) required for evaluating groundwater monitoring data, as required by the CCR Rule and Part 115 Rule 908.

2.0 Statistical Analysis

Monitoring will include analyzing groundwater data and groundwater levels from wells upgradient and downgradient of the CCR unit at the Site. The Groundwater Monitoring System Certification for the facility describes the hydrogeologic characterization and rationale for the upgradient and downgradient sample locations.

This section provides the methodology to statistically evaluate the groundwater data, select appropriate statistical method(s), and develop the appropriate background threshold values (BTVs)[1] for required constituents of interest (COIs) from the federal CCR Rule Title 40 Parts §257 and the Michigan Part 11511a(3) and 11519b(2), referred to herein as the COIs. The 40 CFR §257.93(f) includes a list of statistical methods from which to choose for evaluating the groundwater monitoring data from CCR management areas. The options include:

- A parametric analysis of variance followed by multiple comparison.
- An analysis of variance based on ranks followed by multiple comparison procedures.
- A tolerance interval procedure, in which an interval for each constituent is established from the distribution of the background data and the level of each constituent in each compliance well is compared to the upper tolerance limit.
- A control chart approach that gives control limits for each constituent.
- Another statistical test method that meets the performance of 40 CFR §257.93(g).

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[1] The CCR Rule does not include the term "background threshold value" or any specific term to represent the upper tolerance limit, or the control limit other than references to the "background value", "background constituent concentration levels" or "background concentration". The EPA's ProUCL documentation uses the term "background threshold value" with explicit reference to upper tolerance limits throughout the documentation. For ease of reference in our planning document, we chose to use the EPA's terminology. Note that a BTV is not a fixed value. It is a statistical test for determining if there is an SSI from a groundwater sample taken at a downgradient well. Its value may change as background sample sizes change over time or if changes are made to the number of downgradient wells.

The goal of statistical analysis is to provide a quantified means to evaluate whether a CCR management unit has released contaminants into the groundwater. Following the collection of groundwater monitoring data, detected constituents will be statistically evaluated to identify if a statistically significant increase (SSI) over background has occurred. The EPA's ProUCL software (Singh and Singh 2015) supported with R script from the EPA's Unified Guidance Appendix C.3 (USEPA 2009b), SPSS[2] and NCSS[3] will be used to conduct statistical analysis of groundwater analytical data collected for the Site. However, if during the period of the groundwater monitoring program at the Site an updated or more comprehensive statistical software program is available or may become available, a different software program may be used.

The steps for this process are summarized in Figure 1 and are described in sections 2.1 and 2.2. As groundwater monitoring progresses, the use of the selected statistical method will be subject to ongoing review. Other statistical tests may be used in place of, or in addition to, the methods specified in this Statistical Procedures Plan if such methods are better suited for analysis of future results. If test methods are changed, this Statistical Procedures Plan will be revised, as appropriate, and its certification updated.

When developing the BTVs for the required constituents since there are multiple background wells, the data from the background wells will be evaluated to determine if it is appropriate to pool the background groundwater data from multiple wells to develop a single BTV for each constituent. The assumption for pooling groundwater data is that the constituent concentrations sampled at multiple background wells, when pooled, serve as an estimate of overall well field conditions for constituents at a site.

Section 2.1 describes the statistical analyses used to assess and transform the groundwater data from the background monitoring wells where necessary such that the data can be used to produce appropriate BTVs and conduct statistical tests. This stage is referred to as the preliminary data analysis. Consideration is given to issues related to outliers, serial correlation, seasonality, spatial variability, and trends. It may be necessary to test for differences in group means across sub-groups of samples to verify assumptions or to add new groundwater samples to existing samples. For example, sub-group testing can be used to determine if background groundwater concentrations are changing over time or background groundwater concentrations are different by season. These differences are important since they determine if new background data can be pooled with historical data or if deseasonalization of the data is required.

Section 2.2 contains the steps to estimate statistically significant increases (SSIs) over background or statistically significant levels (SSLs) over a groundwater protection standard (GPS) where relevant for each of the detection, assessment and closure phases of the CCR Rule. A suite of prediction limits, tolerance limits, and confidence limits are used to address the statistical test requirements covered through parts 40 CFR §257.93, §257.94, §257.95, and §257.102.

As recommended by the EPA Unified Guidance (2009b) and pending confirmation as appropriate after evaluation of site specific background water quality data, upper tolerance limits (UTLs) are proposed to be used to establish BTVs for each of the COIs at the Site for the purposes of complying with the detection monitoring requirements to confirm SSIs.

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[2] IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.

[3] NCSS 12 Statistical Software (2018). NCSS, LLC. Kaysville, Utah, USA, ncss.com/software/ncss.

The Site is in Assessment Monitoring and Corrective Action under the federal CCR Rule compliance program, which requires comparison of COIs from downgradient wells to their groundwater protection standards (GPS) (40 CFR §257.95(g)). Under the federal CCR Rule compliance program, the GPS value is the maximum contaminant levels (MCLs) or the background value (using the 95% upper tolerance limits (UTLs)), whichever is higher, estimated from the background samples as statistically equivalent BTVs. The results of the evaluation as to whether or not an COI is above its GPS based on SSLs determines if the CCR Unit remains in assessment monitoring or moves into corrective action. However, under the State Part 115 compliance program described herein, the GPS value is the lowest of the MCL or the applicable cleanup criteria for that constituent for groundwater as established pursuant to section 20120a of the act. Or for constituents for which the background level (UTL) is higher than the MCL or applicable cleanup criteria for groundwater, the background concentration will be the GPS. Therefore, at this Site, there may be a different GPS value for the State Part 115 compliance program than the federal compliance program.

A decision flow chart which summarizes the logic and statistical methods used to determine which groundwater data are suitable to establish or update background and which types of BTVs can be used to describe background levels is shown in Figure 1 below.

The decision flow diagram allows for updates to the BTVs as samples from the background wells continue to be collected at either the scheduled semi-annual or annual sampling events, depending on the quality or quantity of the samples. While the initial required 8 sampling events in 2020 provide the minimum number of samples from which to estimate BTVs[4], as additional samples are collected, the BTVs may be updated at scheduled time intervals. In that way, the BTVs may change periodically.

The eighth sampling event for Part 115 COIs was completed in March 2024. BTVs for these COIs were established and BTVs for federal CCR COIs were updated based on the additional data collected since the BTVs were initially developed.

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[4] “The Unified Guidance recommends that a minimum of at least 8 to 10 independent background observations be collected before running most statistical tests. Although still a small sample size by statistical standards, these levels allow for minimally acceptable estimates of variability and evaluation of trend and goodness-of fit. However, this recommendation should be considered a temporary minimum until additional background sampling can be conducted and the background sample size enlarged”, page 5-3.

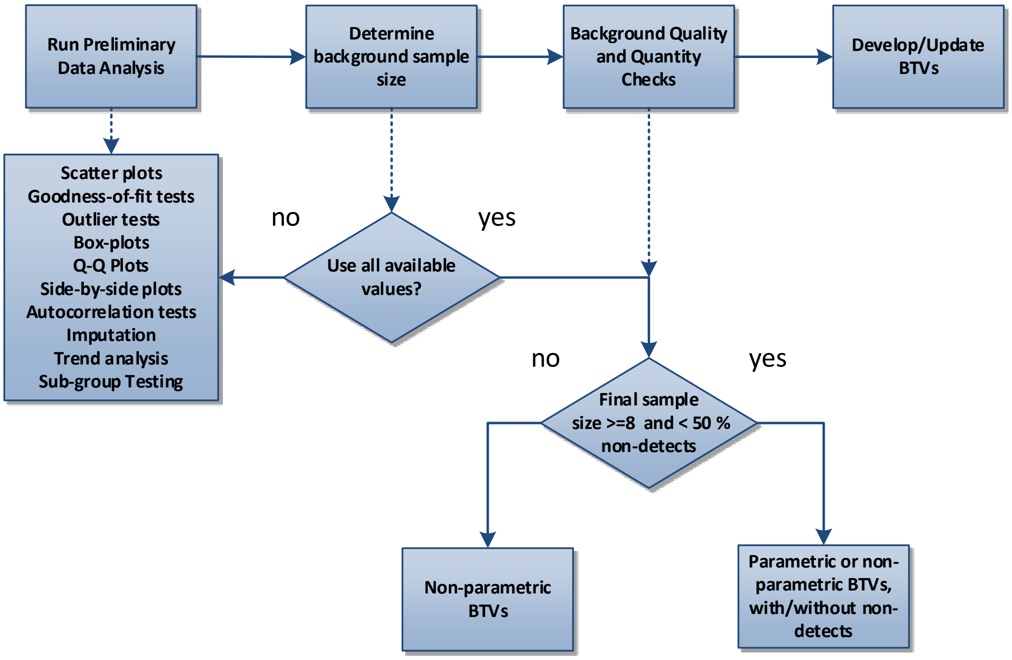

Figure 1: Decision Flow Chart for Preliminary Data Analysis and BTVs

2.1 Preliminary Data Analysis

The CCR Rule references requirements that statistical assumptions and data quality conditions associated with the test procedures are validated as described in 40 CFR §257.93 (g)(5)(6). A preliminary data analysis (PDA) is conducted to confirm such assumptions and bring awareness to the quality of data at the time background concentrations are estimated. A type of statistical analyses to support sub-group testing of differences in population means and medians is given special treatment at the end of this section as different aspects of the PDA will draw from it depending on the purpose of the statistical testing collected from the upgradient and downgradient wells.

a. Descriptive Statistics

Descriptive statistics will be developed per well per constituent and repeated for data pooled across all wells within a location. The purpose of descriptive analysis is to characterize data and assess quality of information. The following statistics will be produced per constituent per well and then pooled over all wells.

- Sample size
- Number of detects
- Percentage of detects
- Number of non-detects
- Percentage of non-detects
- Number of distinct observations
- Number of distinct MDLs
- Mean
- Median
- Minimum
- Maximum
- Standard deviation
- Coefficient of variation

- Range of collection period in months: Difference between last sampling date and first sampling date
- MAD/0.675[5]
- Skewness
- Kurtosis

b. Graphical Analysis

Scatter plots of observations will be produced as a function of time. Different colors will be used to differentiate detects from non-detects (NDs). The graphs visually provide clues as to whether the period of record is reflective of a steady-state baseline period. The graphs should be evaluated to determine if all data can be incorporated into analysis or if older historical data may need to be dropped (multiple detection limits over time may affect usability of the data). Outliers and seasonality can also be visually detected. Further statistical tests will need to be conducted to confirm assumptions from visual inspections.

c. Identify Outliers

A statistical outlier is defined as a value originating from a different statistical population than the rest of the sample. Outliers or observations not derived from the same population as the rest of the sample violate the basic statistical assumption of identically distributed measurements. If an outlier is suspected, an initial helpful step is to construct a probability plot of the ordered sample data versus the standardized normal distribution.

Two tests will be used to test for possible outliers. Dixon's Outlier Test is appropriate for data series with sample sizes less than 25, and Rosner's Outlier Test is applicable to those with a sample size larger than 25. These outlier tests assume that the rest of the data except for the suspect observation(s) are normally distributed. In conjunction with Dixon's and Rosner's Tests, observations that are greater than 3 standard deviations from the mean will be flagged. Values greater than 3 standard deviations from the mean may be outliers.

If outliers are found from the tests, the anomalous numbers will be investigated. If they are correct values and collected under standard, consistent protocols, they should remain in the data series. Otherwise, they can be dropped before proceeding. Some distributions naturally have anomalously low or high values. The subsequent tests for distribution types should find the best fitting distribution that can explain the anomalous values.

While some literature suggests repeating the statistical procedures with and without the outliers, the risk of this method is that the estimated distributions and statistics tend to be chosen to suit a goal. After a comparison of the estimates is made, a decision needs to be made as to which data set is representative. The decision to use or reject outliers will be done at the data collection and assessment stage. An example would be where a sample was qualified as "J+" (biased high), due to equipment blank contamination. If such a sample was seen as an outlier, it may be possible to

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[5] The MAD/0.675 is a robust estimate of variability of the population standard deviation. A robust estimate of variability, which is less likely impacted by outliers in the sample, is derived by dividing the median absolute deviation (MAD) with the constant of 0.675. The MAD is the sum of the differences between each of the observations and the median. Any differences that are less than zero are converted to positive values before a total sum is computed.

eliminate it from further analysis for this reason. If there is a doubt as to the authenticity and reliability of the measured value, it should not be used. Otherwise, it is a value that was generated by the system regulating the water quality conditions of the tested groundwater well. Groundwater monitoring reports will indicate any outliers that have been rejected from the dataset.

d. Identify Distributions

Since many tests make an explicit assumption concerning the distribution represented by the sample data, the form and exact type of distribution must be checked using a goodness-of-fit test. A goodness-of-fit test assesses how closely the observed sample data resemble a proposed distributional model. The best goodness-of-fit tests attempt to assess whether the sample data closely resemble the tails of the candidate distributional model. The models under consideration for water quality samples are normal, lognormal, or gamma distributions.

The Shapiro-Wilk (sample sizes <= 50) and Lilliefors (sample sizes >50) tests will be used to test for normal distribution. Note that these two tests can be used to test for lognormal distributions after the data are transformed using the natural log function. The empirical distribution function (EDF) based methods, the Kolmogorov-Smirnov (K-S) and Anderson-Darling (A-D) test, are used to test for a gamma distribution. The software package from the USEPA, ProUCL has incorporated these methods to automatically test for either normal, lognormal, or gamma distribution types. If all goodness-of-fit tests fail, a non-parametric estimation method will be used.

e. Test for Spatial Variability

Spatial variability exists when the distribution or pattern of concentration measurements changes from well location to well location, either from natural or anthropogenic factors. Natural spatial variability refers to a pattern of changing mean levels in groundwater associated with normal geochemical conditions unaffected by human activities such as variation in contents of COIs in the soil and variation in geochemical conditions resulting in different solubility of COIs. Natural spatial variability is not an indication of groundwater contamination, even if concentrations at one or more compliance wells exceed (upgradient) background concentrations. Sources of anthropogenic spatial variability can include recent or historic releases from an on-site source or migration of contaminants from off-site sources. In groundwater monitoring, *mean* levels of a given constituent are usually compared from one well to the next to determine if natural or anthropogenic spatial variability is present[6]. Side-by-side box plots will be developed for each constituent at each well where data permit to evaluate the potential for natural spatial variability in the upgradient wells. If sufficient data is available on a per well basis, sub-group testing for differences in population means and medians will be conducted as described in section (i) below.

f. Test for Serial Correlation

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[6] Analysis of variance (ANOVA) techniques (see Section 2.1 for details on these techniques) can also be used to establish evidence of spatial variation. If there is evidence of spatial variation, the unified guidance recommends using an intrawell statistical analysis. For an intrawell analysis to be meaningful at the downgradient sites, samples would have had to be taken prior to human activity such the installation of ash basins or ponds. Since the activity has occurred, it is important that the selection of groundwater wells at both upgradient and downgradient sites be done to minimize spatial variability to the extent possible.

Sources for serial correlation in water samples can be due to seasonal effects or temporal effects related to the timing of the sample collections. Trend analysis using regression techniques of a water quality constituent sampled over time is confounded if the data exhibits serial correlation. The regression errors from adjacent observations may be correlated. For example, if the residual from a given month's observation is high, then it is likely that the residual from the next month's observation will also be high. The same logic follows for low residuals giving rise to other low residuals. This type of correlation is referred to as serial correlation or autocorrelation. The autocorrelation function test will be run at the 5 percent level of significance (statistical software application SPSS[7] to run this test).

g. Test for Seasonality

As explained in the previous paragraph, there are different reasons why a series of water quality constituent samples exhibit serial correlation. A common reason arises from changes in season as evidenced from varying temperatures and precipitation. These changes impact water quality constituents in a predictable and cyclical manner over the months. The study of water quality changes over time is focused on the ability to discern true trend through regression analysis amidst the cyclical nature of the data or its "seasonality". The correct use of these regression analyses rests on the crucial assumption that regression errors or residuals arising from the model fitting are independent of each other. This is often not the case with data that is seasonal in nature. If seasonality exists, then the autocorrelation function test described in step f will pick up the pattern. To better understand the type of seasonality (monthly, quarterly, bi-annually) which factors into the observed variability of data, a visual inspection of the data as a function of time is recommended.

Box plots of observations on a monthly or quarterly basis will be developed (provided one has at least 8-10 observations per sampling period). These results will be used to determine how to group the data into seasons. If sufficient data is available on a per season basis, sub-group testing for differences in population means and medians will be conducted as described in sub-section (i) below.

h. Test for Trend

The samples from background wells represent water quality conditions exhibiting natural variability and unaffected by anthropogenic activities. As such, the measurements taken at regular intervals over time (3 or more years) are expected to demonstrate a steady or stationary time series. The data from the background wells will be tested to determine whether trends exist (values steadily increasing or steadily decreasing). Depending on the presence of NDs and seasonality, one of the following regression tests will be selected:

- MLE Regression (with or without NDs) with best fitting distribution
- Mann-Kendall (non-parametric, no seasonality, only 1 MDL)

In the circumstances when changes in trend may occur within a constituent's collection of samples over time, the piece-wise polynomial model has proven useful. This approach attempts to find a statistically significant break in the trend direction. The piece-wise models should be applied mainly as a visual guide when interpreting the background linear trend tests.

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[7] IBM®, SPSS®, Statistics ,Version 19

i. Test for Sub-Group Testing

When assessing if concentration means or medians are statistically different across wells, seasons or between two different background collection periods, various statistical procedures are available. This section describes the tests which may be used depending on the nature of the data and number of tests required. A significance level of 0.05 will be used to decide whether to accept or reject the null hypothesis that there are no differences across the sub-group means. In instances where multiple comparisons are made, adjustments will be incorporated to control for false positive rate (e.g., Bonferroni's adjustment) or statistical tests used with built-in functionality to address the multiple comparison issue (e.g., Tukey-Kramer test).

Before proceeding to test for differences across the sub-group means, one needs a sufficient sample size of at least 8-10 samples per sub-group. Testing for sub-groups can be done in three steps: 1. Graphical analysis, 2. Hypothesis tests for sub-group differences, and 3. Tests to identify which sub-groups are different.

Graphical Analysis

Background groundwater data can be assessed for sub-groups using graphical representation tools such as box-and-whisker and Q-Q plots. Multiple box-and-whisker and Q-Q plots can be constructed for comparing constituent concentrations and variability across potential sub-groups.

Hypothesis Tests for Sub-Group Differences

The following methods can be used to detect for population differences across the sub-groups:

- ANOVA (under normal distribution assumptions)
- Log-ANOVA (under log-normal distribution assumptions)
- Kruskal-Wallis One-Way Analysis on Ranks (distribution free assumptions/non-parametric, presence of non-detects, corrected for ties)
- Kaplan-Meir (non-parametric, useful with heavy censoring).

The decision as to which test to use is predicated on the presence of censorship and whether the distribution follows a parametric distribution of either normal, log-normal, or gamma type or does not have a discernible distribution and hence is non-parametric. Note that the Log-ANOVA is simply the ANOVA approach applied to the natural-logarithm of the time series.

The ANOVA tests require that normality assumptions are valid for each sub-group. In addition, the variances across the groups should be approximately equal.

Testing for potential sub-groups within background groundwater data sets will be performed using a significance level of 0.05.

Tests to Identify Which Sub-Groups Are Different

Provided any of the tests described above show sub-group differences, further tests will be performed to identify which sub-group(s) is different from the others provided each sub-group has at least 20-30 observations.

- Post-Hoc Test for Multiple Comparisons
    - Tukey-Kramer Test (parametric)

- Dunn's Test (non-parametric)

2.2 Background Threshold Values

Using the upgradient data from the background well(s) specific to the CCR multiunit system, the appropriate BTVs will be computed for each constituent. Since the site has more than one background well, the upgradient data are defined by data pooled over the wells, as appropriate.

As recommended in the Unified Guidance (2009b), background values should be updated every four to eight measurements (e.g., every two to four years if samples are collected semiannually). New background groundwater data will be evaluated against the existing background dataset, as appropriate. If the new background data does not indicate a statistically significant difference using the approaches described in the sub-group testing section 2.1(i), the new data will be combined with the existing background data to calculate updated BTVs. Increasing the background dataset will increase the power of subsequent statistical tests. If the new background data does indicate a significant difference between the two populations, the data should be reviewed to evaluate the cause of the difference. In the absence of evidence of a release, the combined dataset should be considered more representative of present-day groundwater conditions and used for background.

2.2.1 Detection Monitoring

Under the detection monitoring programs of 40 CFR §257.94 and Michigan Statute 324.11511a(3) COI monitoring results will be statistically compared to BTVs through interwell statistical methods. As recommended by the Unified Guidance (2009b), the statistical test to define the BTV for detection monitoring is the upper tolerance limit. The formulation of the tolerance limit may vary slightly with the particulars of the test to be made and the characteristics of the data involved such as whether the data follow parametric or non-parametric distributions and the percentage of NDs. For example, in the case of log-normally parametrically distributed data, the tolerance limit is described by the mean and standard deviation of the natural log of the observations. The confidence level associated with each upper tolerance limit test is selected such that the site-wide false positive rate does not exceed 10 percent as recommended by the Unified Guidance (2009b). The per-test confidence levels will typically range between 95 and 99 percent. Whatever the formula specification, tolerance limits represent a range where a future result is expected to lie at a given confidence level. Both the upper and lower tolerance limits (LTL) will be produced for pH since lower and higher pH values relative to background are of concern.

Determination of Statistically Significant Increases above Background

If the groundwater concentration of any detection monitoring COI at any downgradient well is greater than the 95 UTL, then that concentration represents an SSI over background. One exception is pH, which can exhibit an SSI if the concentration in a monitoring well is either greater than the UTL or less than the LTL. The CCR Rule, as described in 40 CFR §257.94(e), indicates that if an SSI over background is identified at the waste boundary for one or more COI during detection monitoring, then the owner or operator of the CCR unit must, within 90 days: 1) establish an assessment monitoring program, 2) demonstrate that a source other than the CCR unit caused the SSI over background, or 3) demonstrate that the SSI over background resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Written documentation for either demonstration above must be completed and certified by a qualified professional engineer within the 90 day timeframe.

If sources other than the CCR Unit, natural variability or errors have been ruled out as the reason for the SSI, a type of verification sampling method called the one-of-m pass method, as described in the Unified Guidance (2009b), allows for an efficient plan to confirm if an SSI over background identified during detection monitoring resulted from the CCR unit. Resampling of wells where an SSI has occurred can either verify the initial SSI determination or disconfirm it, thereby avoiding false positives. Depending on the number of background samples, the selected site-wide false positive rate, and the available time period in which to do the resampling, either a 1-of-2 or 3 pass method is recommended should verification sampling be considered.

2.2.2 Assessment Monitoring

Under the assessment monitoring program in 40 CFR §257.95 and Michigan Statute 324.11519b(2), monitoring results are compared to BTVs as described in 40 CFR §257.95(e). The UTLs discussed in section 2.2.1 are also used to compare assessment monitoring results to background values.

According to 40 CFR §257.95(e), the CCR unit may return from assessment monitoring to detection monitoring when all COIs are “shown to be at or below background values, using the statistical procedures in paragraph 40 CFR §257.93(g) for two consecutive sampling events.” A notification letter stating that detection monitoring is resuming for the CCR unit will be placed in the facility’s operating record as required by §257.105(h)(7).

According to 40 CFR §257.95(f), if assessment monitoring concentrations of all COIs are above background concentrations (UTLs) and COIs are below the GPS, then assessment monitoring will continue. MERG will establish GPS for each COI detected in the groundwater.

The Unified Guidance recommends the upper tolerance limit (UTL) to represent the background concentration for this purpose. The limits can be considered as statistically equivalent BTVs to an MCL or other health based numbers. The UTLs are derived from the same background data sourced to produce the UTLs and are used in these situations to represent the GPS. Tolerance intervals represent a range where a proportion of the population is expected at a given confidence level. For the purpose of this certification plan, a 95 percent confidence level is assumed. Specification for tolerance limits vary depending on whether the background data follow parametric or non-parametric distributions and the incidence of NDs. Both the upper and lower tolerance limits will be produced for pH to establish lower and upper GPS.

The GPS shall be defined as the lowest of the following:

- U.S. EPA Maximum Contaminant Level (MCL) for constituents for which an MCL has been established;
- The applicable cleanup criteria for that constituent for groundwater as established pursuant to section 20120a of the act.

Or for constituents for which the background level (UTL) is higher than the MCL or applicable cleanup criteria for groundwater, the background concentration will be the GPS. Table 1 provides the background level, the MCL, the cleanup criteria, and the GPS values for the Site. The UTLs were updated following the March 2024 sampling event, which was the eighth event analyzing for Part 115 COIs. GPS values have been updated as required based on the updated UTLs.

Table 1. Background Values and Groundwater Protection Standards

Parameter		Site-Specific Background Level Upper Tolerance Limit (UTL) (ug/L)	Federal Maximum Contaminant Level (ug/L)	Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria (ug/L)^	State Non-Residential Drinking Water Cleanup Criteria for Groundwater (ug/L)*	Groundwater Protection Standards for Site (ug/L)
Sb, total	Antimony	1.4	6	130	6	6
As, total	Arsenic	18	10	10	10	18
Ba, total	Barium	270	2000	690	2000	690
Be, total	Beryllium	1.2	4	14	4	4
B, total	Boron	5,400	NV	7,200	500	5,400
Cd, total	Cadmium	0.22	5	3.1	5	3.1
Cr, total	Chromium	3.7	100	11	100	11
Co, total	Cobalt	1.2	6	100	100	6
Cu, total	Copper	4.9	1300	13	1000	13
Fe, total	Iron	12,000	NV[1]	NV	5,600	12,000
Pb, total	Lead	2.0	15	35	4	4
Li, total	Lithium	48	40	440	350	48
Hg, total	Mercury	0.20	2	0.0013	2	0.2
Mo, total	Molybdenum	9.7	100	3,200	210	100
Ni, total	Nickel	0.84	NV	75	100	75
Se, total	Selenium	3.3	50	5.0	50	5.0
Ag, total	Silver	0.20	100	0.2	98	0.2
Tl, total	Thallium	0.19	2	3.7	2	2
V, total	Vanadium	1.7	NV	27	62	27
Zn, total	Zinc	48	5,000	170	5,000	170
Ca	Calcium	260	NV	500	NV	500
F	Fluoride	1,400	4,000	NV	2,000	2,000
Cl	Chloride	2,500,000	250,000	50,000	250,000	2,500,000
SO_4	Sulfate	330,000	250,000	NV	250,000	330,000
TDS	Total Dissolved Solids	4,800,000	500,000	500,000	500,000	4,800,000

Table 1. Background Values and Groundwater Protection Standards

Parameter		Site-Specific Background Level Upper Tolerance Limit (UTL) (ug/L)	Federal Maximum Contaminant Level (ug/L)	Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria (ug/L)^	State Non-Residential Drinking Water Cleanup Criteria for Groundwater (ug/L)*	Groundwater Protection Standards for Site (ug/L)
TSS	Total Suspended Solids	--	NV	NV	NV	NV
RA226/228	Radium 226 and 228 combined	3.74	5.0	NV	NV	5.0

*Cleanup Criteria Requirements for Response Activity (Formerly the Part 201 Generic Cleanup Criteria and Screening Levels) found in R 299.44 Generic groundwater cleanup criteria.

NV=no value

^Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 154 mg CaCO3/L as measured at surface water sample SW-01 collected on February 22, 2018 from the North Channel Muskegon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

1. No primary Federal Maximum Contaminant Level

Determination of Statistically Significant Levels above GPS

The CCR Rule stipulates in 40 CFR §257.95(g) that if constituents are detected as statistically significant levels (SSLs) above the GPS, the following actions are required to be taken by the owner:

- Place a notification in the operating record identifying the GPS exceedances.
- Characterize the nature and extent of the release and any relevant site conditions that may affect the remedy ultimately selected in accordance with 40 CFR §257.97.
- Notify all persons who own the land or reside on the land that directly overlies any part of the plume of contamination.
- Within 90 days:
  - Prepare an alternative source determination for the exceedance, or
  - Initiate an assessment of corrective measures in accordance with 40 CFR §257.96.

Therefore, if COIs exceed BTVs according to §257.95(e), and COIs exceed GPS per §257.95(f), then constituents will be statistically compared to the GPS to identify SSLs above the GPS per §257.95(g). In order to evaluate if an exceedance of the GPS is statistically significant, the 99 percent lower confidence limit (LCL) concentrations from downgradient monitoring wells are used.

During the statistical analysis of confidence intervals from each constituent, if the LCL exceeds the GPS at the 99 percent confidence level, then the constituent has been detected at an SSL above the GPS at a particular monitoring well. As with the UTLs, the particularities of the LCL are based on whether parametric or non-parametric distributions best fit the data and the incidence of NDs observed in the monitoring data. For example, in the case of normally distributed data, a normal-based parametric confidence interval is used. If the data cannot be explained by parametric distributions, a non-parametric confidence interval on the median is used.

2.3 Criteria for Conducting Closure

Post-ash-removal groundwater concentrations will be reviewed and the closure criteria will be described and approved by EGLE in the Remedial Action Plan once the remedy has been selected.

3.0 References

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Attachment 1

2017 and 2018 Groundwater Monitoring Reports for Statistical Evaluations

Annual Groundwater Monitoring Report

Former BC Cobb Power Plant
Bottom Ash Pond & Ponds 0-8 CCR Unit
Muskegon, Michigan

January 2018

Annual Groundwater Monitoring Report

Former BC Cobb Power Plant
Bottom Ash Pond & Ponds 0-8 CCR Unit

Muskegon, Michigan

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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). The CCR Rule, which became effective on October 19, 2015, applies to the Consumers Energy Company (CEC) Bottom Ash Pond and Ponds 0-8 (BCC Ponds) at the former BC Cobb Power Plant Site (the Site). The BCC Ponds are monitored using a multiunit groundwater monitoring system (in accordance with 40 CFR §257.91). Pursuant to the CCR Rule, no later than January 31, 2018, and annually thereafter, the owner or operator of a CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with §257.90(e).

TRC Environmental Corporation (TRC) prepared this Annual Groundwater Monitoring Report for the BCC Ponds CCR unit on behalf of CEC. This Annual Report was prepared in accordance with the requirements of §257.90(e) and presents the monitoring results and the statistical evaluation of the detection monitoring parameters (Appendix III to Part 257 of the CCR Rule) for the September 2017 semiannual groundwater monitoring event for the BCC Ponds CCR unit. This event is the initial detection monitoring event performed to comply with §257.94. As part of the statistical evaluation, the data collected during detection monitoring events are evaluated to identify statistically significant increases (SSIs) in detection monitoring parameters to determine if concentrations in detection monitoring well samples exceed background levels.

Potential SSIs over background limits were noted for boron, fluoride and pH in one or more downgradient wells for the September 2017 monitoring event. This is the initial detection monitoring event; therefore, it is the initial identification of a SSI over background levels. According to §257.94(e), if the facility determines, pursuant to §257.93(h), that there is a SSI over background levels for one or more of the Appendix III constituents, the facility will, within 90 days of detecting a SSI, establish an assessment monitoring program **<or>** demonstrate that:

- A source other than the CCR unit caused the SSI, or
- The SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

In response to the potential SSIs over background limits noted during September 2017, CEC plans to prepare an Alternative Source Demonstration (ASD) to evaluate whether a source other than the CCR unit caused the SSIs prior to initiating assessment monitoring.

Section 1
Introduction

1.1 Program 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). The CCR Rule, which became effective on October 19, 2015, applies to the Consumers Energy Company (CEC) Bottom Ash Pond and Ponds 0-8 (BCC Ponds) at the former BC Cobb Power Plant Site (the Site). The BCC Ponds are monitored using a multiunit groundwater monitoring system (in accordance with 40 CFR §257.91). Pursuant to the CCR Rule, no later than January 31, 2018, and annually thereafter, the owner or operator of a CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with §257.90(e).

TRC Environmental Corporation (TRC) prepared this Annual Groundwater Monitoring Report (Annual Report) for the BCC Ponds CCR unit on behalf of CEC. This Annual Report was prepared in accordance with the requirements of §257.90(e) and presents the monitoring results and the statistical evaluation of the detection monitoring parameters (Appendix III to Part 257 of the CCR Rule) for the September 2017 semiannual groundwater monitoring event for the BCC Ponds CCR unit. This event is the initial detection monitoring event performed to comply with §257.94. The monitoring was performed in accordance with the *BC Cobb Monitoring Program Sample Analysis Plan* (SAP) (ARCADIS, 2016) and statistically evaluated per the *Groundwater Statistical Evaluation Plan* (Stats Plan) (TRC, October 2017). As part of the statistical evaluation, the data collected during detection monitoring events are evaluated to identify statistically significant increases (SSIs) of detection monitoring parameters compared to background levels.

1.2 Site Overview

The former BC Cobb coal-fired power generation facility is located east of Muskegon Lake, south of Cedar Creek, northwest of the CSX rail line, and west of the Muskegon River marsh in Muskegon, Michigan (Figure 1). The plant began generating electricity in 1948, and plant operations ceased in April 2016. There are two RCRA CCR units associated with the plant—the Bottom Ash Pond and Ponds 0-8, both of which are wet ash dewatering areas. From 1984 through plant closure in 2016, CCR have been deposited in the ash ponds by utilizing sluicing methods. Some of the CCR was periodically removed from the ponds and transported by truck to the JH Campbell Type III landfill (West Olive, Michigan) for disposal or were commercially marketed for beneficial reuse to the extent possible. Site features are shown on Figure 2.

1.3 Geology/Hydrogeology

The majority of the BCC Ponds CCR unit is comprised of surficial CCR and sand fill. 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 20 to 30 ft bgs, beneath the fine-grained sand, ranging in thickness from approximately 1 to 13 feet. 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 BCC Ponds CCR unit is bound by several surface water features (Figure 2): the North Channel Muskegon River and former plant-associated discharge channel adjoin the northwestern and southernmost boundaries of the pond area, and Veterans Memorial Pond (at the time of the September 2017 monitoring event, Veteran Memorial Pond was separated from the River by a weir, drained, and undergoing construction, but as of the report completion date, is no longer drained and construction appears to be mostly complete) 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. In general, groundwater is typically encountered at a similar or slightly higher elevation relative to the surrounding surface water features, flowing outward toward the bounding surface water features. 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 CCR unit.

Based on the hydrogeology at the Site, particularly the conductive properties of the sandy aquifer, the proximity of the BCC Ponds CCR unit to the surrounding surface water bodies, and consistent groundwater flow direction toward the adjacent surface water bodies, an inter-well statistical approach is recommended for detection monitoring as outlined in the Stats Plan.

Section 2
Groundwater Monitoring

2.1 Monitoring Well Network

A groundwater monitoring system has been established for the BCC Ponds CCR unit, which established the monitoring well locations for detection monitoring. The detection monitoring well network for the BCC Ponds CCR unit currently consists of 22 monitoring wells that are screened in the uppermost aquifer. The monitoring well locations are shown on Figure 2. 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 affected 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 CCR unit (total of 15 downgradient wells). As shown on Figure 2, 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.

2.2 Background Sampling

Background groundwater monitoring was conducted at the BCC Ponds CCR unit from November 2015 through July 2017 in accordance with the SAP. Data collection included eight rounds (Rounds 1 through 8) of static water elevation measurements, analysis for parameters required in the CCR Rule's Appendix III and Appendix IV to Part 257, and field parameters (dissolved oxygen, oxidation reduction potential, pH, specific conductivity, temperature, and turbidity) from all 23 monitoring wells installed at the site. The Rounds 1 through 7 groundwater samples were collected and analyzed by CEC's Laboratory Services, Jackson, Michigan. Round 8 groundwater sampling was conducted by TRC the week of July 11, 2017, and analyzed by Pace Analytical Services, LLC (Pace). Background data are included in Appendix A Tables 1 through 3, where: Table 1 is a summary of static water elevation data; Table 2 is a summary of groundwater analytical data compared to potentially relevant criteria; and Table 3 is a summary of field data.

In addition to the data tables, groundwater contour maps were developed for each of the background events to evaluate groundwater flow directions. The contour maps for each background monitoring event are also included in Appendix A as Figures 1 through 8.

2.3 Semiannual Groundwater Monitoring

The semiannual monitoring parameters for the detection groundwater monitoring program were selected per the CCR Rule's Appendix III to Part 257 – Constituents for Detection Monitoring. The Appendix III indicator parameters consist of boron, calcium, chloride, fluoride, pH (field reading), sulfate, and total dissolved solids (TDS) and were analyzed in accordance with the SAP. In addition to pH, the collected field parameters included dissolved oxygen, oxidation reduction potential, specific conductivity, temperature, and turbidity.

2.3.1 Data Summary

The initial semiannual groundwater detection monitoring event for 2017 was performed during September 12 through 14, 2017, by TRC personnel and samples were analyzed by Pace in accordance with the SAP. Static water elevation data were collected at all monitoring well locations. Groundwater samples were collected from the seven background monitoring wells and 15 downgradient monitoring wells for the Appendix III indicator parameters and field parameters. A summary of the groundwater data collected during the September 2017 event is provided on Table 1 (static groundwater elevation data), Table 2 (analytical results), and Table 3 (field data).

2.3.2 Data Quality Review

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

2.3.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected during the most recent background sampling events (post-April 2016) showed that groundwater is 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 elevations measured during the September 2017 sampling event are provided on Table 1 and were used to construct a groundwater contour map (Figure 3).

The map indicates that current groundwater flow continues to radiate outward non-uniformly toward the surface water. The direction of the highest gradient (towards the northeast) appears to be influenced by dewatering activities that were taking place at the Veteran's Pond relative to previous monitoring events. The average hydraulic gradient throughout the BCC Ponds CCR unit area during this event is estimated at 0.004 ft/ft. The gradient was calculated using the following well pairs: BCC-MW-15007/BCC-MW-15001 and BCC-MW-15012/BCC-MW-15022 (Figure 3). Using the mean hydraulic conductivity of 58 ft/day (ARCADIS, 2016) and an assumed effective porosity of 0.3, the estimated average seepage velocity is approximately 0.78 ft/day or 280 ft/year for this event.

Although the gradient toward the northeast has increased since the background sampling events commenced in November 2015, the general flow direction is similar to that identified in previous monitoring rounds and continues to demonstrate that the downgradient wells are appropriately positioned to detect the presence of Appendix III parameters that could potentially migrate from the BCC Ponds CCR unit.

Section 3
Statistical Evaluation

3.1 Establishing Background Limits

Per the Stats Plan, background limits were established for the Appendix III indicator parameters following the eighth round of background monitoring using data collected from the seven established background monitoring wells (BCC-MW-15002 through BCC-MW-15008). The statistical evaluation of the background data is presented in detail in Appendix C. The Appendix III background limits will be used throughout the detection monitoring period to determine whether groundwater has been impacted from the BCC Ponds CCR unit by comparing concentrations in the downgradient wells to the background limits for each Appendix III indicator parameter.

3.2 Data Comparison to Background Limits

The concentrations of the indicator parameters in the downgradient wells were compared to the statistical background limits calculated from the background data collected from MW-15002 through MW-15008. The comparisons are presented on Table 4.

The statistical evaluation of the September 2017 Appendix III indicator parameters shows potential SSIs over background for:

- Boron at BCC-MW-15009, BCC-MW-15010, BCC-MW-15011, and BCC-MW-15014;
- Fluoride at BCC-MW-15012; and
- pH at BCC-MW-15009, BCC-MW-15011, BCC-MW-15012, BCC-MW-15014, BCC-MW-15015, and BCC-MW-15017.

The initial observation of an indicator parameter concentration above the established background limits does not necessarily constitute a SSI. Per the Stats Plan, if there is an exceedance of a prediction limit for one or more of the parameters, the well(s) of concern can be resampled within 30 days of the completion of the initial statistical analysis for verification purposes. There were no SSIs compared to background for calcium, chloride, sulfate or TDS at any of the downgradient wells.

Section 4
Conclusions and Recommendations

Potential SSIs over background limits were noted for boron, fluoride and pH in one or more downgradient wells during September 2017. This is the initial detection monitoring event; therefore, it is the initial identification of a SSI over background levels. According to §257.94(e), if the facility determines, pursuant to §257.93(h), that there is a SSI over background levels for one or more of the Appendix III constituents, the facility will, within 90 days of detecting a SSI, establish an assessment monitoring program **<or>** demonstrate that:

- A source other than the CCR unit caused the SSI, or
- The SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

The owner or operator must complete a written demonstration (i.e., Alternative Source Demonstration, ASD), of the above within 90 days of confirming the SSI. Based on the outcome of the ASD the following steps will be taken:

- If a successful ASD is completed, a certification from a qualified professional engineer is required, and the CCR unit may continue with detection monitoring.
- If a successful ASD is not completed within the 90-day period, the owner or operator of the CCR unit must initiate an assessment monitoring program as required under §257.95. The facility must also include the ASD in the annual groundwater monitoring and corrective action report required by §257.90(e), in addition to the certification by a qualified professional engineer.

During the 90-day period after triggering assessment monitoring, the groundwater monitoring system wells will have groundwater samples collected and analyzed for Appendix IV constituents pursuant to §257.95(b). Within 90 days of obtaining the results from the first assessment monitoring event, the groundwater monitoring system wells will have groundwater samples collected and analyzed for Appendix III parameters and the detected Appendix IV parameters in the initial assessment monitoring event.

In response to the potential SSIs over background limits noted during September 2017, CEC plans to prepare an ASD to evaluate whether a source other than the BCC Ponds CCR unit caused the SSIs prior to initiating assessment monitoring. Based on the results from the ASD, CEC will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Section 5
References

ARCADIS. May 13, 2016. Summary of Monitoring Well Design, Installation, and Development. BC Cobb Electric Generation Facility – Muskegon, Michigan. Prepared for Consumers Energy Company.

ARCADIS. May 18, 2016. Electric Generation Facilities RCRA CCR Detection Monitoring Program. BC Cobb Monitoring Program Sample Analysis Plan, Muskegon, Michigan. Prepared for Consumers Energy Company.

TRC Environmental Corporation. October 2017. Groundwater Statistical Evaluation Plan – Former BC Cobb Power Plant, Bottom Ash Pond & Ponds 0-8, Muskegon, Michigan. Prepared for Consumers Energy Company.

Tables

Table 1

Summary of Groundwater Elevation Data – September 2017
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Depth (ft BGS)			Screen Interval Elevation (ft)			Borehole Terminus Depth (ft BGS)	Borehole Terminus Elevation (ft)	September 13, 2017	
												Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background													
BCC-MW-15001	583.6	586.52	Sand w/ organic seam at 18.8 ft bgs	10.0	to	20.0	573.6	to	563.6	20.0	563.6	7.42	579.10
BCC-MW-15002	583.8	586.87	Sand	15.0	to	20.0	568.8	to	563.8	20.0	563.8	7.32	579.55
BCC-MW-15003	584.1	587.12	Sand	13.0	to	18.0	571.1	to	566.1	20.0	564.1	6.96	580.16
BCC-MW-15004	587.7	590.57	Sand	5.0	to	15.0	582.7	to	572.7	20.0	567.7	10.11	580.46
BCC-MW-15005	584.8	587.77	Sand	5.0	to	15.0	579.8	to	569.8	20.0	564.8	6.90	580.87
BCC-MW-15006	584.9	587.81	Sand	5.0	to	15.0	579.9	to	569.9	20.0	564.9	7.10	580.71
BCC-MW-15007	584.5	587.43	Sand	4.0	to	10.0	580.5	to	574.5	20.0	564.5	7.05	580.38
BCC-MW-15008	584.8	587.76	Sand	4.0	to	9.0	580.8	to	575.8	20.0	564.8	6.80	580.96
Downgradient													
BCC-MW-15009	586.3	589.27	Sand (14 - 17.2 ft bgs) and Clay/silt (17.2 - 24 ft bgs)	14.0	to	24.0	572.3	to	562.3	24.0	562.3	8.85	580.42
BCC-MW-15010	585.2	588.11	Sand w/ little silt and organic matter	12.0	to	22.0	573.2	to	563.2	24.0	561.2	8.44	579.67
BCC-MW-15011	592.3	595.22	Sand w/ some silt	21.0	to	31.0	571.3	to	561.3	32.0	560.3	15.44	579.78
BCC-MW-15012	594.5	597.39	Sand	21.0	to	31.0	573.5	to	563.5	35.0	559.5	17.54	579.85
BCC-MW-15013	595.9	598.50	Sand with clay/silt and organic material from 36.5 - 37.5 ft bgs	30.0	to	40.0	565.9	to	555.9	40.0	555.9	17.77	580.73
BCC-MW-15014	596.2	599.04	Sand/silty sand	23.0	to	31.0	573.2	to	565.2	40.0	556.2	18.64	580.40
BCC-MW-15015	593.9	596.75	Sand with clay/silt and organic material from 29 - 29.5 ft bgs	20.0	to	30.0	573.9	to	563.9	30.0	563.9	15.80	580.95
BCC-MW-15016	586.2	589.05	Sand	35.0	to	40.0	551.2	to	546.2	45.0	541.2	8.16	580.89
BCC-MW-15017	585.7	588.61	Sand	35.0	to	40.0	550.7	to	545.7	40.0	545.7	7.68	580.93
BCC-MW-15018	589.4	592.43	Sand	37.5	to	42.5	551.9	to	546.9	45.0	544.4	11.48	580.95
BCC-MW-15019	589.4	592.42	Sand	37.0	to	42.0	552.4	to	547.4	45.0	544.4	11.70	580.72
BCC-MW-15020	589.5	592.23	Sand	35.0	to	40.0	554.5	to	549.5	45.0	544.5	12.00	580.23
BCC-MW-15021	590.7	593.73	Sand	39.5	to	42.5	551.2	to	548.2	50.0	540.7	13.71	580.02
BCC-MW-15022	592.6	595.82	Sand	24.0	to	30.0	568.6	to	562.6	45.0	547.6	17.60	578.22
BCC-MW-15023	585.4	588.08	Sand/silty sand	12.0	to	19.5	573.4	to	565.9	20.0	565.4	11.85	576.23

Notes:

Survey conducted by Williams & Works, November 2015.

Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).

TOC: Top of well casing.

ft BTOC: Feet below top of well casing.

ft BGS: Feet below ground surface.

Table 2

Summary of Groundwater Sampling Results (Analytical) – September 2017

BC Cobb – RCRA CCR Monitoring Program

Muskegon, Michigan

					Sample Location:	**BCC-MW-15002**	**BCC-MW-15003**	**BCC-MW-15004**	**BCC-MW-15005**	**BCC-MW-15006**	**BCC-MW-15007**	**BCC-MW-15008**	**BCC-MW-15009**	**BCC-MW-15010**	**BCC-MW-15011**	**BCC-MW-15012**
					Sample Date:	9/14/2017	9/14/2017	9/14/2017	9/14/2017	9/14/2017	9/14/2017	9/14/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							downgradient			
Appendix III																
Boron	ug/L	NC	**500**	**500**	7,200	**1,130**	361	325	36.8	45.1	141	401	**2,120**	**1,770**	**1,490**	**1,140**
Calcium	mg/L	NC	NC	NC	500	132	145	115	64.2	79.6	133	51.8	34.9	129	23.9	48.7
Chloride	mg/L	**250****	**250**	**250**	**500**	152	**493**	**382**	7.0	16.1	**1,940**	68.9	26.0	24.5	24.0	23.3
Fluoride	ug/L	4,000	NC	NC	NC	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	1,000	1,100
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.2	7.1	6.8	7.3	7.2	6.7	7.7	**10.2**	7.8	8.5	**11.4**
Sulfate	mg/L	250**	250	250	500	13.8	<2.0	5.8	2.9	11.6	8.3	3.0	41.7	143	6.4	59.6
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**772**	**1,370**	**934**	240	322	**2,690**	448	188	**570**	140	318

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion.

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Groundwater Sampling Results (Analytical) – September 2017
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15013**	**BCC-MW-15014**	**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**
					Sample Date:	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient										
Appendix III																
Boron	ug/L	NC	**500**	**500**	7,200	**1,270**	**1,410**	433	83.0	82.8	492	**1,010**	**745**	**602**	**833**	**504**
Calcium	mg/L	NC	NC	NC	500	34.4	57.8	36.9	182	245	90.7	107	107	91.3	35.2	60.9
Chloride	mg/L	**250****	**250**	**250**	**500**	21.2	22.5	20.3	226	224	49.1	73.9	87.8	108	23.3	25.5
Fluoride	ug/L	4,000	NC	NC	NC	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.9	**12.0**	**8.7**	6.6	6.5	6.8	6.7	6.8	6.8	7.6	7.6
Sulfate	mg/L	250**	250	250	500	59.9	19.2	16.1	<2.0	<2.0	<2.0	<2.0	3.0	<2.0	44.1	36.2
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	192	282	192	**995**	**1,130**	392	**618**	**608**	490	266	408

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion.

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 3
Summary of Field Parameter Results – September 2017
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Background							
BCC-MW-15002	9/14/2017	0.21	56.4	7.2	1,338	14.73	2.33
BCC-MW-15003	9/14/2017	0.21	69.1	7.1	2,151	14.13	<1
BCC-MW-15004	9/14/2017	0.25	77.4	6.8	1,740	15.57	1.76
BCC-MW-15005	9/14/2017	0.19	-117.9	7.3	424	17.26	4.20
BCC-MW-15006	9/14/2017	0.39	-25.0	7.2	545	20.60	2.28
BCC-MW-15007	9/14/2017	0.13	-67.7	6.7	4,965	19.70	2.19
BCC-MW-15008	9/14/2017	0.13	-108.0	7.7	743	19.03	1.49
Downgradient							
BCC-MW-15009	9/13/2017	0.03	-363.9	10.2	307	16.14	2.88
BCC-MW-15010	9/13/2017	0.11	-126.9	7.8	875	14.98	1.43
BCC-MW-15011	9/13/2017	0.11	-127.8	8.5	247	15.07	<1
BCC-MW-15012	9/13/2017	0.12	-172.3	11.4	441	15.91	<1
BCC-MW-15013	9/13/2017	0.12	-122.3	7.9	320	15.46	<1
BCC-MW-15014	9/13/2017	0.09	-185.6	12.0	679	15.11	1.65
BCC-MW-15015	9/13/2017	0.07	-183.4	8.7	340	15.06	<1
BCC-MW-15016	9/13/2017	0.11	-87.9	6.6	2,018	15.55	3.11
BCC-MW-15017	9/13/2017	0.17	-71.2	6.5	2,420	14.49	2.68
BCC-MW-15018	9/13/2017	0.19	-55.3	6.8	839	14.52	4.65
BCC-MW-15019	9/13/2017	0.16	-70.2	6.7	1,058	13.81	2.94
BCC-MW-15020	9/13/2017	0.22	-59.7	6.8	985	14.40	4.62
BCC-MW-15021	9/13/2017	0.24	-81.7	6.8	1,123	13.87	2.32
BCC-MW-15022	9/13/2017	0.30	-71.3	7.6	376	15.43	2.84
BCC-MW-15023	9/13/2017	0.22	-33.4	7.6	519	14.16	1.28

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

SU - Standard units

umhos/cm - Micromhos per centimeter.

NTU - Nephelometric Turbidity Unit.

Table 4

Comparison of Appendix III Parameter Results to Background Limits – September 2017

BC Cobb – RCRA CCR Monitoring Program

Muskegon, Michigan

		Sample Location:	**BCC-MW-15009**	**BCC-MW-15010**	**BCC-MW-15011**	**BCC-MW-15012**	**BCC-MW-15013**	**BCC-MW-15014**	**BCC-MW-15015**	**BCC-MW-15016**
		Sample Date:	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017
Constituent	Unit	UTL	downgradient							
Appendix III										
Boron	ug/L	**1,320**	**2,120**	**1,770**	**1,490**	1,140	1,270	**1,410**	433	83.0
Calcium	mg/L	259	34.9	129	23.9	48.7	34.4	57.8	36.9	182
Chloride	mg/L	5,980	26.0	24.5	24.0	23.3	21.2	22.5	20.3	226
Fluoride	ug/L	**1,000**	<1,000	<1,000	1,000	**1,100**	<1,000	<1,000	<1,000	<1,000
pH, Field	SU	**6.6 - 8.3**	**10.2**	7.8	**8.5**	**11.4**	7.9	**12.0**	**8.7**	6.6
Sulfate	mg/L	200	41.7	143	6.4	59.6	59.9	19.2	16.1	<2.0
Total Dissolved Solids	mg/L	5,170	188	570	140	318	192	282	192	995

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

All metals were analyzed as total unless otherwise specified.

RESULT Shading and bold font indicates an exceedance of the Upper Tolerance Limit (UTL) using the number of significant figures in the UTL.

Table 4

Comparison of Appendix III Parameter Results to Background Limits – September 2017

BC Cobb – RCRA CCR Monitoring Program

Muskegon, Michigan

		Sample Location:	**BCC-MW-15017**	**BCC-MW-15018**	**BCC-MW-15019**	**BCC-MW-15020**	**BCC-MW-15021**	**BCC-MW-15022**	**BCC-MW-15023**
		Sample Date:	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017	9/13/2017
Constituent	Unit	UTL	downgradient						
Appendix III									
Boron	ug/L	**1,320**	82.8	492	1,010	745	602	833	504
Calcium	mg/L	259	245	90.7	107	107	91.3	35.2	60.9
Chloride	mg/L	5,980	224	49.1	73.9	87.8	108	23.3	25.5
Fluoride	ug/L	**1,000**	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000
pH, Field	SU	**6.6 - 8.3**	**6.5**	6.8	6.7	6.8	6.8	7.6	7.6
Sulfate	mg/L	200	<2.0	<2.0	<2.0	3.0	<2.0	44.1	36.2
Total Dissolved Solids	mg/L	5,170	1,130	392	618	608	490	266	408

Notes:

ug/L - micrograms per liter.

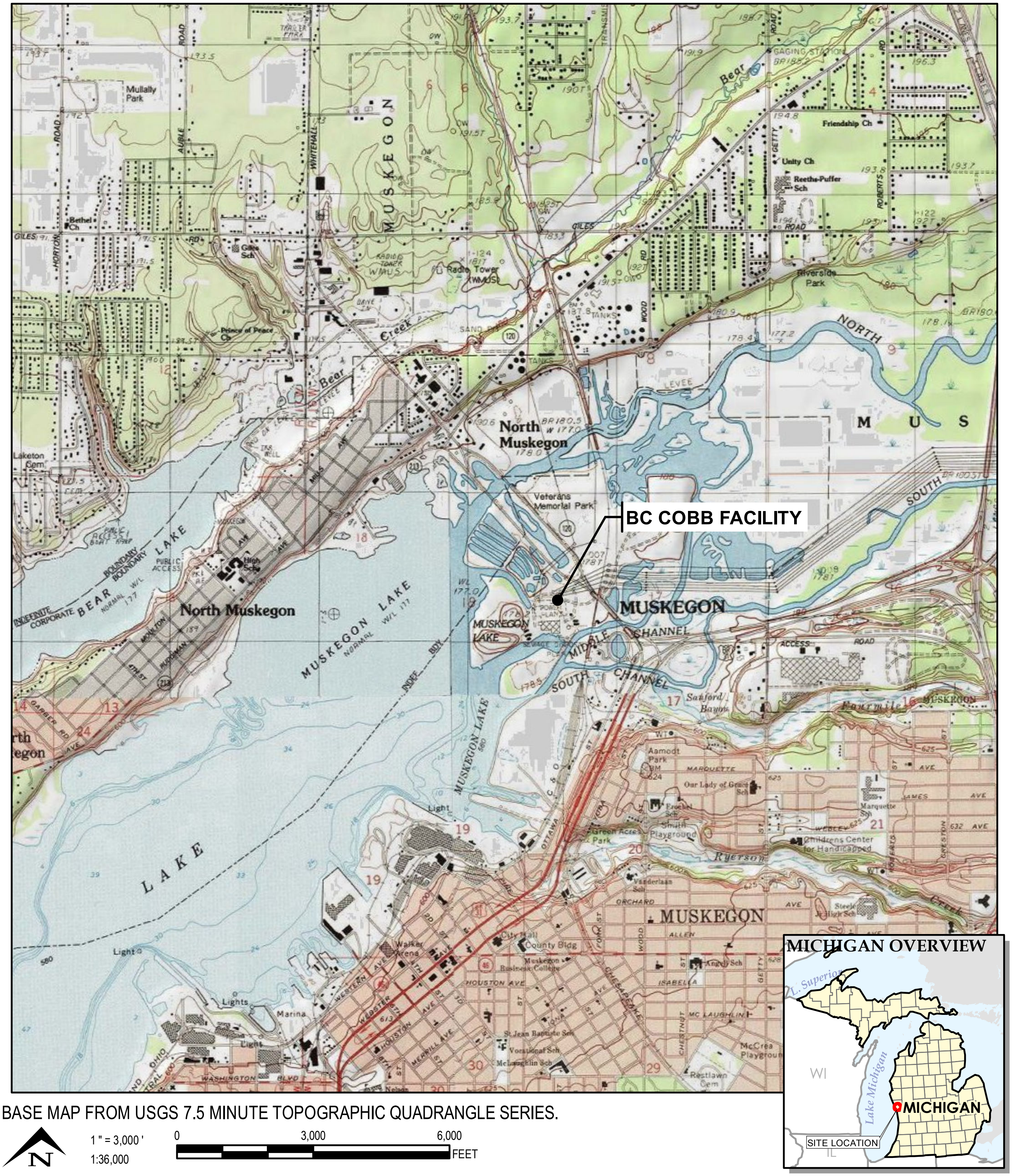
mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

All metals were analyzed as total unless otherwise specified.

RESULT Shading and bold font indicates an exceedance of the Upper Tolerance Limit (UTL) using the number of significant figures in the UTL.

Figures



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080

TRC - GIS

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:

SITE LOCATION MAP

DRAWN BY:	J. PAPEZ
CHECKED BY:	S. HOLMSTROM
APPROVED BY:	G. CROCKFORD
DATE:	OCTOBER 2017
PROJ. NO.:	269767-001
FILE:	269767-001-010slm.mxd

FIGURE 1

E:\ConsumersEnergy\CCR_GW\2017_269767\269767-001-010slm.mxd -- Saved By: SMAJOR on 10/11/2017, 10:19:47 AM

LEGEND

BACKGROUND MONITORING WELL

DOWNGRADIENT MONITORING WELL

MONITORING WELL (STATIC WATER LEVEL ONLY)

APPROXIMATE POND BOUNDARY

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.

0 300 600 Feet

1 " = 300 '

1:3,600

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:

SITE PLAN
WITH CCR MONITORING WELL LOCATIONS

DRAWN BY:	J. PAPEZ	PROJ NO.:	269767-001
CHECKED BY:	S HOLMSTROM	**FIGURE 2**	
APPROVED BY:	G. CROCKFORD		
DATE:	JANUARY 2018		

1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
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FILE NO.: 269767-001-002X.mxd

TRC - GIS

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

Plot Date: 1/12/2018, 16:44:48 PM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\269767-001-002X.mxd

TRC - GIS

Plot Date: 1/15/2018, 14:42:57 PM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\269767-001-016A.mxd

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

LEGEND

⊕	BACKGROUND MONITORING WELL
●	DOWNGRADIENT MONITORING WELL
⊕	MONITORING WELL (STATIC WATER LEVEL ONLY)
◯	APPROXIMATE POND BOUNDARY
(580.85)	GROUNDWATER ELEVATION (FEET, MSL)
∼	GROUNDWATER ELEVATION CONTOUR (1' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
3. NU= NOT USED. WELL SCREENED AT DEEPER INTERVAL RELATIVE TO ADJACENT WELLS, NOT USED TO CONSTRUCT CONTOUR MAP.

0 300 600
Feet

1 " = 300 '
1:3,600

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:

GROUNDWATER CONTOUR MAP
SEPTEMBER 13, 2017

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

TRC

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FILE NO.: 269767-001-016A.mxd

Appendix A
Background Data

Table 1
Summary of Groundwater Elevation Data
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Depth (ft BGS)			Screen Interval Elevation (ft)			Borehole Terminus Depth (ft BGS)	Borehole Terminus Elevation (ft)	Round 1		Round 2		Round 3		Round 4	
												November 30, 2015		February 16, 2016		April 12, 2016		July 11, 2016	
												Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background																			
BCC-MW-15001	583.6	586.52	Sand w/ organic seam at 18.8 ft bgs	10.0	to	20.0	573.6	to	563.6	20.0	563.6	5.68	580.84	5.89	580.63	5.34	581.18	5.76	580.76
BCC-MW-15002	583.8	586.87	Sand	15.0	to	20.0	568.8	to	563.8	20.0	563.8	6.01	580.86	6.23	580.64	5.66	581.21	6.13	580.74
BCC-MW-15003	584.1	587.12	Sand	13.0	to	18.0	571.1	to	566.1	20.0	564.1	6.28	580.84	6.48	580.64	5.89	581.23	6.39	580.73
BCC-MW-15004	587.7	590.57	Sand	5.0	to	15.0	582.7	to	572.7	20.0	567.7	9.75	580.82	9.90	580.67	9.29	581.28	9.84	580.73
BCC-MW-15005	584.8	587.77	Sand	5.0	to	15.0	579.8	to	569.8	20.0	564.8	7.23	580.54	7.37	580.40	6.77	581.00	6.94	580.83
BCC-MW-15006	584.9	587.81	Sand	5.0	to	15.0	579.9	to	569.9	20.0	564.9	6.67	581.14	6.90	580.91	6.23	581.58	6.89	580.92
BCC-MW-15007	584.5	587.43	Sand	4.0	to	10.0	580.5	to	574.5	20.0	564.5	6.30	581.13	6.58	580.85	5.88	581.55	6.61	580.82
BCC-MW-15008	584.8	587.76	Sand	4.0	to	9.0	580.8	to	575.8	20.0	564.8	6.77	580.99	7.17	580.59	5.79	581.97	6.99	580.77
Downgradient																			
BCC-MW-15009	586.3	589.27	Sand (14 - 17.2 ft bgs) and Clay/silt (17.2 - 24 ft bgs)	14.0	to	24.0	572.3	to	562.3	24.0	562.3	7.39	581.88	7.64	581.63	6.99	582.28	8.40	580.87
BCC-MW-15010	585.2	588.11	Sand w/ little silt and organic matter	12.0	to	22.0	573.2	to	563.2	24.0	561.2	6.69	581.42	6.96	581.15	6.38	581.73	7.31	580.80
BCC-MW-15011	592.3	595.22	Sand w/ some silt	21.0	to	31.0	571.3	to	561.3	32.0	560.3	13.09	582.13	13.30	581.92	12.76	582.46	14.37	580.85
BCC-MW-15012	594.5	597.39	Sand	21.0	to	31.0	573.5	to	563.5	35.0	559.5	13.93	583.46	14.11	583.28	13.60	583.79	16.48	580.91
BCC-MW-15013	595.9	598.50	Sand with clay/silt and organic material from 36.5 - 37.5 ft bgs	30.0	to	40.0	565.9	to	555.9	40.0	555.9	16.71	581.79	16.81	581.69	16.22	582.28	17.65	580.85
BCC-MW-15014	596.2	599.04	Sand/silty sand	23.0	to	31.0	573.2	to	565.2	40.0	556.2	15.85	583.19	16.02	583.02	15.53	583.51	18.18	580.86
BCC-MW-15015	593.9	596.75	Sand with clay/silt and organic material from 29 - 29.5 ft bgs	20.0	to	30.0	573.9	to	563.9	30.0	563.9	15.94	580.81	15.95	580.80	15.50	581.25	15.97	580.78
BCC-MW-15016	586.2	589.05	Sand	35.0	to	40.0	551.2	to	546.2	45.0	541.2	8.97	580.08	8.77	580.28	8.65	580.40	8.40	580.65
BCC-MW-15017	585.7	588.61	Sand	35.0	to	40.0	550.7	to	545.7	40.0	545.7	8.62	579.99	8.47	580.14	8.26	580.35	7.94	580.67
BCC-MW-15018	589.4	592.43	Sand	37.5	to	42.5	551.9	to	546.9	45.0	544.4	12.35	580.08	12.26	580.17	11.90	580.53	11.70	580.73
BCC-MW-15019	589.4	592.42	Sand	37.0	to	42.0	552.4	to	547.4	45.0	544.4	12.31	580.11	12.25	580.17	12.88	579.54	11.71	580.71
BCC-MW-15020	589.5	592.23	Sand	35.0	to	40.0	554.5	to	549.5	45.0	544.5	12.09	580.14	12.06	580.17	11.66	580.57	11.50	580.73
BCC-MW-15021	590.7	593.73	Sand	39.5	to	42.5	551.2	to	548.2	50.0	540.7	13.63	580.10	13.45	580.28	13.38	580.35	13.12	580.61
BCC-MW-15022	592.6	595.82	Sand	24.0	to	30.0	568.6	to	562.6	45.0	547.6	12.40	583.42	12.31	583.51	12.14	583.68	15.00	580.82
BCC-MW-15023	585.4	588.08	Sand/silty sand	12.0	to	19.5	573.4	to	565.9	20.0	565.4	4.02	584.06	4.20	583.88	3.80	584.28	7.41	580.67

Notes:

Survey conducted by Williams & Works, November 2015.

Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).

TOC: Top of well casing.

ft BTOC: Feet below top of well casing.

ft BGS: Feet below ground surface.

Table 1
Summary of Groundwater Elevation Data
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Depth (ft BGS)			Screen Interval Elevation (ft)			Round 5		Round 6		Round 7		Round 8	
										September 27, 2016		February 13, 2017		April 4, 2017		July 11, 2017	
										Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background																	
BCC-MW-15001	583.6	586.52	Sand w/ organic seam at 18.8 ft bgs	10.0	to	20.0	573.6	to	563.6	5.63	580.89	6.52	580.00	5.75	580.77	6.10	580.42
BCC-MW-15002	583.8	586.87	Sand	15.0	to	20.0	568.8	to	563.8	5.77	581.10	6.75	580.12	5.91	580.96	6.18	580.69
BCC-MW-15003	584.1	587.12	Sand	13.0	to	18.0	571.1	to	566.1	6.02	581.10	6.96	580.16	6.34	580.78	6.09	581.03
BCC-MW-15004	587.7	590.57	Sand	5.0	to	15.0	582.7	to	572.7	9.47	581.10	10.35	580.22	9.75	580.82	9.39	581.18
BCC-MW-15005	584.8	587.77	Sand	5.0	to	15.0	579.8	to	569.8	6.86	580.91	7.83	579.94	7.11	580.66	6.46	581.31
BCC-MW-15006	584.9	587.81	Sand	5.0	to	15.0	579.9	to	569.9	6.31	581.50	7.46	580.35	6.63	581.18	6.36	581.45
BCC-MW-15007	584.5	587.43	Sand	4.0	to	10.0	580.5	to	574.5	6.24	581.19	7.32	580.11	6.45	580.98	6.22	581.21
BCC-MW-15008	584.8	587.76	Sand	4.0	to	9.0	580.8	to	575.8	6.91	580.85	8.02	579.74	7.08	580.68	6.50	581.26
Downgradient																	
BCC-MW-15009	586.3	589.27	Sand (14 - 17.2 ft bgs) and Clay/silt (17.2 - 24 ft bgs)	14.0	to	24.0	572.3	to	562.3	8.48	580.79	9.49	579.78	8.66	580.61	8.15	581.12
BCC-MW-15010	585.2	588.11	Sand w/ little silt and organic matter	12.0	to	22.0	573.2	to	563.2	7.17	580.94	8.14	579.97	7.35	580.76	7.34	580.77
BCC-MW-15011	592.3	595.22	Sand w/ some silt	21.0	to	31.0	571.3	to	561.3	14.35	580.87	15.29	579.93	14.53	580.69	14.38	580.84
BCC-MW-15012	594.5	597.39	Sand	21.0	to	31.0	573.5	to	563.5	16.56	580.83	17.43	579.96	16.70	580.69	16.50	580.89
BCC-MW-15013	595.9	598.50	Sand with clay/silt and organic material from 36.5 - 37.5 ft bgs	30.0	to	40.0	565.9	to	555.9	18.00	580.50	18.95	579.55	18.04	580.46	17.40	581.10
BCC-MW-15014	596.2	599.04	Sand/silty sand	23.0	to	31.0	573.2	to	565.2	18.46	580.58	19.29	579.75	18.51	580.53	18.03	581.01
BCC-MW-15015	593.9	596.75	Sand with clay/silt and organic material from 29 - 29.5 ft bgs	20.0	to	30.0	573.9	to	563.9	16.45	580.30	17.36	579.39	16.42	580.33	15.64	581.11
BCC-MW-15016	586.2	589.05	Sand	35.0	to	40.0	551.2	to	546.2	8.61	580.44	9.61	579.44	8.75	580.30	8.03	581.02
BCC-MW-15017	585.7	588.61	Sand	35.0	to	40.0	550.7	to	545.7	8.20	580.41	9.28	579.33	8.53	580.08	7.55	581.06
BCC-MW-15018	589.4	592.43	Sand	37.5	to	42.5	551.9	to	546.9	12.14	580.29	13.13	579.30	12.18	580.25	11.33	581.10
BCC-MW-15019	589.4	592.42	Sand	37.0	to	42.0	552.4	to	547.4	12.12	580.30	13.11	579.31	12.16	580.26	11.41	581.01
BCC-MW-15020	589.5	592.23	Sand	35.0	to	40.0	554.5	to	549.5	11.92	580.31	12.87	579.36	11.91	580.32	11.33	580.90
BCC-MW-15021	590.7	593.73	Sand	39.5	to	42.5	551.2	to	548.2	13.05	580.68	14.13	579.60	13.33	580.40	13.06	580.67
BCC-MW-15022	592.6	595.82	Sand	24.0	to	30.0	568.6	to	562.6	14.94	580.88	15.66	580.16	15.08	580.74	15.65	580.17
BCC-MW-15023	585.4	588.08	Sand/silty sand	12.0	to	19.5	573.4	to	565.9	7.35	580.73	8.00	580.08	7.13	580.95	8.44	579.64

Notes:

Survey conducted by Williams & Works, November 2015.

Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).

TOC: Top of well casing.

ft BTOC: Feet below top of well casing.

ft BGS: Feet below ground surface.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15001**							
					Sample Date:	11/30/2015	2/17/2016	4/12/2016	7/12/2016	9/27/2016	2/13/2017	4/4/2017	7/11/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**1,120**	**1,290**	**1,310**	**1,290**	**1,010**	**1,060**	**1,080**	**1,100**
Calcium	mg/L	NC	NC	NC	500	118	129	105	113	130	105	107	91.1
Chloride	mg/L	**250****	**250**	**250**	**500**	35.0	22.4	21.3	19.7	19.9	23.2	22.3	27.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	6.96	7.0	7.1	7.1	6.7	6.9	7.0	6.92
Sulfate	mg/L	**250****	**250**	**250**	500	67.0	46.2	33.8	33.5	35.6	41.9	37.0	44.8
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**580**	**520**	460	470	**520**	470	470	**526**
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	<1	<1	<1	<1	<1	<1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	**670**	127	118	114	98	116	102	105	109
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	1	3	2	<1	1	1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	32.2	32.2	31	30	30	28	27	32
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.366	0.387	0.312	0.255	0.311	0.297	<0.276	<0.948
Radium-226/228	pCi/L	**5**	NC	NC	NC	1.54	0.963	1.23	1.39	<1.11	1.55	0.885	<1.80
Radium-228	pCi/L	5	NC	NC	NC	1.17	<0.812	0.921	1.13	<1.11	1.25	0.610	<0.855
Selenium	ug/L	50	50	50	**5**	<1	<1	<1	1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15002**							
					Sample Date:	11/30/2015	2/17/2016	4/12/2016	7/12/2016	9/27/2016	2/13/2017	4/4/2017	7/11/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**1,320**	**1,200**	**1,050**	**834**	**979**	**1,110**	**1,170**	**988**
Calcium	mg/L	NC	NC	NC	500	214	259	197	169	165	184	167	185
Chloride	mg/L	**250****	**250**	**250**	**500**	**720**	**519**	**681**	**577**	**328**	226	**354**	**472**
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	6.74	7.1	7.0	7.0	7.0	7.2	7.2	7.11
Sulfate	mg/L	**250****	**250**	**250**	500	250	**327**	**300**	202	127	116	85.6	113
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**1,900**	**1,900**	**1,900**	**1,800**	**1,100**	**1,100**	**1,200**	**1,500**
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	10	4	2	2	1	1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	**670**	274	257	252	232	148	134	146	186
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	1	2	3	2	<1	2	2	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	11
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.816	0.600	0.893	0.641	<0.254	0.419	0.387	<0.912
Radium-226/228	pCi/L	**5**	NC	NC	NC	3.03	2.03	2.32	1.88	<0.927	1.41	1.79	2.20
Radium-228	pCi/L	5	NC	NC	NC	2.21	1.43	1.43	1.24	<0.927	0.995	1.40	1.49
Selenium	ug/L	50	50	50	**5**	1	<1	<1	1	<1	<1	1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15003**							
					Sample Date:	11/30/2015	2/17/2016	4/12/2016	7/12/2016	9/27/2016	2/13/2017	4/4/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**542**	**574**	**2,370**	**528**	494	**608**	**679**	**695**
Calcium	mg/L	NC	NC	NC	500	216	233	180	177	179	163	167	154
Chloride	mg/L	**250****	**250**	**250**	**500**	**700**	**682**	**640**	**581**	**512**	**456**	**363**	**293**
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.24	7.1	7.2	7.1	7.1	7.4	7.3	7.07
Sulfate	mg/L	**250****	**250**	**250**	500	46.0	48.7	41.2	28.3	27.2	20.1	16.7	6.8
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**1,900**	**1,900**	**1,700**	**1,600**	**1,500**	**1,400**	**1,200**	**1,110**
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	2	<1	<1	1	<1	<1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	**670**	236	219	189	170	159	137	138	112
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	2	2	2	1	1	1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	11
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.667	0.633	0.522	0.387	0.284	0.350	0.442	0.442
Radium-226/228	pCi/L	**5**	NC	NC	NC	2.40	1.30	1.39	1.66	1.53	1.58	1.25	<1.03
Radium-228	pCi/L	5	NC	NC	NC	1.73	0.664	0.870	1.27	1.25	1.23	0.807	<0.858
Selenium	ug/L	50	50	50	**5**	2	<1	<1	1	<1	<1	1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15004**							
					Sample Date:	11/30/2015	2/17/2016	4/12/2016	7/12/2016	9/27/2016	2/13/2017	4/4/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	198	124	166	338	279	193	376	302
Calcium	mg/L	NC	NC	NC	500	94.6	80.9	70.7	87.0	81.9	75.1	73.4	67.2
Chloride	mg/L	**250****	**250**	**250**	**500**	27.0	18.1	22.0	30.9	22.1	28.2	35.2	45.7
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.28	7.2	6.9	6.7	6.9	7.1	7.1	6.95
Sulfate	mg/L	**250****	**250**	**250**	500	33.0	17.8	13.6	<2	8.06	7.20	<2	2.9
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	440	340	350	420	380	340	380	450
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	10	**10**	**10**	**10**	2	1	1	2	7	2	2	3.2
Barium	ug/L	2,000	2,000	2,000	**670**	33	18	29	43	42	29	33	38.4
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	1	2	2	1	1	3	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	7	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	<0.203	<0.216	<0.370	<0.157	<0.292	<0.181	<0.308	<0.654
Radium-226/228	pCi/L	5	NC	NC	NC	1.02	<0.565	0.518	0.808	1.08	1.18	1.02	<1.45
Radium-228	pCi/L	5	NC	NC	NC	0.879	<0.565	0.518	0.768	0.986	1.10	1.02	<0.796
Selenium	ug/L	50	50	50	**5**	<1	2	2	<1	<1	<1	1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15005**							
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/12/2016	9/27/2016	2/13/2017	4/4/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	<20	51	35	46	43	39	25	31.3
Calcium	mg/L	NC	NC	NC	500	57.2	93.3	60.6	75.4	67.3	99.2	43.9	60.2
Chloride	mg/L	**250****	**250**	**250**	**500**	9.50	137	66.6	13.1	1.23	181	20.1	3.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.18	7.2	7.3	7.2	7.1	7.3	7.6	7.33
Sulfate	mg/L	**250****	**250**	**250**	500	10.0	5.27	4.69	5.39	<2	5.57	7.88	4.4
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	230	480	340	**590**	230	**570**	200	204
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	1	1	<1	2	2	<1	<1	1.1
Barium	ug/L	2,000	2,000	2,000	**670**	83	125	97	151	147	173	82	116
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	<1	2	1	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.180	<0.336	<0.244	0.221	<0.332	<0.192	<0.279	<0.675
Radium-226/228	pCi/L	**5**	NC	NC	NC	0.882	<0.494	<0.378	0.662	0.545	1.02	0.447	<1.41
Radium-228	pCi/L	5	NC	NC	NC	0.702	<0.494	<0.378	0.441	0.471	1.02	0.447	<0.739
Selenium	ug/L	50	50	50	**5**	<1	<1	<1	<1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15006**							
					Sample Date:	11/30/2015	2/17/2016	4/13/2016	7/12/2016	9/28/2016	2/13/2017	4/4/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	48	39	33	43	55	32	35	42.3
Calcium	mg/L	NC	NC	NC	500	84.5	73.9	60.0	60.6	86.2	70.5	67.9	68.8
Chloride	mg/L	250**	**250**	**250**	**500**	50.0	12.8	32.5	63.1	19.6	48.0	23.5	69.8
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.03	7.3	7.2	6.9	6.9	7.3	7.4	7.15
Sulfate	mg/L	250**	**250**	**250**	500	17.0	17.1	12.7	8.54	12.2	7.34	6.88	9.4
Total Dissolved Solids	mg/L	500**	**500**	**500**	**500**	380	290	300	380	320	330	260	346
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	1	<1	<1	1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	1	1	<1	2	3	3	2	4.3
Barium	ug/L	2,000	2,000	2,000	**670**	26	16	17	20	26	17	17	27.8
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	1	2	1	<1	1	1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	5	6	7	7	7	8	8	8.5
Radium-226	pCi/L	5	NC	NC	NC	<0.301	<0.268	<0.205	<0.225	<0.416	<0.240	<0.198	<0.701
Radium-226/228	pCi/L	**5**	NC	NC	NC	0.629	<0.623	<0.479	<0.522	<0.571	<0.483	0.652	<1.41
Radium-228	pCi/L	5	NC	NC	NC	0.584	<0.623	<0.479	<0.522	<0.571	<0.483	0.459	<0.708
Selenium	ug/L	50	50	50	**5**	3	3	2	1	1	<1	1	1.2
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15007							
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/12/2016	9/28/2016	2/14/2017	4/4/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	79	74	65	89	135	76	83	130
Calcium	mg/L	NC	NC	NC	500	165	222	226	234	250	181	169	170
Chloride	mg/L	**250****	**250**	**250**	**500**	**1,900**	**2,300**	**2,480**	**2,280**	**2,390**	**1,850**	**1,670**	**1,900**
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	6.74	6.6	6.6	6.6	6.6	6.7	6.7	6.74
Sulfate	mg/L	**250****	**250**	**250**	500	21.0	15.7	11.0	9.87	9.38	3.19	4.25	9.1
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**3,700**	**2,000**	**3,900**	**4,500**	**4,800**	**3,700**	**3,100**	**3,700**
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	5	1	1	5	3	1	2	5.8
Barium	ug/L	2,000	2,000	2,000	**670**	285	267	236	294	377	227	167	229
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	2	2	2	1	2	2	1.1
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	8	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.686	0.659	0.289	0.554	1.15	0.629	0.492	<0.711
Radium-226/228	pCi/L	**5**	NC	NC	NC	2.19	1.69	1.56	1.65	2.75	2.02	1.29	<1.45
Radium-228	pCi/L	5	NC	NC	NC	1.50	1.03	1.27	1.10	1.60	1.39	0.796	0.850
Selenium	ug/L	50	50	50	**5**	1	<1	<1	<1	<1	<1	2	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15008**							
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/12/2016	9/28/2016	2/14/2017	4/4/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	background							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**1,060**	**897**	**794**	**866**	**1,160**	489	416	396
Calcium	mg/L	NC	NC	NC	500	39.6	39.5	48.4	77.2	109	63.4	63.0	54.4
Chloride	mg/L	250**	**250**	**250**	**500**	160	157	193	**546**	**423**	129	95.9	70.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	8.15	8.3	8.1	8.1	7.8	7.8	7.6	7.62
Sulfate	mg/L	250**	**250**	**250**	500	45.0	3.05	5.13	22.3	12.0	8.70	4.60	3.9
Total Dissolved Solids	mg/L	500**	**500**	**500**	**500**	**540**	**530**	**590**	**1,300**	**1,100**	**650**	**510**	414
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	1	<1	<1	4	<1	<1	<1	2.3
Barium	ug/L	2,000	2,000	2,000	**670**	39	42	49	61	100	63	59	54.6
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	<1	1	2	<1	<1	1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	12.9	13.5	16	19	28	17	18	23
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	<0.188	<0.215	<0.199	0.174	<0.217	<0.173	<0.284	<0.592
Radium-226/228	pCi/L	**5**	NC	NC	NC	0.620	<0.457	0.646	<0.405	1.03	0.843	<0.346	1.66
Radium-228	pCi/L	5	NC	NC	NC	0.521	<0.457	0.516	<0.405	0.893	0.672	<0.346	1.47
Selenium	ug/L	50	50	50	**5**	<1	<1	<1	1	<1	<1	1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15009							
					Sample Date:	12/1/2015	2/17/2016	4/18/2016	7/12/2016	9/28/2016	2/14/2017	4/5/2017	7/11/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**2,380**	**2,520**	**2,170**	**2,070**	**2,190**	**2,110**	**2,190**	**2,210**
Calcium	mg/L	NC	NC	NC	500	42.7	44.1	40.1	44.1	46.7	37.7	38.2	37.6
Chloride	mg/L	**250****	**250**	**250**	**500**	24.0	24.0	27.1	26.9	24.3	22.8	24.9	26.3
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	**10.62**	**10.8**	**10.3**	**10**	**10**	**10.2**	**10.1**	**9.6**
Sulfate	mg/L	**250****	**250**	**250**	500	63.0	39.3	49.5	55.2	49.1	31.6	39.8	43.0
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	240	230	220	220	230	200	190	216
Appendix IV													
Antimony	ug/L	6	6	6	130	1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	**45**	**31**	**24**	**24**	**20**	**14**	**13**	**12.0**
Barium	ug/L	2,000	2,000	2,000	**670**	16	12	11	11	11	9	10	13.2
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	<1	1	2	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	15.6	14.6	15	14	14	13	14	19
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	57	60	50	49	49	40	38	43.7
Radium-226	pCi/L	5	NC	NC	NC	<0.166	<0.157	<0.209	<0.158	<0.269	<0.159	<0.347	<0.756
Radium-226/228	pCi/L	**5**	NC	NC	NC	<0.451	<0.475	<0.467	<0.461	<0.628	0.747	<0.502	<2.72
Radium-228	pCi/L	5	NC	NC	NC	<0.451	<0.475	<0.467	<0.461	<0.628	0.678	<0.502	<1.96
Selenium	ug/L	50	50	50	**5**	<1	<1	2	<1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15010**							
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/12/2016	9/28/2016	2/14/2017	4/5/2017	7/11/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**1,970**	**1,510**	**1,340**	**1,270**	**1,570**	**1,440**	**1,760**	**1,340**
Calcium	mg/L	NC	NC	NC	500	71.2	51.9	37.4	58.2	66.4	49.8	80.5	40.7
Chloride	mg/L	**250****	**250**	**250**	**500**	23.0	22.5	21.5	22.7	25.1	22.3	24.2	25.5
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.74	7.8	7.8	7.8	8.0	8.0	7.8	7.8
Sulfate	mg/L	**250****	**250**	**250**	500	120	52.6	31.0	50.7	69.7	24.2	53.5	24.8
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	410	270	220	260	320	250	360	288
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	<1	<1	<1	<1	<1	<1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	**670**	49	34	28	42	45	31	51	29.2
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	<1	2	<1	<1	1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	36.1	22.7	18	15	22	14	18	21
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	33	29	27	15	20	9	7	16.2
Radium-226	pCi/L	5	NC	NC	NC	<0.302	<0.217	<0.244	<0.145	<0.297	<0.179	<0.216	<0.642
Radium-226/228	pCi/L	5	NC	NC	NC	0.973	<0.502	<0.447	0.451	0.820	<0.363	<0.380	<1.60
Radium-228	pCi/L	5	NC	NC	NC	0.849	<0.502	<0.447	0.420	0.728	<0.363	<0.380	<0.956
Selenium	ug/L	50	50	50	**5**	<1	<1	1	1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15011**							
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/12/2016	9/28/2016	2/14/2017	4/5/2017	7/11/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**1,680**	**1,420**	**1,340**	**1,210**	**1,180**	**1,280**	**1,340**	**1,060**
Calcium	mg/L	NC	NC	NC	500	53.0	47.6	36.9	47.3	48.0	47.9	52.0	42.2
Chloride	mg/L	**250****	**250**	**250**	**500**	22.0	20.7	22.1	24.8	21.0	19.5	22.2	22.9
Fluoride	ug/L	4,000	NC	NC	NC	1,200	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	**8.68**	8.5	8.2	8.5	**8.7**	**9.2**	**9.0**	8.2
Sulfate	mg/L	**250****	**250**	**250**	500	50.0	30.8	35.8	43.8	38.5	37.2	42.8	29.1
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	270	230	210	240	230	230	240	224
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	5	3	3	4	6	7	8	<1.0
Barium	ug/L	2,000	2,000	2,000	**670**	36	29	25	30	31	31	32	30.7
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	1	<1	2	1	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	1,200	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	17.2	16	14	15	16	17	17	20
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	20	29	35	26	27	25	22	21.4
Radium-226	pCi/L	5	NC	NC	NC	<0.199	<0.141	<0.319	<0.166	<0.284	<0.160	<0.296	<1.12
Radium-226/228	pCi/L	**5**	NC	NC	NC	1.01	<0.447	<0.435	<0.402	<0.496	<0.394	<0.599	<2.07
Radium-228	pCi/L	5	NC	NC	NC	0.956	<0.447	<0.435	<0.402	<0.496	<0.394	<0.599	<0.954
Selenium	ug/L	50	50	50	**5**	<1	<1	<1	1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15012**							
					Sample Date:	12/1/2015	2/17/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**961**	**1,390**	**1,830**	**1,450**	**1,470**	**1,380**	**1,500**	**1,340**
Calcium	mg/L	NC	NC	NC	500	49.5	82.1	65.5	44.5	43.5	32.0	34.9	24.6
Chloride	mg/L	**250****	**250**	**250**	**500**	20.0	20.4	23.7	23.0	22.6	19.7	22.7	24.1
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	1,200
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.98	8.1	8.1	**8.9**	**9.2**	**8.6**	8.5	**9.89**
Sulfate	mg/L	**250****	**250**	**250**	500	69.0	111	106	65.6	50.9	55.7	57.2	21.8
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	300	370	340	250	210	190	200	168
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	<1	2	8	**12**	9	2	3	6.1
Barium	ug/L	2,000	2,000	2,000	**670**	40	63	68	34	22	25	28	14.3
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	<1	1	1	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	1,200
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	15.6	20.8	19	18	15	11	12	12
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	29	9	35	37	44	35	27	**94.5**
Radium-226	pCi/L	5	NC	NC	NC	<0.164	<0.243	<0.256	<0.216	<0.335	<0.153	<0.243	0.436
Radium-226/228	pCi/L	**5**	NC	NC	NC	<0.471	<0.634	0.919	<0.539	<0.548	<0.416	<0.554	<2.28
Radium-228	pCi/L	5	NC	NC	NC	<0.471	<0.634	0.827	<0.539	<0.548	<0.416	<0.554	<2.08
Selenium	ug/L	50	50	50	**5**	<1	<1	<1	<1	<1	<1	<1	1.2
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15013**							
					Sample Date:	12/1/2015	2/18/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**1,140**	**1,290**	**1,180**	**1,080**	**1,090**	**1,050**	**1,120**	**916**
Calcium	mg/L	NC	NC	NC	500	65.2	58.3	47.5	48.4	59.7	52.5	50.9	43.9
Chloride	mg/L	**250****	**250**	**250**	**500**	21.0	20.9	21.5	21.0	22.9	19.8	19.9	23.4
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.61	7.2	7.4	7.3	7.4	7.7	7.4	7.36
Sulfate	mg/L	**250****	**250**	**250**	500	89.0	44.3	34.3	27.5	31.3	23.1	15.1	8.7
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	330	290	260	250	250	260	250	240
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	<1	<1	<1	<1	<1	<1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	**670**	71	58	49	47	51	52	48	41.9
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	<1	2	1	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	17.5	19.9	18	17	18	18	17	23
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	17	20	21	12	11	10	9	7.7
Radium-226	pCi/L	5	NC	NC	NC	0.272	<0.299	0.173	<0.181	<0.215	<0.230	<0.215	0.731
Radium-226/228	pCi/L	**5**	NC	NC	NC	1.19	<0.527	0.900	0.596	<0.598	<0.481	<0.516	<1.56
Radium-228	pCi/L	5	NC	NC	NC	0.914	<0.527	0.727	0.483	<0.598	<0.481	<0.516	<0.940
Selenium	ug/L	50	50	50	**5**	<1	<1	<1	1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15014**							
					Sample Date:	12/1/2015	2/18/2016	4/18/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**2,560**	**2,230**	**1,840**	**1,630**	**1,690**	**1,530**	**1,560**	**1,300**
Calcium	mg/L	NC	NC	NC	500	75.6	75.3	63.9	73.5	64.7	66.3	65.3	61.8
Chloride	mg/L	**250****	**250**	**250**	**500**	21.0	21.9	21.9	22.0	22.7	18.6	22.1	22.4
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	**11.53**	**11.6**	**11.2**	**11**	**11.1**	**11.5**	**11.3**	**11.5**
Sulfate	mg/L	**250****	**250**	**250**	500	43.0	34.7	31.4	35.6	23.7	27.8	23.9	24.9
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	350	310	270	290	250	280	270	292
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	1.7
Arsenic	ug/L	**10**	**10**	**10**	**10**	**15**	**11**	**11**	8	9	7	7	8.4
Barium	ug/L	2,000	2,000	2,000	**670**	329	376	257	508	357	571	546	**732**
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	2	1	1	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	19
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	**119**	**76**	58	69	**81**	**80**	**77**	70.9
Radium-226	pCi/L	5	NC	NC	NC	<0.176	<0.175	<0.177	0.214	<0.218	<0.211	<0.289	<0.511
Radium-226/228	pCi/L	**5**	NC	NC	NC	1.31	<0.735	<0.562	<0.606	<0.485	0.883	<0.423	<1.58
Radium-228	pCi/L	5	NC	NC	NC	1.23	<0.735	<0.562	<0.606	<0.485	0.810	<0.423	<1.07
Selenium	ug/L	50	50	50	**5**	<1	1	<1	<1	<1	1	**8**	2.3
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15015**							
					Sample Date:	12/1/2015	2/18/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**1,190**	**1,170**	**963**	**614**	**656**	**662**	**599**	489
Calcium	mg/L	NC	NC	NC	500	32.8	33.0	30.6	36.2	40.1	38.4	37.6	29.4
Chloride	mg/L	**250****	**250**	**250**	**500**	21.0	22.0	21.6	20.4	19.5	19.2	22.7	20.1
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.56	7.4	7.4	7.4	7.8	7.7	7.6	8.35
Sulfate	mg/L	**250****	**250**	**250**	500	7.80	6.56	8.34	13.9	9.26	10.4	13.8	18.8
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	220	200	190	180	180	200	190	166
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	2	2	2	6	5	5	6	6.4
Barium	ug/L	2,000	2,000	2,000	**670**	23	22	21	25	28	30	28	30.1
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	<1	1	1	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	12
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	17	14	17	11	10	9	11	11.9
Radium-226	pCi/L	5	NC	NC	NC	<0.193	<0.157	<0.242	<0.133	<0.378	<0.166	<0.340	<0.832
Radium-226/228	pCi/L	**5**	NC	NC	NC	<0.578	<0.577	<0.521	<0.467	0.850	<0.408	<0.420	<1.63
Radium-228	pCi/L	5	NC	NC	NC	<0.578	<0.577	<0.521	<0.467	0.850	<0.408	<0.420	<0.799
Selenium	ug/L	50	50	50	**5**	<1	<1	<1	1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15016**							
					Sample Date:	12/1/2015	2/18/2016	4/13/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	108	119	86	100	88	92	83	85.9
Calcium	mg/L	NC	NC	NC	500	172	184	164	172	181	176	172	170
Chloride	mg/L	**250****	**250**	**250**	**500**	200	204	203	165	204	196	200	10.4
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	6.55	6.5	**6.4**	**6.3**	**6.4**	**6.4**	6.6	**6.44**
Sulfate	mg/L	**250****	**250**	**250**	500	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**980**	**1,000**	**980**	**920**	**930**	**990**	**1,000**	**1,050**
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	2	2	3	3	2	2	2	1.5
Barium	ug/L	2,000	2,000	2,000	**670**	656	647	614	619	621	666	613	596
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	2	3	3	4	3	3	3	1.9
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	<0.263	1.51	1.31	1.50	1.06	1.17	1.60	1.30
Radium-226/228	pCi/L	5	NC	NC	NC	2.29	3.83	3.00	3.18	2.74	3.54	3.66	2.36
Radium-228	pCi/L	5	NC	NC	NC	2.29	2.32	1.69	1.68	1.68	2.37	2.06	1.06
Selenium	ug/L	50	50	50	**5**	2	4	2	**7**	1	2	2	3.6
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15017**							
					Sample Date:	12/1/2015	2/18/2016	4/18/2016	7/13/2016	9/29/2016	2/14/2017	4/5/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	59	90	66	76	78	76	75	75.0
Calcium	mg/L	NC	NC	NC	500	225	247	220	232	252	232	232	203
Chloride	mg/L	**250****	**250**	**250**	**500**	200	201	184	204	182	192	187	199
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	**6.46**	**6.4**	**6.4**	**6.4**	**6.4**	6.6	6.5	**6.41**
Sulfate	mg/L	**250****	**250**	**250**	500	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**850**	**1,100**	**1,200**	**1,100**	**1,100**	**1,200**	**1,100**	**1,230**
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	**13**	7	5	**12**	**12**	5	4	3.0
Barium	ug/L	2,000	2,000	2,000	**670**	**1,030**	**981**	**924**	**985**	**955**	**968**	**876**	**772**
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	4	4	4	9	11	5	5	5.3
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	1.61	2.38	2.18	1.91	1.94	1.82	1.56	1.97
Radium-226/228	pCi/L	**5**	NC	NC	NC	4.30	**5.35**	**5.68**	**5.89**	4.44	4.97	4.34	4.75
Radium-228	pCi/L	5	NC	NC	NC	2.69	2.97	3.50	3.98	2.50	3.15	2.78	2.78
Selenium	ug/L	50	50	50	**5**	3	4	3	**8**	2	2	3	2.7
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15018**							
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	9/29/2016	2/14/2017	4/5/2017	7/11/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	487	**526**	478	399	438	479	493	**538**
Calcium	mg/L	NC	NC	NC	500	88.6	100	87.9	86.8	98.5	100	92.1	84.8
Chloride	mg/L	**250****	**250**	**250**	**500**	38.0	38.0	40.8	39.3	37.5	43.6	44.4	53.4
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.0	6.9	6.8	6.5	6.5	6.7	6.8	6.78
Sulfate	mg/L	**250****	**250**	**250**	500	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	290	400	430	390	410	450	410	420
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	1	<1	<1	2	<1	<1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	**670**	155	149	139	133	143	171	149	153
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	1	1	1	1	<1	1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	21.4	23.1	24	12	14	21	21	26
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.227	0.394	0.430	0.234	0.522	0.363	<0.314	<0.479
Radium-226/228	pCi/L	**5**	NC	NC	NC	<0.586	1.17	1.08	1.08	1.33	1.36	1.37	<1.25
Radium-228	pCi/L	5	NC	NC	NC	<0.586	0.778	0.649	0.845	0.803	0.996	1.08	<0.767
Selenium	ug/L	50	50	50	**5**	<1	<1	1	4	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15019**							
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/13/2016	9/30/2016	2/15/2017	4/5/2017	7/11/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**1,530**	**1,590**	**1,440**	**1,320**	**1,260**	**1,370**	**1,410**	**1,430**
Calcium	mg/L	NC	NC	NC	500	84.6	93.6	83.0	90.0	92.6	91.8	92.8	90.1
Chloride	mg/L	**250****	**250**	**250**	**500**	34.0	32.4	33.7	37.7	35.6	34.5	33.6	52.5
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.0	6.8	6.9	6.7	6.4	6.8	6.9	6.79
Sulfate	mg/L	**250****	**250**	**250**	500	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	340	390	440	410	370	410	420	470
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	<1	<1	<1	<1	<1	<1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	**670**	91	94	88	88	96	93	90	109
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	<1	1	1	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	23.7	27.9	26	24	22	23	22	27
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.333	0.279	0.465	0.282	0.315	0.329	<0.360	<0.620
Radium-226/228	pCi/L	**5**	NC	NC	NC	0.674	0.798	0.997	0.969	<0.739	2.13	0.974	<1.64
Radium-228	pCi/L	5	NC	NC	NC	<0.484	<0.567	0.532	<0.718	<0.739	1.80	0.872	<1.02
Selenium	ug/L	50	50	50	**5**	<1	<1	<1	2	<1	<1	<1	1.2
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15020**							
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	9/30/2016	2/15/2017	4/5/2017	7/11/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	**630**	**738**	**638**	**603**	**608**	**621**	**667**	**618**
Calcium	mg/L	NC	NC	NC	500	61.0	67.6	59.1	60.7	66.5	67.0	66.6	68.1
Chloride	mg/L	**250****	**250**	**250**	**500**	39.0	35.4	34.3	69.6	33.5	33.3	33.9	45.7
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.27	7.2	7.0	6.9	6.9	7.0	7.1	7.01
Sulfate	mg/L	**250****	**250**	**250**	500	2.20	2.34	<2	<2	<2	<2	<2	<2.0
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	320	310	320	310	310	330	320	388
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	<1	<1	<1	<1	<1	<1	<1	<1.0
Barium	ug/L	2,000	2,000	2,000	**670**	48	52	51	47	54	53	52	60.4
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	2	<1	1	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	15.1	17.8	16	14	14	14	14	18
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	<0.269	<0.240	<0.341	<0.190	<0.276	<0.294	<0.290	<0.761
Radium-226/228	pCi/L	**5**	NC	NC	NC	<0.467	0.847	0.730	<0.598	0.724	<0.591	0.652	<1.39
Radium-228	pCi/L	5	NC	NC	NC	<0.467	0.731	0.474	<0.598	0.682	<0.591	0.543	<0.627
Selenium	ug/L	50	50	50	**5**	<1	1	<1	2	<1	<1	<1	1.4
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15021							
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/13/2016	10/5/2016	2/15/2017	4/5/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	362	489	400	425	491	465	**519**	**519**
Calcium	mg/L	NC	NC	NC	500	86.4	98.5	89.6	97.4	96.9	97.9	96.3	86.8
Chloride	mg/L	**250****	**250**	**250**	**500**	88.0	82.7	87.2	98.3	98.9	94.6	93.9	97.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	6.83	6.8	6.8	6.7	6.8	6.9	6.9	6.81
Sulfate	mg/L	**250****	**250**	**250**	500	<2	<2	<2	<2	<2	<2	<2	<2.0
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**610**	**540**	**570**	**590**	**620**	**570**	**560**	**548**
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	3	1	1	2	2	2	2	1.0
Barium	ug/L	2,000	2,000	2,000	**670**	274	244	236	233	252	240	228	211
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	2	2	2	1	2	2	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	<5	<5	<5	<5	<5	<5	<5	<5.0
Radium-226	pCi/L	5	NC	NC	NC	0.569	0.629	0.563	0.429	0.483	0.524	<0.215	<0.768
Radium-226/228	pCi/L	**5**	NC	NC	NC	1.55	1.41	1.41	1.30	2.00	0.966	<0.354	<1.47
Radium-228	pCi/L	5	NC	NC	NC	0.984	0.782	0.846	0.871	1.52	<0.582	<0.354	<0.697
Selenium	ug/L	50	50	50	**5**	1	2	1	4	<1	<1	1	1.6
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15022**							
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	10/5/2016	2/15/2017	4/6/2017	7/12/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	250	388	387	362	391	394	434	478
Calcium	mg/L	NC	NC	NC	500	46.7	46.4	47.8	43.0	43.7	54.1	49.3	51.8
Chloride	mg/L	**250****	**250**	**250**	**500**	25.0	18.7	17.6	16.8	17.1	18.2	18.6	22.1
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	8.29	8.5	8.2	8.2	8.1	7.8	8.1	8.36
Sulfate	mg/L	**250****	**250**	**250**	500	39.0	38.3	29.9	34.3	32.8	34.1	32.8	45.9
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	270	210	250	250	210	250	230	254
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	6	7	8	8	6	4	4	5.8
Barium	ug/L	2,000	2,000	2,000	**670**	139	119	155	116	119	137	129	138
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	1	2	1	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	22	16	11	17	19	12	14	13.6
Radium-226	pCi/L	5	NC	NC	NC	0.246	<0.242	<0.247	<0.150	<0.346	<0.217	<0.291	<0.468
Radium-226/228	pCi/L	**5**	NC	NC	NC	<0.484	<0.450	0.812	<0.472	<0.514	<0.477	0.862	<1.27
Radium-228	pCi/L	5	NC	NC	NC	<0.484	<0.450	0.740	<0.472	<0.514	<0.477	0.709	<0.799
Selenium	ug/L	50	50	50	**5**	<1	<1	<1	<1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 2
Summary of Analytical Results for Groundwater Samples
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15023**							
					Sample Date:	12/2/2015	2/18/2016	4/14/2016	7/14/2016	10/5/2016	2/15/2017	4/6/2017	7/11/2017
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	414	284	267	308	**526**	484	**1,590**	**701**
Calcium	mg/L	NC	NC	NC	500	59.7	59.4	53.3	54.1	64.0	59.9	74.5	50.8
Chloride	mg/L	**250****	**250**	**250**	**500**	30.0	26.9	24.6	28.7	24.8	23.8	24.6	26.8
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
pH, Field	SU	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.43	7.5	7.5	7.5	7.4	7.6	7.6	7.63
Sulfate	mg/L	**250****	**250**	**250**	500	20.0	26.5	28.9	25.0	24.3	21.0	22.5	22.6
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	240	270	270	290	290	280	300	290
Appendix IV													
Antimony	ug/L	6	6	6	130	<1	<1	<1	<1	<1	<1	<1	<1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	2	2	1	3	2	2	<1	1.9
Barium	ug/L	2,000	2,000	2,000	**670**	57	48	43	40	47	42	46	38.0
Beryllium	ug/L	4	4	4	6.7	<1	<1	<1	<1	<1	<1	<1	<1.0
Cadmium	ug/L	5	5	5	3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Chromium	ug/L	100	100	100	11	<1	<1	2	1	<1	<1	<1	<1.0
Cobalt	ug/L	NC	40	100	100	<15	<15	<15	<15	<15	<15	<15	<15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Lead	ug/L	NC	4	4	29	<1	<1	<1	<1	<1	<1	<1	<1.0
Lithium	ug/L	NC	170	350	440	12.1	10.6	<10	<10	<10	<10	11	<10
Mercury	ug/L	2	2	2	0.20#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Molybdenum	ug/L	NC	**73**	210	3,200	8	6	<5	7	6	6	<5	6.0
Radium-226	pCi/L	5	NC	NC	NC	0.232	<0.237	<0.242	0.226	<0.309	0.257	0.455	<0.889
Radium-226/228	pCi/L	**5**	NC	NC	NC	<0.530	0.599	<0.456	<0.545	<0.355	0.426	1.42	<1.53
Radium-228	pCi/L	5	NC	NC	NC	<0.530	0.426	<0.456	<0.545	<0.355	<0.400	0.963	<0.636
Selenium	ug/L	50	50	50	**5**	<1	<1	<1	1	<1	<1	<1	<1.0
Thallium	ug/L	2	2	2	3.7	<2	<2	<2	<2	<2	<2	<2	<2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using default hardness of 150 mg CaCO3/L per MDEQ RRD Op Memo 5, Sept. 30, 2004. Generic GSI criterion for calcium, chloride, and sulfate is the total dissolved solids criterion. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 3
Summary of Field Parameters
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen	Oxidation Reduction Potential	Specific Conductivity	Temperature	Turbidity
		mg/L	mV	umhos/cm	°C	NTU
BCC-MW-15001	11/30/15	0.09	-139.3	884	13.12	0.94
	02/17/16	0.8	-92.3	859	8.4	2.4
	04/12/16	0.5	-66.1	802	9.3	5.6
	07/12/16	0.4	-162.2	766	15.4	4.5
	09/27/16	0.4	-83.1	880	12.7	<1
	02/13/17	0.5	-93.6	780	11.2	5.5
	04/04/17	0.1	-94.8	848	10.7	<1
	07/11/17	0.11	-110.8	721.0	14.60	3.94
BCC-MW-15002	11/30/15	0.14	-129.4	3,401	12.52	1.72
	02/17/16	0.2	-82.0	3,114	9.6	<1
	04/12/16	0.3	-82.9	3,693	10.5	<1
	07/12/16	0.4	-43.4	3,087	17.0	<1
	09/27/16	0.4	-50.5	2,003	14.1	<1
	02/13/17	0.5	-77.4	1,784	11.4	<1
	04/04/17	0.6	-59.8	2,072	10.2	<1
	07/11/17	0.10	-11.0	2,479.2	14.21	<1
BCC-MW-15003	11/30/15	2.32	34.1	2,957	11.24	5.1
	02/17/16	0.3	-76.2	3,291	7.5	<1
	04/12/16	0.3	-51.2	2,991	9.8	<1
	07/12/16	0.3	-119.9	2,796	15.5	<1
	09/27/16	0.4	-67.8	2,749	14.3	<1
	02/13/17	0.4	-82.6	2,438	9.9	2.1
	04/04/17	0.0	-107.0	2,349	9.2	1.6
	07/12/17	0.15	-87.2	1,803.0	14.60	5.79
BCC-MW-15004	11/30/15	1.64	-7.3	655	11.07	3.09
	02/17/16	1.0	41.1	556	7.0	2.3
	04/12/16	0.5	-14.0	616	7.6	<1
	07/12/16	0.3	-120.7	741	15.9	<1
	09/27/16	0.4	-69.5	688	16.9	<1
	02/13/17	0.6	-11.2	570	9.0	<1
	04/04/17	0.6	-67.3	615	8.7	<1
	07/12/17	0.14	-39.2	647.9	15.02	3.08
BCC-MW-15005	12/01/15	0.67	-100.7	345	9.19	1.23
	02/17/16	0.3	-65.7	731	5.4	<1
	04/13/16	0.7	-37.1	573	6.7	1.1
	07/12/16	0.3	-141.1	482	17.3	2.3
	09/27/16	0.5	-79.1	387	19.0	2.3
	02/13/17	0.9	-35.7	921	7.1	4.5
	04/04/17	3.2	-66.6	424	7.4	8.0
	07/12/17	0.20	-90.8	374.9	18.31	2.68

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

umhos/cm - Micromhos per centimeter.

NTU - Nephelometric Turbidity Unit.

Table 3

Summary of Field Parameters
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen	Oxidation Reduction Potential	Specific Conductivity	Temperature	Turbidity
		mg/L	mV	umhos/cm	°C	NTU
BCC-MW-15006	11/30/15	2.71	-55.1	683	9.71	2.81
	02/17/16	2.7	73.4	471	4.6	8.7
	04/13/16	2.6	60.5	518	6.8	<1
	07/12/16	1.4	-18.5	678	23.9	<1
	09/28/16	1.2	-5.5	557	19.4	<1
	02/13/17	2.0	-49.7	503	5.5	<1
	04/04/17	3.5	-10.0	414	8.0	<1
	07/12/17	1.49	33.2	598.8	21.51	<1
BCC-MW-15007	12/01/15	0.23	-134.8	6,286	10.56	2.03
	02/17/16	1.4	-72.5	7,506	5.3	1
	04/13/16	0.3	-48.7	7,861	7.1	<1
	07/12/16	0.3	-109.9	7,314	19.1	<1
	09/28/16	0.4	-94.8	8,664	20.3	<1
	02/14/17	0.5	-90.8	6,474	6.1	1.3
	04/04/17	0.1	-72.9	6,047	7.6	<1
	07/12/17	0.13	-118.7	4,980.0	19.60	2.12
BCC-MW-15008	12/01/15	0.00	-308.4	938	12.78	1.18
	02/17/16	0.1	-219.5	956	6.2	<1
	04/13/16	0.2	-230.2	1,133	6.7	<1
	07/12/16	0.2	-239.0	2,443	21.8	<1
	09/28/16	0.4	-250.7	2,149	19.9	<1
	02/14/17	0.6	-117.9	1,078	6.5	<1
	04/04/17	0.5	-88.3	864	7.8	<1
	07/12/17	0.11	-114.3	710.6	18.29	3.79
BCC-MW-15009	12/01/15	0.41	-236.7	335	13.50	1.93
	02/17/16	0.2	-280.2	352	12.7	<1
	04/18/16	0.4	-195.5	346	17.7	<1
	07/12/16	0.2	-367.1	356	19.7	<1
	09/28/16	0.4	-365.3	358	16.8	<1
	02/14/17	0.4	-361.2	329	13.6	1.2
	04/05/17	0.0	-292.0	338	13.5	2.5
	07/11/17	0.05	-319.6	295.7	17.00	6.99
BCC-MW-15010	12/01/15	0.01	-246.0	587	12.97	2.51
	02/17/16	0.1	-197.3	402	11.4	2.8
	04/13/16	0.2	-182.6	344	10.9	<1
	07/13/16	0.3	-174.7	449	16.0	3.1
	09/28/16	0.4	-104.8	547	18.5	<1
	02/14/17	0.5	-192.3	390	12.0	<1
	04/05/17	0.5	-52.9	556	11.3	<1
	07/11/17	0.08	-193.4	345.0	15.50	4.71

Notes:

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Table 3
Summary of Field Parameters
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen	Oxidation Reduction Potential	Specific Conductivity	Temperature	Turbidity
		mg/L	mV	umhos/cm	°C	NTU
BCC-MW-15011	12/01/15	0.00	-322.4	391	13.76	3.54
	02/17/16	0.2	-180.3	346	10.4	<1
	04/13/16	0.3	-145.7	323	14.1	<1
	07/12/16	0.2	-208.0	371	19.2	<1
	09/28/16	0.4	-100.0	390	15.2	<1
	02/14/17	0.5	-221.3	389	12.2	<1
	04/05/17	0.1	-198.5	427	13.0	<1
	07/11/17	0.10	-198.1	345.5	16.00	2.65
BCC-MW-15012	12/01/15	0.49	0.8	374	14.33	2.25
	02/17/16	0.2	-201.2	569	12.6	<1
	04/13/16	0.2	-217.3	570	14.2	1.8
	07/13/16	0.4	-179.0	406	19.9	<1
	09/29/16	0.5	-174.9	354	14.7	<1
	02/14/17	0.6	-186.8	318	12.2	<1
	04/05/17	0.4	-208.8	340	12.6	<1
	07/12/17	0.12	-297.0	264.7	15.20	4.41
BCC-MW-15013	12/01/15	0.07	-262.9	528	14.25	1.59
	02/18/16	0.4	-119.7	436	8.7	<1
	04/13/16	0.3	-130.3	400	13.5	<1
	07/13/16	0.4	-117.9	392	15.8	<1
	09/29/16	0.5	-118.8	449	14.4	<1
	02/14/17	0.4	-161.6	444	12.4	1.2
	04/05/17	0.1	-137.0	435	13.0	<1
	07/12/17	0.13	-169.9	416.8	14.80	3.97
BCC-MW-15014	12/01/15	0.17	-308.7	605	15.87	3.47
	02/18/16	0.1	-215.0	642	10.8	<1
	04/18/16	0.2	-221.3	654	13.6	1
	07/13/16	0.3	-205.9	676	14.8	1.6
	09/29/16	0.4	-242.5	590	12.4	<1
	02/14/17	0.4	-226.2	576	10.9	<1
	04/05/17	0.3	-237.2	568	10.5	<1
	07/12/17	0.14	-315.6	761.0	14.00	4.76
BCC-MW-15015	12/01/15	0.02	-299.8	313	14.51	1.84
	02/18/16	0.2	-230.1	298	9.4	<1
	04/13/16	0.2	-222.5	296	12.5	<1
	07/13/16	0.3	-140.4	318	15.8	<1
	09/29/16	0.4	-152.8	349	13.6	<1
	02/14/17	0.4	-201.7	354	10.8	<1
	04/05/17	0.1	-170.2	369	11.1	1.2
	07/12/17	0.14	-222.6	328.7	14.10	1.77

Notes:

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Table 3
Summary of Field Parameters
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen	Oxidation Reduction Potential	Specific Conductivity	Temperature	Turbidity
		mg/L	mV	umhos/cm	°C	NTU
BCC-MW-15016	12/01/15	0.84	-109.7	1,902	10.85	2.92
	02/18/16	0.1	-61.8	2,061	11.0	2.8
	04/13/16	0.1	-92.2	2,170	12.1	<1
	07/13/16	0.3	-126.3	2,171	16.7	5
	09/29/16	0.3	-90.1	2,161	15.0	<1
	02/14/17	0.5	-97.3	2,061	11.4	1.3
	04/05/17	0.4	-96.3	1,929	10.6	<1
	07/12/17	0.09	-63.7	2,005.4	14.21	3.58
BCC-MW-15017	12/01/15	0.04	-204.9	1,963	11.22	1.39
	02/18/16	0.2	-132.6	2,237	10.1	<1
	04/18/16	0.3	-95.2	2,159	14.8	<1
	07/13/16	0.2	-101.2	2,211	16.1	<1
	09/29/16	0.5	-83.1	2,242	13.9	3.2
	02/14/17	0.5	-86.8	1,988	11.1	5.4
	04/05/17	0.0	-99.8	2,410	10.0	3.5
	07/12/17	0.07	-79.5	2,182.4	13.75	3.52
BCC-MW-15018	12/02/15	0.20	-138.5	710	12.77	5.46
	02/18/16	0.2	-76.6	753	9.8	<1
	04/14/16	0.3	-80.8	772	10.1	<1
	07/14/16	0.4	-83.7	819	14.9	<1
	09/29/16	0.5	-53.5	824	13.0	<1
	02/14/17	0.5	-71.1	793	10.5	<1
	04/05/17	0.5	-55.3	680	9.5	7
	07/11/17	0.11	-36.7	762.1	14.54	1.71
BCC-MW-15019	12/02/15	1.46	-88.0	646	12.09	8
	02/18/16	0.2	-122.7	727	6.6	<1
	04/14/16	0.5	-105.9	707	9.5	<1
	07/13/16	0.2	-106.7	733	17.5	<1
	09/30/16	0.6	-70.7	762	13.0	<1
	02/15/17	0.6	-119.2	692	9.7	<1
	04/05/17	0.0	-125.9	821	9.0	<1
	07/11/17	0.09	-78.9	843.2	14.50	1.56
BCC-MW-15020	12/02/15	0.77	-97.2	475	12.61	2.1
	02/18/16	0.1	-112.5	526	9.8	<1
	04/14/16	2.7	-79.8	555	11.3	<1
	07/14/16	0.4	-95.3	549	15.7	<1
	09/30/16	0.6	-65.9	560	13.7	<1
	02/15/17	0.5	-96.7	540	9.8	<1
	04/05/17	0.5	-79.3	507	10.0	<1
	07/11/17	0.12	-76.7	604.3	15.57	3.42

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Table 3
Summary of Field Parameters
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen	Oxidation Reduction Potential	Specific Conductivity	Temperature	Turbidity
		mg/L	mV	umhos/cm	°C	NTU
BCC-MW-15021	12/02/15	0.33	-144.3	1,019	13.17	2.29
	02/18/16	0.2	-111.7	1,032	9.1	<1
	04/14/16	0.3	-101.2	1,018	12.6	<1
	07/13/16	0.2	-97.6	1,040	17.3	<1
	10/05/16	0.6	-15.8	1,114	14.8	1
	02/15/17	0.5	-108.6	962	10.9	<1
	04/06/17	0.1	-122.1	1,189	7.3	<1
	07/12/17	0.11	-83.0	1,038.8	13.76	1.05
BCC-MW-15022	12/02/15	0.53	-72.3	383	10.47	0.34
	02/18/16	0.2	-91.2	377	5.0	<1
	04/14/16	0.4	-64.5	422	11.6	<1
	07/14/16	0.3	-74.4	356	14.6	<1
	10/05/16	0.3	-172.3	365	13.9	<1
	02/15/17	0.5	-121.4	421	9.6	<1
	04/06/17	0.5	-163.8	380	10.1	<1
	07/12/17	0.10	-271.2	413.5	15.20	1.30
BCC-MW-15023	12/02/15	0.27	-139.1	493	13.49	0.89
	02/18/16	0.2	-82.7	456	6.8	<1
	04/14/16	0.3	-79.0	436	10.7	<1
	07/14/16	0.5	-72.7	447	16.9	<1
	10/05/16	0.5	-75.0	480	14.8	<1
	02/15/17	0.6	-53.4	446	7.3	<1
	04/05/17	0.1	-83.6	600	8.1	2
	07/11/17	0.13	-46.3	451.7	12.84	0.56

Notes:

mg/L - Milligrams per Liter.

mV - Millivolts.

umhos/cm - Micromhos per centimeter.

NTU - Nephelometric Turbidity Unit.

TRC - GIS

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

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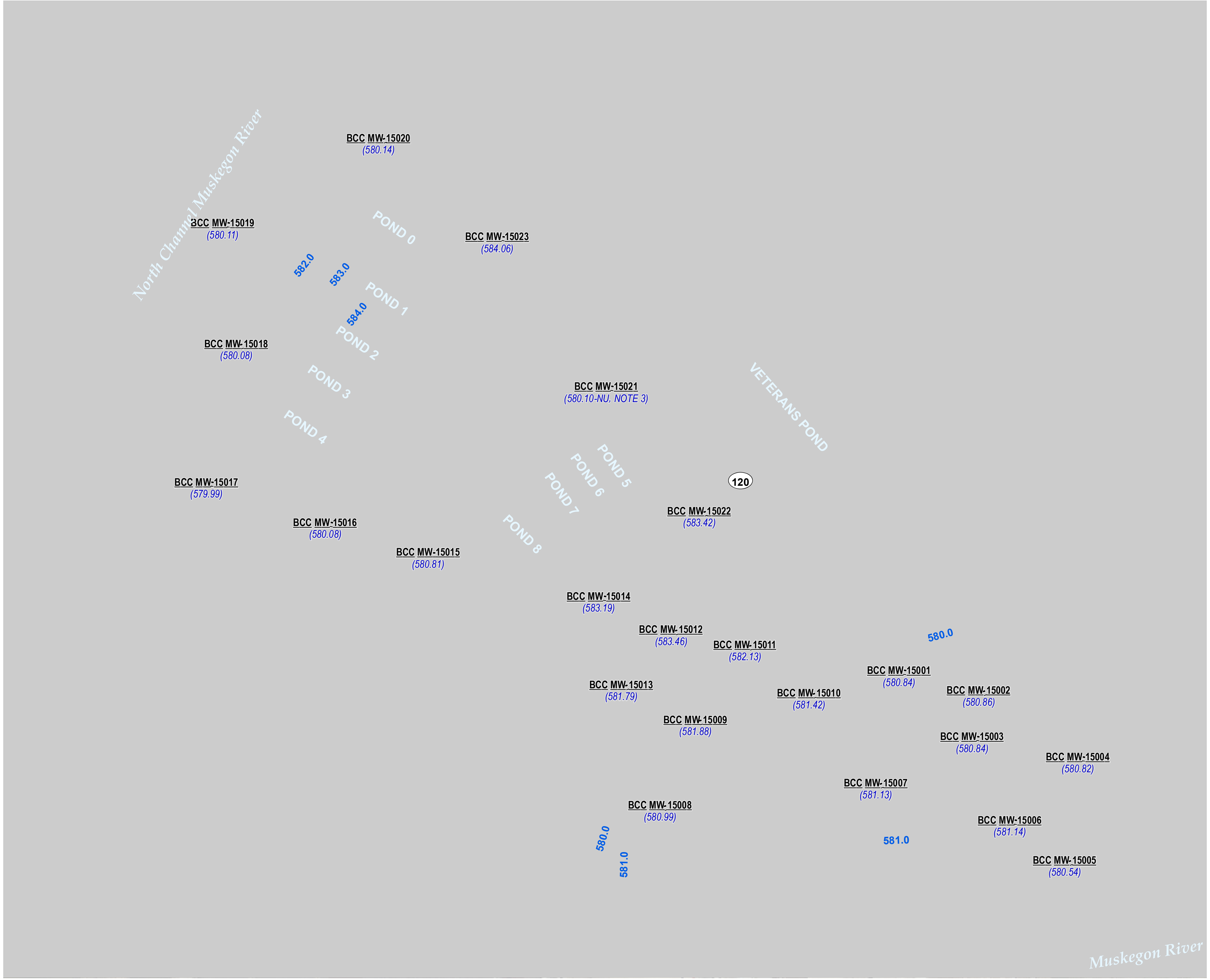

LEGEND

⌖	BACKGROUND MONITORING WELL
●	DOWNGRADIENT MONITORING WELL
◯	APPROXIMATE POND BOUNDARY
(580.85)	GROUNDWATER ELEVATION (FEET, MSL)
∼	GROUNDWATER ELEVATION CONTOUR (1' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO & PARTNERS, 04/04/2016.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
3. NU= NOT USED. WELL SCREENED AT DEEPER INTERVAL RELATIVE TO ADJACENT WELLS, NOT USED TO CONSTRUCT CONTOUR MAP.

N

0 300 600
Feet

1 " = 300 '
1:3,600

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

TITLE:
GROUNDWATER CONTOUR MAP
NOVEMBER 30, 2015

DRAWN BY:	B DEEGAN	PROJ NO.:	269767-001
CHECKED BY:	S HOLMSTROM		
APPROVED BY:	G. CROCKFORD	**FIGURE 1**	
DATE:	JANUARY 2018		

TRC

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FILE NO.: 269767-001-005.mxd

LEGEND

- ⌖ BACKGROUND MONITORING WELL
- ◆ DOWNGRADIENT MONITORING WELL
- APPROXIMATE POND BOUNDARY
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)
- GROUNDWATER ELEVATION CONTOUR (1' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH & PARTNERS, 04/04/2016.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
3. NU = NOT USED. WELL SCREENED AT DEEPER INTERVAL RELATIVE TO ADJACENT WELLS, NOT USED TO CONSTRUCT CONTOUR MAP.

N

0 300 600 Feet

1 " = 300 '

1:3,600

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:

GROUNDWATER CONTOUR MAP
FEBRUARY 16, 2016

DRAWN BY:	J. PAPEZ	PROJ NO.:	269767-001
CHECKED BY:	S HOLMSTROM	**FIGURE 2**	
APPROVED BY:	G. CROCKFORD		
DATE:	JANUARY 2018		

TRC

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FILE NO.: 269767-001-003.mxd

TRC - GIS

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

Plot Date: 1/12/2018, 17:01:20 PM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\269767-001-003.mxd

LEGEND

- ⌖ BACKGROUND MONITORING WELL
- ⌖ DOWNGRADIENT MONITORING WELL
- APPROXIMATE POND BOUNDARY
- *(580.85)* GROUNDWATER ELEVATION (FEET, MSL)
- GROUNDWATER ELEVATION CONTOUR (1' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO & PARTNERS, 04/04/2016.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
3. NU= NOT USED. WELL SCREENED AT DEEPER INTERVAL RELATIVE TO ADJACENT WELLS, NOT USED TO CONSTRUCT CONTOUR MAP.

N

0 300 600 Feet

1 " = 300 '
1:3,600

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:

GROUNDWATER CONTOUR MAP
APRIL 12, 2016

DRAWN BY:	B DEEGAN	PROJ NO.:	269767-001
CHECKED BY:	S HOLMSTROM		
APPROVED BY:	G. CROCKFORD		**FIGURE 3**
DATE:	JANUARY 2018		

TRC

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FILE NO.: 269767-001-006.mxd

TRC - GIS

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

Plot Date: 1/12/2018, 17:02:52 PM by SMAJOR -- LAYOUT: ANSI B(11"X17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\269767-001-006.mxd

LEGEND

✛ BACKGROUND MONITORING WELL

⊕ DOWNGRADIENT MONITORING WELL

APPROXIMATE POND BOUNDARY

(580.85) GROUNDWATER ELEVATION (FEET, MSL)

∼ GROUNDWATER ELEVATION CONTOUR (0.5' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.

N

0 300 600 Feet

1 " = 300 '

1:3,600

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:

GROUNDWATER CONTOUR MAP
JULY 11, 2016

DRAWN BY:	B DEEGAN	PROJ NO.:	269767-001
CHECKED BY:	S HOLMSTROM	**FIGURE 4**	
APPROVED BY:	G. CROCKRFORD		
DATE:	JANUARY 2018		

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FILE NO.: 269767-001-007.mxd

TRC - GIS

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

Plot Date: 1/12/2018, 17:05:55 PM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\269767-001-007.mxd

LEGEND

⌖	BACKGROUND MONITORING WELL
●	DOWNGRADIENT MONITORING WELL
◯	APPROXIMATE POND BOUNDARY
(580.85)	GROUNDWATER ELEVATION (FEET, MSL)
～	GROUNDWATER ELEVATION CONTOUR (0.5' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.

N

0 300 600
Feet

1 " = 300 '
1:3,600

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:

GROUNDWATER CONTOUR MAP
SEPTEMBER 27, 2016

DRAWN BY:	J. PAPEZ	PROJ NO.:	269767-001
CHECKED BY:	S HOLMSTROM		
APPROVED BY:	G. CROCKFORD		FIGURE 5
DATE:	JANUARY 2018		

TRC

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FILE NO.: 269767-001-004.mxd

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

Plot Date: 1/12/2018, 17:08:06 PM by SMAJOR -- LAYOUT: ANSI B(11"x17")
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TRC - GIS

Plot Date: 1/12/2018, 17:10:06 PM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\269767-001-008.mxd

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

LEGEND

⊕	BACKGROUND MONITORING WELL
●	DOWNGRADIENT MONITORING WELL
◌	APPROXIMATE POND BOUNDARY
(580.85)	GROUNDWATER ELEVATION (FEET, MSL)
∼	GROUNDWATER ELEVATION CONTOUR (0.5' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.

N

0 300 600 Feet

1 " = 300 '
1:3,600

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:

GROUNDWATER CONTOUR MAP
FEBRURAY 13, 2017

DRAWN BY:	B DEEGAN	PROJ NO.:	269767-001
CHECKED BY:	S HOLMSTROM		
APPROVED BY:	G. CROCKFORD	**FIGURE 6**	
DATE:	JANUARY 2018		

TRC

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FILE NO.: 269767-001-008.mxd

LEGEND

⊕	BACKGROUND MONITORING WELL
●	DOWNGRADIENT MONITORING WELL
▢	APPROXIMATE POND BOUNDARY
(580.85)	GROUNDWATER ELEVATION (FEET, MSL)
∼	GROUNDWATER ELEVATION CONTOUR (0.5' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.

0 300 600
Feet

1 " = 300 '
1:3,600

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

TITLE:
GROUNDWATER CONTOUR MAP
APRIL 04, 2017

DRAWN BY:	B DEEGAN	PROJ NO.:	269767-001
CHECKED BY:	S HOLMSTROM	**FIGURE 7**	
APPROVED BY:	G. CROCKFORD		
DATE:	JANUARY 2018		

TRC
1540 Eisenhower Place
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Phone: 734.971.7080
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FILE NO.: 269767-001-009.mxd

Plot Date: 1/12/2018, 17:11:44 PM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\269767-001-009.mxd

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

TRC - GIS

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- APPROXIMATE POND BOUNDARY
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)
- GROUNDWATER ELEVATION CONTOUR (0.5' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.

N

0 300 600
Feet

1 " = 300 '
1:3,600

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:

GROUNDWATER CONTOUR MAP
JULY 11, 2017

DRAWN BY:	J. PAPEZ	PROJ NO.:	269767-001
CHECKED BY:	S. HOLMSTROM		
APPROVED BY:	G. CROCKFORD		**FIGURE 8**
DATE:	JANUARY 2018		

TRC

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FILE NO.: 269767-001-014.mxd

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

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Appendix B
Data Quality Review

Laboratory Data Quality Review
Groundwater Monitoring Event September 2017
CEC BC Cobb

Groundwater samples were collected by TRC for the September 2017 sampling event. Samples were analyzed for anions, total metals, and total dissolved solids by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan. The laboratory analytical results are reported in laboratory report 462581.

During the September 2017 sampling event, a groundwater sample was collected from each of the following wells:

- BCC-MW-15001
- BCC-MW-15002
- BCC-MW-15003
- BCC-MW-15004
- BCC-MW-15005
- BCC-MW-15006
- BCC-MW-15007
- BCC-MW-15008
- BCC-MW-15009
- BCC-MW-15010
- BCC-MW-15011
- BCC-MW-15012
- BCC-MW-15013
- BCC-MW-15014
- 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

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Chloride, Fluoride, Sulfate)	EPA 300.0
Total Metals	EPA 6020A, EPA 6010C
Total Dissolved Solids	SM 2540C

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

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017). The following items were included in the evaluation of the data:

- Sample receipt, as noted in the cover page or case narrative;
- Technical holding times for analyses;

- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD). Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Reporting limits (RLs) compared to project-required RLs;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes;
- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Findings

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose, with the non-conformances and issues identified in this evaluation noted below.

- Appendix III constituents will be utilized for the purposes of developing a detection monitoring program.
- Data are usable for the purposes of this episodic report.
- When the data are evaluated for preparing a detection monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- Three equipment blanks (EB-01, EB-01, and EB-03) and two field blanks (FB-01 and FB-02) were collected.
- Dup-01 corresponds to BCC-MW-15010, Dup-02 corresponds to BCC-MW-15015, and Dup-03 corresponds to BCC-MW-15018.

- MS/MSDs were performed on samples BCC-MW-15002, BCC-MW-15003, BCC-MW-15008, BCC-MW-15010, and BCC-MW-15014.

Pace Analytical:

- MS/MSD recoveries
  - MS/MSDs were performed on BCC-MW-15003 and BCC-MW-15002 for batch 5122. The recoveries for chloride in the MS/MSD performed on BCC-MW-15003 were below the lower laboratory control limit. The recoveries for sulfate in the MS/MSD performed on BCC-MW-15002 were below the lower laboratory control limit. The chloride and sulfate results for samples analyzed in the same batch may be biased low.
  - MS/MSDs were performed on BCC-MW-15010 and BCC-MW-15014 for batch 5123. The MS/MSD performed on BCC-MW-15010 had chloride and sulfate recoveries that were below the lower laboratory control limits. Chloride and sulfate results for samples analyzed in the same batch may be biased low.
  - MS/MSD was performed on BCC-MW-15003 for batch 5047. The calcium recoveries in the MS/MSD were above the upper laboratory control limit; however, the calcium concentration in the parent sample was >4x the spike concentration, therefore, the laboratory control limits are not applicable.
  - MS/MSD was performed on BCC-MW-15014 for batch 5113. The boron recovery in the MS was below the lower laboratory control limit and the recovery in the MSD was above the upper laboratory control limit. The boron concentration in the parent sample was >4x the spike concentration, therefore, the laboratory control limits are not applicable.
- The RPD for TDS for the sample duplicate pair (BCC-MW-15015/Dup-02) exceeded the 20% acceptance limit. Potential uncertainty exists for TDS results in samples BCC-MW-15015 and Dup-02 due to field duplicate variability.

Appendix C
Statistical Background Limits

Technical Memorandum

Date: January 15, 2018

To: Michelle Marion, CEC
J.R. Register, CEC
Brad Runkel, CEC

From: Sarah Holmstrom, TRC
Darby Litz, TRC
Joyce Peterson, TRC

Project No.: 269767.0000 Phase 001, Task 003

Subject: Background Statistical Evaluation (R1-R8) – Consumers Energy, BC Cobb

---

Pursuant to the United States Environmental Protection Agency's (U.S. EPA's) Resource Conservation and Recovery Act (RCRA) Coal Combustion Residual rule ("CCR Rule") promulgated on April 17, 2015, the owner or operator of a CCR Unit must collect a minimum of eight rounds of background groundwater data to initiate a detection monitoring program and evaluate statistically significant increases above background (40 CFR §257.94). This memorandum presents the background statistical limits derived for the Consumers Energy Company (CEC) former BC Cobb Power Plant (BC Cobb site) in Muskegon, Michigan.

There are two RCRA CCR units associated with the plant—the Bottom Ash Pond and Ponds 0-8, both of which are wet ash dewatering areas. From 1984 through plant closure in 2016, CCR has been deposited in the ash ponds by utilizing sluicing methods. In response to the CCR Rule, CEC had 23 groundwater monitoring wells installed at the Bottom Ash Pond and Ponds 0-8 to serve as a multiunit groundwater monitoring system (in accordance with 40 CFR §257.91).

Following the baseline data collection period (November 2015 through July 2017), the background data for the BC Cobb site were evaluated in accordance with the Groundwater Statistical Evaluation Plan (Stats Plan) (TRC, October 2017). The BC Cobb site groundwater data are maintained within a database accessible through Sanitas™ statistical software. Sanitas™ is a software tool that is commercially available for performing statistical evaluation consistent with procedures outlined in U.S.EPA's Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (Unified Guidance; UG). Within the Sanitas™ statistical program (and the UG), tolerance limits were selected to perform the statistical calculation for background limits. Use of tolerance limits is a streamlined approach that offers adequate statistical power under the current, initial stage of establishing background and developing the monitoring program and is an acceptable approach for detection monitoring under the CCR rule. Upper tolerance limits (UTLs) were calculated for each of the CCR Appendix III parameters. The following narrative describes the methods employed and the results obtained and the Sanitas™ output files are included as an attachment.

The set of background wells utilized for the two CCR units at the BC Cobb site includes BCC-MW-15002 through BCC-MW-15008. The background evaluation included the following steps:

- Review of data quality reports for the baseline/background data sets for CCR Appendix III constituents;
- Graphical representation of the baseline data as time versus concentration (T v. C) by well/constituent pair;
- Graphical representation of cumulative baseline background data sorted from lowest to highest concentration for each constituent;
- Outlier testing of individual data points that appear from the graphical representations as potential outliers;
- Evaluation of percentage of nondetects for each baseline/background well-constituent (w/c) pair;
- Distribution of the data; and
- Calculation of the UTL for each cumulative baseline/background data set (upper and lower tolerance limits were calculated for field pH).

The results of these evaluations are presented and discussed below.

Data Quality

Data from each sampling round were evaluated for completeness, overall quality and usability, method-specified sample holding times, precision and accuracy, and potential sample contamination. The review was completed using the following quality control (QC) information which at a minimum included chain-of-custody forms, investigative sample results including blind field duplicates, and matrix spike and matrix spike duplicates (MS/MSDs) recoveries, and, as provided by the laboratory, method blanks, laboratory control spikes, laboratory duplicates. The data were found to be complete and usable for the purposes of the CCR monitoring program.

Time versus Concentration Graphs

The T v. C graphs show a potential outlier for boron (high value for BCC-MW-15003 in April 2016) (Figure 1). This data set will be tested by the Sanitas™ software to assess whether the potential outlier is statistically significant.

While variations in results are present, the graphs do not suggest that data sets as a whole, likely have overall trending or seasonality. The data sets are of relatively short duration for making such observations.

Cumulative Baseline Data Sets

Ideally, the background data sets provide a continuous concentration distribution. The ideal is rarely achieved by multiple background wells representing a relatively large geographic area, such as in the case at the BC Cobb site. When sorted by concentration, the data generally group by smaller subsets of the overall background well network (Figure 2). Some of the parameters have a relatively consistent distribution, but chloride, sulfate, and TDS clearly have some wells with higher values than the other background wells. These results need to be taken into consideration as they represent potential non-CCR upgradient contributions to downgradient wells.

Outlier Testing

The Dixon's Outlier Test in Sanitas™ was used to test the potential outlier graphs in the boron data set for BCC-MW-15003 that was identified in the T v. C graphs (Figure 1) and in the cumulative concentration distribution (Figure 2). The suspect data point was found to be an outlier at the 0.05 significance level (see attached Sanitas™ output file). With the outlier removed, Sanitas found that the boron data set at BCC-MW-15003 was normally distributed at the 0.01 significance level. The outlier data point will be excluded from the background/baseline UTL calculations.

Percentage of Nondetects

Table 1 summarizes the percentage of results below the reporting limit for each w/c pair.

Table 1
Summary of Percentage of Baseline Results Below Reporting Limit

WELL	CONSTITUENT	PERCENT NON-DETECT
BCC-MW-15002	Boron	0
	Calcium	0
	Chloride	0
	Fluoride	100
	Field pH	0
	Sulfate	0
	Total Dissolved Solids	0
BCC-MW-15003	Boron	0
	Calcium	0
	Chloride	0
	Fluoride	100
	Field pH	0
	Sulfate	0
	Total Dissolved Solids	0

Table 1
Summary of Percentage of Baseline Results Below Reporting Limit

WELL	CONSTITUENT	PERCENT NON-DETECT
BCC-MW-15004	Boron	0
	Calcium	0
	Chloride	0
	Fluoride	100
	Field pH	0
	Sulfate	25
	Total Dissolved Solids	0
BCC-MW-15005	Boron	12.5
	Calcium	0
	Chloride	0
	Fluoride	100
	Field pH	0
	Sulfate	12.5
	Total Dissolved Solids	0
BCC-MW-15006	Boron	0
	Calcium	0
	Chloride	0
	Fluoride	100
	Field pH	0
	Sulfate	0
	Total Dissolved Solids	0
BCC-MW-15007	Boron	0
	Calcium	0
	Chloride	0
	Fluoride	100
	Field pH	0
	Sulfate	0
	Total Dissolved Solids	0
BCC-MW-15008	Boron	0
	Calcium	0
	Chloride	0
	Fluoride	100
	Field pH	0
	Sulfate	0
	Total Dissolved Solids	0

Table 1
Summary of Percentage of Baseline Results Below Reporting Limit

WELL	CONSTITUENT	PERCENT NON-DETECT
COMBINED	Boron	1.8
	Calcium	0
	Chloride	0
	Fluoride	100
	Field pH	0
	Sulfate	5.4
	Total Dissolved Solids	0

Distribution of the Data Sets

The distribution of the data sets is determined by the Sanitas™ software during calculation of the upper tolerance limit. The Shapiro-Francia test is used for samples sizes greater than 50. Non-detect/censored data were handled in accordance with the Stats Plan. If the data appear to be non-normal, mathematical transformations of the data may be utilized such that the transformed data follow a normal distribution (e.g., lognormal distributions). Alternatively, non-parametric tests may be utilized when data cannot be normalized. Table 2 summarizes the distributions determined by the Sanitas™ software. The distribution is based on the combined baseline results for all seven background monitoring wells.

Table 2
Summary of Background/Baseline Data Distributions

CONSTITUENT	DISTRIBUTION
Boron (outlier removed)	Nonnormal
Calcium	Nonnormal
Chloride	Normalized by natural log transformation
Fluoride	All ND – use highest RL
Field pH	Nonnormal
Sulfate	Normalized by natural log transformation
Total Dissolved Solids	Normalized by natural log transformation

Upper Tolerance Limits

Table 3 presents the calculated upper tolerance limits for the background/baseline data sets. The UTL for the data set with an observed outlier was calculated with the outlier removed. The UTL is calculated based on the distribution listed above. UTLs are calculated for 95 percent coverage and 95 percent confidence. Verification resampling (1 of 2) is recommended per the Stats Plan and UG to achieve a site-wide false positive rate within the range specified in the CCR rules.

Table 3
Summary of Baseline Upper Tolerance Limits

CONSTITUENT	UPPER TOLERANCE LIMIT – FROM SANITAS™
Boron (outlier removed)	1,320 µg/L
Calcium	259 mg/L
Chloride	5,980 mg/L
Fluoride	1,000 µg/L
Field pH	6.6 – 8.3 s.u.
Sulfate	200 mg/L
Total Dissolved Solids	5,170 mg/L

Attachments

Figure 1 – Background Concentration Time-Series Charts
Figure 2 – Combined Background Distribution
Sanitas™ Output Files

Figures

Figure 1
Background Concentration Time-Series Charts
BC Cobb - RCRA CCR Monitoring Program

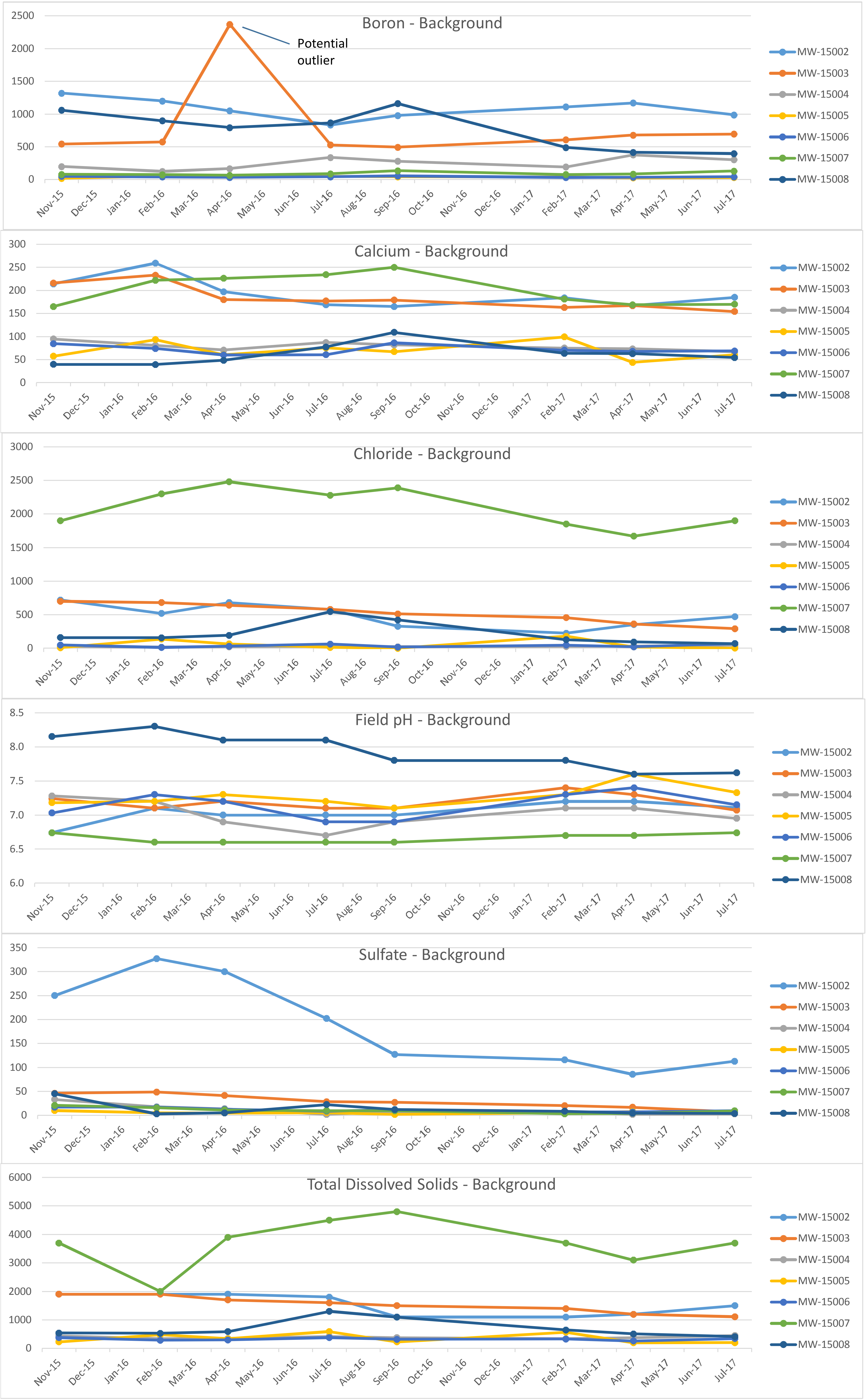
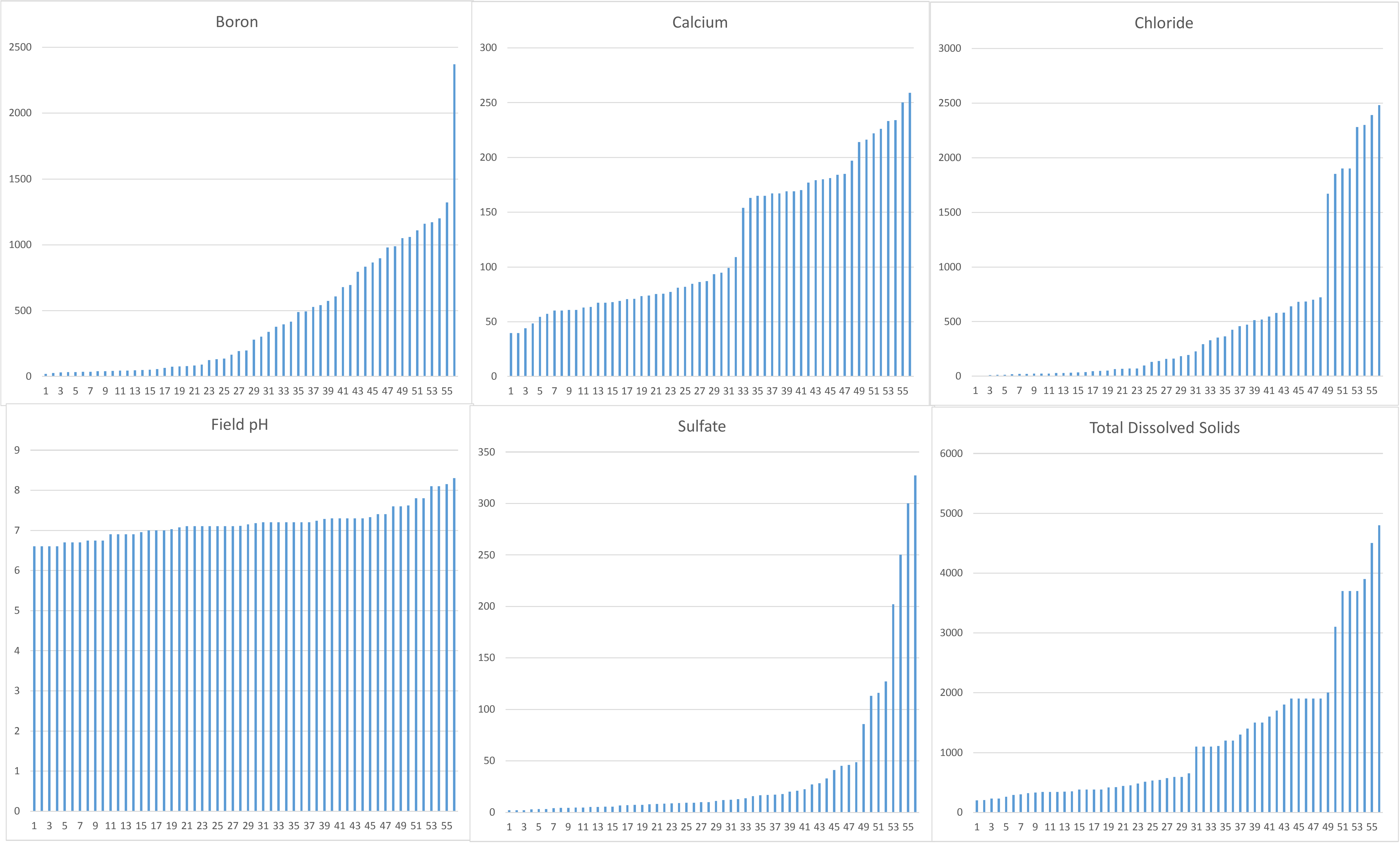


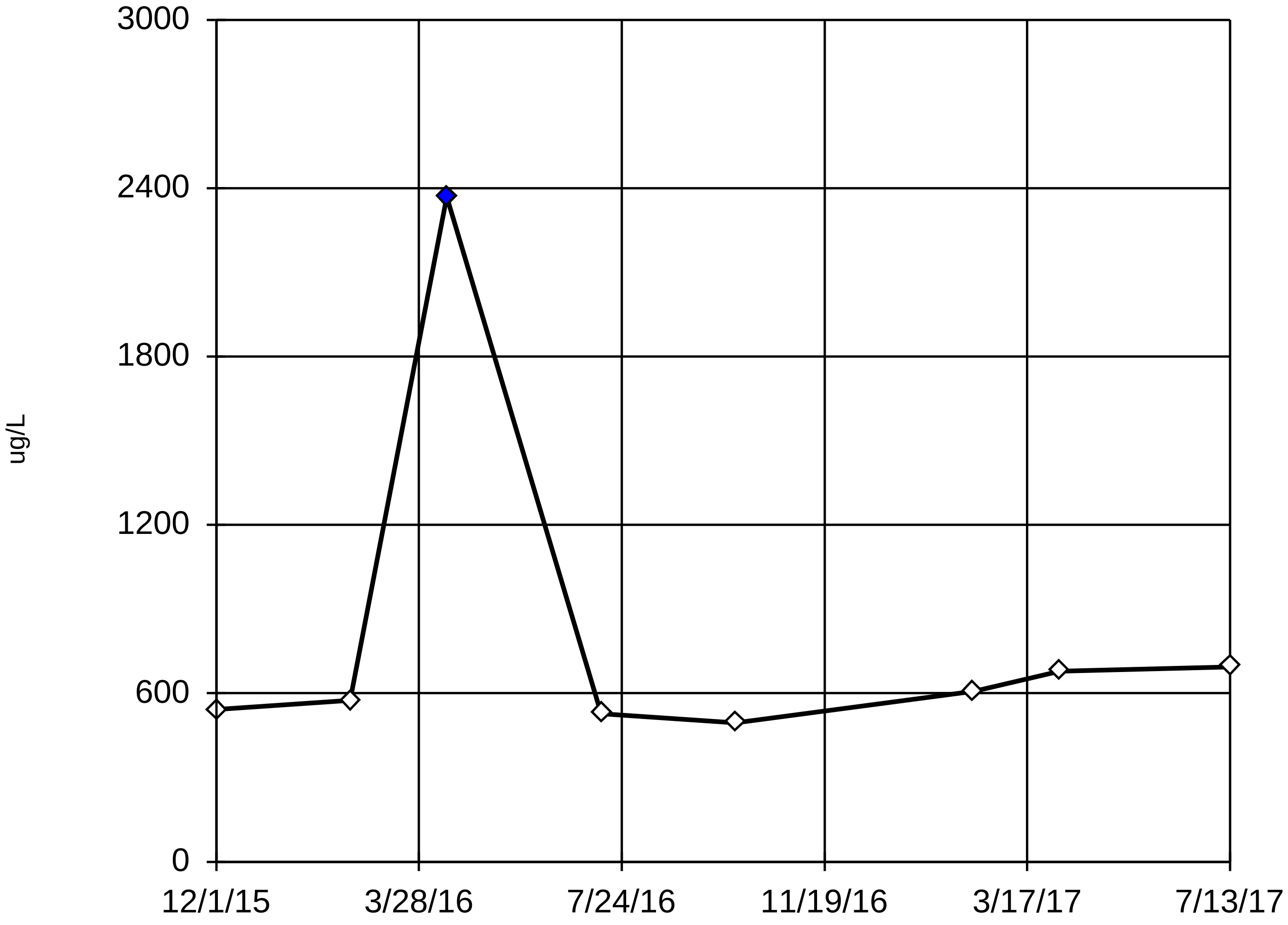
Figure 2
Combined Background Distribution
BC Cobb - RCRA CCR Monitoring Program



Sanitas™ Output Files

Dixon's Outlier Test

BCC-MW-15003 (bg)



n = 8

Statistical outlier is
drawn as solid.
Testing for 1 high outlier.
Mean = 811.3.
Std. Dev. = 633.8.
2370: c = 0.9093
tabl = 0.554.
Alpha = 0.05.

Normality test used:
Shapiro Wilk@alpha = 0.1
Calculated = 0.9321
Critical = 0.838
The distribution, after removal of suspect value, was found to be normally distributed.

Constituent: Boron, Total   Analysis Run 11/13/2017 3:03 PM

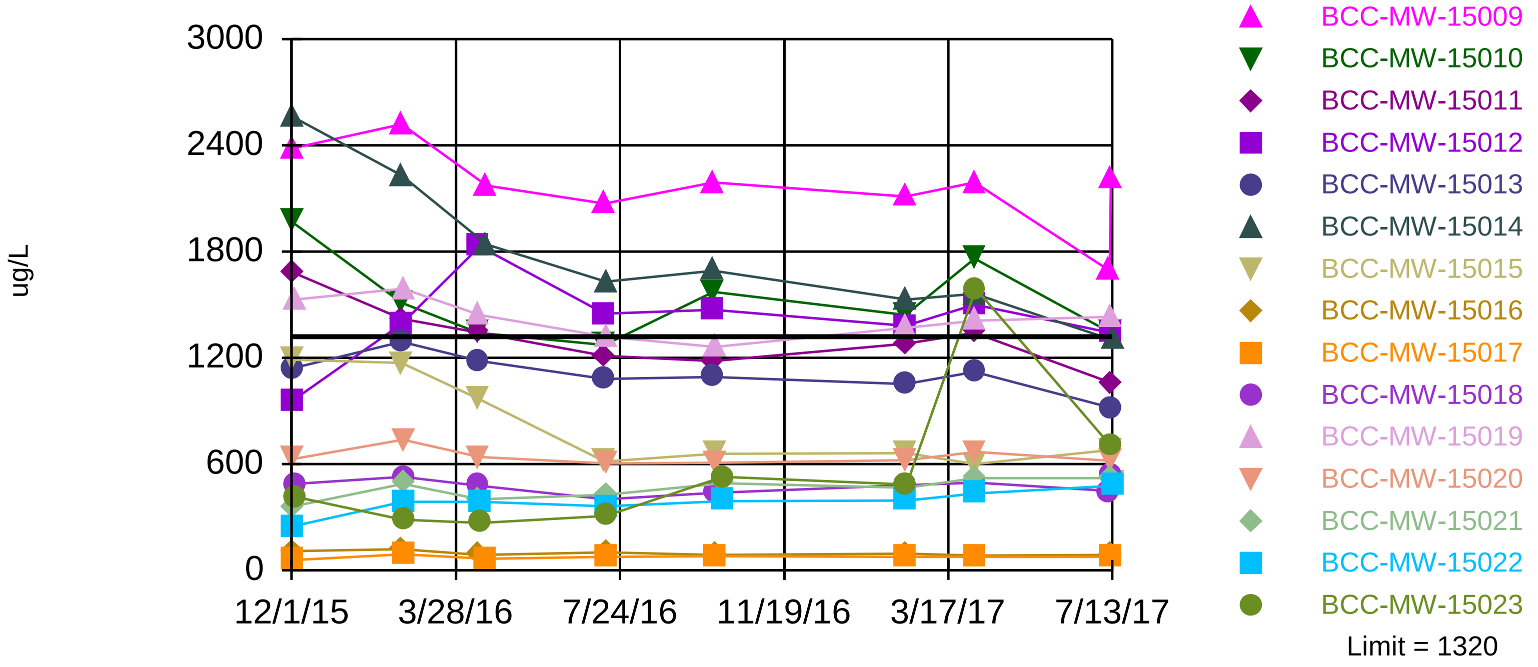
Client: Consumers Energy   Data: BCC_Sanitas

Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG

Exceeds Limit: BCC-MW-15009, BCC-MW-15010, BCC-MW-15012, BCC-MW-15019

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.01 alpha level. Most recent observation is compared with limit. Limit is highest of 55 background values. 1.818% NDs. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha = 0.05954.

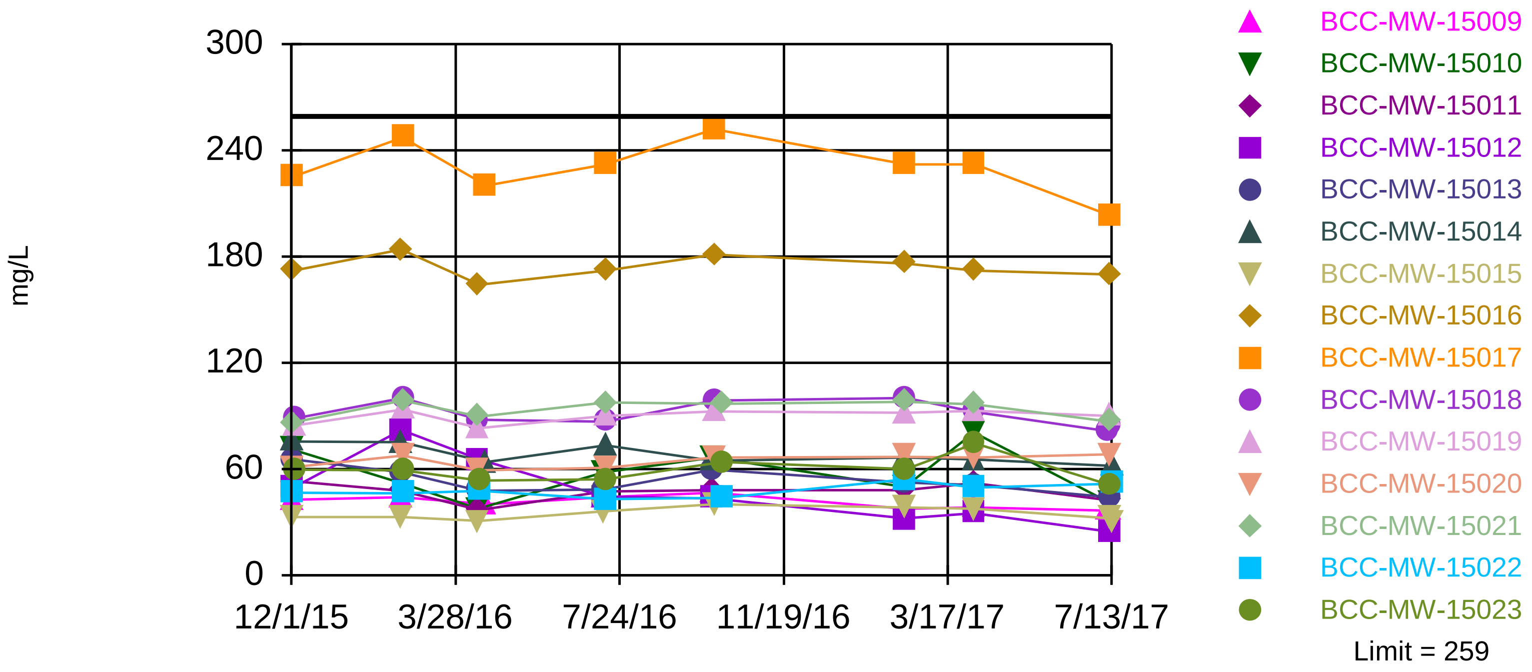
Constituent: Boron, Total Analysis Run 11/14/2017 9:18 AM

Client: Consumers Energy Data: BCC_Sanitas

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.01 alpha level. Most recent observation is compared with limit. Limit is highest of 56 background values. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha = 0.05656.

Constituent: Calcium, Total Analysis Run 11/14/2017 9:18 AM

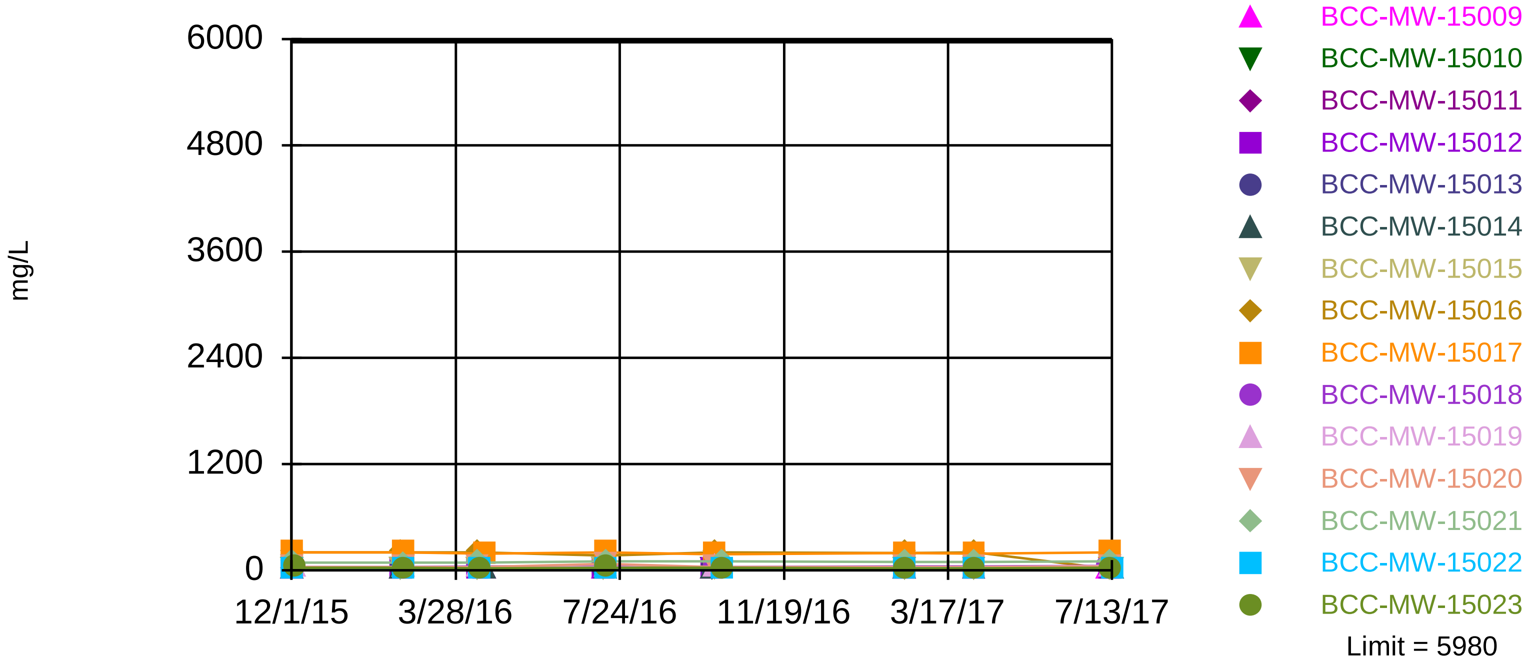
Client: Consumers Energy Data: BCC_Sanitas

Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG

Within Limit

Tolerance Limit

Interwell Parametric



95% coverage. Most recent observation is compared with limit. Background Data Summary (based on natural log transformation): Mean=4.993, Std. Dev.=1.822, n=56. Normality test: Shapiro Francia @alpha = 0.01, calculated = 0.9681, critical = 0.942. Report alpha = 0.05.

Constituent: Chloride Analysis Run 11/14/2017 9:18 AM

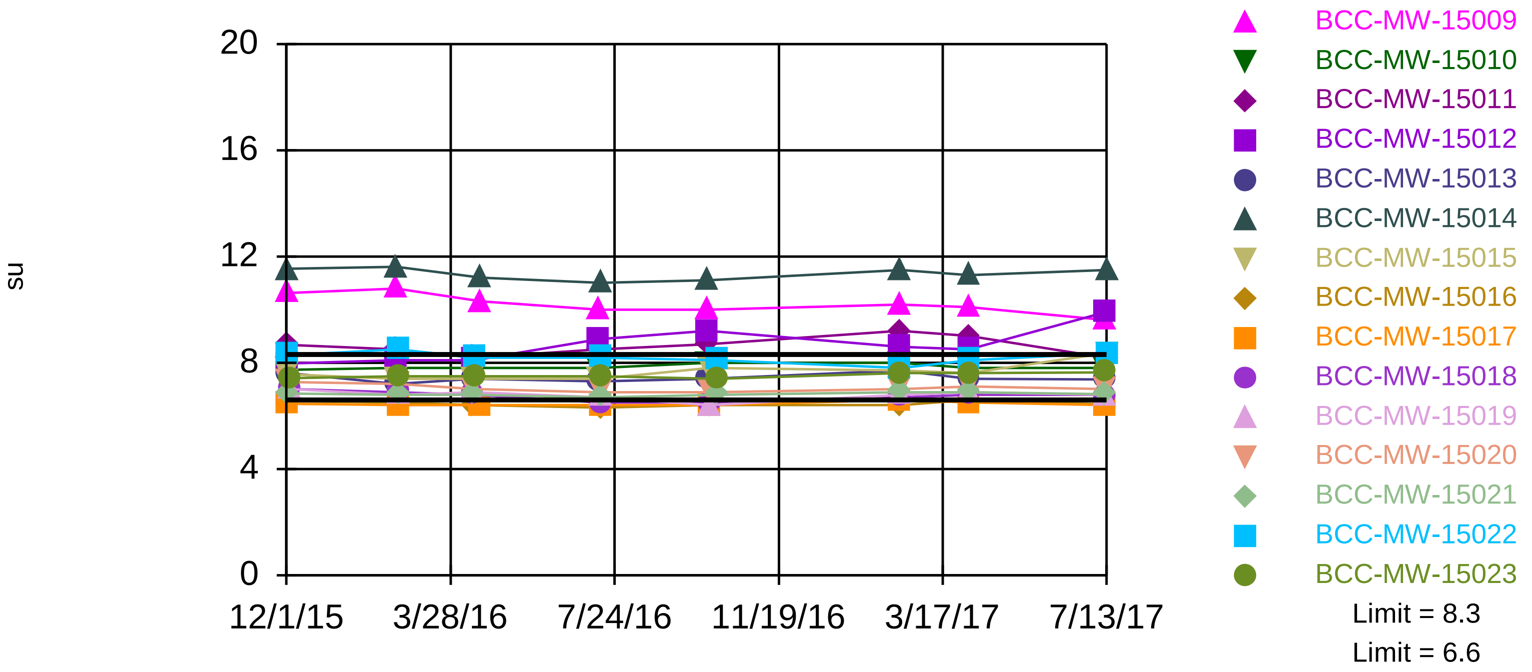
Client: Consumers Energy Data: BCC_Sanitas

Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG

Exceeds Limits: BCC-MW-15009, BCC-MW-15012, BCC-MW-15014, BCC-MW-15015,..

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.01 alpha level. Most recent observation is compared with limit. Limits are highest and lowest of 56 background values. 88.87% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 97.07% coverage at alpha=0.5. Report alpha = 0.2233 (0.1116 per tail).

Constituent: pH, Field Analysis Run 11/14/2017 9:19 AM

Client: Consumers Energy Data: BCC_Sanitas

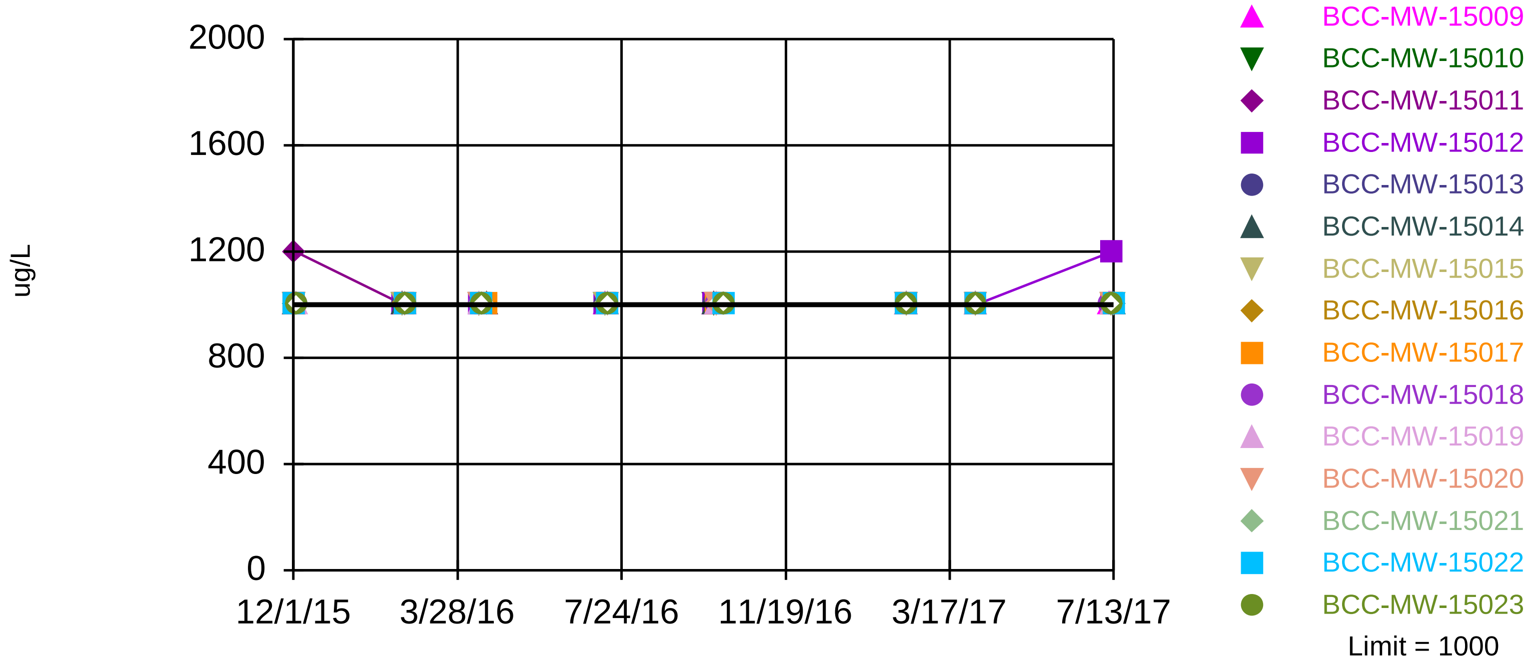
Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG

Hollow symbols indicate censored values.

Exceeds Limit: BCC-MW-15012

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 91.99% coverage at alpha=0.01; 94.73% coverage at alpha=0.05; 98.63% coverage at alpha=0.5. Report alpha = 0.05656.

Constituent: Fluoride Analysis Run 11/14/2017 9:19 AM

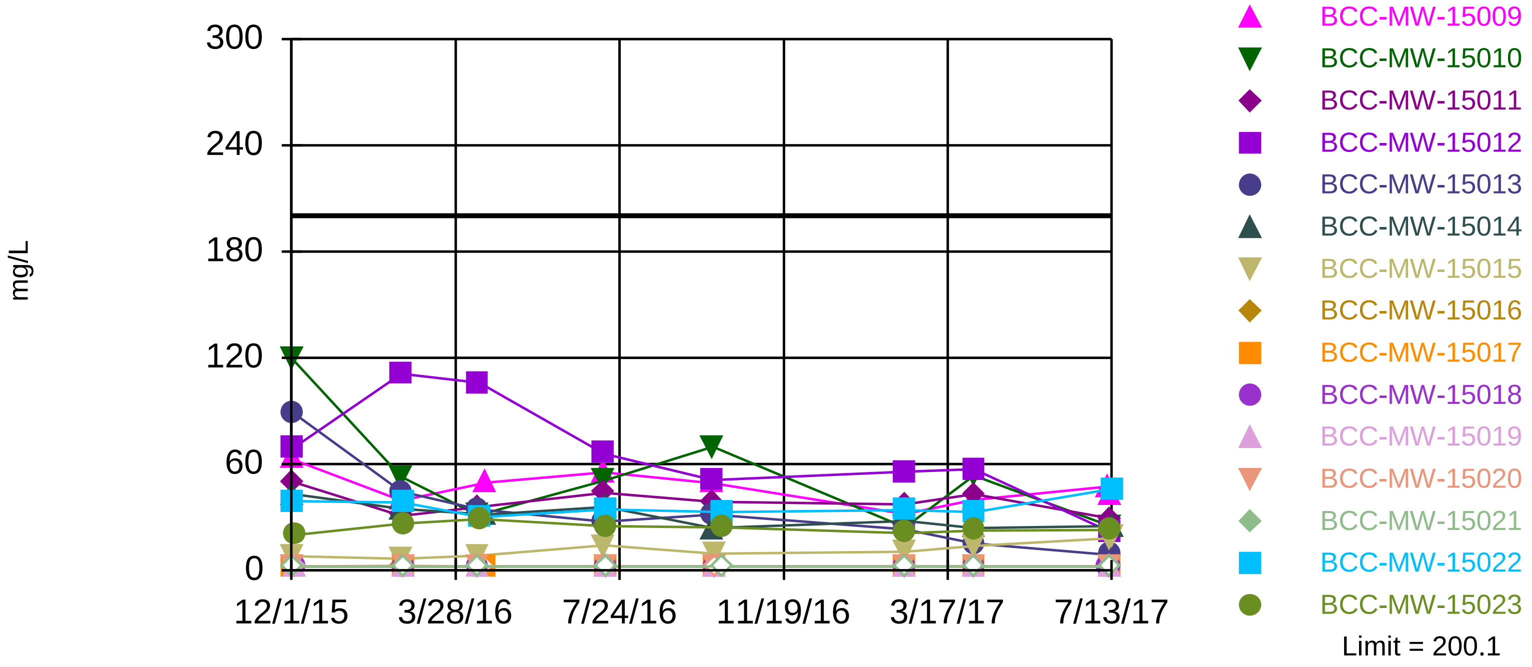
Client: Consumers Energy Data: BCC_Sanitas

Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG
Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Parametric



95% coverage. Most recent observation is compared with limit. Background Data Summary (based on natural log transformation): Mean=2.666, Std. Dev.=1.295, n=56, 5.357% NDs. Normality test: Shapiro Francia @alpha = 0.01, calculated = 0.9429, critical = 0.942. Report alpha = 0.05.

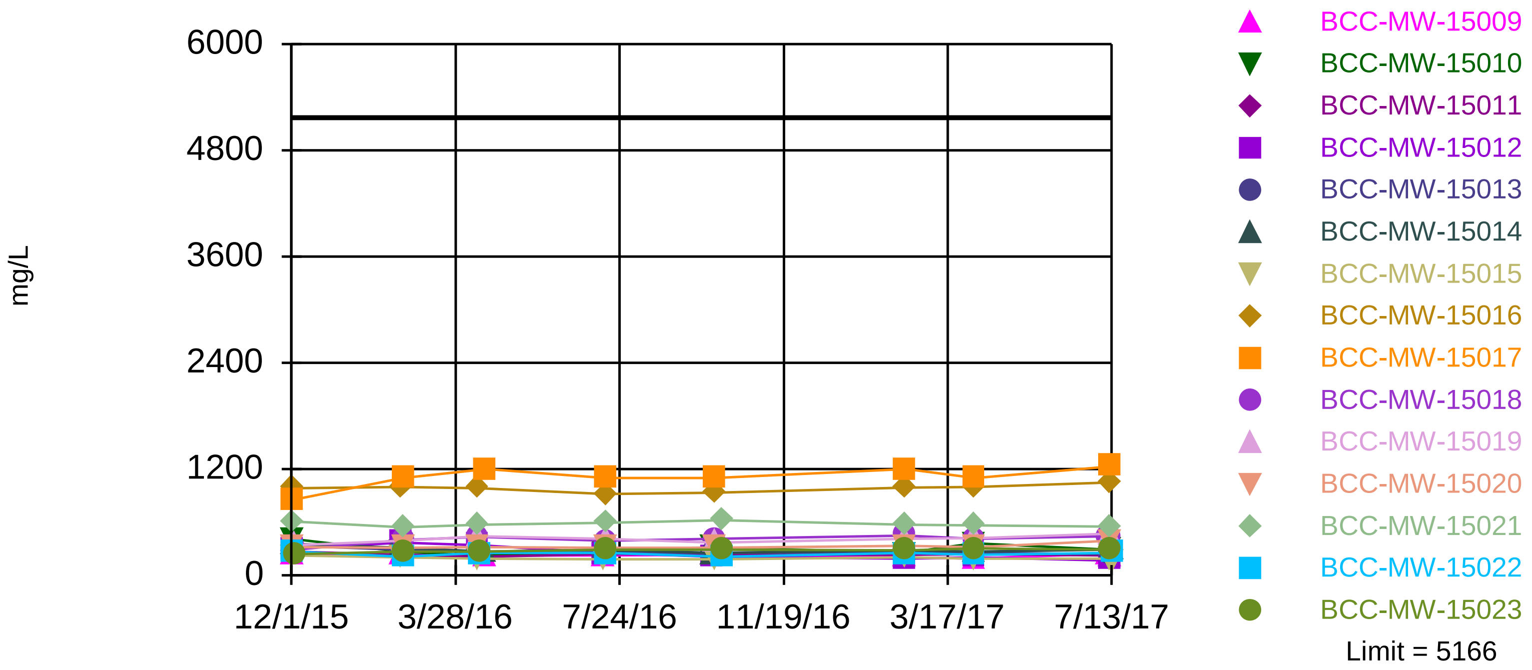
Constituent: Sulfate Analysis Run 11/14/2017 9:19 AM

Client: Consumers Energy Data: BCC_Sanitas

Within Limit

Tolerance Limit

Interwell Parametric



95% coverage. Most recent observation is compared with limit. Background Data Summary (based on natural log transformation): Mean=6.688, Std. Dev.=0.9164, n=56. Normality test: Shapiro Francia @alpha = 0.01, calculated = 0.9447, critical = 0.942. Report alpha = 0.05.

Constituent: Total Dissolved Solids, Dissolved Analysis Run 11/14/2017 9:20 AM

Client: Consumers Energy Data: BCC_Sanitas

2018 Annual Groundwater Monitoring Report

Former BC Cobb Power Plant
Bottom Ash Pond & Ponds 0-8

Muskegon, Michigan

January 2019

2018 Annual Groundwater Monitoring Report

Former BC Cobb Power Plant
Bottom Ash Pond & Ponds 0-8

Muskegon, Michigan

January 2019

Prepared For
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TRC | Consumers Energy Company
Final
X:\WPAAM\PJT2\284111\0000\2018 GWPS\R284111-BCC FINAL.DOCX

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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 Consumers Energy Company (CEC) Bottom Ash Pond and Ponds 0-8 (BCC Ponds) at the former BC Cobb Power Plant Site (the Site) located in Muskegon, Michigan. Pursuant to the CCR Rule, no later than January 31, 2018, and annually thereafter, the owner or operator of a CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with §257.90(e). On behalf of CEC, TRC Environmental Corporation (TRC) has prepared this Annual Groundwater Monitoring Report for calendar year 2018 activities at the BCC Ponds CCR units.

In the January 31, 2018 *Annual Groundwater Monitoring Report for the Former BC Cobb Power Plant Bottom Ash Pond & Ponds 0-8 CCR Unit*, covering calendar year 2017 activities, CEC reported that boron, fluoride, and pH were observed during groundwater detection monitoring at one or more downgradient monitoring well(s) with potential statistically significant increases (SSIs) above background concentration levels. TRC performed an Alternate Source Demonstration (ASD) for the aforementioned constituents and did not find strong enough evidence within 90 days to determine the observation of constituents above background was attributable to a source other than the CCR units. Therefore, CEC initiated an Assessment Monitoring Program for the BCC Ponds pursuant to §257.95 of the CCR Rule that included sampling and analyzing groundwater within the groundwater monitoring system for all constituents listed in Appendix IV. The monitoring system was subsequently sampled for the Appendix III and Appendix IV constituents in June 2018, within 90 days from the initial assessment monitoring (Appendix IV only) sampling event. The results from the initial assessment monitoring sampling event were used to establish groundwater protection standards (GWPSs) for the Appendix IV constituents in accordance with §257.95(h), as presented in the *Groundwater Protection Standards* technical memorandum dated October 15, 2018. Assessment monitoring data that has been collected and evaluated in 2018, including the establishment of the GWPSs, are presented in this report.

In 2019, CEC compared the assessment monitoring data to the GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs in accordance with §257.95. The statistical comparison of the June 2018 data to the GWPSs was completed on January 14, 2019, in accordance with §257.93(h)(2) and within the compliance schedule clarified by USEPA in April 2018.

According to §257.95(g)(3), if the facility determines pursuant to §257.93(h), that any Appendix IV constituents were detected at a statistically significant level exceeding the GWPSs, the facility will either conduct an ASD or initiate an assessment of corrective measures according to §257.96 within 90 days. Based on the results of the statistical evaluation, CEC will be seeking to initiate an assessment of corrective measures within 90 days of the completion of the statistical analysis. CEC will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Section 1
Introduction

1.1 Program 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) (USEPA, April 2015), as amended (USEPA, July 2018). The CCR Rule, which became effective on October 19, 2015 (amendment effective August 29, 2018), applies to the Consumers Energy Company (CEC) Bottom Ash Pond and Ponds 0-8 (BCC Ponds) at the former BC Cobb Power Plant Site (the Site) located in Muskegon, Michigan. Pursuant to the CCR Rule, no later than January 31, 2018, and annually thereafter, the owner or operator of a CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with §257.90(e). On behalf of CEC, TRC Environmental Corporation (TRC) has prepared this Annual Groundwater Monitoring Report for calendar year 2018 activities at the BCC Ponds CCR unit.

In the January 31, 2018 *Annual Groundwater Monitoring Report for the Former BC Cobb Power Plant Bottom Ash Pond & Ponds 0-8 CCR Unit* (2017 Annual Report), covering calendar year 2017 activities, CEC reported that boron, fluoride, and pH were observed during groundwater detection monitoring at one or more downgradient monitoring well(s) with potential statistically significant increases (SSIs) above background concentration levels. TRC performed an Alternate Source Demonstration (ASD) for the aforementioned constituents and did not find strong enough evidence within 90 days to determine the observation of constituents above background was attributable to a source other than the CCR unit. Therefore, CEC initiated an Assessment Monitoring Program for the BCC Ponds pursuant to §257.95 of the CCR Rule that included sampling and analyzing groundwater within the groundwater monitoring system for all constituents listed in Appendix IV.

The results from the preliminary assessment monitoring sampling event were used to establish groundwater protection standards (GWPSs) for the Appendix IV constituents in accordance with §257.95(h), as presented in the *Groundwater Protection Standards* technical memorandum dated October 15, 2018 (Appendix C) (TRC, October 2018). The monitoring system was subsequently sampled for the Appendix III and Appendix IV constituents within 90 days from the initial Appendix IV sampling event. Assessment monitoring data that has been collected and evaluated in 2018 are presented in this report.

1.2 Site Overview

The former BC Cobb coal-fired power generation facility is located east of Muskegon Lake, south of Cedar Creek, northwest of the CSX rail line, and west of the Muskegon River marsh in Muskegon, Michigan (Figure 1). The plant began generating electricity in 1948, and plant operations ceased in April 2016. There are two RCRA CCR units associated with the plant—the Bottom Ash Pond and Ponds 0-8, both of which were wet ash dewatering areas. From 1984 through plant closure in 2016, CCR were deposited in the ash ponds by utilizing sluicing methods. Some of the CCR was periodically removed from the ponds and transported by truck to the JH Campbell Type III landfill (West Olive, Michigan) for disposal or were commercially marketed for beneficial reuse to the extent possible. Site features are shown on Figure 2.

1.3 Geology/Hydrogeology

The majority of the BCC Ponds are comprised of surficial CCR and sand fill. 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 20 to 30 ft bgs, beneath the fine-grained sand, ranging in thickness from approximately 1 to 13 feet. 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 BCC Ponds are bound by several surface water features (Figure 2): The North Channel 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. Prior to 2018, Veterans Memorial Pond was separated from the River by a weir. In 2017 it was drained, underwent maintenance and construction modifications, and the weir was removed.

Significant changes occurred in the ash management area during the CCR Rule baseline period that caused variations in groundwater flow at the Site. The monitoring well system was installed in October 2015 while the plant and the pond system were in operation. The plant shut down in April 2016 and ceased sluicing ash to the BCC Ponds and the ponds began dewatering. Veterans Memorial Pond to the north of the BCC Ponds was dewatered for maintenance activities sometime during the period between August and December 2017. These changes have had a profound effect on groundwater flow rates and directions at both the upgradient and downgradient monitoring wells.

While the ponds were in operation, groundwater mounded within the pond area and flowed radially toward the surrounding water bodies. Starting with the July 2016 groundwater sampling round, groundwater continued to flow radially to the surrounding water bodies, but with a much lower gradient. When Veterans Memorial Pond was drained, a stronger gradient was established along the eastern side of the peninsula toward the Veterans Memorial Pond area. Veterans Memorial Pond is no longer drained and hydraulic loading of the BCC Ponds was discontinued back in 2016, therefore currently groundwater flow gradients in the BCC Ponds are essentially flat.

Section 2
Groundwater Monitoring

2.1 Monitoring Well Network

In accordance with 40 CFR 257.91, CEC established a groundwater monitoring system for the BCC Ponds, which had initially consisted of 22 monitoring wells (seven background monitoring wells and 15 downgradient monitoring wells) that are screened in the uppermost aquifer. Six additional downgradient monitoring wells were installed in late 2017 and incorporated into the groundwater monitoring system in 2018. Seven monitoring wells located southwest of the BCC Ponds provide data on background groundwater quality that has not been affected by the CCR unit (BCC-MW-15002 through BCC-MW-15008). The monitoring well locations are shown on Figure 2.

Prior to the initiation of the assessment monitoring program, it was determined that additional wells were needed along the North Channel 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. Thus, CEC retained TRC to install six shallow monitoring wells paired with the six existing deeper wells and characterize groundwater quality and flow directions. Monitoring wells BCC-MW-17001 through BCC-MW-17006 (shallow 2017 wells) were installed in December 2017 and were sampled quarterly in accordance with the SAP for Appendix III and IV constituents in December 2017, February 2018, June 2018, and August 2018 to accumulate a background data set for the new wells. The locations of the monitoring wells are depicted on Figure 2. The soil boring logs and well construction diagrams for the 2017 shallow wells are included in Appendix A.

Monitoring wells BCC-MW-15009 through BCC-MW-15014 encircle the BAP, while BCC-MW-15015 through BCC-MW-15023 and BCC-MW-17001 through BCC-MW-17006 are located at the outer edge of the peninsula formed by the bottom ash pond system. Because the perimeter and interior berms within the ash management area were constructed in part with ash and bodies of water surround the ash management area, wells could not be installed entirely beyond the CCR material boundary.

2.2 Shallow Well Background Sampling

Background groundwater monitoring was conducted at the 2017 shallow wells quarterly from December 2017 through August 2018 in accordance with the SAP. Data collection included four rounds of static water elevation measurements, analysis for constituents required in the CCR

Rule's Appendix III and Appendix IV to Part 257, and field parameters (dissolved oxygen, oxidation reduction potential, pH, specific conductivity, temperature, and turbidity) from the six shallow monitoring wells. The sampling was conducted by TRC and the collected groundwater samples were analyzed by Pace Analytical Services, LLC (Pace) in accordance with the SAP. Background data are included in Tables 1 through 3, where: Table 1 is a summary of static water elevation data; Table 2 is a summary of field data; and Table 3 is a summary of groundwater analytical data compared to potentially relevant criteria. The shallow monitoring wells were incorporated into the assessment monitoring program in April 2018.

2.3 Preliminary Assessment Monitoring

CEC reported in the 2017 Annual Report that Appendix III constituents boron, fluoride, and pH were observed within groundwater at one or more downgradient monitoring well(s) with potential SSIs above background concentration levels. TRC performed an alternative source demonstration (ASD) evaluation for the constituents and did not find strong enough evidence within 90 days to determine the observation of constituents above background was attributable to a source other than the BCC Ponds. Therefore, CEC initiated an Assessment Monitoring Program for the BCC Ponds pursuant to §257.95 of the CCR Rule that included sampling and analyzing groundwater within the groundwater monitoring system for all constituents listed in Appendix IV. The monitoring was performed in accordance with the BC Cobb Monitoring Program Sample and Analysis Plan (SAP) (ARCADIS, 2016).

2.3.1 Data Summary

The preliminary Appendix IV only assessment monitoring event (per §257.95(b)) was performed on April 16 through April 19, 2018 in accordance with the SAP and §257.95. Downgradient monitoring wells BCC-MW-15009 through BCC-MW-15023, BCC-MW-17001 through BCC-MW-17006, and background monitoring wells BCC-MW-15002 through BCC-MW-15008 were sampled during this event.

Static water elevation measurements were collected at all monitoring well locations. Static water elevation data are summarized in Table 1 and groundwater elevation data are shown on Figure 2. Monitoring wells were purged with peristaltic pumps utilizing low-flow sampling methodology. Field parameters were stabilized at each monitoring well prior to collecting groundwater samples. Field parameters for each monitoring well are summarized in Table 2.

The groundwater samples were analyzed by Pace for Appendix IV constituents during the preliminary assessment monitoring event in accordance with the SAP. The analytical results from each event are summarized in Table 3.

2.3.2 Data Quality Review

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

2.3.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected during the April preliminary assessment monitoring event are provided in Table 1. The April 2018 groundwater elevation data were used to construct a groundwater contour map (Figure 3).

Groundwater elevation data collected during the April 2018 assessment monitoring sampling event showed that the hydraulic gradient for groundwater within the uppermost aquifer is so low that groundwater flow across the Ponds 0-8 CCR unit is essentially nonexistent. The average gradient observed on April 16, 2018, using well pairs BCC-MW-15007/BCC-MW-15001, BCC-MW-17006/BCC-MW-15015, BCC-MW-15023/BCC-MW-17002, and BCC-MW-15023/BCC-MW-17005, showed a horizontal gradient of approximately 0.00011 ft/ft with a minimal discernible overall flow direction across the BCC Ponds. Using the average hydraulic conductivity measured at the Ponds 0-8 monitoring wells of 58 feet/day (ARCADIS, 2016), and an assumed effective porosity of 0.3, this results in groundwater flow rate of approximately 0.02 feet/day (approximately 8 feet/year).

2.4 Semiannual Groundwater Monitoring

Per §257.95(d), within 90 days of the preliminary assessment monitoring event and semiannually thereafter, all wells must be resampled and analyzed for all constituents from Appendix III and for those constituents in Appendix IV of the CCR Rule that were detected during prior sampling. In addition to the Appendix III and IV constituents, field parameters including dissolved oxygen, oxidation reduction potential, specific conductivity, temperature, and turbidity were collected at each well. Samples were collected and analyzed according to the SAP.

2.4.1 Data Summary

The first semiannual groundwater assessment monitoring event for 2018 was performed on June 11 through June 15, 2018 by TRC personnel, and samples were analyzed by Pace in accordance with the SAP. Static water elevation data were collected at all monitoring well locations. Groundwater samples were collected from the 7 background monitoring wells and 21 downgradient monitoring wells for the Appendix III and Appendix IV constituents and field parameters. A summary of the groundwater data collected during the June 2018 event is provided on Table 1 (static groundwater elevation data), Table 2 (field data), and Table 3 (analytical results).

The second semiannual groundwater assessment monitoring event for 2018 was performed on November 26 through November 30, 2018 by TRC personnel, and samples were analyzed by Pace in accordance with the SAP. Static water elevation data were collected at all monitoring well locations. Groundwater samples were collected from the 7 background monitoring wells and 21 downgradient monitoring wells for the Appendix III and Appendix IV constituents and field parameters. As of the writing of this report, lab analysis and data quality review are ongoing. Therefore, a summary of groundwater data will be provided under separate cover after laboratory analysis is complete and results have been reviewed for usability. Consumers Energy will enter this information into the operating record as soon as it is available and include it in the forthcoming 2019 Annual Groundwater Monitoring and Corrective Action Report.

2.4.2 Data Quality Review

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

2.4.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected during the June 2018 assessment monitoring event are provided in Table 1. The June 2018 groundwater elevation data were used to construct groundwater contour map (Figure 4).

The groundwater elevation data collected during the June 2018 event were similar to the April 2018 event, with no discernable flow direction across the area of the BCC Ponds. The average hydraulic gradient throughout the Site during the June 2018 event is estimated at 0.00017 ft/ft. The gradient was calculated using the same well pairs, hydraulic conductivity and effective porosity as the aforementioned April 2018 event, and resulted in an estimated average seepage velocity of approximately 0.03 ft/day or 12 ft/year for the June 2018 event.

The low hydraulic gradient and lack of general flow direction is similar to that identified in recent sampling events; however, in the past, 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 and has undergone several changes over time due to permanent discontinuation of hydraulic loading in the BCC

Ponds CCR unit area and the dewatering of Veteran's Memorial Pond in 2017 (as discussed in the 2017 Annual Report). Although the overall gradient has diminished, general groundwater flow is still expected to be slightly outward toward the river, or equal to the river, with groundwater flowing toward the BCC Ponds from the area of the background wells (Figures 3 and 4) and continues to demonstrate that the downgradient wells are appropriately positioned to detect the presence of Appendix III/IV constituents that could potentially migrate from the BCC Ponds.

Section 3
Statistical Evaluation

3.1 Establishing Groundwater Protection Standards

In accordance with §257.95(h) and the *Groundwater Statistical Evaluation Plan* (Stats Plan) (TRC, October 2017), GWPSs were established for the Appendix IV constituents following the preliminary assessment monitoring event using nine rounds of data collected from the background monitoring wells BCC-MW-15002 through BCC-MW-15008 (December 2015 through April 2018). The calculation of the GWPSs is documented in the *Groundwater Protection Standards* technical memorandum included in Appendix C of this annual report (TRC, October 2018). The GWPS is established as the higher of the USEPA Maximum Contaminant Level (MCL) or statistically derived background level for constituents with MCLs and the higher of the USEPA Regional Screening Levels (RSLs) or background level for constituents with RSLs. The Appendix IV GWPSs will be used to assess whether groundwater has been impacted from the BCC Ponds by statistically comparing concentrations in the downgradient wells to the GWPSs for each Appendix IV constituent.

3.2 Data Comparison to Groundwater Protection Standards

Consistent with the *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (Unified Guidance) (USEPA, 2009), the preferred method for comparisons to a fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS. The statistical data comparison was reported on January 14, 2019, within 90 days of establishing the GWPSs in accordance with §257.93(h)(2) and within the compliance schedule clarified by the USEPA in a letter dated April 30, 2018 (USEPA, April 2018).

The statistical evaluation report has been entered into operating record by CEC on January 14, 2019 in accordance with §257.105(h)(8). Notification of the statistical analysis of the assessment monitoring data compared to the GWPS, if necessary, will be made in accordance with §257.106(h) and posting such notification to the publicly accessible compliance website in accordance with §257.107(h) will be completed within 30 days of the completion of the statistical analysis. This evaluation will be included in the forthcoming 2019 Annual Groundwater Monitoring and Corrective Action Report since it was completed in calendar year 2019.

Subsequently, following receipt of final laboratory reports for all Appendix IV constituents and completion of data quality review, the results from the November 2018 semiannual sampling event will also be statistically compared to the GWPSs using the same approach as the initial event. It is anticipated that the statistical comparison of the second semiannual 2018 event will be completed in March/April 2019. Consumers Energy will enter this information into the operating record as soon as it is available and will include it in the forthcoming 2019 Annual Groundwater Monitoring and Corrective Action Report.

Section 4
Conclusions and Recommendations

Semiannually after triggering assessment monitoring, groundwater samples will be collected from the groundwater monitoring system wells and analyzed for Appendix III and Appendix IV constituents pursuant to §257.95(d). In accordance with §257.93(h)(2) and within the compliance schedule clarified by the USEPA in April 2018, the first round of semiannual assessment monitoring data were statistically evaluated against the GWPSs on January 14, 2019. CEC has placed this analysis in the operating record in accordance with §257.105(h)(8) on January 14, 2019. Notification that one or more Appendix IV constituents have been detected at statistically significant levels above the GWPS will be submitted, if necessary, in accordance with §257.106(h) and posting such notifications to the publicly accessible compliance website in accordance with §257.107(h) will be completed within 30 days of the completion of the statistical analysis. This evaluation will be included in the forthcoming 2019 Annual Groundwater Monitoring and Corrective Action Report since it was completed in calendar year 2019.

According to §257.95(g)(3), if the facility determines pursuant to §257.93(h), that any Appendix IV constituents were detected at a statistically significant level exceeding the GWPSs, the facility will either conduct an ASD or initiate an assessment of corrective measures according to §257.96 within 90 days. Based on the results of the statistical evaluation CEC will be seeking to initiate an assessment of corrective measures within 90 days of the completion of the statistical analysis. CEC will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

In addition, the statistical evaluation of the second semiannual 2018 monitoring event is anticipated to be completed in March/April 2019 and will be posted to the public website within 30 days of being finalized. Consumers Energy will enter this information into the operating record as soon as it is available and include it in the forthcoming 2019 Annual Groundwater Monitoring and Corrective Action Report.

The next semiannual monitoring event is tentatively scheduled for the second calendar quarter of 2019.

Section 5
References

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Tables

Table 1

Summary of Groundwater Elevation Data
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Depth (ft BGS)			Screen Interval Elevation (ft)			Borehole Terminus Depth (ft BGS)	Borehole Terminus Elevation (ft)	December 7, 2017		February 22, 2018	
												Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background															
BCC-MW-15001	583.6	586.52	Sand with organic seam at 18.8 ft bgs	10.0	to	20.0	573.6	to	563.6	20.0	563.6	7.92	578.60	5.05	581.47
BCC-MW-15002	583.8	586.87	Sand	15.0	to	20.0	568.8	to	563.8	20.0	563.8	7.75	579.12	5.00	581.87
BCC-MW-15003	584.1	587.12	Sand	13.0	to	18.0	571.1	to	566.1	20.0	564.1	7.38	579.74	5.15	581.97
BCC-MW-15004	587.7	590.57	Sand	5.0	to	15.0	582.7	to	572.7	20.0	567.7	10.45	580.12	8.59	581.98
BCC-MW-15005	584.8	587.77	Sand	5.0	to	15.0	579.8	to	569.8	20.0	564.8	7.32	580.45	6.21	581.56
BCC-MW-15006	584.9	587.81	Sand	5.0	to	15.0	579.9	to	569.9	20.0	564.9	7.29	580.52	5.20	582.61
BCC-MW-15007	584.5	587.43	Sand	4.0	to	10.0	580.5	to	574.5	20.0	564.5	7.35	580.08	5.09	582.34
BCC-MW-15008	584.8	587.76	Sand	4.0	to	9.0	580.8	to	575.8	20.0	564.8	7.21	580.55	6.02	581.74
Downgradient															
BCC-MW-15009	586.3	589.27	Sand (14 - 17.2 ft bgs) and Clay/silt (17.2 - 24 ft bgs)	14.0	to	24.0	572.3	to	562.3	24.0	562.3	9.25	580.02	7.79	581.48
BCC-MW-15010	585.2	588.11	Sand with little silt and organic material	12.0	to	22.0	573.2	to	563.2	24.0	561.2	8.88	579.23	6.33	581.78
BCC-MW-15011	592.3	595.22	Sand with some silt	21.0	to	31.0	571.3	to	561.3	32.0	560.3	15.81	579.41	13.61	581.61
BCC-MW-15012	594.5	597.39	Sand	21.0	to	31.0	573.5	to	563.5	35.0	559.5	17.86	579.53	16.00	581.39
BCC-MW-15013	595.9	598.50	Sand with clay/silt and organic material from 36.5 - 37.5 ft bgs	30.0	to	40.0	565.9	to	555.9	40.0	555.9	18.37	580.13	17.53	580.97
BCC-MW-15014	596.2	599.04	Sand/silty sand	23.0	to	31.0	573.2	to	565.2	40.0	556.2	19.10	579.94	18.01	581.03
BCC-MW-15015	593.9	596.75	Sand with clay/silt and organic material from 29 - 29.5 ft bgs	20.0	to	30.0	573.9	to	563.9	30.0	563.9	16.45	580.30	16.10	580.65
BCC-MW-15016	586.2	589.05	Sand	35.0	to	40.0	551.2	to	546.2	45.0	541.2	8.99	580.06	8.60	580.45
BCC-MW-15017	585.7	588.61	Sand	35.0	to	40.0	550.7	to	545.7	40.0	545.7	8.43	580.18	8.19	580.42
BCC-MW-15018	589.4	592.43	Sand	37.5	to	42.5	551.9	to	546.9	45.0	544.4	12.22	580.21	11.94	580.49
BCC-MW-15019	589.4	592.42	Sand	37.0	to	42.0	552.4	to	547.4	45.0	544.4	12.42	580.00	11.88	580.54
BCC-MW-15020	589.5	592.23	Sand	35.0	to	40.0	554.5	to	549.5	45.0	544.5	12.65	579.58	11.58	580.65
BCC-MW-15021	590.7	593.73	Sand	39.5	to	42.5	551.2	to	548.2	50.0	540.7	14.50	579.23	13.20	580.53
BCC-MW-15022	592.6	595.82	Sand	24.0	to	30.0	568.6	to	562.6	45.0	547.6	18.00	577.82	14.55	581.27
BCC-MW-15023	585.4	588.08	Sand/silty sand	12.0	to	19.5	573.4	to	565.9	20.0	565.4	11.94	576.14	6.40	581.68
Shallow 2017 Wells															
BCC-MW-17001	586.1	589.29	Sand with some organic material	15.0	to	20.0	571.1	to	566.1	20.0	566.1	8.91	580.38	8.84	580.45
BCC-MW-17002	585.8	588.79	Sand	13.5	to	18.5	572.3	to	567.3	19.0	566.8	8.43	580.36	8.69	580.1
BCC-MW-17003	589.3	592.37	Sand	17.0	to	22.0	572.3	to	567.3	22.0	567.3	11.97	580.40	11.90	580.47
BCC-MW-17004	589.1	591.84	Sand	17.5	to	22.5	571.6	to	566.6	22.5	566.6	11.63	580.21	11.18	580.66
BCC-MW-17005	589.3	592.42	Sand	20.0	to	25.0	569.3	to	564.3	30.0	559.3	13.06	579.36	11.45	580.97
BCC-MW-17006	590.5	593.78	Sand	24.5	to	29.5	566.0	to	561.0	30.0	560.5	16.80	576.98	12.30	581.48

Notes:

Survey conducted by Williams & Works, November 2015, and Consumers Energy Company in January 2018.

Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).

TOC: Top of well casing.

ft BTOC: Feet below top of well casing.

ft BGS: Feet below ground surface.

Table 1
Summary of Groundwater Elevation Data
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Depth (ft BGS)			Screen Interval Elevation (ft)			April 16, 2018		June 11, 2018		August 7, 2018	
										Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background															
BCC-MW-15001	583.6	586.52	Sand with organic seam at 18.8 ft bgs	10.0	to	20.0	573.6	to	563.6	4.95	581.57	5.11	581.41	5.35	581.17
BCC-MW-15002	583.8	586.87	Sand	15.0	to	20.0	568.8	to	563.8	5.32	581.55	5.42	581.45	5.72	581.15
BCC-MW-15003	584.1	587.12	Sand	13.0	to	18.0	571.1	to	566.1	5.67	581.45	5.65	581.47	5.98	581.14
BCC-MW-15004	587.7	590.57	Sand	5.0	to	15.0	582.7	to	572.7	9.21	581.36	9.10	581.47	9.43	581.14
BCC-MW-15005	584.8	587.77	Sand	5.0	to	15.0	579.8	to	569.8	6.37	581.40	6.33	581.44	6.55	581.22
BCC-MW-15006	584.9	587.81	Sand	5.0	to	15.0	579.9	to	569.9	6.25	581.56	6.23	581.58	6.64	581.17
BCC-MW-15007	584.5	587.43	Sand	4.0	to	10.0	580.5	to	574.5	5.88	581.55	5.84	581.59	6.30	581.13
BCC-MW-15008	584.8	587.76	Sand	4.0	to	9.0	580.8	to	575.8	6.23	581.53	6.32	581.44	6.64	581.12
Downgradient															
BCC-MW-15009	586.3	589.27	Sand (14 - 17.2 ft bgs) and Clay/silt (17.2 - 24 ft bgs)	14.0	to	24.0	572.3	to	562.3	7.79	581.48	7.75	581.52	8.09	581.18
BCC-MW-15010	585.2	588.11	Sand with little silt and organic material	12.0	to	22.0	573.2	to	563.2	6.56	581.55	6.60	581.51	6.99	581.12
BCC-MW-15011	592.3	595.22	Sand with some silt	21.0	to	31.0	571.3	to	561.3	13.75	581.47	13.71	581.51	14.09	581.13
BCC-MW-15012	594.5	597.39	Sand	21.0	to	31.0	573.5	to	563.5	15.95	581.44	15.92	581.47	16.29	581.10
BCC-MW-15013	595.9	598.50	Sand with clay/silt and organic material from 36.5 - 37.5 ft bgs	30.0	to	40.0	565.9	to	555.9	17.09	581.41	17.12	581.38	17.41	581.09
BCC-MW-15014	596.2	599.04	Sand/silty sand	23.0	to	31.0	573.2	to	565.2	17.66	581.38	17.69	581.35	17.99	581.05
BCC-MW-15015	593.9	596.75	Sand with clay/silt and organic material from 29 - 29.5 ft bgs	20.0	to	30.0	573.9	to	563.9	15.44	581.31	15.53	581.22	15.82	580.93
BCC-MW-15016	586.2	589.05	Sand	35.0	to	40.0	551.2	to	546.2	7.71	581.34	7.74	581.31	7.93	581.12
BCC-MW-15017	585.7	588.61	Sand	35.0	to	40.0	550.7	to	545.7	7.27	581.34	7.33	581.28	7.52	581.09
BCC-MW-15018	589.4	592.43	Sand	37.5	to	42.5	551.9	to	546.9	11.02	581.41	11.18	581.25	11.40	581.03
BCC-MW-15019	589.4	592.42	Sand	37.0	to	42.0	552.4	to	547.4	10.99	581.43	11.15	581.27	11.35	581.07
BCC-MW-15020	589.5	592.23	Sand	35.0	to	40.0	554.5	to	549.5	10.77	581.46	10.91	581.32	11.13	581.10
BCC-MW-15021	590.7	593.73	Sand	39.5	to	42.5	551.2	to	548.2	12.42	581.31	12.40	581.33	12.60	581.13
BCC-MW-15022	592.6	595.82	Sand	24.0	to	30.0	568.6	to	562.6	14.40	581.42	14.45	581.37	14.78	581.04
BCC-MW-15023	585.4	588.08	Sand/silty sand	12.0	to	19.5	573.4	to	565.9	6.60	581.48	6.81	581.27	6.95	581.13
Shallow 2017 Wells															
BCC-MW-17001	586.1	589.29	Sand with some organic material	15.0	to	20.0	571.1	to	566.1	7.87	581.42	8.07	581.22	8.32	580.97
BCC-MW-17002	585.8	588.79	Sand	13.5	to	18.5	572.3	to	567.3	7.35	581.44	7.53	581.26	7.78	581.01
BCC-MW-17003	589.3	592.37	Sand	17.0	to	22.0	572.3	to	567.3	10.97	581.40	11.15	581.22	11.44	580.93
BCC-MW-17004	589.1	591.84	Sand	17.5	to	22.5	571.6	to	566.6	10.43	581.41	10.60	581.24	10.91	580.93
BCC-MW-17005	589.3	592.42	Sand	20.0	to	25.0	569.3	to	564.3	11.05	581.37	11.20	581.22	11.52	580.90
BCC-MW-17006	590.5	593.78	Sand	24.5	to	29.5	566.0	to	561.0	12.40	581.38	12.52	581.26	12.98	580.80

Notes:

Survey conducted by Williams & Works, November 2015, and Consumers Energy Company in January 2018.

Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).

TOC: Top of well casing.

ft BTOC: Feet below top of well casing.

ft BGS: Feet below ground surface.

Table 2

Summary of Field Parameter Results – December 2017 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Background							
BCC-MW-15002	4/19/2018	0.25	-7.1	7.5	1,318	10.8	0.8
	6/14/2018	0.30	18.4	7.4	1,014	16.2	1.6
BCC-MW-15003	4/19/2018	0.23	-28.9	7.5	3,911	8.9	2.5
	6/14/2018	0.28	14.5	7.3	3,522	14.2	2.3
BCC-MW-15004	4/19/2018	0.37	-29.7	7.3	957	8.8	2.5
	6/12/2018	0.35	-23.6	7.0	909	17.0	3.6
BCC-MW-15005	4/19/2018	4.22	-62.5	7.7	513	6.3	2.9
	6/14/2018	0.31	-14.7	7.4	451	17.2	4.4
BCC-MW-15006	4/19/2018	4.34	-6.0	7.5	642	5.1	2.8
	6/14/2018	1.16	-15.3	7.3	420	18.8	8.1
BCC-MW-15007	4/19/2018	0.44	-3.0	7.0	2,993	5.9	2.5
	6/14/2018	0.39	-22.2	6.9	2,626	17.4	3.7
BCC-MW-15008	4/18/2018	0.23	-1.0	7.8	896	6.7	0.9
	6/14/2018	0.30	-23.4	7.5	786	17.5	6.8
BCC-MW-15009	4/16/2018	0.30	-381.1	9.8	482	10.9	2.4
	6/13/2018	0.31	-107.9	9.8	477	18.1	0.5

Notes:

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

Table 2

Summary of Field Parameter Results – December 2017 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Downgradient							
BCC-MW-15010	4/16/2018	0.26	-146.3	7.8	941	10.6	0.7
	6/14/2018	0.34	5.30	7.4	991	13.3	5.1
BCC-MW-15011	4/16/2018	0.25	-215.1	9.1	272	12.5	3.5
	6/13/2018	0.34	-25.9	8.5	251	18.3	1.2
BCC-MW-15012	4/17/2018	0.24	-345.6	9.7	774	12.3	0.5
	6/13/2018	0.34	-98.6	10.2	884	18.3	0.8
BCC-MW-15013	4/17/2018	0.28	-91.5	7.6	423	12.4	1.6
	6/13/2018	0.41	-17.8	7.7	400	18.3	1.2
BCC-MW-15014	4/17/2018	0.21	-155.1	11.6	554	11.6	2.9
	6/13/2018	0.27	-71.2	11.4	474	17.9	2.2
BCC-MW-15015	4/17/2018	0.24	-125.4	8.3	407	11.2	1.2
	6/13/2018	0.33	11.3	7.9	408	16.4	1.5
BCC-MW-15016	4/17/2018	0.20	-71.6	6.8	2,121	9.9	2.2
	6/12/2018	0.27	-88.4	6.5	2,038	17.8	3.2
BCC-MW-15017	4/17/2018	0.21	-85.4	6.8	2,334	9.6	2.8
	6/12/2018	0.24	-96.8	6.5	2,225	17.4	1.3

Notes:

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mV - Millivolts.
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umhos/cm - Micromhos per centimeter.
°C - Degrees Celcius.
NTU - Nephelometric Turbidity Unit.

Table 2

Summary of Field Parameter Results – December 2017 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Downgradient							
BCC-MW-15018	4/18/2018	0.27	-45.0	6.9	817	10.0	4.6
	6/12/2018	0.32	-68.7	6.8	771	17.8	2.9
BCC-MW-15019	4/18/2018	0.25	-89.9	7.0	944	11.1	2.6
	6/12/2018	0.31	-102.6	6.7	980	18.4	3.4
BCC-MW-15020	4/18/2018	0.24	-89.9	7.0	853	11.2	4.2
	6/12/2018	0.30	-102.4	6.7	968	18.0	2.0
BCC-MW-15021	4/18/2018	0.21	-97.3	7.1	1,131	12.2	8.3
	6/12/2018	0.37	-107.8	6.8	1,035	17.0	0.7
BCC-MW-15022	4/18/2018	0.21	-82.1	7.8	388	14.0	1.9
	6/11/2018	0.35	-190.5	8.3	377	18.8	1.1
BCC-MW-15023	4/18/2018	0.29	-15.5	7.6	981	11.3	1.1
	6/11/2018	0.35	-68.7	7.4	702	17.8	0.4

Notes:

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

Table 2

Summary of Field Parameter Results – December 2017 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Shallow 2017 Wells (Downgradient)							
BCC-MW-17001	12/7/2017	0.10	-253.7	7.1	920	11.9	3.4
	2/20/2018	0.20	-206.4	7.0	943	11.6	3.1
	6/15/2018	0.22	-328.2	7.2	903	15.0	3.6
	8/6/2018	0.35	69.7	6.9	894	17.6	3.7
BCC-MW-17002	12/7/2017	0.10	-283.4	7.0	1,069	11.3	4.3
	2/20/2018	0.21	-262.1	7.1	1,252	11.1	2.9
	6/15/2018	0.26	-365.0	7.2	1,227	14.6	2.0
	8/6/2018	0.35	-294.3	7.1	1,090	17.4	2.8
BCC-MW-17003	12/7/2017	0.19	81.3	7.0	580	11.7	4.1
	2/20/2018	0.28	-115.5	7.2	510	11.2	1.9
	6/15/2018	0.38	5.10	7.4	517	14.9	1.2
	8/7/2018	0.33	-84.3	7.3	553	16.8	1.8
BCC-MW-17004	12/6/2017	0.25	28.7	7.2	452	14.0	3.4
	2/20/2018	0.26	-72.0	7.3	450	13.6	<1.0
	6/15/2018	0.36	7.90	7.4	569	15.4	<1.0
	8/7/2018	0.37	-51.2	7.3	550	18.5	1.4
BCC-MW-17005	12/6/2017	0.22	28.9	7.3	426	14.9	3.8
	2/20/2018	0.23	-80.8	7.3	483	13.9	2.5
	6/15/2018	0.38	9.20	7.4	568	16.7	3.6
	8/7/2018	0.35	-104.3	7.3	512	20.8	<1.0
BCC-MW-17006	12/6/2017	0.22	60.7	7.7	794	11.1	3.0
	2/20/2018	2.09	10.8	7.3	11	13.5	1.3
	6/15/2018	0.42	16.4	7.5	717	15.8	1.3
	8/7/2018	0.37	-60.7	7.5	693	19.6	<1.0

Notes:

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

Table 3

Summary of Groundwater Sampling Results (Analytical) – December 2017 to August 2018

BC Cobb – RCRA CCR Monitoring Program

Muskegon, Michigan

					Sample Location:	BCC-MW-15009		BCC-MW-15010		BCC-MW-15011		BCC-MW-15012		BCC-MW-15013		BCC-MW-15014	
					Sample Date:	4/16/2018	6/13/2018	4/16/2018	6/14/2018	4/16/2018	6/13/2018	4/17/2018	6/13/2018	4/17/2018	6/13/2018	4/17/2018	6/13/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient											
Appendix III																	
Boron	ug/L	NC	**500**	**500**	7,200	--	**1,670**	--	**2,100**	--	**1,630**	--	**1,450**	--	**1,130**	--	**1,370**
Calcium	mg/L	NC	NC	NC	500	--	42.4	--	133	--	22.6	--	95.1	--	47.3	--	50.8
Chloride	mg/L	250**	250	250	500	--	95.7	--	29.3	--	23.2	--	22.7	--	21.5	--	21.3
Fluoride	ug/L	4,000	NC	NC	NC	< 1000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	**9.8**	**9.8**	7.8	7.4	**9.1**	**8.5**	**9.7**	**10.2**	7.6	7.7	**11.6**	**11.4**
Sulfate	mg/L	**250****	**250**	**250**	**500**	--	< 2.0	--	73.7	--	12.3	--	**355**	--	8.7	--	2.4
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	--	456	--	**636**	--	244	--	**902**	--	324	--	338
Appendix IV																	
Antimony	ug/L	6	6	6	130	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.1	< 1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	9.4	8.5	< 1.0	< 1.0	6.4	1.5	1.8	3.4	< 1.0	< 1.0	6.2	5.5
Barium	ug/L	2,000	2,000	2,000	**690**	16.5	13.8	63.4	64.8	15.2	16.6	109	105	43.3	43.9	**779**	607
Beryllium	ug/L	4	4	4	7.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5	5	3.1	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NC	NC	NC	< 1000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000
Lead	ug/L	NC	4	4	29	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440	24	21	46	54	21	11	13	11	27	24	27	16
Mercury	ug/L	2	2	2	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	**73**	210	3200	16.0	11.6	< 5.0	< 5.0	8.9	5.8	50.8	71.3	< 5.0	< 5.0	**94.7**	**100**
Radium-226	pCi/L	NC	NC	NC	NC	< 0.934	< 0.580	< 0.869	0.661	< 0.742	0.350	< 0.693	< 0.526	< 0.505	< 0.546	< 1.11	< 1.17
Radium-226/228	pCi/L	**5**	NC	NC	NC	< 1.89	< 3.85	< 1.75	< 1.45	< 1.61	< 1.25	< 1.43	< 1.32	< 1.14	< 1.30	< 2.08	< 3.02
Radium-228	pCi/L	NC	NC	NC	NC	< 0.957	< 3.27	< 0.877	< 0.978	< 0.872	< 0.923	< 0.733	< 0.789	< 0.633	< 0.754	< 0.972	< 1.85
Selenium	ug/L	50	50	50	5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2	3.3	< 1.0	< 1.0	1.2	1.2
Thallium	ug/L	2	2	2	3.7	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 154 mg CaCO3/L as measured at surface water sample SW-01 collected on February 22, 2018 from the North Channel Muskegon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 3

Summary of Groundwater Sampling Results (Analytical) – December 2017 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-15015**		**BCC-MW-15016**		**BCC-MW-15017**		**BCC-MW-15018**		**BCC-MW-15019**		**BCC-MW-15020**	
					Sample Date:	4/17/2018	6/13/2018	4/17/2018	6/12/2018	4/17/2018	6/12/2018	4/18/2018	6/12/2018	4/18/2018	6/12/2018	4/18/2018	6/12/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient											
Appendix III																	
Boron	ug/L	NC	**500**	**500**	7,200	--	398	--	76.6	--	83.8	--	**559**	--	**1,170**	--	**708**
Calcium	mg/L	NC	NC	NC	500	--	45.0	--	168	--	243	--	87.6	--	97.7	--	96.3
Chloride	mg/L	250**	250	250	500	--	19.5	--	197	--	224	--	48.9	--	67.7	--	92.1
Fluoride	ug/L	4,000	NC	NC	NC	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	8.3	7.9	6.8	**6.5**	6.8	**6.5**	6.9	6.8	7.0	6.7	7.0	6.7
Sulfate	mg/L	**250****	**250**	**250**	**500**	--	12.6	--	< 2.0	--	< 2.0	--	< 2.0	--	< 2.0	--	< 2.0
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	--	316	--	**986**	--	**1,120**	--	**598**	--	**524**	--	**622**
Appendix IV																	
Antimony	ug/L	6	6	6	130	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	4.7	5.5	1.5	1.3	2.3	2.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	2,000	2,000	**690**	39.9	37.9	649	652	**955**	**936**	139	156	161	187	148	197
Beryllium	ug/L	4	4	4	7.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5	5	3.1	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11	< 1.0	< 1.0	2.1	2.0	3.4	3.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000
Lead	ug/L	NC	4	4	29	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440	16	13	< 10	< 10	< 10	< 10	29	26	25	23	16	16
Mercury	ug/L	2	2	2	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	**73**	210	3200	9.4	7.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC	< 0.467	< 0.475	1.56	< 0.810	2.23	2.13	< 0.843	< 0.756	< 0.717	< 0.594	0.744	< 0.899
Radium-226/228	pCi/L	**5**	NC	NC	NC	< 1.20	< 1.24	3.64	2.50	**5.16**	**5.43**	1.59	1.77	< 1.46	1.75	1.56	2.64
Radium-228	pCi/L	NC	NC	NC	NC	< 0.730	< 0.763	2.08	1.81	2.93	3.30	0.869	1.39	< 0.742	1.36	0.813	1.75
Selenium	ug/L	50	50	50	5	< 1.0	< 1.0	1.5	1.4	1.7	2.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	2	2	3.7	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 154 mg CaCO3/L as measured at surface water sample SW-01 collected on February 22, 201 from the North Channel Muskegon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.
BOLD value indicates an exceedance of one or more of the listed criteria.
RED value indicates an exceedance of the MCL.
All metals were analyzed as total unless otherwise specified.

Table 3

Summary of Groundwater Sampling Results (Analytical) – December 2017 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15021		BCC-MW-15022		BCC-MW-15023		BCC-MW-17001			
					Sample Date:	4/18/2018	6/12/2018	4/18/2018	6/11/2018	4/18/2018	6/11/2018	12/7/2017	2/20/2018	6/15/2018	8/6/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient						Shallow 2017 Wells (downgradient)			
Appendix III															
Boron	ug/L	NC	**500**	**500**	7,200	--	**809**	--	**1,170**	--	**1,650**	**991**	**827**	**1,100**	**1,220**
Calcium	mg/L	NC	NC	NC	500	--	89.4	--	38.2	--	98.9	118	118	124	117
Chloride	mg/L	250**	250	250	500	--	112	--	21.5	--	19.4	27.3	28.5	29.1	29.1
Fluoride	ug/L	4,000	NC	NC	NC	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.1	6.8	7.8	8.3	7.6	7.4	7.1	7.0	7.2	6.9
Sulfate	mg/L	**250****	**250**	**250**	**500**	--	< 2.0	--	24.1	--	139	156	135	90.8	18.7
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	--	**576**	--	210	--	474	**558**	**552**	**566**	476
Appendix IV															
Antimony	ug/L	6	6	6	130	< 1.0	< 1.0	1.9	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	< 1.0	< 1.0	< 1.0	1.1	< 1.0	< 1.0	5.2	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	2,000	2,000	**690**	236	238	102	104	97.1	87.8	85.6	71.3	65.8	73.8
Beryllium	ug/L	4	4	4	7.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5	5	3.1	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11	< 1.0	1.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NC	NC	NC	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4	4	29	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440	< 10	< 10	13	11	19	18	55	73	65	62
Mercury	ug/L	2	2	2	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	**73**	210	3200	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	7.1	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC	< 0.461	< 0.689	0.666	< 0.708	< 0.572	< 0.958	< 0.509	< 0.890	< 0.766	< 0.616
Radium-226/228	pCi/L	**5**	NC	NC	NC	< 1.96	1.97	1.13	< 1.45	< 1.32	< 1.85	< 1.34	< 1.79	< 1.71	< 1.44
Radium-228	pCi/L	NC	NC	NC	NC	< 1.50	1.60	< 0.644	< 0.742	< 0.749	< 0.891	< 0.830	< 0.901	< 0.947	< 0.822
Selenium	ug/L	50	50	50	5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Thallium	ug/L	2	2	2	3.7	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 154 mg CaCO3/L as measured at surface water sample SW-01 collected on February 22, 201 from the North Channel Muskegon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 3

Summary of Groundwater Sampling Results (Analytical) – December 2017 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-17002				BCC-MW-17003				BCC-MW-17004			
					Sample Date:	12/7/2017	2/20/2018	6/15/2018	8/6/2018	12/7/2017	2/20/2018	6/15/2018	8/7/2018	12/6/2017	2/20/2018	6/15/2018	8/7/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	Shallow 2017 Wells (downgradient)											
Appendix III																	
Boron	ug/L	NC	**500**	**500**	7,200	**8,280**	**12,800**	**13,300**	**9,440**	413	394	369	383	367	429	**525**	425
Calcium	mg/L	NC	NC	NC	500	178	201	224	194	74.3	55.7	63.2	74.6	53.7	48.1	73.1	68.9
Chloride	mg/L	250**	250	250	500	15.3	14.2	13.2	15.4	18.3	21.5	22.7	21.9	21.3	21.3	21.4	21.2
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.0	7.1	7.2	7.1	7.0	7.2	7.4	7.3	7.2	7.3	7.4	7.3
Sulfate	mg/L	**250****	**250**	**250**	**500**	**330**	**325**	**332**	226	48.4	< 2.0	< 2.0	17.7	< 2.0	< 2.0	8.3	< 2.0
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**726**	**892**	**936**	**740**	324	330	412	326	228	238	410	320
Appendix IV																	
Antimony	ug/L	6	6	6	130	1.5	< 1.0	< 1.0	< 2.0	1.1	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 2.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	**45.5**	2.0	2.6	3.8	**26.0**	< 1.0	< 1.0	1.0	2.5	1.8	1.1	< 1.0
Barium	ug/L	2,000	2,000	2,000	**690**	148	76.7	62.8	57.6	128	78.1	66.5	77.9	145	116	175	148
Beryllium	ug/L	4	4	4	7.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5	5	3.1	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2	< 1.0
Cobalt	ug/L	NC	40	100	100	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4	4	29	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440	75	160	150	130	19	17	13	18	< 10	< 10	< 10	< 10
Mercury	ug/L	2	2	2	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	**73**	210	3200	30.1	< 5.0	< 5.0	< 5.0	48.8	6.3	< 5.0	< 5.0	9.9	5.9	< 5.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC	< 1.03	< 1.07	< 0.757	0.306	< 0.889	< 0.755	< 0.594	< 0.687	< 0.945	< 0.723	< 0.441	< 0.519
Radium-226/228	pCi/L	**5**	NC	NC	NC	< 2.03	< 4.84	< 3.11	1.56	< 1.55	< 1.46	< 1.42	< 1.49	< 1.75	< 1.44	< 1.25	< 1.46
Radium-228	pCi/L	NC	NC	NC	NC	< 0.996	< 3.77	< 2.35	1.25	< 0.663	< 0.707	< 0.828	0.932	< 0.804	< 0.719	< 0.810	1.03
Selenium	ug/L	50	50	50	5	1.1	< 1.0	< 1.0	< 2.0	< 1.0	2.2	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 2.0
Thallium	ug/L	2	2	2	3.7	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 154 mg CaCO3/L as measured at surface water sample SW-01 collected on February 22, 201 from the North Channel Muskegon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

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

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Table 3

Summary of Groundwater Sampling Results (Analytical) – December 2017 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	**BCC-MW-17005**				**BCC-MW-17006**			
					Sample Date:	12/6/2017	2/20/2018	6/15/2018	8/7/2018	12/6/2017	2/20/2018	6/15/2018	8/7/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	Shallow 2017 Wells (downgradient)							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	191	238	377	342	**669**	**594**	**653**	**765**
Calcium	mg/L	NC	NC	NC	500	51.9	54.2	71.2	68.1	106	95.0	97.5	90.4
Chloride	mg/L	250**	250	250	500	19.4	21.6	20.5	19.6	19.0	20.3	20.9	21.5
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.3	7.3	7.4	7.3	7.7	7.3	7.5	7.5
Sulfate	mg/L	**250****	**250**	**250**	**500**	11.5	< 2.0	9.6	4.3	129	93.1	69.8	46.2
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	262	310	358	318	474	472	478	438
Appendix IV													
Antimony	ug/L	6	6	6	130	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 2.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	2.9	< 1.0	< 1.0	< 1.0	4.9	2.4	4.6	< 1.0
Barium	ug/L	2,000	2,000	2,000	**690**	168	123	161	179	83.3	79.0	70.3	73.0
Beryllium	ug/L	4	4	4	7.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5	5	3.1	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4	4	29	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440	10	11	< 10	13	38	37	31	36
Mercury	ug/L	2	2	2	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	**73**	210	3200	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC	< 0.863	< 0.804	< 0.692	0.440	< 0.930	< 0.766	< 0.862	< 0.582
Radium-226/228	pCi/L	**5**	NC	NC	NC	< 1.59	< 1.71	< 1.49	< 1.15	< 1.76	< 1.48	< 1.75	< 1.34
Radium-228	pCi/L	NC	NC	NC	NC	< 0.722	< 0.904	< 0.796	< 0.741	< 0.833	< 0.716	< 0.888	< 0.757
Selenium	ug/L	50	50	50	5	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 2.0
Thallium	ug/L	2	2	2	3.7	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 154 mg CaCO3/L as measured at surface water sample SW-01 collected on February 22, 201 from the North Channel Muskegon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

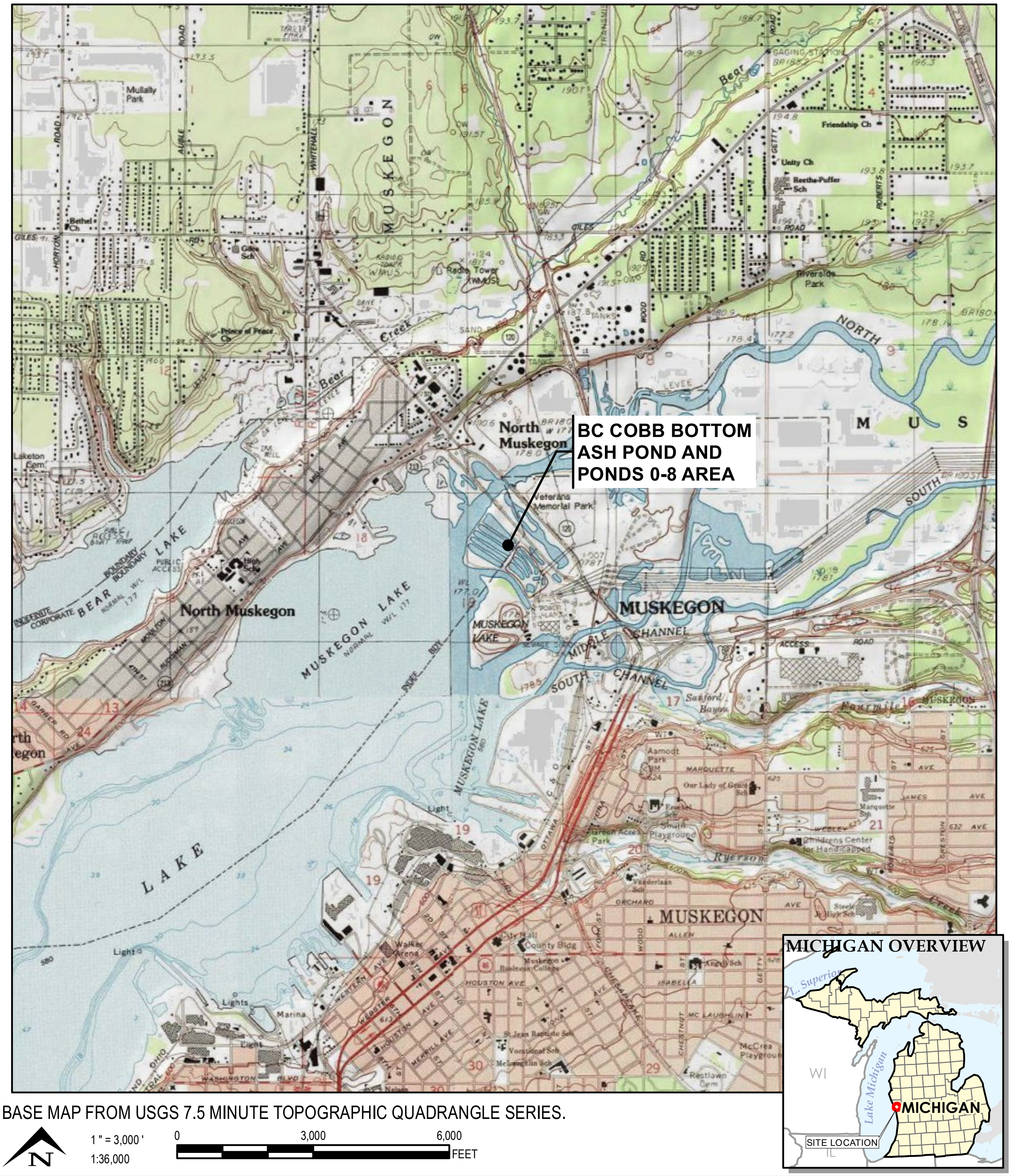
- If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Figures



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

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

0 3,000 6,000
FEET

1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080

TRC - GIS

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB BOTTOM ASH POND AND PONDS 0-8 AREA
MUSKEGON, MICHIGAN

TITLE:

SITE LOCATION MAP

DRAWN BY:	J. PAPEZ
CHECKED BY:	S. HOLMSTROM
APPROVED BY:	G. CROCKFORD
DATE:	NOVEMBER 2018
PROJ. NO.:	269767-001
FILE:	269767-001-020slm.mxd

FIGURE 1

LEGEND

✛	BACKGROUND MONITORING WELL
●	DOWNGRADIENT MONITORING WELL
✛	MONITORING WELL (STATIC WATER LEVEL ONLY)
▭	APPROXIMATE POND BOUNDARY

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
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.

N

0 300 600 Feet

1 " = 300 '

1:3,600

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:

SITE PLAN WITH CCR MONITORING WELL LOCATIONS

DRAWN BY: S. MAJOR
PROJ NO.: 284111-001
CHECKED BY: C. SCIESZKA
APPROVED BY: S. HOLMSTROM
DATE: OCTOBER 2018

FIGURE 2

TRC

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

FILE NO.: 284111-001-011.mxd

TRC - GIS

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

Plot Date: 10/16/2018, 11:13:29 AM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\284111-001-011.mxd

LEGEND

✛	BACKGROUND MONITORING WELL
◆	DOWNGRADIENT MONITORING WELL
✦	MONITORING WELL (STATIC WATER LEVEL ONLY)
▢	APPROXIMATE POND BOUNDARY
(580.85)	GROUNDWATER ELEVATION (FEET, MSL)
∼	GROUNDWATER ELEVATION CONTOUR (0.5' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
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, AND WERE NOT USED TO CONSTRUCT CONTOUR MAP.

N

0 300 600 Feet

1 " = 300 '
1:3,600

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

TITLE:
SHALLOW GROUNDWATER
CONTOUR MAP
APRIL 16, 2018

DRAWN BY: S. MAJOR
PROJ NO.: 284111-001
CHECKED BY: C. SCIESZKA
APPROVED BY: S. HOLMSTROM
DATE: OCTOBER 2018

FIGURE 3

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

FILE NO.: 284111-001-010.mxd

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

Plot Date: 10/16/2018, 11:28:50 AM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\284111-001-010.mxd

LEGEND

⌖	BACKGROUND MONITORING WELL
●	DOWNGRADIENT MONITORING WELL
✦	MONITORING WELL (STATIC WATER LEVEL ONLY)
◯	APPROXIMATE POND BOUNDARY
(580.85)	GROUNDWATER ELEVATION (FEET, MSL)
∼	GROUNDWATER ELEVATION CONTOUR (0.5' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
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 CHRACTERIZED BY WELL SCREENS SET BELOW 555 FEET MSL, AND WERE NOT USED TO CONSTRUCT CONTOUR MAP.

0 300 600 Feet

1 " = 300 '

1:3,600

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:

SHALLOW GROUNDWATER CONTOUR MAP JUNE 11, 2018

DRAWN BY:	S. MAJOR	PROJ NO.:	284111-001
CHECKED BY:	C. SCIESZKA	**FIGURE 4**	
APPROVED BY:	S. HOLMSTROM		
DATE:	OCTOBER 2018		

TRC

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

FILE NO.: 284111-001-009.mxd

TRC - GIS

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

Plot Date: 10/16/2018, 11:24:41 AM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\284111-001-009.mxd

Appendix A
Monitoring Well Installation Logs

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17001

Page 1 of 1

Facility/Project Name: CEC: BC Cobb	Date Drilling Started: 12/6/17	Date Drilling Completed: 12/6/17	Project Number: 269767.0000.0000

Drilling Firm: Stearns	Drilling Method: Sonic	Surface Elev. (ft) 586.1	TOC Elevation (ft) 589.29	Total Depth (ft bgs) 20.0	Borehole Dia. (in) 6

Boring Location: 7 feet west of BCC-MW-15016.

N: 646228.0 E: 12622452.1

Personnel
Logged By - T. Hess
Driller - B. Marshal

Drilling Equipment: Geoprobe 8140 LS

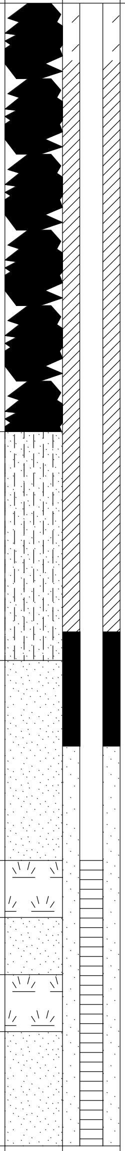
Civil Town/City/or Village: Muskegon

County: Muskegon

State: MI

Water Level Observations:
While Drilling: Date/Time 12/6/17 00:00 ▽ Depth (ft bgs) 10.0
After Drilling: Date/Time 12/7/17 11:35 ▼ Depth (ft bgs) 5.81

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
1 HA	100		0–5	**SANDY COAL ASH** mostly coal ash, some fine to medium sand, dark gray (10YR 4/1), loose, dry.		
2 CS	100		5–10	Change to some woody material at 5.0 feet. ▼ (5.81)		
			7.5	**SILTY SAND WITH ASH** mostly fine to medium sand, some silt and ash, few to little woody material, light brownish gray (10YR 6/2), loose, moist.	SM	
3 CS	100		10–20	▽ Change to saturated at 10.0 feet.		
			11.5	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, moist.	SP	
			15	**PEAT** dark organic woody material (10YR 2/1), brittle, saturated.		
			16	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP	
			17	**PEAT** dark organic woody material (10YR 2/1), brittle, saturated.		
			18	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP	
			20	End of boring at 20.0 feet below ground surface.		



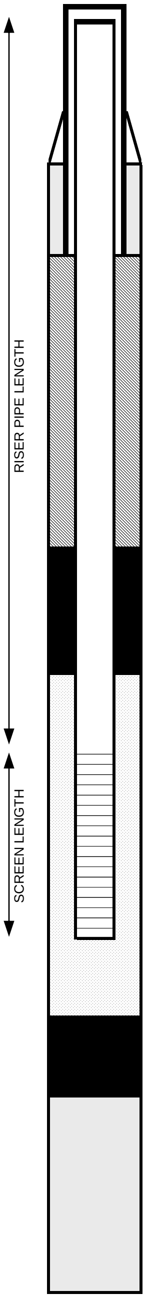
Signature: For Tanner Hess

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

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME:	CEC: BC Cobb	WELL ID:	**BCC-MW-17001**
PROJ. NO:	269767.0000	DATE INSTALLED: 12/6/2017 INSTALLED BY: Tanner Hess	CHECKED BY: CS



ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
589.29	3.1	TOP OF CASING
586.1	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL BENTONITE SLURRY
		GROUT/BACKFILL METHOD TREMIE
18.1		
	11.0	GROUT
		BENTONITE SEAL MATERIAL MEDIUM CHIPS
	13.0	BENTONITE SEAL
571.1	15.0	TOP OF SCREEN
5.00		FILTER PACK MATERIAL MEDIUM, WASHED SAND
566.1	20.0	BOTTOM OF SCREEN
	20.0	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL NA
566.1	20.0	HOLE BOTTOM

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 20 FT.
IN. FROM ___ TO ___ FT.

SURF. CASING DIAMETER: ___ IN. FROM ___ TO ___ FT.
___ IN. FROM ___ TO ___ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS

WATER REMOVED: 9.5 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	23.36	T/PVC	12/6/2017	1653
DTB AFTER DEVELOPING:	23.36	T/PVC	12/6/2017	1727
SWL BEFORE DEVELOPING:	8.99	T/PVC	12/6/2017	1653
SWL AFTER DEVELOPING:	9.59	T/PVC	12/6/2017	1727
OTHER SWL:	8.91	T/PVC	12/7/2017	1135
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

REVISED 11/2013

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17002

Page 1 of 1

Facility/Project Name: CEC: BC Cobb	Date Drilling Started: 12/6/17	Date Drilling Completed: 12/6/17	Project Number: 269767.0000.0000

Drilling Firm: Stearns	Drilling Method: Sonic	Surface Elev. (ft) 585.8	TOC Elevation (ft) 588.79	Total Depth (ft bgs) 19.0	Borehole Dia. (in) 6

Boring Location: 6 feet southeast of BCC-MW-15017.
N: 646348.8 E: 12622087.2

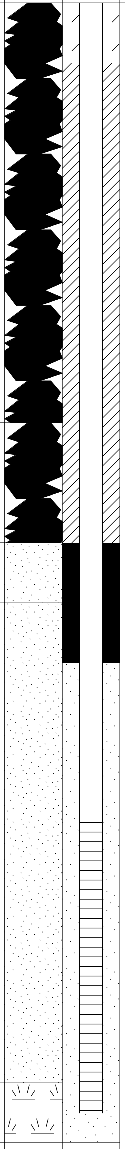
Personnel
Logged By - T. Hess
Driller - B. Marshal

Drilling Equipment: Geoprobe 8140 LS

Civil Town/City/or Village: Muskegon
County: Muskegon
State: MI

Water Level Observations:
While Drilling: Date/Time 12/6/17 00:00 ▽ Depth (ft bgs) 10.0
After Drilling: Date/Time 12/7/17 11:28 ▼ Depth (ft bgs) 5.43

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		2 4 ▼ 6	**SANDY COAL ASH** mostly coal ash, some fine to medium sand, trace gravel, dark gray (10YR 4/1), loose, dry.				
2 CS	100		8	**COAL ASH** mostly coal ash, dark gray (10YR 4/1), loose, dry.				
3 CS	100		▽	**SAND WITH COAL ASH** mostly fine to medium sand, little coal ash, dark gray (10YR 4/1), loose, dry.	SP			
			10 12 14 16	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
			18	**PEAT** mostly organic material, some silt and woody material, black (10YR 2/1), saturated.				
				End of boring at 19.0 feet below ground surface.				



Signature: Saul S. Holmstrom
For Tanner Hess

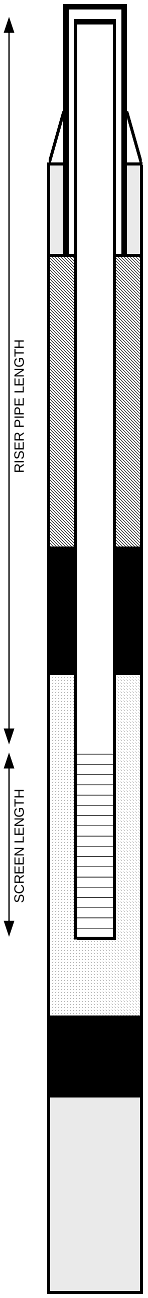
Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, MI 48108
(734) 971-7080
Fax (734) 971-9022

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb		WELL ID:	**BCC-MW-17002**
PROJ. NO: 269767.0000	DATE INSTALLED: 12/6/2017 INSTALLED BY: Tanner Hess		CHECKED BY: CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
588.79	3.0	TOP OF CASING
585.8	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL BENTONITE SLURRY
		GROUT/BACKFILL METHOD TREMIE
16.5		
	9.0	GROUT
		BENTONITE SEAL MATERIAL MEDIUM CHIPS
	11.0	BENTONITE SEAL
572.3	13.5	TOP OF SCREEN
5.00		FILTER PACK MATERIAL MEDIUM, WASHED SAND
567.3	18.5	BOTTOM OF SCREEN
	18.5	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL NATURAL COLLAPSE
566.8	19.0	HOLE BOTTOM



NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 18 FT.
IN. FROM TO FT.

SURF. CASING DIAMETER: IN. FROM TO FT.
IN. FROM TO FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS
WATER REMOVED: 9.5 GALLONS
WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY
COLOR BEFORE: LIGHT BROWN
CLARITY AFTER: CLEAR
COLOR AFTER: CLEAR

ODOR (IF PRESENT): SLIGHT SULFUR

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	21.49	T/PVC	12/6/2017	1533
DTB AFTER DEVELOPING:	21.49	T/PVC	12/6/2017	1615
SWL BEFORE DEVELOPING:	8.49	T/PVC	12/6/2017	1533
SWL AFTER DEVELOPING:	8.58	T/PVC	12/6/2017	1615
OTHER SWL:	8.43	T/PVC	12/7/2017	1128
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO
PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO
LOCK KEY NUMBER: Consumers

REVISED 11/2013

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17003

Page 1 of 1

Facility/Project Name: CEC: BC Cobb		Date Drilling Started: 12/5/17	Date Drilling Completed: 12/5/17	Project Number: 269767.0000.0000
Drilling Firm: Stearns	Drilling Method: Sonic	Surface Elev. (ft) 589.3	TOC Elevation (ft) 592.37	Total Depth (ft bgs) 22.0
				Borehole Dia. (in) 6

Boring Location: 7.5 feet northeast of BCC-MW-15018.

N: 646794.9 E: 12622184.8

Personnel
Logged By - T. Hess
Driller - B. Marshal

Drilling Equipment: Geoprobe 8140 LS

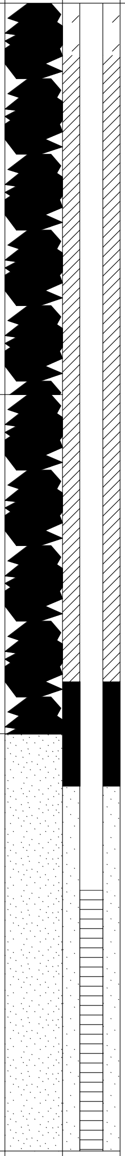
Civil Town/City/or Village: Muskegon

County: Muskegon

State: MI

Water Level Observations:
While Drilling: Date/Time 12/5/17 00:00 ▽ Depth (ft bgs) 11.0
After Drilling: Date/Time 12/7/17 11:24 ▼ Depth (ft bgs) 9.07

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		2 4	**SANDY COAL ASH** mostly coal ash, some fine to medium sand, trace gravel, brown (10YR 4/3), loose, dry.				
2 CS	100		6 8	**COAL ASH** mostly coal ash, dark gray (10YR 4/1), loose, dry.				
			▼					
3 CS	100		10					
			▽	Change to saturated at 11.0 feet.				
			12 14	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
			16 18					
4 CS	100		20					
			22	End of boring at 22.0 feet below ground surface.				



SOIL BORING WELL CONSTRUCTION LOG BCC GSI WELLS.GPJ TRC_CORP_INCHES.GDT 2/7/18

Signature: Saul B. Holmstrom
For Tanner Hess

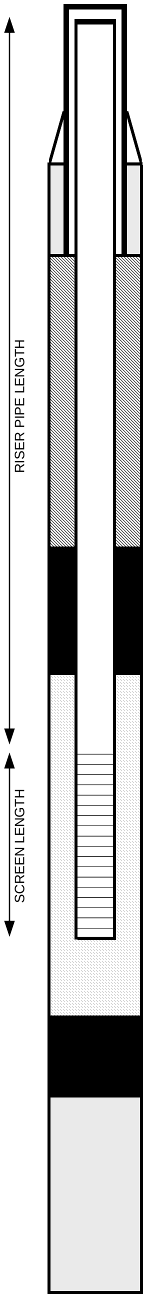
Firm: TRC Environmental Corporation (734) 971-7080
1540 Eisenhower Place Ann Arbor, MI 48108 Fax (734) 971-9022

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb		WELL ID:	**BCC-MW-17003**
PROJ. NO: 269767.0000	DATE INSTALLED: 12/6/2017 INSTALLED BY: Tanner Hess	CHECKED BY: CS	

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)
592.37	2.9 TOP OF CASING
589.3	0.0 GROUND SURFACE
	1.0 CEMENT SURFACE PLUG
	GROUT/BACKFILL MATERIAL BENTONITE SLURRY
19.9	GROUT/BACKFILL METHOD TREMIE
	13.0 GROUT
	BENTONITE SEAL MATERIAL MEDIUM CHIPS
	15.0 BENTONITE SEAL
572.3	17.0 TOP OF SCREEN
5.00	FILTER PACK MATERIAL MEDIUM, WASHED SAND
567.3	22.0 BOTTOM OF SCREEN
	22.0 BOTTOM OF FILTER PACK
	NA BENTONITE PLUG
	BACKFILL MATERIAL NA
567.3	22.0 HOLE BOTTOM



NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 22 FT.
IN. FROM TO FT.

SURF. CASING DIAMETER: IN. FROM TO FT.
IN. FROM TO FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS
WATER REMOVED: 9.5 GALLONS
WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY
COLOR BEFORE: BROWN
CLARITY AFTER: CLEAR
COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	25.25	T/PVC	12/6/2017	1258
DTB AFTER DEVELOPING:	25.25	T/PVC	12/6/2017	1337
SWL BEFORE DEVELOPING:	12.05	T/PVC	12/6/2017	1258
SWL AFTER DEVELOPING:	12.10	T/PVC	12/6/2017	1337
OTHER SWL:	11.97	T/PVC	12/7/2017	1124
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO
PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO
LOCK KEY NUMBER: Consumers

REVISED 11/2013

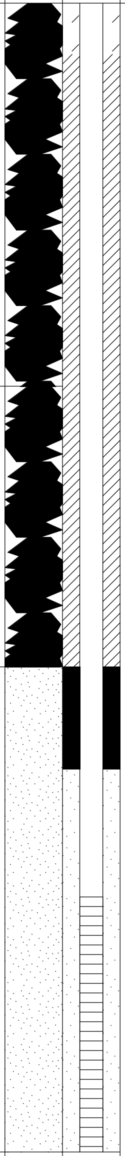
WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17004

Page 1 of 1

Facility/Project Name: CEC: BC Cobb		Date Drilling Started: 12/5/17	Date Drilling Completed: 12/5/17	Project Number: 269767.0000.0000
Drilling Firm: Stearns	Drilling Method: Sonic	Surface Elev. (ft) 589.1	TOC Elevation (ft) 591.84	Total Depth (ft bgs) 22.5 Borehole Dia. (in) 6
Boring Location: 8 feet northeast of BCC-MW-15019. N: 647110.1 E: 12622373.4		Personnel Logged By - T. Hess Driller - B. Marshal		Drilling Equipment: Geoprobe 8140 LS
Civil Town/City/or Village: Muskegon	County: Muskegon State: MI	Water Level Observations: While Drilling: Date/Time 12/5/17 00:00 ▽ Depth (ft bgs) 10.0 After Drilling: Date/Time 12/7/17 11:20 ▼ Depth (ft bgs) 9.03		

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		2 4	**SANDY COAL ASH** mostly coal ash, some fine to medium sand, trace gravel, brown (10YR 4/3), loose, dry.				
2 CS	0		6 8	**COAL ASH** mostly coal ash, dark gray (10YR 4/1), loose. ▼				No recovery from 5.0 to 10.0 feet.
3 CS	100		10 12 14 16 18	▽ Change to saturated at 10.0 feet. **SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
4 CS	80		20 22					
				End of boring at 22.5 feet below ground surface.				



Signature: For Tanner Hess

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

Checked By: C. Scieszka

SOIL BORING WELL CONSTRUCTION LOG BCC GSI WELLS.GPJ TRC_CORP_INCHES.GDT 2/7/18

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb

WELL ID: **BCC-MW-17004**

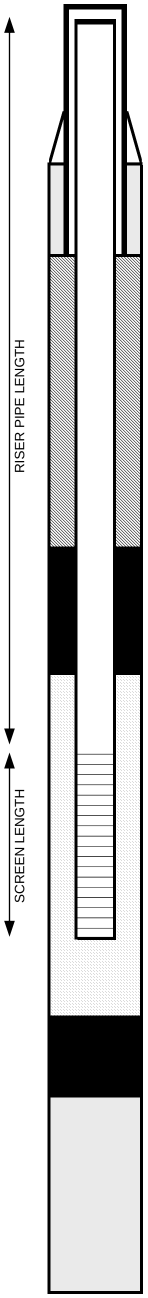
PROJ. NO: 269767.0000

DATE INSTALLED: 12/5/2017

INSTALLED BY: Tanner Hess

CHECKED BY: CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
591.84	2.6	TOP OF CASING
589.1	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL BENTONITE SLURRY
		GROUT/BACKFILL METHOD TREMIE
20.1		
	13.0	GROUT
		BENTONITE SEAL MATERIAL MEDIUM CHIPS
	15.0	BENTONITE SEAL
571.6	17.5	TOP OF SCREEN
		FILTER PACK MATERIAL MEDIUM, WASHED SAND
5.00		
566.6	22.5	BOTTOM OF SCREEN
	22.5	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL NA
566.6	22.5	HOLE BOTTOM



NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 22 FT.
IN. FROM ___ TO ___ FT.

SURF. CASING DIAMETER: ___ IN. FROM ___ TO ___ FT.
___ IN. FROM ___ TO ___ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS

WATER REMOVED: 9.5 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	25.27	T/PVC	12/5/2017	1544
DTB AFTER DEVELOPING:	25.27	T/PVC	12/5/2017	1625
SWL BEFORE DEVELOPING:	11.20	T/PVC	12/5/2017	1544
SWL AFTER DEVELOPING:	11.30	T/PVC	12/5/2017	1625
OTHER SWL:	11.63	T/PVC	12/7/2017	1120
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17005

Page 1 of 1

Facility/Project Name: CEC: BC Cobb	Date Drilling Started: 12/4/17	Date Drilling Completed: 12/5/17	Project Number: 269767.0000.0000

Drilling Firm: Stearns	Drilling Method: Sonic	Surface Elev. (ft) 589.3	TOC Elevation (ft) 592.42	Total Depth (ft bgs) 30.0	Borehole Dia. (in) 6

Boring Location: 8 feet southwest of BCC-MW-15020.
N: 647433.9 E: 12622619.7

Personnel
Logged By - T. Hess
Driller - B. Marshal

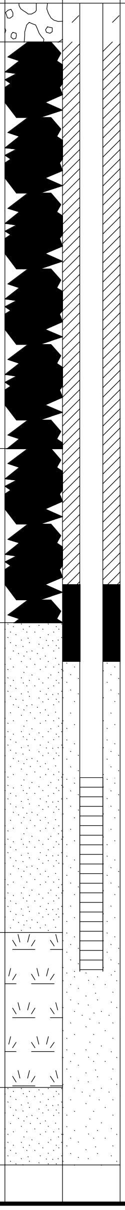
Drilling Equipment: Geoprobe 8140 LS

Civil Town/City/or Village: Muskegon	County: Muskegon	State: MI

Water Level Observations:
While Drilling: Date/Time 12/4/17 00:00 ▽ Depth (ft bgs) 11.5
After Drilling: Date/Time 12/7/17 11:17 ▼ Depth (ft bgs) 9.96

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS
1 HA	100	
2 CS	50	
3 CS	100	
4 CS	100	

DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
0	**GRAVEL** mostly gravel, white (10YR 8/1), road base.	GP	
1	**SANDY COAL ASH** mostly coal ash, some fine to medium sand, trace gravel, brown (10YR 4/3), loose, dry.		
8	Change to very dark gray (10YR 3/1) at 8.0 feet.		
9.96	▼		
11.5	▽		
11.5	**COAL ASH** mostly coal ash, dark gray (10YR 4/1), loose, saturated.		
16	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP	
24	**PEAT** mostly organic material, some silt and woody material, black (10YR 2/1), saturated.		
28	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP	
30	End of boring at 30.0 feet below ground surface.		



Signature:
For Tanner Hess

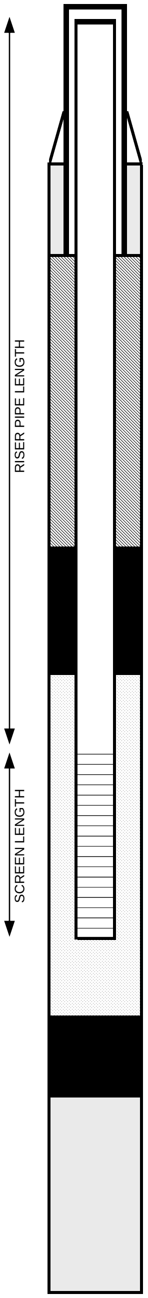
Firm: TRC Environmental Corporation (734) 971-7080
1540 Eisenhower Place Ann Arbor, MI 48108 Fax (734) 971-9022

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb			WELL ID: **BCC-MW-17005**
PROJ. NO: 269767.0000	DATE INSTALLED: 12/5/2017	INSTALLED BY: Tanner Hess	CHECKED BY: CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
592.42	3.1	TOP OF CASING
589.3	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL BENTONITE SLURRY
		GROUT/BACKFILL METHOD TREMIE
23.1		
	15.0	GROUT
		BENTONITE SEAL MATERIAL MEDIUM CHIPS
	17.0	BENTONITE SEAL
569.3	20.0	TOP OF SCREEN
		FILTER PACK MATERIAL MEDIUM, WASHED SAND
5.00		
564.3	25.0	BOTTOM OF SCREEN
	25.0	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL NATURAL COLLAPSE
559.3	30.0	HOLE BOTTOM



NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 24 FT.
IN. FROM TO FT.

SURF. CASING DIAMETER: IN. FROM TO FT.
IN. FROM TO FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS

WATER REMOVED: 9.5 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	27.89	T/PVC	12/5/2017	1400
DTB AFTER DEVELOPING:	27.89	T/PVC	12/5/2017	1445
SWL BEFORE DEVELOPING:	12.73	T/PVC	12/5/2017	1400
SWL AFTER DEVELOPING:	12.80	T/PVC	12/5/2017	1445
OTHER SWL:	13.06	T/PVC	12/7/2017	1117
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

REVISED 11/2013

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17006

Page 1 of 1

Facility/Project Name: CEC: BC Cobb	Date Drilling Started: 12/4/17	Date Drilling Completed: 12/4/17	Project Number: 269767.0000.0000

Drilling Firm: Stearns	Drilling Method: Sonic	Surface Elev. (ft) 590.5	TOC Elevation (ft) 593.78	Total Depth (ft bgs) 30.0	Borehole Dia. (in) 6

Boring Location: 9 feet west of BCC-MW-15021.
N: 646657.7 E: 12623301.3

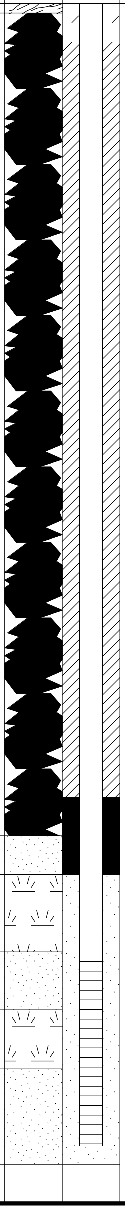
Personnel
Logged By - T. Hess
Driller - B. Marshal

Drilling Equipment: Geoprobe 8140 LS

Civil Town/City/or Village: Muskegon
County: Muskegon
State: MI

Water Level Observations:
While Drilling: Date/Time 12/4/17 00:00 ▽ Depth (ft bgs) 11.5
After Drilling: Date/Time 12/7/17 11:11 ▼ Depth (ft bgs) 13.5

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		0–5	**TOPSOIL** black (10YR 2/1). **COAL ASH** mostly coal ash, dark gray (10YR 4/1), fine, soft, loose.				
2 CS	100		5–10	Change to moist at 9.0 feet.				
3 CS	100		10–20	Change to dry at 10.0 feet. ▽ Change to saturated at 11.5 feet. ▼				
4 CS	100		20–30	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
				PEAT mostly organic material, some silt and woody material, black (10YR 2/1), saturated.				
			25	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
				PEAT mostly organic material, some silt and woody material, black (10YR 2/1), saturated.				
				SAND mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
			30	End of boring at 30.0 feet below ground surface.				



Signature: For Tanner Hess

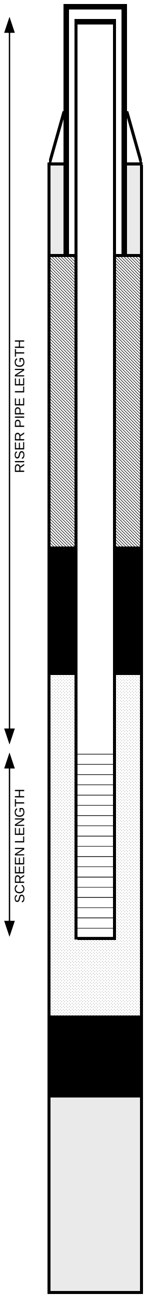
Firm: TRC Environmental Corporation (734) 971-7080
1540 Eisenhower Place Ann Arbor, MI 48108 Fax (734) 971-9022

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME:	CEC: BC Cobb	WELL ID:	**BCC-MW-17006**
PROJ. NO: 269767.0000	DATE INSTALLED: 12/4/2017	INSTALLED BY: Tanner Hess	CHECKED BY: CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
593.78	3.3	TOP OF CASING
590.5	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL BENTONITE SLURRY
		GROUT/BACKFILL METHOD TREMIE
27.8		
	20.5	GROUT
		BENTONITE SEAL MATERIAL MEDIUM CHIPS
	22.5	BENTONITE SEAL
566.0	24.5	TOP OF SCREEN
		FILTER PACK MATERIAL MEDIUM, WASHED SAND
5.00		
561.0	29.5	BOTTOM OF SCREEN
	29.5	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL NATURAL COLLAPSE
560.5	30.0	HOLE BOTTOM



NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 30 FT.
IN. FROM ____ TO ____ FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.75 HOURS
WATER REMOVED: 14.25 GALLONS
WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY
COLOR BEFORE: BROWN
CLARITY AFTER: CLEAR
COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	32.69	T/PVC	12/5/2017	1153
DTB AFTER DEVELOPING:	32.69	T/PVC	12/5/2017	1315
SWL BEFORE DEVELOPING:	16.60	T/PVC	12/5/2017	1153
SWL AFTER DEVELOPING:	16.90	T/PVC	12/5/2017	1315
OTHER SWL:	16.80	T/PVC	12/7/2017	1111
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO
PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO
LOCK KEY NUMBER: Consumers

REVISED 11/2013

Appendix B
Data Quality Review

Laboratory Data Quality Review
Groundwater Monitoring Event April 2018
CEC BC Cobb

Groundwater samples were collected by TRC for the April 2018 sampling event. Samples were analyzed for anions and total metals by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and for radium by Pace located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory reports 4610965, 4610966, and 4611064.

During the April 2018 sampling event, a groundwater sample was collected from each of the following wells:

- BCC-MW-15002
- BCC-MW-15003
- BCC-MW-15004
- BCC-MW-15005
- BCC-MW-15006
- BCC-MW-15007
- BCC-MW-15008
- BCC-MW-15009
- BCC-MW-15010
- BCC-MW-15011
- BCC-MW-15012
- BCC-MW-15013
- BCC-MW-15014
- 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

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride)	EPA 300.0
Total Metals	EPA 6020A, EPA 6010C, EPA 7470A
Radium (Radium-226, Radium-228, Total Radium)	EPA 903.1, EPA 904.0

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

Data Usability Review Procedure

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

- Sample receipt;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field blanks are used to assess potential contamination arising from field procedures;
- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation, are noted below.

- Appendix IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- A method blank was analyzed with each analytical batch; no analytes were detected in the blank samples.

- Three equipment blanks (EB-01, EB-02, and EB-03) and two field blanks (FB-01 and FB-02) were collected.
  - Antimony was detected in FB-01 at a concentration of 1.4 μg/L. The concentration of antimony in sample BCC-MW-15014 was <10x the blank concentration and therefore may be a false positive (see attached table); however, the antimony concentration detected at BCC-MW-15014 was within the range of historical concentrations observed at that well.
  - Normalized absolute difference comparisons between blank and sample that are between 1.96 and 2.58 may indicate biased high results and normalized absolute differences <1.96 may indicate a false positive sample result, as summarized in the attached table.
    - Radium-226 was detected in the equipment blank EB-02 at 0.491 ± 0.369 pCi/L and in the field blank FB-01 at 0.273 ± 0.313 pCi/L. Radium-226 sample results are potentially impacted (see attached table); however, the radium-226 concentrations were consistent with the range of historical results.
- LCS recoveries were within laboratory control limits for all analytes.
- MS/MSDs were performed on samples BCC-MW-15003, BCC-MW-15009, and BCC-MW-15022.
  - MS/MSDs were performed on BCC-MW-15009 for batch 21132 for metals. The MS/MSD recoveries for selenium were below the lower laboratory control limit. The selenium results for samples analyzed in the same batch may be biased low (see attached table); however, the selenium concentrations for batch 21132 samples were consistent with the range of historical results.
  - MS/MSDs were performed on BCC-MW-15022 for batch 21833 for mercury. The MS had a recovery that was below the lower laboratory control limit. Mercury results for samples analyzed in the same batch may be biased low (see attached table); however, the mercury concentrations for batch 21833 samples were consistent with the range of historical results.
  - MS/MSD was performed on BCC-MW-15009 for batch 21061 for fluoride. The MSD had a recovery that was below the lower laboratory control limit. Fluoride results for samples analyzed in the same batch may be biased low (see attached table); however, the fluoride concentrations for batch 21061 samples were consistent with the range of historical results.
- Laboratory duplicates were performed on BCC-MW-15003, BCC-MW-15009, and BCC-MW-15022 for fluoride. Relative percent differences (RPDs) were within laboratory control limits.
- Dup-01 corresponds to sample MW-15013, Dup-02 corresponds to sample BCC-MW-15018, and Dup-03 corresponds to sample BCC-MW-15008. RPDs were within QC limits.

Attachment B

Summary of Data Non-Conformances for Groundwater Analytical Data

BC Cobb – RCRA CCR Monitoring Program

Muskegon, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
BCC-MW-15014_20180417	4/17/2018	Antimony	Detection in field blank (FB-01). Sample result ≤10X the blank concentration. Results may be false positives.
BCC-MW-15002_20180419	4/19/2018	Radium-226	Detection in equipment blank EB-02 and field blank FB-01. Normalized absolute difference between blank and sample result <1.96. Results may be false positives.
BCC-MW-15003_20180419	4/19/2018		
BCC-MW-15004_20180419	4/19/2018		
BCC-MW-15008_20180418	4/18/2018		
BCC-MW-15016_20180417	4/17/2018		
BCC-MW-15017_20180417	4/17/2018		
BCC-MW-15020_20180418	4/18/2018		
BCC-MW-15022_20180418	4/18/2018		
Dup-02_20180418	4/18/2018		
BCC-MW-15009_20180416	4/16/2018	Fluoride	Recovery in the MSD was below acceptance criteria. Results may be biased low.
BCC-MW-15010_20180416	4/16/2018		
BCC-MW-15011_20180416	4/16/2018		
BCC-MW-15012_20180417	4/17/2018		
BCC-MW-15013_20180417	4/17/2018		
BCC-MW-15014_20180417	4/17/2018		
BCC-MW-15015_20180417	4/17/2018		
BCC-MW-15016_20180417	4/17/2018		
BCC-MW-15017_20180417	4/17/2018		
Dup-01_20180417	4/17/2018		
EB-01_20180417	4/17/2018		
FB-01_20180417	4/17/2018		

Attachment B

Summary of Data Non-Conformances for Groundwater Analytical Data

BC Cobb – RCRA CCR Monitoring Program

Muskegon, Michigan

Samples	**Collection Date**	**Analyte**	**Non-Conformance/Issue**
BCC-MW-15009_20180416	4/16/2018	Selenium	Recovery in the MS/MSD was below acceptance criteria. Results may be biased low.
BCC-MW-15010_20180416	4/16/2018		
BCC-MW-15011_20180416	4/16/2018		
BCC-MW-15012_20180417	4/17/2018		
BCC-MW-15013_20180417	4/17/2018		
BCC-MW-15014_20180417	4/17/2018		
BCC-MW-15015_20180417	4/17/2018		
BCC-MW-15016_20180417	4/17/2018		
BCC-MW-15017_20180417	4/17/2018		
Dup-01_20180417	4/17/2018		
BCC-MW-15005_20180419	4/19/2018	Mercury	Recovery in the MS was below acceptance criteria. Results may be biased low.
BCC-MW-15006_20180419	4/19/2018		
BCC-MW-15007_20180419	4/19/2018		
BCC-MW-15008_20180418	4/18/2018		
BCC-MW-15018_20180418	4/18/2018		
BCC-MW-15019_20180418	4/18/2018		
BCC-MW-15020_20180418	4/18/2018		
BCC-MW-15021_20180418	4/18/2018		
BCC-MW-15022_20180418	4/18/2018		
BCC-MW-15023_20180418	4/18/2018		
Dup-02_20180418	4/18/2018		
Dup-03_20180418	4/18/2018		
EB-02_20180418	4/18/2018		
FB-02_20180418	4/18/2018		

Laboratory Data Quality Review
Groundwater Monitoring Event June 2018
CEC BC Cobb

Groundwater samples were collected by TRC for the June 2018 sampling event. Samples were analyzed for anions, total dissolved solids, and total metals by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and for radium by Pace located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory reports 4613592, 4613593, 4613433, and 4613432.

During the June 2018 sampling event, a groundwater sample was collected from each of the following wells:

- BCC-MW-15002
- BCC-MW-15003
- BCC-MW-15004
- BCC-MW-15005
- BCC-MW-15006
- BCC-MW-15007
- BCC-MW-15008
- BCC-MW-15009
- BCC-MW-15010
- BCC-MW-15011
- BCC-MW-15012
- BCC-MW-15013
- BCC-MW-15014
- 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

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Total Dissolved Solids	SM 2540C-11
Total Metals	EPA 6020A, EPA 6010C, EPA 7470A
Radium (Radium-226, Radium-228, Total Radium)	EPA 903.1, EPA 904.0

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

Data Usability Review Procedure

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

- Sample receipt;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field blanks are used to assess potential contamination arising from field procedures;
- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation, are noted below.

- Appendix IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- A method blank was analyzed with each analytical batch
    - Normalized absolute difference comparisons between blank and sample that are between 1.96 and 2.58 may indicate biased high results and normalized absolute differences <1.96 may indicate a false positive sample result, as summarized in the attached table.
        - Radium-228 was detected in the method blank in batch 302940 at a concentration 2.86 ± 1.71 pCi/L. Radium-228 sample results are potentially impacted (see attached table); however, radium-228 concentrations from batch 302940 samples were within the range of historical radium-228 concentrations, with the exception of BCC-MW-15018 and BCC-MW-15020. Radium at BCC-MW-15018 and BCC-MW-15020 were above the range of historical results.
- Three equipment blanks (EB-01, EB-02, and EB-03) and two field blanks (FB-01 and FB-02) were collected.
    - Barium was detected in FB-02 at a concentration of 1.1 µg/L. The concentrations of barium in samples associated with the field blank were >10x the blank concentration. Therefore, there is no impact to data usability.
    - Normalized absolute difference comparisons between blank and sample that are between 1.96 and 2.58 may indicate biased high results and normalized absolute differences <1.96 may indicate a false positive sample result, as summarized in the attached table.
        - Radium-226 was detected in the equipment blank EB-02 at 0.211 ± 0.242 pCi/L. Radium-226 sample results are potentially impacted (see attached table); however, the concentrations of radium-226 were within range of historical radium-226 concentrations. Data are deemed usable for the intended purpose.
- LCS recoveries were within laboratory control limits for all analytes.
- MS/MSDs were performed on samples BCC-MW-15008, BCC-MW-15009, and BCC-MW-15022.
    - The boron recovery in the MS performed on BCC-MW-15009 for batch 26308 was below the lower laboratory control limit. However, the boron concentration in the parent sample was >4x the spike concentration; therefore, the laboratory control limit is not applicable. The selenium recoveries in the MS/MSD in this batch were below the lower laboratory control limit. The selenium results for samples analyzed in the same batch may be biased low (see attached table); however, the selenium concentrations observed in batch 26308 samples were within the range of historical selenium concentrations, with the exception of BCC-MW-15012. The BCC-MW-15012 selenium concentration was slightly above the historical range.

  - The barium recovery in the MSD was below the lower laboratory control limit for batch 26122; however, the barium concentration in the parent sample was >4x the spike concentration; therefore, the laboratory control limits are not applicable.
  - The sulfate recoveries in the MS/MSD were above the upper laboratory control limit in batch 25977. The positive sulfate results for samples analyzed in the same batch may be biased high (see attached table); however, the concentrations of sulfate observed in batch 25977 samples were within the range of historical sulfate concentrations with the exception of BCC-MW-15012. Sulfate is suspect and potentially an outlier, it was detected at BCC-MW-15012 at 355 mg/L, an order of magnitude higher than the historical range of sulfate concentrations at that well.
  - The radium-228 recoveries in the MS/MSD performed on BCC-MW-15009 for batch 302943 were low and outside of the default acceptance criteria for MS/MSD recovery. The low MS/MSD recovery is due to sample matrix interference as indicated by a low Ba-133 tracer yield on the MS, MSD, and parent sample. The radium-228 results for this sample may be biased low (see attached table); however, the radium-228 concentration detected in BCC-MW-15019 was measured at its highest concentration to date.
- Laboratory duplicates were performed on BCC-MW-15009 for anions and total dissolved solids, BCC-MW-15015 for total dissolved solids, BCC-MW-22 for anions and total dissolved solids (TDS), and Dup-02 for anions. Relative percent differences (RPDs) were within laboratory control limits.
- Field duplicate sample Dup-01 corresponds to sample BCC-MW-15020, Dup-02 corresponds to sample BCC-MW-15017, and Dup-03 corresponds to sample BCC-MW-15013. RPDs were within QC limits.

Attachment B

Summary of Data Non-Conformances for Groundwater Analytical Data
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
BCC-MW-15019_20180612	6/12/2018	Radium-228	Detection in method blank. Normalized absolute difference between blank and sample result <1.96. Results may be false positives.
BCC-MW-15018_20180612	6/12/2018		
Dup-01_20180612	6/12/2018		
BCC-MW-15021_20180612	6/12/2018		
BCC-MW-15020_20180612	6/12/2018		
BCC-MW-15016_20180612	6/12/2018		
Dup-02_20180612	6/12/2018		
BCC-MW-15017_20180612	6/12/2018		
EB-02_20180613	6/13/2018	Radium-226	Detection in equipment blank EB-02. Normalized absolute difference between blank and sample result <1.96. Results may be false positives.
BCC-MW-15003_20180614	6/14/2018		
BCC-MW-15010_20180614	6/14/2018		
BCC-MW-15011_20180613	6/13/2018		
BCC-MW-15002_20180614	6/14/2018	Selenium	Recoveries in the MS/MSD were below acceptance criteria. Results may be biased low.
BCC-MW-15003_20180614	6/14/2018		
BCC-MW-15005_20180614	6/14/2018		
BCC-MW-15006_20180614	6/14/2018		
BCC-MW-15007_20180614	6/14/2018		
BCC-MW-15008_20180614	6/14/2018		
BCC-MW-15009_20180613	6/13/2018		
BCC-MW-15010_20180614	6/14/2018		
BCC-MW-15011_20180613	6/13/2018		
BCC-MW-15012_20180613	6/13/2018		
BCC-MW-15013_20180613	6/13/2018		
BCC-MW-15014_20180613	6/13/2018		
BCC-MW-15015_20180613	6/13/2018		
Dup-03_20180613	6/13/2018		
EB-02_20180613	6/13/2018		
EB-03_20180613	6/13/2018		
FB-02_20180613	6/13/2018		

Attachment B

Summary of Data Non-Conformances for Groundwater Analytical Data
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Samples	**Collection Date**	**Analyte**	**Non-Conformance/Issue**
BCC-MW-15002_20180614	6/14/2018	Sulfate	Recoveries in the MS/MSD were above acceptance criteria. Results may be biased high.
BCC-MW-15005_20180614	6/14/2018		
BCC-MW-15006_20180614	6/14/2018		
BCC-MW-15007_20180614	6/14/2018		
BCC-MW-15010_20180614	6/14/2018		
BCC-MW-15011_20180613	6/13/2018		
BCC-MW-15012_20180613	6/13/2018		
Dup-03_20180613	6/13/2018		
BCC-MW-15009_20180613	6/13/2018	Radium-228	Recoveries in the MS/MSD were below acceptance criteria. Results may be biased low.

Laboratory Data Quality Review
Groundwater Monitoring Event December 2017
CEC BC Cobb

Groundwater samples were collected by TRC for the December 2017 sampling event. Samples were analyzed for anions, total metals, total dissolved solids, and alkalinity by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and radium-226, radium-228, and total radium by Pace, located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory report 465626.

During the December 2017 sampling event, a groundwater sample was collected from each of the following wells:

- BCC-MW-17001
- BCC-MW-17002
- BCC-MW-17003
- BCC-MW-17004
- BCC-MW-17005
- BCC-MW-17006

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Chloride, Fluoride, Sulfate)	EPA 300.0
Total Metals	EPA 6020A, EPA 6010C, EPA 7470A
Total Dissolved Solids	SM 2540C
Radium-226, Radium-228, and Total Radium	EPA 903.1, EPA 904.0

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

Data Usability Review Procedure

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

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

- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD). Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Reporting limits (RLs) compared to project-required RLs;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes;
- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation are noted below.

QA/QC Sample Summary:

- One equipment blank (EB-01) and one field blank (FB-01) were collected; no analytes were detected in the blank samples. Sample FB-01 was not preserved properly based on laboratory pH readings.
- Dup-01 corresponds to BCC-MW-17005; relative percent differences (RPDs) between the parent and duplicate sample were within the QC limits with the following exception:
    - The RPD for radium-226 for the sample duplicate pair (BCC-MW-17005/Dup-01) exceeded the 20% acceptance limit. In addition, the duplicate error ratio (DER) was calculated to further evaluate precision. The DER was within acceptance limits. Sample precision for radium-226 for the field duplicate pair is acceptable. Data usability is not affected.
- No target analytes were detected in the method blanks.
- LCS recoveries were within laboratory control limits.

- MS/MSD analyses were performed on samples BCC-MW-17006 and BCC-MW-17002.
  - MS/MSD analyses were performed on BCC-MW-17006 for batch 11511. The recoveries for sulfate in the MS/MSD performed on BCC-MW-17006 were below the lower laboratory control limit. The sulfate results for samples analyzed in the same batch may be biased low (see attached table).
  - MS/MSD analyses were performed on BCC-MW-17006 for batch 11544. The boron recoveries in the MS/MSD were above the upper laboratory control limit; however, the boron concentration in the parent sample was >4x the spike concentration, therefore, the laboratory control limits are not applicable.
- Laboratory duplicates were performed on samples BCC-MW-17002 and BCC-MW-17006 for anions, total dissolved solids, and alkalinity. The RPDs for the laboratory duplicates were within the QC limits.

Attachment B

Summary of Data Non-Conformances for Groundwater Analytical Data
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Samples	**Collection Date**	**Analyte**	**Non-Conformance/Issue**
BCC-MW-17001	12/7/2017	Sulfate	Recovery in the MS/MSD was below acceptance criteria. Results may be biased low.
BCC-MW-17002	12/7/2017		
BCC-MW-17003	12/7/2017		
BCC-MW-17004	12/6/2017		
BCC-MW-17005	12/6/2017		
BCC-MW-17006	12/6/2017		
FB-01	12/6/2017		
Dup-01	12/6/2017		
EB-01	12/6/2017		

Laboratory Data Quality Review
Groundwater Monitoring Event February 2018
CEC BC Cobb

Groundwater samples were collected by TRC for the February 2018 sampling event. Samples were analyzed for anions, total dissolved solids, alkalinity, and total metals by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and for radium by Pace located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory reports 468629 and 468630.

During the February 2018 sampling event, a groundwater sample was collected from each of the following wells:

- BCC-MW-17001
- BCC-MW-17002
- BCC-MW-17003
- BCC-MW-17004
- BCC-MW-17005
- BCC-MW-17006

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Alkalinity	SM 2320B-11
Total Dissolved Solids	SM 2540C-11
Total Metals	EPA 6020A, EPA 6010C, EPA 7470A
Radium (Radium-226, Radium-228, Total Radium)	EPA 903.1, EPA 904.0

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

Data Usability Review Procedure

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

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

- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation, are noted below.

- Appendix IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- Sample receipt: Although the temperature was recorded as <6°C for the temperature blanks in laboratory reports 468629, some samples had measured temperatures >6°C. Not all samples were collected on the day of laboratory receipt but were kept on ice until delivery to the laboratory. The coolers were hand delivered to the courier and received by the laboratory on the day sampling concluded and contained ice upon receipt; thus, there was no impact to data usability
- Potassium was detected in the method blank associated with batch 16334 at a concentration of 1 mg/L. Potassium results for samples analyzed in the same batch with concentrations ≤10x the method blank concentration may be false positives (see attached table). The potassium concentration detected in sample BCC-MW-17001 was ≤10x the method blank concentration, the potassium result may be a false positive.

- An equipment blank (EB-01) and a field blank (FB-01) were collected; no analytes were detected in the blank samples.
- LCS recoveries were within laboratory control limits for all analytes.
- MS/MSDs were performed on samples BCC-MW-17001 and BCC-MW-17004.
    - MS/MSDs were performed on BCC-MW-17004 for batch 16473 for 6020A metals. The MS recovery for boron was below the lower laboratory control limit. The boron concentration in the parent sample was >4x the spike concentrations; therefore, the laboratory control limits are not applicable. Data usability was not affected.
- Laboratory duplicates were performed on BCC-MW-17004 for anions, alkalinity, and total dissolved solids. Relative percent differences (RPDs) were within laboratory control limits.
- The field duplicate pair samples were Dup-01 and BCC-MW-17005. RPDs were within QC limits.

Attachment B

Summary of Data Non-Conformances for Groundwater Analytical Data
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
BCC-MW-17001_20180220	2/20/2018	Potassium	Detection in method blank. Results with concentrations ≤10x the method blank concentration may be false positives.

Laboratory Data Quality Review
Groundwater Monitoring Event June 2018
CEC BC Cobb

Groundwater samples were collected by TRC for the June 2018 sampling event. Samples were analyzed for anions, total dissolved solids, alkalinity, and total metals by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and for radium by Pace located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory reports 4613648 and 4613649.

During the June 2018 sampling event, a groundwater sample was collected from each of the following wells:

- BCC-MW-17001
- BCC-MW-17002
- BCC-MW-17003
- BCC-MW-17004
- BCC-MW-17005
- BCC-MW-17006

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Alkalinity	SM 2320B-11
Total Dissolved Solids	SM 2540C-11
Total Metals	EPA 6020A, EPA 6010C, EPA 7470A
Radium (Radium-226, Radium-228, Total Radium)	EPA 903.1, EPA 904.0

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

Data Usability Review Procedure

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

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

- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation, are noted below.

- Appendix IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- A method blank was analyzed with each analytical batch; no analytes were detected in the blank samples.
- An equipment blank (EB-04) and a field blank (FB-04) were collected.
- LCS recoveries were within laboratory control limits for all analytes.
- MS/MSDs were performed on samples BCC-MW-17004 and BCC-MW-17006.
    - MS/MSDs were performed on BCC-MW-17006 for batch 26414 for 6010C metals. The MS recovery for calcium was above the upper laboratory control limits. The calcium concentration in the parent sample was >4x the spike concentration; therefore, the laboratory control limits are not applicable. Data usability was not affected.

  - MS/MSDs were performed on BCC-MW-17006 for batch 26416 for 6020A metals. The MSD recovery for boron below the lower laboratory control limit. The boron concentration in the parent sample was >4x the spike concentrations; therefore, the laboratory control limits are not applicable. Data usability was not affected.

- Laboratory duplicates were performed on BCC-MW-17004, BCC-MW-17005, and BCC-MW-17006 for anions, alkalinity, and total dissolved solids. Relative percent differences (RPDs) were within laboratory control limits.

- The field duplicate pair samples were Dup-04 and BCC-MW-17005. RPDs were within QC limits.

Laboratory Data Quality Review
Groundwater Monitoring Event August 2018
CEC BC Cobb

Groundwater samples were collected by TRC for the August 2018 sampling event. Samples were analyzed for anions, total dissolved solids, alkalinity, and total metals by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and for radium by Pace located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory reports 4615955 and 4615957.

During the August 2018 sampling event, a groundwater sample was collected from each of the following wells:

- BCC-MW-17001
- BCC-MW-17004
- BCC-MW-17002
- BCC-MW-17005
- BCC-MW-17003
- BCC-MW-17006

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Alkalinity	SM 2320B-11
Total Dissolved Solids	SM 2540C-11
Total Metals	EPA 6020A, EPA 6010C, EPA 7470A
Radium (Radium-226, Radium-228, Total Radium)	EPA 903.1, EPA 904.0

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

Data Usability Review Procedure

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

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

- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation, are noted below.

- Appendix III and IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- Sample receipt: Although the temperature was recorded as <6°C for the temperature blanks in laboratory reports 4615595 and 4615597, two samples had measured temperatures >6°C (11.1 and 13.2°C). Not all samples were collected on the day of laboratory receipt, but were kept on ice until delivery to the laboratory. The coolers were hand delivered to the courier and received by the laboratory on the day sampling concluded and contained ice upon receipt; thus, there was no impact to data usability.
- A method blank was analyzed with each analytical batch. For radium, normalized absolute difference comparisons between blank and sample that are between 1.96 and 2.58 may indicate biased high results and normalized absolute differences <1.96 may indicate a false positive sample result.

  - Radium-228 was detected in the method blank in batch 309143 at 0.708 ± 0.374 pCi/L. The positive results for radium-228 in samples associated with this method blank were potentially impacted, as summarized in the attached table; however, radium-228 concentrations in batch 309143 samples were within the range of historical radium-228 concentrations, or consistent with apparent trends. The data are deemed usable for their intended purpose.

- An equipment blank (EB-04) and a field blank (FB-04) were collected. No analytes were detected in FB-04.
  - Radium-228 was detected in EB-04 at 0.918 ± 0.433 pCi/L. However, the positive result for radium-228 in this sample was potentially due to method blank contamination, as summarized in the attached table. Therefore, data usability was not further affected.

- LCS recoveries were within laboratory control limits for all analytes except for mercury.
  - The LCS recovery for mercury in batch 30104 was above the upper laboratory control limit. However, mercury was not detected in any samples in this data set. Therefore, data usability was not affected.

- MS and/or MSDs were performed on sample BCC-MW-17005 for radium-226, radium-228, anions, metals, and alkalinity.
  - The MS/MSD recoveries for mercury in batch 30104 were above the upper laboratory control limit. However, mercury was not detected in any samples in this data set. Therefore, data usability was not affected.

- Laboratory duplicates were performed on BCC-MW-17005 for anions, alkalinity, and total dissolved solids. Relative percent differences (RPDs) were within laboratory control limits.

- The field duplicate pair samples were Dup-04 and BCC-MW-17003. RPDs between the parent and duplicate sample were within the QC limits (20%), with the exception of sulfate (38%). Potential variability exists for sulfate results for samples Dup-04 and BCC-MW-17003 due to field duplicate variability, as summarized in the attached table; however, the sulfate concentrations for both the primary and duplicate samples were within the range of historical sulfate concentrations observed at that well. The data are deemed usable for their intended purpose.

Attachment B

Summary of Data Non-Conformances for Groundwater Analytical Data

BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
BCC-MW-17002_20180806	8/6/2018	Radium-228	Detection in method blank. Normalized absolute difference between blank and sample result <1.96. Results may be false positives.
BCC-MW-17003_20180807	8/7/2018		
BCC-MW-17004_20180807	8/7/2018		
EB-04_20180807	8/7/2018		
Dup-04_20180807	8/7/2018	Sulfate	RPD for the field duplicate pair exceeded 30%. Potential uncertainty exists for sulfate results due to the field duplicate variability.
BCC-MW-17003_20180807	8/7/2018		

Appendix C

Groundwater Protection Standards

Results you can rely on

Technical Memorandum

Date:	October 15, 2018; Revised December 7, 2018
To:	Michelle Marion, CEC
From:	Darby Litz, TRC Sarah Holmstrom, TRC Joyce Peterson, TRC
Project No.:	284111.0000 Phase 001, Task 002
Subject:	Groundwater Protection Standards – Consumers Energy, Former BC Cobb Power Plant Site, Bottom Ash Ponds & Ponds 0-8 CCR Unit

Pursuant to the United States Environmental Protection Agency's (U.S. EPA's) Resource Conservation and Recovery Act (RCRA) Coal Combustion Residual rule ("CCR Rule") promulgated on April 17, 2015, the owner or operator of a CCR Unit must collect a minimum of eight rounds of background groundwater data to initiate a detection monitoring program and evaluate statistically significant increases above background (40 CFR §257.94). The first detection monitoring event for the Consumers Energy Company (CEC) BC Cobb Power Plant (BC Cobb site) in Muskegon, Michigan, was conducted on September 13 and 14, 2017. During this event several Appendix III constituents were observed in downgradient monitoring wells at concentrations constituting statistically significant increases (SSIs) over the background concentrations established for the site (2017 Annual Report). Alternative Source Demonstrations (ASDs) were unsuccessful for one or more SSI, thereby triggering the requirement for establishing an Assessment Monitoring Program in accordance with 40 CFR 257.95. Groundwater samples were collected on April 17 through 20, 2018, that were analyzed for Appendix IV parameters pursuant to §257.95(b). In compliance with §257.95(d), additional groundwater samples were collected on June 11 through 14, 2018, and were analyzed for Appendix III and IV parameters. Analytical data collected from the background monitoring wells are presented in attached Table A1.

If assessment monitoring is triggered pursuant to §257.94(e)(1), data are compared to Groundwater Protection Standards (GWPSs). The CCR Rule [§257.95(h)] requires GWPSs to be established for Appendix IV constituents that have been detected during baseline sampling. Per §257.95(h)[1], the MCLs will be the GWPSs for those constituents that have established MCLs. For Appendix IV constituents that do not have established MCLs, the GWPS are based upon the EPA Regional Screening Levels

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[1] As amended per Phase One, Part One of the CCR Rule (83 FR 36435).

(RSLs). For constituents that have statistically derived background levels higher than the MCL and/or RSL, the GWPS becomes the background level.

This memorandum presents the background statistical limits and GWPS derived for the Appendix IV parameters for the BC Cobb site using the aforementioned approach pursuant to §257.95(h). However, it should be noted that in the future, risk-based standards may be used in place of the GWPSs presented in this memorandum based on promulgated rule changes and/or authorization for the state of Michigan to administer and enforce compliance with the CCR Rule.

Following the Appendix IV baseline data collection period (December 2015 through April 2018), the background data for the BC Cobb site were evaluated in accordance with the Groundwater Statistical Evaluation Plan (Stats Plan) (TRC, October 2017). The June 2018 data were not included in the baseline dataset and were not used to establish background limits. The BC Cobb site groundwater data are maintained within a database accessible through Sanitas™ statistical software. Sanitas™ is a software tool that is commercially available for performing statistical evaluation consistent with procedures outlined in U.S. EPA's Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (Unified Guidance; UG). Within the Sanitas™ statistical program (and the UG), tolerance limits were selected to perform the statistical calculation for background limits. Use of tolerance limits is a streamlined approach that offers adequate statistical power under the current, initial stage of establishing background and developing the monitoring program. Additionally, tolerance limits are recommended by the UG as an acceptable approach to establish background-based groundwater protection standards for assessment monitoring under the CCR rule. Upper tolerance limits (UTLs) were calculated for each of the CCR Appendix IV parameters. The following narrative describes the methods employed and the results obtained and the Sanitas™ output files are included as an attachment.

The set of background wells utilized for the BCC Ponds CCR unit at the BC Cobb site includes BCC-MW-15002, BCC-MW-15003, BCC-MW-15004, BCC-MW-15005, BCC-MW-15006, BCC-MW-15007, and MW-15008. The background evaluation included the following steps:

- Review of data quality reports for the baseline/background data sets for CCR Appendix IV constituents;
- Graphical representation of the baseline data as time versus concentration (T v. C) by well/constituent pair;
- Graphical representation of cumulative baseline background data sorted from lowest to highest concentration for each constituent;
- Outlier testing of individual data points that appear from the graphical representations as potential outliers;
- Evaluation of percentage of nondetects for each background well-constituent (w/c) pair;

- Distribution of the data;
- Calculation of the UTL for each cumulative background data set; and
- Establishment of GWPS as the higher of the MCL, RSL, or the UTL for each Appendix IV constituent.

The results of these evaluations are presented and discussed below.

Data Quality

Data from each sampling round were evaluated for completeness, overall quality and usability, method-specified sample holding times, precision and accuracy, and potential sample contamination. The review was completed using the following quality control (QC) information which at a minimum included chain-of-custody forms, investigative sample results including blind field duplicates, and matrix spike and matrix spike duplicates (MS/MSDs) recoveries, and, as provided by the laboratory, method blanks, laboratory control spikes, and laboratory duplicates. The data were found to be complete and usable for the purposes of the CCR monitoring program.

Time versus Concentration Graphs

The T v. C graphs show no potential outlier for Appendix IV constituents in the background well sets (Figure 1).

The T v. C graphs showed potential trending for some Appendix IV well/constituent pairs. These were tested by the Sanitas™ software to assess whether the potential outliers are statistically significant. The Sens Slope test results provided the following conclusions. The Sanitas™ trend test outputs are attached. Despite the trending concentrations, these data sets will be included in the establishment of background/baseline concentrations and groundwater protection standards.

Sens Slope Test Results for Potential Trends in Background Data Sets

WELL	CONSTITUENT	DIRECTION	RESULT
BCC-MW-15002	Arsenic	Down	Confirmed
BCC-MW-15002	Barium	Down	Confirmed
BCC-MW-15003	Barium	Down	Confirmed
BCC-MW-15006	Molybdenum	Up	Not Statistically Significant at 95% Confidence
BCC-MW-15008	Lithium	Up	Confirmed

Cumulative Baseline Data Sets

Ideally, the background data sets provide a continuous concentration distribution. The ideal is rarely achieved by multiple background wells representing a relatively large geographic area such as is the case at the BC Cobb site. When sorted by concentration, the data generally group by well (Figure 2). Most of the parameters have a relatively consistent distribution. These results need to be taken into consideration as they represent potential non-CCR upgradient contributions to downgradient wells.

Outlier Testing

No suspect data points were identified in the T v. C graphs (Figure 1) or in the cumulative concentration distribution (Figure 2). The Dixon's Outlier Test in Sanitas™ was therefore not employed for outlier testing.

Percentage of Nondetects

Table 1 summarizes the percentage of results below the reporting limit for each w/c pair.

Table 1
Summary of Percentage of Appendix IV Baseline Results Below Reporting Limit

WELL	CONSTITUENT	PERCENT NON-DETECT
BCC-MW-15002	Antimony	100
	Arsenic	25
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	25
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	88
	Mercury	100
	Molybdenum	100
	Selenium	63
	Thallium	100
	Radium 226 and 228 combined	13
BCC-MW-15003	Antimony	100
	Arsenic	75
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	25

Table 1
Summary of Percentage of Appendix IV Baseline Results Below Reporting Limit

WELL	CONSTITUENT	PERCENT NON-DETECT
BCC-MW-15003 *(cont'd)*	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	88
	Mercury	100
	Molybdenum	100
	Selenium	63
	Thallium	100
	Radium 226 and 228 combined	13
BCC-MW-15004	Antimony	100
	Arsenic	0
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	25
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	100
	Mercury	100
	Molybdenum	88
	Selenium	63
	Thallium	100
	Radium 226 and 228 combined	25
BCC-MW-15005	Antimony	100
	Arsenic	38
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	75
	Cobalt	100
	Fluoride	100
	Lead	88
	Lithium	100
	Mercury	100
	Molybdenum	100
	Selenium	100
	Thallium	100
	Radium 226 and 228 combined	38

Table 1
Summary of Percentage of Appendix IV Baseline Results Below Reporting Limit

WELL	CONSTITUENT	PERCENT NON-DETECT
BCC-MW-15006	Antimony	75
	Arsenic	13
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	38
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	100
	Mercury	100
	Molybdenum	0
	Selenium	13
	Thallium	100
	Radium 226 and 228 combined	75
BCC-MW-15007	Antimony	88
	Arsenic	0
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	13
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	100
	Mercury	100
	Molybdenum	88
	Selenium	75
	Thallium	100
	Radium 226 and 228 combined	13
BCC-MW-15008	Antimony	100
	Arsenic	63
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	63
	Cobalt	100
	Fluoride	100
	Lead	100

Table 1
Summary of Percentage of Appendix IV Baseline Results Below Reporting Limit

WELL	CONSTITUENT	PERCENT NON-DETECT
BCC-MW-15008 *(cont'd)*	Lithium	0
	Mercury	100
	Molybdenum	100
	Selenium	75
	Thallium	100
	Radium 226 and 228 combined	38
COMBINED	Antimony	95
	Arsenic	30
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	38
	Cobalt	100
	Fluoride	100
	Lead	98
	Lithium	82
	Mercury	100
	Molybdenum	82
	Selenium	64
	Thallium	100
	Radium 226 and 228 combined	30

Distribution of the Data Sets

The distribution of the data sets is determined by the Sanitas™ software during calculation of the upper tolerance limit. The Shapiro-Wilk normality test is used for samples sizes less than 50. Non-detect/censored data were handled in accordance with the Stats Plan. If the data appear to be nonnormal, mathematical transformations of the data may be utilized such that the transformed data follow a normal distribution (e.g., lognormal distributions). Alternatively, non-parametric tests may be utilized when data cannot be normalized. Table 2 summarizes the distributions determined by the Sanitas™ software. The distribution is based on the combined baseline results for all seven background monitoring wells.

Table 2
Summary of Background/Baseline Data Distributions

CONSTITUENT	DISTRIBUTION
Antimony	Nonnormal (>50% censored data)
Arsenic	Nonnormal
Barium	Normalized by square root transformation
Beryllium	All ND – use highest RL
Cadmium	All ND – use highest RL
Chromium	Nonnormal
Cobalt	All ND – use highest RL
Fluoride	All ND – use highest RL
Lead	Nonnormal (>50% censored data)
Lithium	Nonnormal (>50% censored data)
Mercury	All ND – use highest RL
Molybdenum	Nonnormal (>50% censored data)
Selenium	Nonnormal (>50% censored data)
Thallium	All ND – use highest RL
Radium 226 and 228 combined	Normal (NDs adjusted by Kaplan-Meier adjustment)

ND = Non-detect
RL = Reporting Limit

Upper Tolerance Limits

Table 3 presents the calculated upper tolerance limits for the background/baseline data sets. For data sets with normal distributions or distributions normalized by transformation, UTLs are calculated for 95 percent coverage and 95 percent confidence using parametric tolerance limits. For nonnormal background datasets, a nonparametric tolerance limit is utilized, resulting in the highest value from the background dataset as the UTL. The achieved confidence and/or coverage rates for nonparametric tests depend entirely on the number of background data points, and coverage rates for various confidence levels are shown in the Sanitas™ outputs for nonparametric tolerance limits. Verification resampling (1 of 2) is recommended per the Stats Plan and UG to achieve a site-wide false positive rate within the range specified in the CCR rules.

Table 3
Summary of Initial Groundwater Protection Standards

CONSTITUENT	UNITS	UPPER TOLERANCE LIMIT – FROM SANITAS™	MAXIMUM CONTAMINANT LEVEL	REGIONAL SCREENING LEVEL	GROUNDWATER PROTECTION STANDARD
Antimony	ug/L	RL (1)	6	NA	6
Arsenic	ug/L	10	10	NA	10
Barium	ug/L	340	2,000	NA	2,000
Beryllium	ug/L	RL (1)	4	NA	4
Cadmium	ug/L	RL (0.2)	5	NA	5
Chromium	ug/L	3	100	NA	100
Cobalt	ug/L	RL (15)	NC	6	15
Fluoride	ug/L	RL (1,000)	4,000	NA	4,000
Lead	ug/L	2	NC	15	15
Lithium	ug/L	28	NC	40	40
Mercury	ug/L	RL (0.2)	2	NA	2
Molybdenum	ug/L	9	NC	100	100
Selenium	ug/L	3	50	NA	50
Thallium	ug/L	RL (2)	2	NA	2
Radium 226 and 228 combined	pCi/L	2.42	5	NA	5

RL = Reporting Limit
NC = No Criteria
NA = Not Applicable

Revised 12/7/2018

Attachments

Table A1 – Summary of Groundwater Sampling Results (Analytical)

Figure 1 – Background Concentration Time-Series Charts
Figure 2 – Combined Background Distribution

Sanitas™ Output Files

Table A1
Summary of Groundwater Sampling Results (Analytical)

Table A1

Summary of Groundwater Sampling Results (Analytical) – November 2015 to June 2018
BC Cobb Background – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location:		BCC-MW-15002										
Sample Date:		11/30/2015	2/17/2016	4/12/2016	7/12/2016	9/27/2016	2/13/2017	4/4/2017	7/11/2017	9/14/2017	4/19/2018	6/14/2018
Constituent	Unit	Background										
Appendix III												
Boron	ug/L	1,320	1,200	1,050	834	979	1,110	1,170	988	1,130	--	422
Calcium	mg/L	214	259	197	169	165	184	167	185	132	--	95.6
Chloride	mg/L	720	519	681	577	328	226	354	472	152	--	115
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.7	7.1	7.0	7.0	7.0	7.2	7.2	7.1	7.2	7.5	7.4
Sulfate	mg/L	250	327	300	202	127	116	85.6	113	13.8	--	3.0
Total Dissolved Solids	mg/L	1,900	1,900	1,900	1,800	1,100	1,100	1,200	1,500	772	--	738
Appendix IV												
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	10	4	2	2	1	1	< 1	< 1.0	--	< 1.0	< 1.0
Barium	ug/L	274	257	252	232	148	134	146	186	--	79.4	79.6
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	1	2	3	2	< 1	2	2	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	11	--	< 10	< 10
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	0.816	0.6	0.893	0.641	< 0.254	0.419	0.387	< 0.912	--	0.586	< 0.482
Radium-226/228	pCi/L	3.03	2.03	2.32	1.88	< 0.927	1.41	1.79	2.20	--	< 1.16	1.60
Radium-228	pCi/L	2.21	1.43	1.43	1.24	< 0.927	0.995	1.4	1.49	--	< 0.685	1.24
Selenium	ug/L	1	< 1	< 1	1	< 1	< 1	1	< 1.0	--	< 1.0	< 1.0
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

-- - not analyzed.

All metals were analyzed as total
unless otherwise specified.

Table A1

Summary of Groundwater Sampling Results (Analytical) – November 2015 to June 2018
BC Cobb Background – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location:		BCC-MW-15003											
Sample Date:		11/30/2015	2/17/2016	4/12/2016	7/12/2016	9/27/2016	2/13/2017	4/4/2017	7/12/2017	9/14/2017	2/21/2018	4/19/2018	6/14/2018
Constituent	Unit	Background											
Appendix III													
Boron	ug/L	542	574	2,370	528	494	608	679	695	361	--	--	290
Calcium	mg/L	216	233	180	177	179	163	167	154	145	--	--	148
Chloride	mg/L	700	682	640	581	512	456	363	293	493	--	--	917
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--	< 1,000	< 1,000
pH, Field	SU	7.2	7.1	7.2	7.1	7.1	7.4	7.3	7.1	7.1	7.3	7.5	7.3
Sulfate	mg/L	46	48.7	41.2	28.3	27.2	20.1	16.7	6.8	< 2.0	--	--	< 2.0
Total Dissolved Solids	mg/L	1,900	1,900	1,700	1,600	1,500	1,400	1,200	1,110	1,370	--	--	2,060
Appendix IV													
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0
Arsenic	ug/L	2	< 1	< 1	1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0
Barium	ug/L	236	219	189	170	159	137	138	112	--	--	151	139
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	--	< 0.20	< 0.20
Chromium	ug/L	< 1	2	2	2	1	1	1	< 1.0	--	--	< 1.0	< 1.0
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	--	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0
Lithium	ug/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	11	--	--	12	12
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	--	< 0.20	< 0.20
Molybdenum	ug/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	--	< 5.0	< 5.0
Radium-226	pCi/L	0.667	0.633	0.522	0.387	0.284	0.35	0.442	0.442	--	--	0.707	0.573
Radium-226/228	pCi/L	2.4	1.3	1.39	1.66	1.53	1.58	1.25	< 1.03	--	--	1.81	1.86
Radium-228	pCi/L	1.73	0.664	0.87	1.27	1.25	1.23	0.807	< 0.858	--	--	1.10	1.29
Selenium	ug/L	2	< 1	< 1	1	< 1	< 1	1	< 1.0	--	--	< 1.0	< 1.0
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

-- - not analyzed.

All metals were analyzed as total
unless otherwise specified.

Table A1

Summary of Groundwater Sampling Results (Analytical) – November 2015 to June 2018

BC Cobb Background – RCRA CCR Monitoring Program

Muskegon, Michigan

Sample Location:		BCC-MW-15004										
Sample Date:		11/30/2015	2/17/2016	4/12/2016	7/12/2016	9/27/2016	2/13/2017	4/4/2017	7/12/2017	9/14/2017	4/19/2018	6/12/2018
Constituent	Unit	Background										
Appendix III												
Boron	ug/L	198	124	166	338	279	193	376	302	325	--	269
Calcium	mg/L	94.6	80.9	70.7	87	81.9	75.1	73.4	67.2	115	--	71.4
Chloride	mg/L	27	18.1	22	30.9	22.1	28.2	35.2	45.7	382	--	98.1
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	7.3	7.2	6.9	6.7	6.9	7.1	7.1	7.0	6.8	7.3	7.0
Sulfate	mg/L	33	17.8	13.6	< 2	8.06	7.2	< 2	2.9	5.8	--	< 2.0
Total Dissolved Solids	mg/L	440	340	350	420	380	340	380	450	934	--	506
Appendix IV												
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	2	1	1	2	7	2	2	3.2	--	1.5	1.1
Barium	ug/L	33	18	29	43	42	29	33	38.4	--	39.4	45.8
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	< 1	1	2	2	1	1	3	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	< 5	< 5	7	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	< 0.203	< 0.216	< 0.37	< 0.157	< 0.292	< 0.181	< 0.308	< 0.654	--	0.602	< 0.728
Radium-226/228	pCi/L	1.02	< 0.565	0.518	0.808	1.08	1.18	1.02	< 1.45	--	1.34	< 1.43
Radium-228	pCi/L	0.879	< 0.565	0.518	0.768	0.986	1.1	1.02	< 0.796	--	< 0.821	< 0.701
Selenium	ug/L	< 1	2	2	< 1	< 1	< 1	1	< 1.0	--	< 1.0	< 1.0
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

-- - not analyzed.

All metals were analyzed as total
unless otherwise specified.

Table A1

Summary of Groundwater Sampling Results (Analytical) – November 2015 to June 2018
BC Cobb Background – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location:		BCC-MW-15005										
Sample Date:		12/1/2015	2/17/2016	4/13/2016	7/12/2016	9/27/2016	2/13/2017	4/4/2017	7/12/2017	9/14/2017	4/19/2018	6/14/2018
Constituent	Unit	Background										
Appendix III												
Boron	ug/L	< 20	51	35	46	43	39	25	31.3	36.8	--	27.8
Calcium	mg/L	57.2	93.3	60.6	75.4	67.3	99.2	43.9	60.2	64.2	--	51.1
Chloride	mg/L	9.5	137	66.6	13.1	1.23	181	20.1	3.0	7.0	--	14.2
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	7.2	7.2	7.3	7.2	7.1	7.3	7.6	7.3	7.3	7.7	7.4
Sulfate	mg/L	10	5.27	4.69	5.39	< 2	5.57	7.88	4.4	2.9	--	4.9
Total Dissolved Solids	mg/L	230	480	340	590	230	570	200	204	240	--	322
Appendix IV												
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	1	1	< 1	2	2	< 1	< 1	1.1	--	1.3	< 1.0
Barium	ug/L	83	125	97	151	147	173	82	116	--	99.3	103
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	< 1	< 1	2	1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1.0	--	2.0	< 1.0
Lithium	ug/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	0.18	< 0.336	< 0.244	0.221	< 0.332	< 0.192	< 0.279	< 0.675	--	< 0.450	< 0.635
Radium-226/228	pCi/L	0.882	< 0.494	< 0.378	0.662	0.545	1.02	0.447	< 1.41	--	< 1.22	< 1.63
Radium-228	pCi/L	0.702	< 0.494	< 0.378	0.441	0.471	1.02	0.447	< 0.739	--	< 0.769	< 0.999
Selenium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
-- - not analyzed.
All metals were analyzed as total
unless otherwise specified.

Table A1

Summary of Groundwater Sampling Results (Analytical) – November 2015 to June 2018
BC Cobb Background – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location:		BCC-MW-15006											
Sample Date:		11/30/2015	2/17/2016	4/13/2016	7/12/2016	9/28/2016	2/13/2017	4/4/2017	7/12/2017	9/14/2017	2/21/2018	4/19/2018	6/14/2018
Constituent	Unit	Background											
Appendix III													
Boron	ug/L	48	39	33	43	55	32	35	42.3	45.1	--	--	42.1
Calcium	mg/L	84.5	73.9	60	60.6	86.2	70.5	67.9	68.8	79.6	--	--	49.8
Chloride	mg/L	50	12.8	32.5	63.1	19.6	48	23.5	69.8	16.1	--	--	16.7
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--	< 1,000	< 1,000
pH, Field	SU	7.0	7.3	7.2	6.9	6.9	7.3	7.4	7.2	7.2	6.9	7.5	7.3
Sulfate	mg/L	17	17.1	12.7	8.54	12.2	7.34	6.88	9.4	11.6	--	--	6.8
Total Dissolved Solids	mg/L	380	290	300	380	320	330	260	346	322	--	--	340
Appendix IV													
Antimony	ug/L	< 1	1	< 1	< 1	1	< 1	< 1	< 1.0	--	--	< 1.0	1.4
Arsenic	ug/L	1	1	< 1	2	3	3	2	4.3	--	--	1.6	40.9
Barium	ug/L	26	16	17	20	26	17	17	27.8	--	--	20.5	52.1
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	--	< 0.20	0.22
Chromium	ug/L	< 1	1	2	1	< 1	1	1	< 1.0	--	--	< 1.0	3.7
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	--	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	1.1
Lithium	ug/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	< 10	< 10
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	--	< 0.20	< 0.20
Molybdenum	ug/L	5	6	7	7	7	8	8	8.5	--	--	5.5	7.9
Radium-226	pCi/L	< 0.301	< 0.268	< 0.205	< 0.225	< 0.416	< 0.24	< 0.198	< 0.701	--	--	< 0.452	< 0.515
Radium-226/228	pCi/L	0.629	< 0.623	< 0.479	< 0.522	< 0.571	< 0.483	0.652	< 1.41	--	--	< 1.13	< 1.62
Radium-228	pCi/L	0.584	< 0.623	< 0.479	< 0.522	< 0.571	< 0.483	0.459	< 0.708	--	--	< 0.682	< 1.10
Selenium	ug/L	3	3	2	1	1	< 1	1	1.2	--	--	1.2	2.2
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

-- - not analyzed.

All metals were analyzed as total
unless otherwise specified.

Table A1

Summary of Groundwater Sampling Results (Analytical) – November 2015 to June 2018
BC Cobb Background – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location:		BCC-MW-15007											
Sample Date:		12/1/2015	2/17/2016	4/13/2016	7/12/2016	9/28/2016	2/14/2017	4/4/2017	7/12/2017	9/14/2017	2/21/2018	4/19/2018	6/14/2018
Constituent	Unit	Background											
Appendix III													
Boron	ug/L	79	74	65	89	135	76	83	130	141	--	--	93.7
Calcium	mg/L	165	222	226	234	250	181	169	170	133	--	--	108
Chloride	mg/L	1,900	2,300	2,480	2,280	2,390	1,850	1,670	1,900	1,940	--	--	759
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--	< 1,000	< 1,000
pH, Field	SU	6.7	6.6	6.6	6.6	6.6	6.7	6.7	6.7	6.7	6.8	7.0	6.9
Sulfate	mg/L	21	15.7	11	9.87	9.38	3.19	4.25	9.1	8.3	--	--	17.9
Total Dissolved Solids	mg/L	3,700	2,000	3,900	4,500	4,800	3,700	3,100	3,700	2,690	--	--	1,510
Appendix IV													
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	1	< 1.0	--	--	< 1.0	< 1.0
Arsenic	ug/L	5	1	1	5	3	1	2	5.8	--	--	2.0	6.4
Barium	ug/L	285	267	236	294	377	227	167	229	--	--	61.0	66.5
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	--	< 0.20	< 0.20
Chromium	ug/L	< 1	2	2	2	1	2	2	1.1	--	--	< 1.0	< 1.0
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	--	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	--	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0
Lithium	ug/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	< 10	< 10
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	--	< 0.20	< 0.20
Molybdenum	ug/L	8	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	--	< 5.0	< 5.0
Radium-226	pCi/L	0.686	0.659	0.289	0.554	1.15	0.629	0.492	< 0.711	--	--	< 0.445	< 0.408
Radium-226/228	pCi/L	2.19	1.69	1.56	1.65	2.75	2.02	1.29	< 1.45	--	--	< 1.21	< 1.38
Radium-228	pCi/L	1.5	1.03	1.27	1.1	1.6	1.39	0.796	0.850	--	--	< 0.760	< 0.972
Selenium	ug/L	1	< 1	< 1	< 1	< 1	< 1	2	< 1.0	--	--	< 1.0	< 1.0
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

-- - not analyzed.

All metals were analyzed as total
unless otherwise specified.

Table A1

Summary of Groundwater Sampling Results (Analytical) – November 2015 to June 2018

BC Cobb Background – RCRA CCR Monitoring Program

Muskegon, Michigan

Sample Location:		**BCC-MW-15008**											
Sample Date:		12/1/2015	2/17/2016	4/13/2016	7/12/2016	9/28/2016	2/14/2017	4/4/2017	7/12/2017	9/14/2017	4/18/2018	4/18/2018	6/14/2018
Constituent	Unit	Background											
Appendix III												Field Dup	
Boron	ug/L	1,060	897	794	866	1,160	489	416	396	401	--	--	242
Calcium	mg/L	39.6	39.5	48.4	77.2	109	63.4	63	54.4	51.8	--	--	56.7
Chloride	mg/L	160	157	193	546	423	129	95.9	70.0	68.9	--	--	93.9
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	8.2	8.3	8.1	8.1	7.8	7.8	7.6	7.6	7.7	7.8	--	7.5
Sulfate	mg/L	45	3.05	5.13	22.3	12	8.7	4.6	3.9	3.0	--	--	< 2.0
Total Dissolved Solids	mg/L	540	530	590	1,300	1,100	650	510	414	448	--	--	534
Appendix IV													
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	1	< 1	< 1	4	< 1	< 1	< 1	2.3	--	< 1.0	< 1.0	2.1
Barium	ug/L	39	42	49	61	100	63	59	54.6	--	64.2	70.7	66.5
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	< 1	< 1	1	2	< 1	< 1	1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	12.9	13.5	16	19	28	17	18	23	--	22	18	19
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	< 0.188	< 0.215	< 0.199	0.174	< 0.217	< 0.173	< 0.284	< 0.592	--	0.690	< 0.444	< 0.422
Radium-226/228	pCi/L	0.62	< 0.457	0.646	< 0.405	1.03	0.843	< 0.346	1.66	--	< 1.19	< 1.06	< 1.44
Radium-228	pCi/L	0.521	< 0.457	0.516	< 0.405	0.893	0.672	< 0.346	1.47	--	< 0.684	< 0.616	< 1.02
Selenium	ug/L	< 1	< 1	< 1	1	< 1	< 1	1	< 1.0	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

-- - not analyzed.

All metals were analyzed as total
unless otherwise specified.

Figures

Figure 1
Background Concentration Time-Series Charts
BC Cobb Site - Appendix IV Constituents

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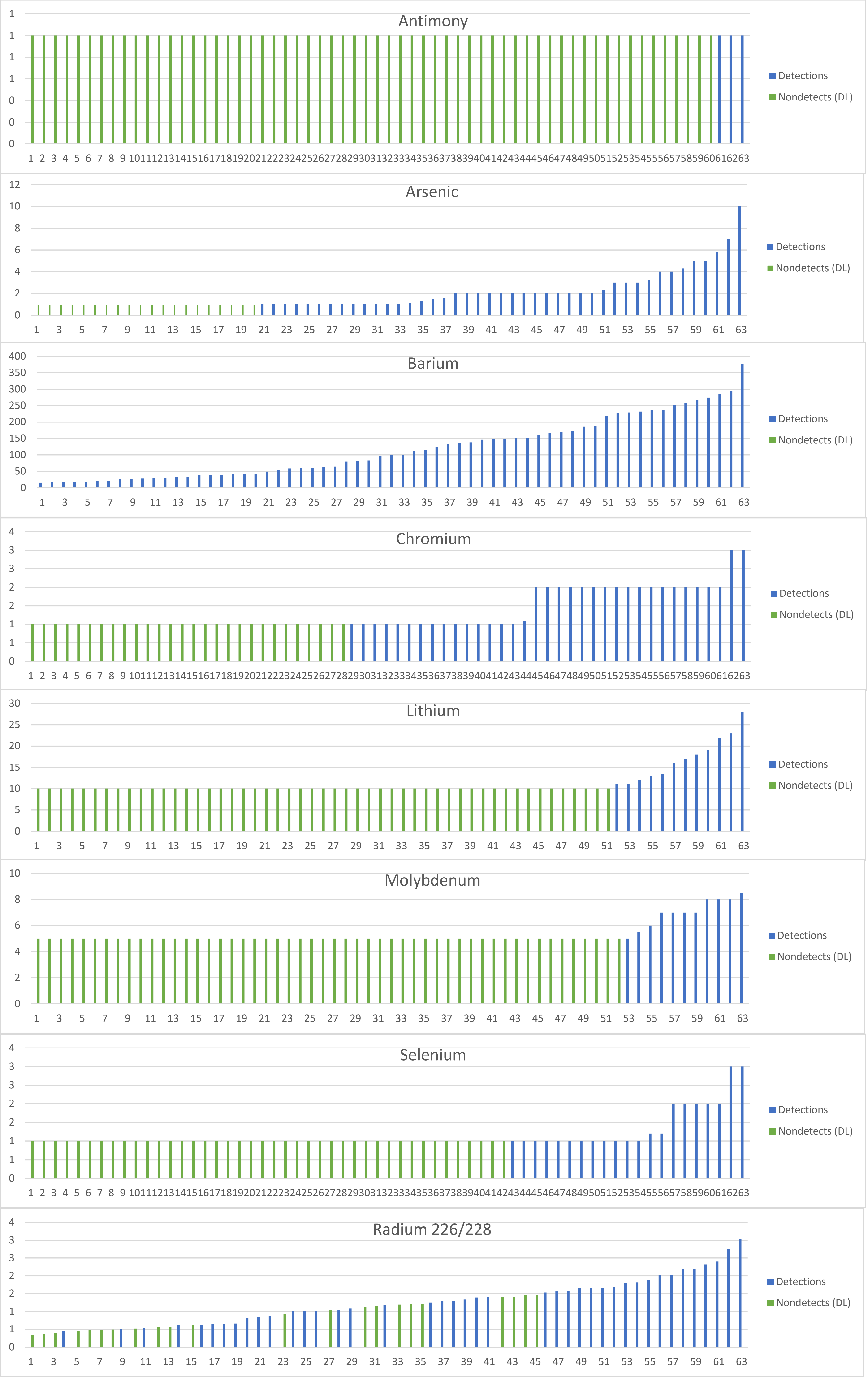
Figure 2
Cumulative Background Concentraitons - Appendix IV
BC Cobb Site



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Sanitas™ Output Files

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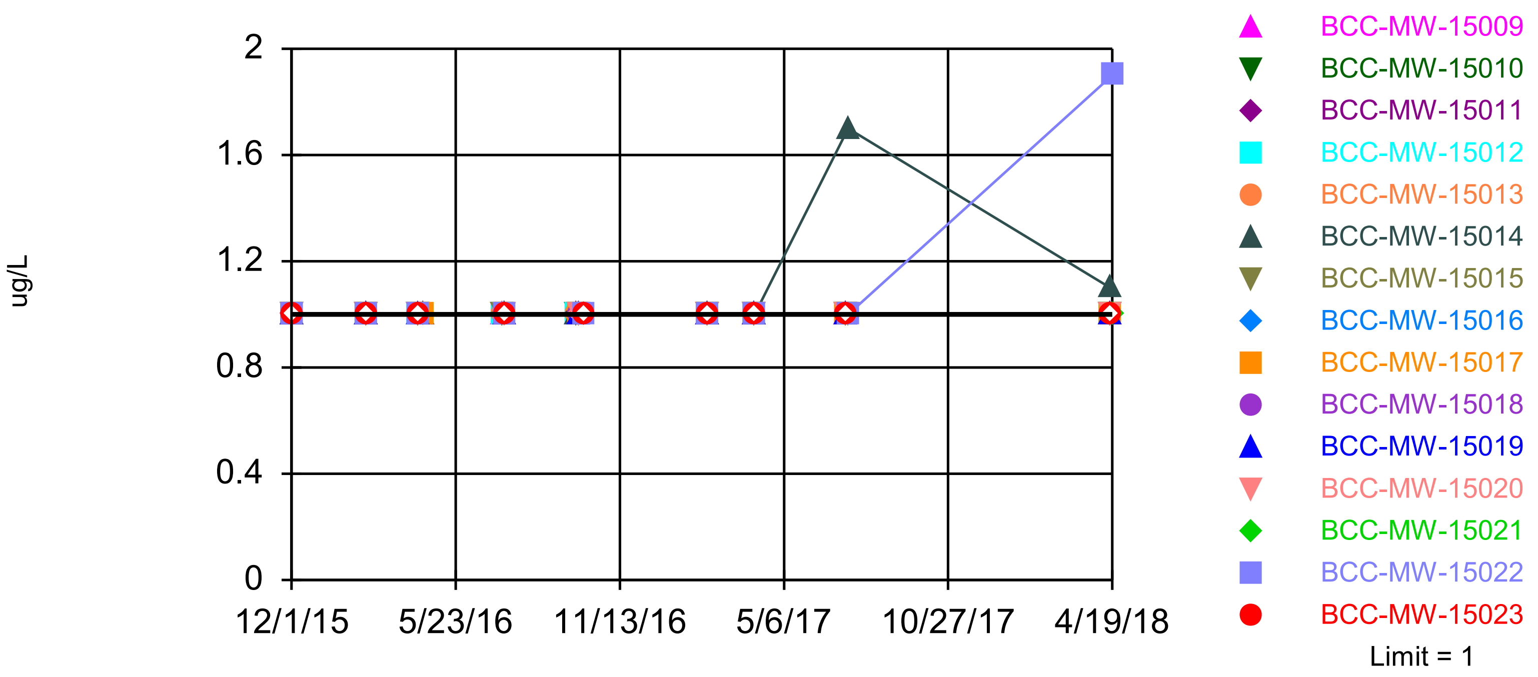
Hollow symbols indicate censored values.

Exceeds Limit: BCC-MW-15014, BCC-MW-15022

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. Limit is highest of 64 background values. 95.31% NDs. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Antimony, Total Analysis Run 5/30/2018 11:20 AM

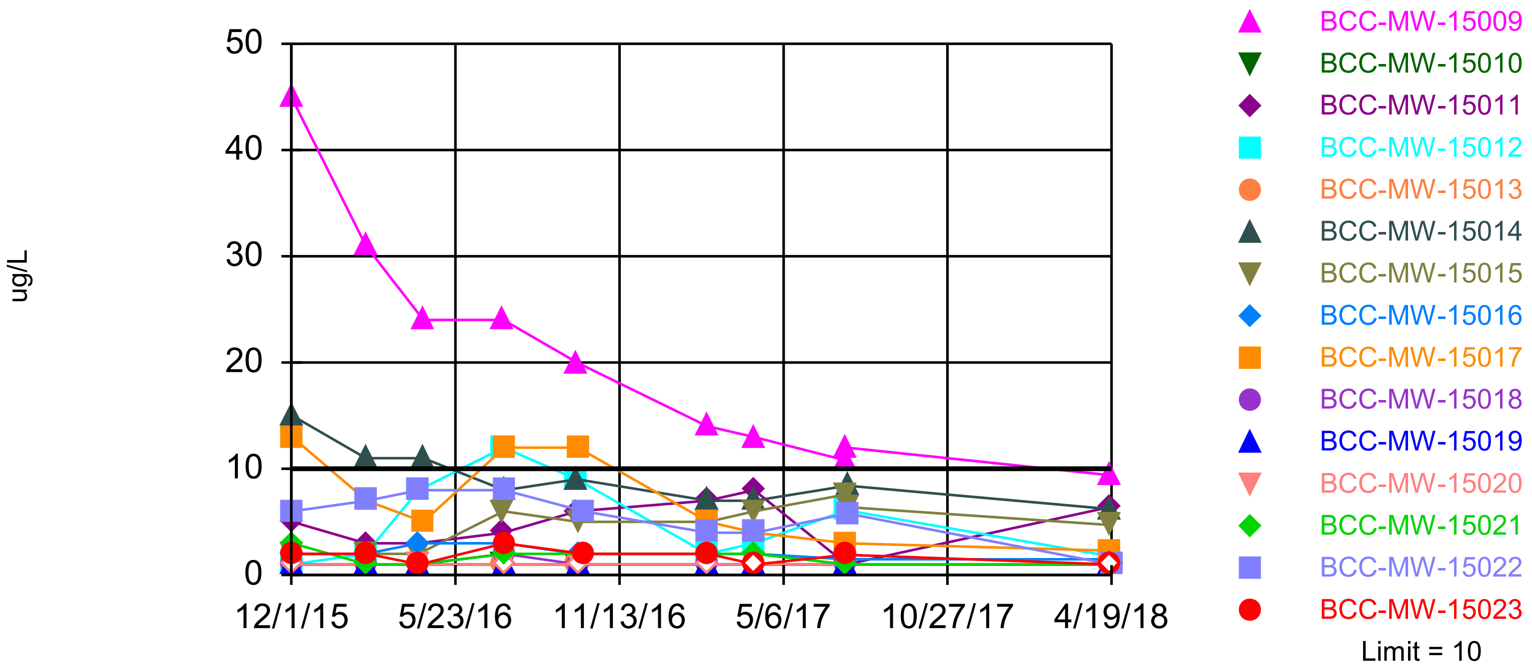
Client: Consumers Energy Data: BCC_Sanitas

Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG
Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.01 alpha level. Most recent observation is compared with limit. Limit is highest of 64 background values. 32.81% NDs. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

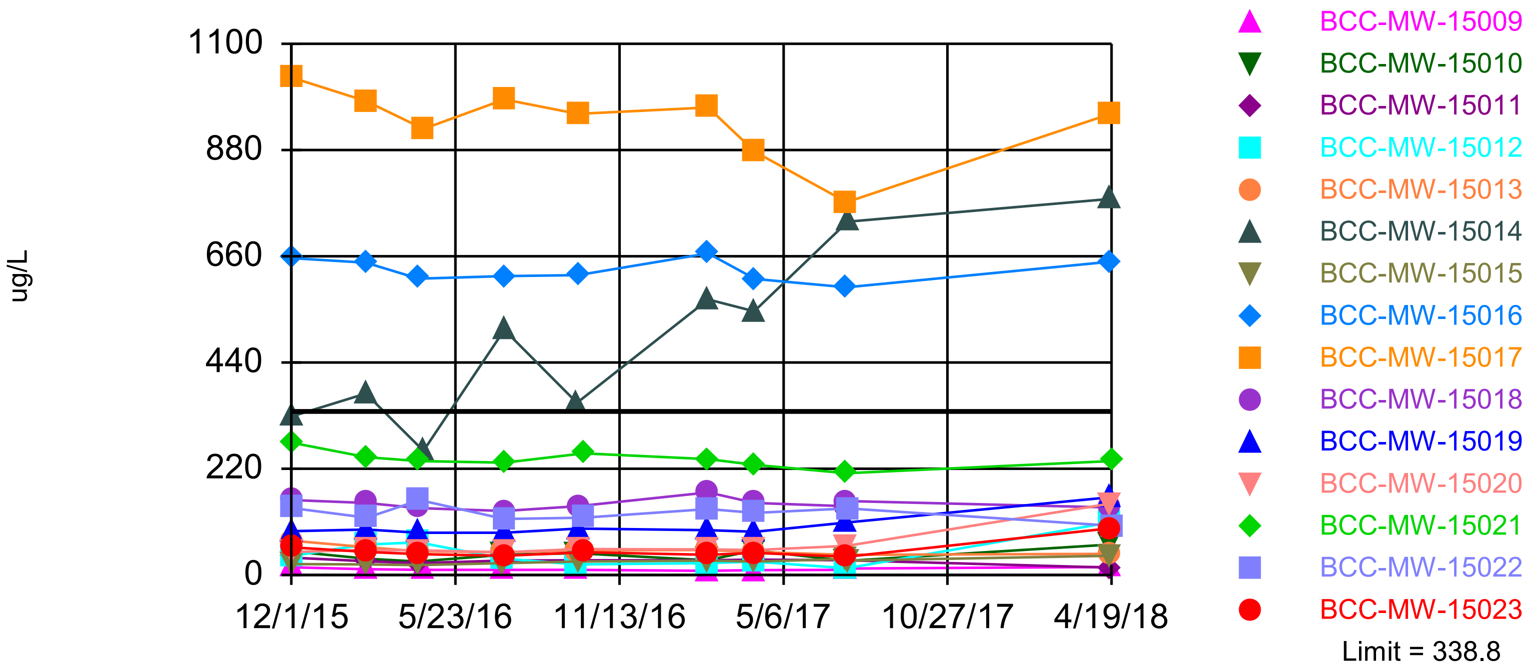
Constituent: Arsenic, Total   Analysis Run 5/30/2018 8:55 AM

Client: Consumers Energy   Data: BCC_Sanitas

Exceeds Limit: BCC-MW-15014, BCC-MW-15016, BCC-MW-15017

Tolerance Limit

Interwell Parametric



95% coverage. Most recent observation is compared with limit. Background Data Summary (based on square root transformation): Mean=10.02, Std. Dev.=4.185, n=64. Normality test: Shapiro Francia @alpha = 0.01, calculated = 0.9603, critical = 0.947. Report alpha = 0.05.

Constituent: Barium, Total Analysis Run 5/30/2018 8:55 AM

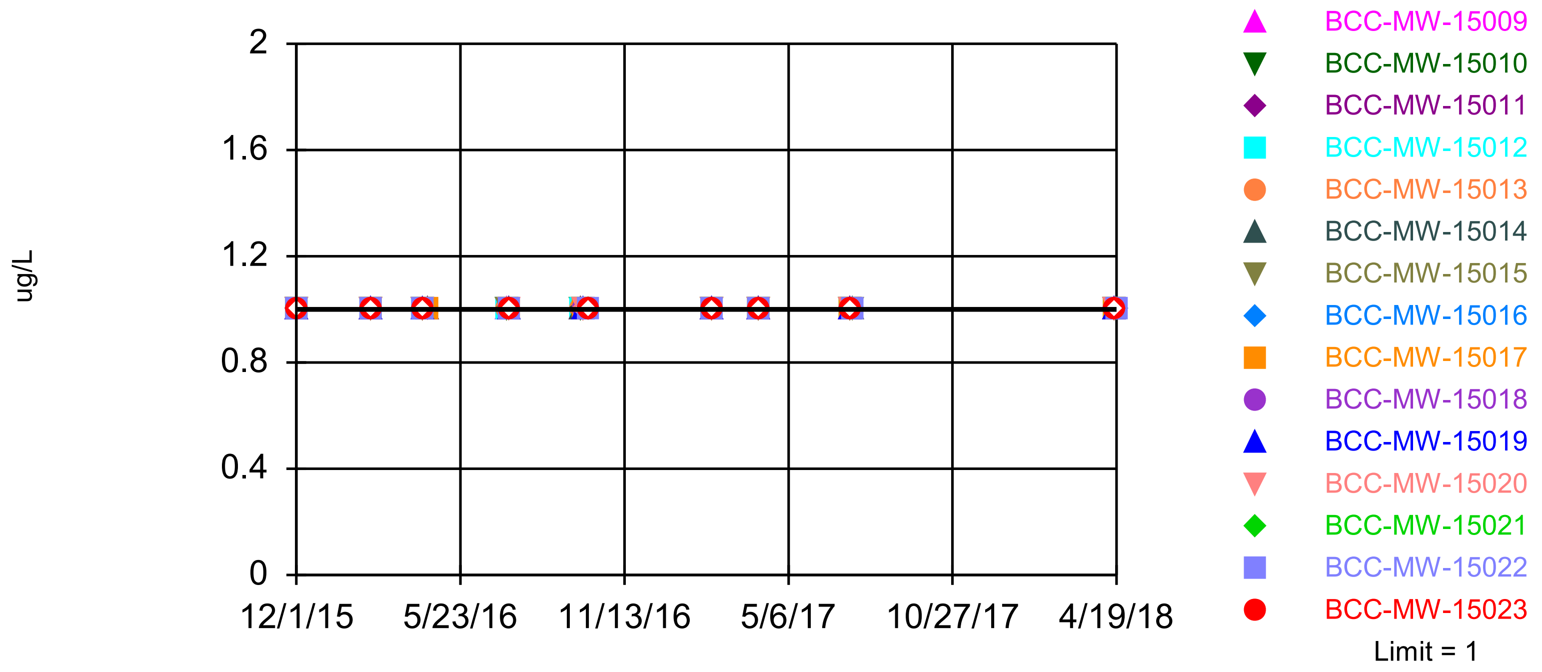
Client: Consumers Energy Data: BCC_Sanitas

Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG
Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Beryllium, Total   Analysis Run 6/12/2018 11:43 AM

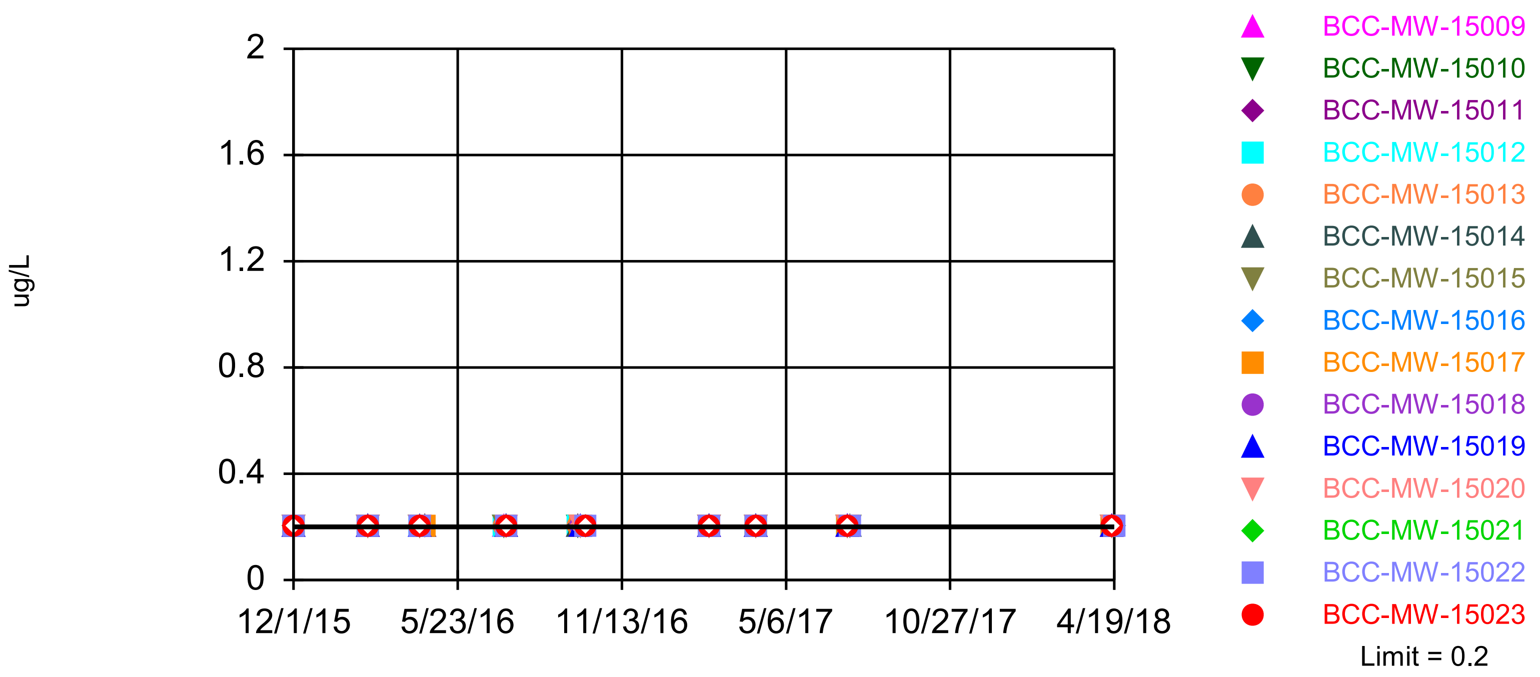
Client: Consumers Energy   Data: BCC_Sanitas

Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG
Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Cadmium, Total Analysis Run 6/12/2018 11:43 AM

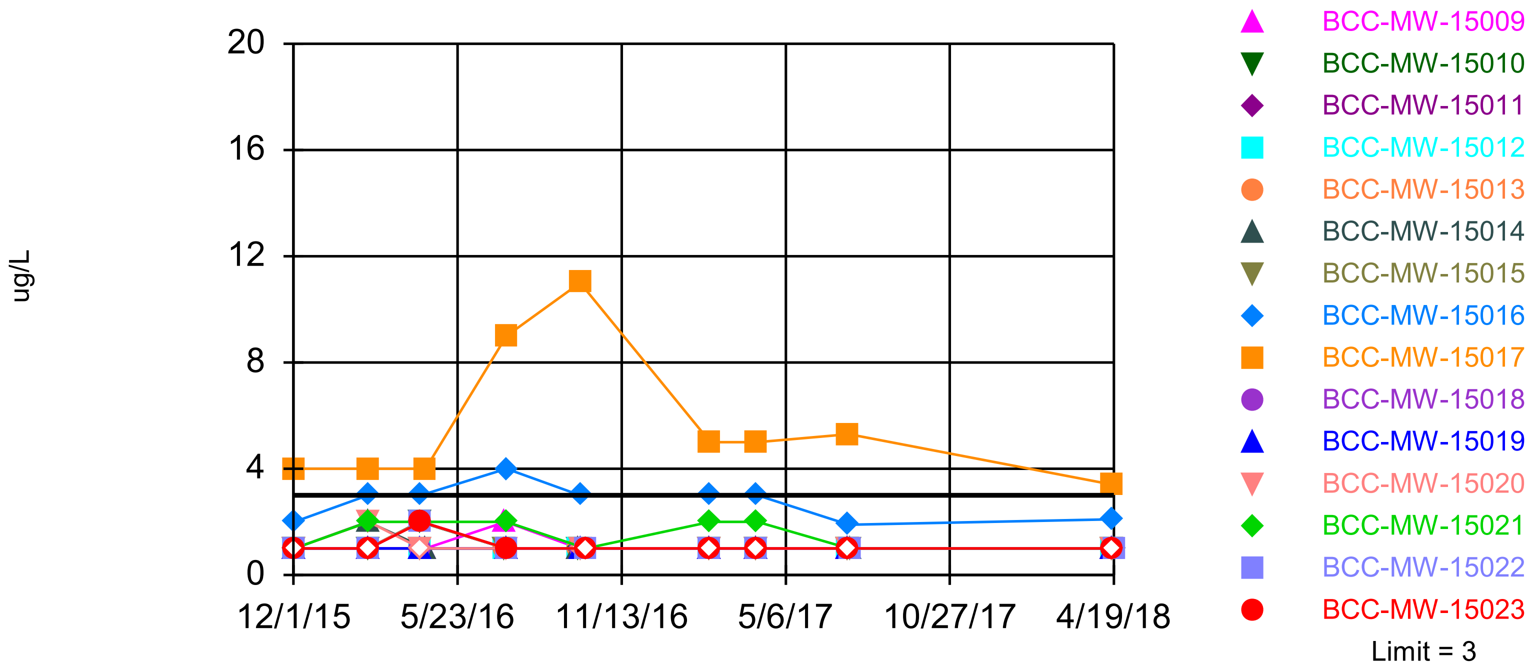
Client: Consumers Energy Data: BCC_Sanitas

Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG
Hollow symbols indicate censored values.

Exceeds Limit: BCC-MW-15017

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.01 alpha level. Most recent observation is compared with limit. Limit is highest of 64 background values. 45.31% NDs. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Chromium, Total   Analysis Run 5/30/2018 8:56 AM

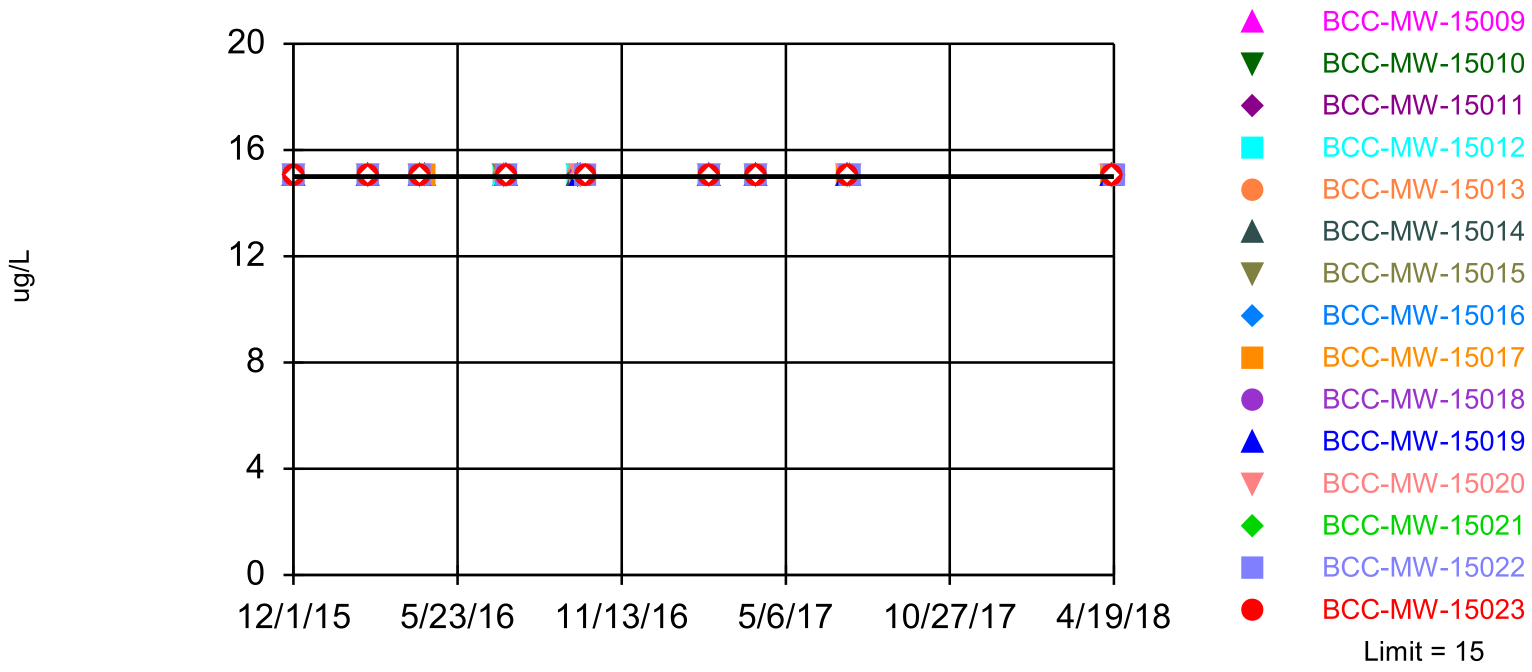
Client: Consumers Energy   Data: BCC_Sanitas

Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG
Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Cobalt, Total Analysis Run 6/12/2018 11:44 AM

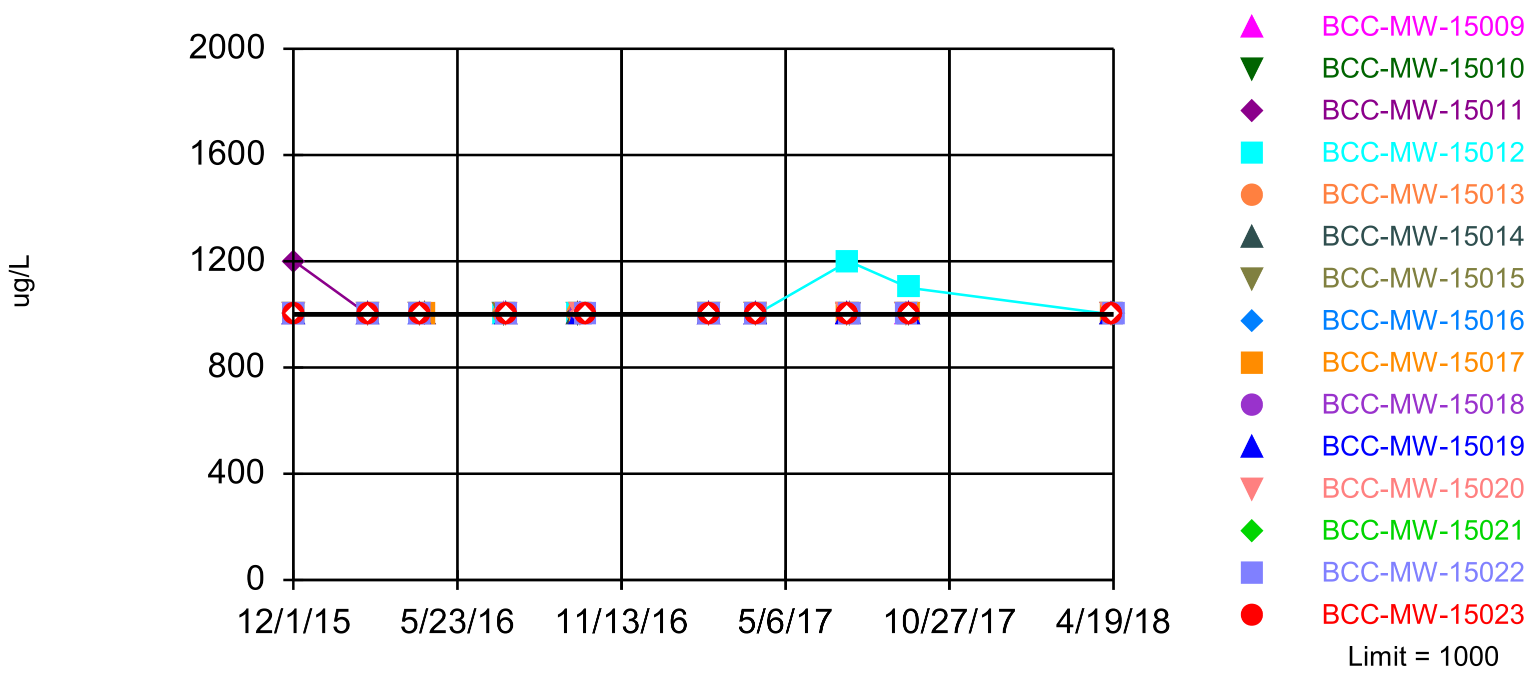
Client: Consumers Energy Data: BCC_Sanitas

Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG
Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 93.55% coverage at alpha=0.01; 95.9% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.0262.

Constituent: Fluoride Analysis Run 6/12/2018 11:44 AM

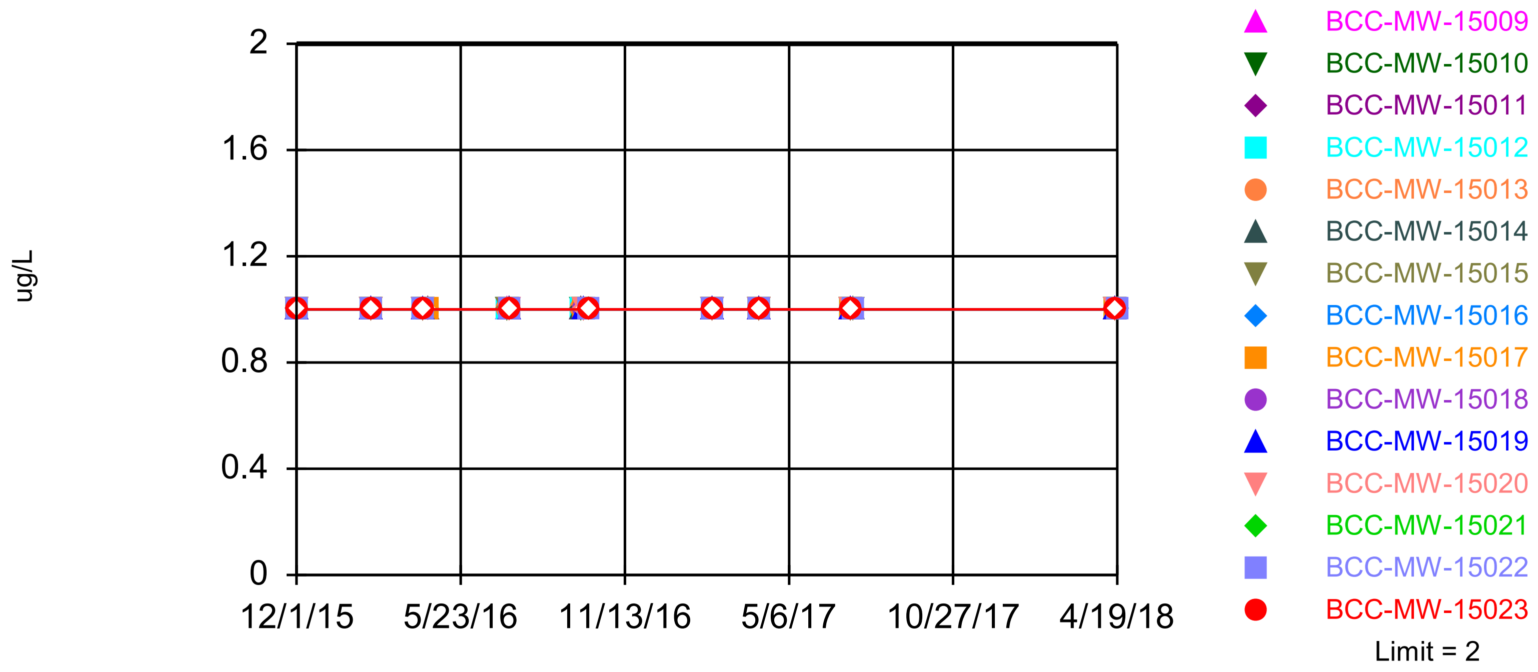
Client: Consumers Energy Data: BCC_Sanitas

Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG
Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. Limit is highest of 64 background values. 96.88% NDs. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Lead, Total   Analysis Run 5/30/2018 11:21 AM

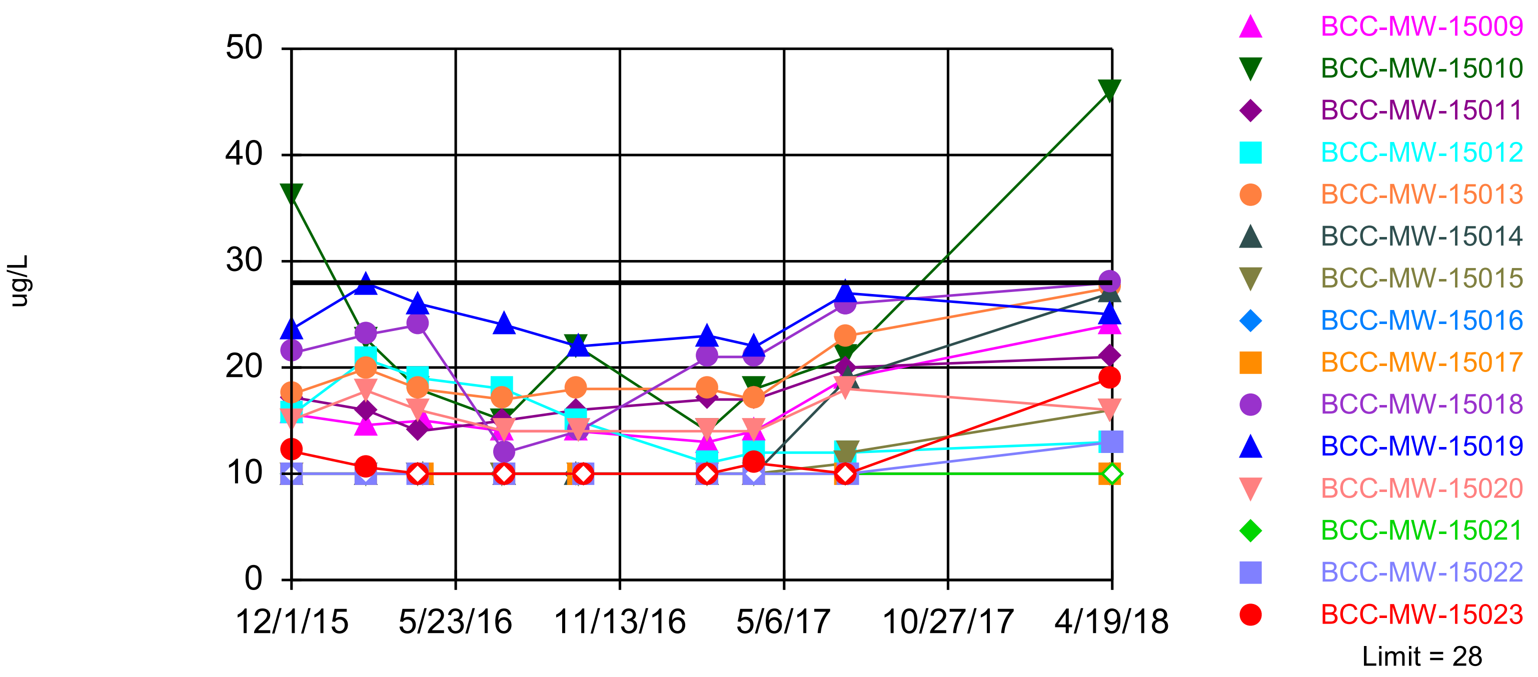
Client: Consumers Energy   Data: BCC_Sanitas

Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG
Hollow symbols indicate censored values.

Exceeds Limit: BCC-MW-15010

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. Limit is highest of 64 background values. 79.69% NDs. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Lithium, Total Analysis Run 5/30/2018 8:57 AM

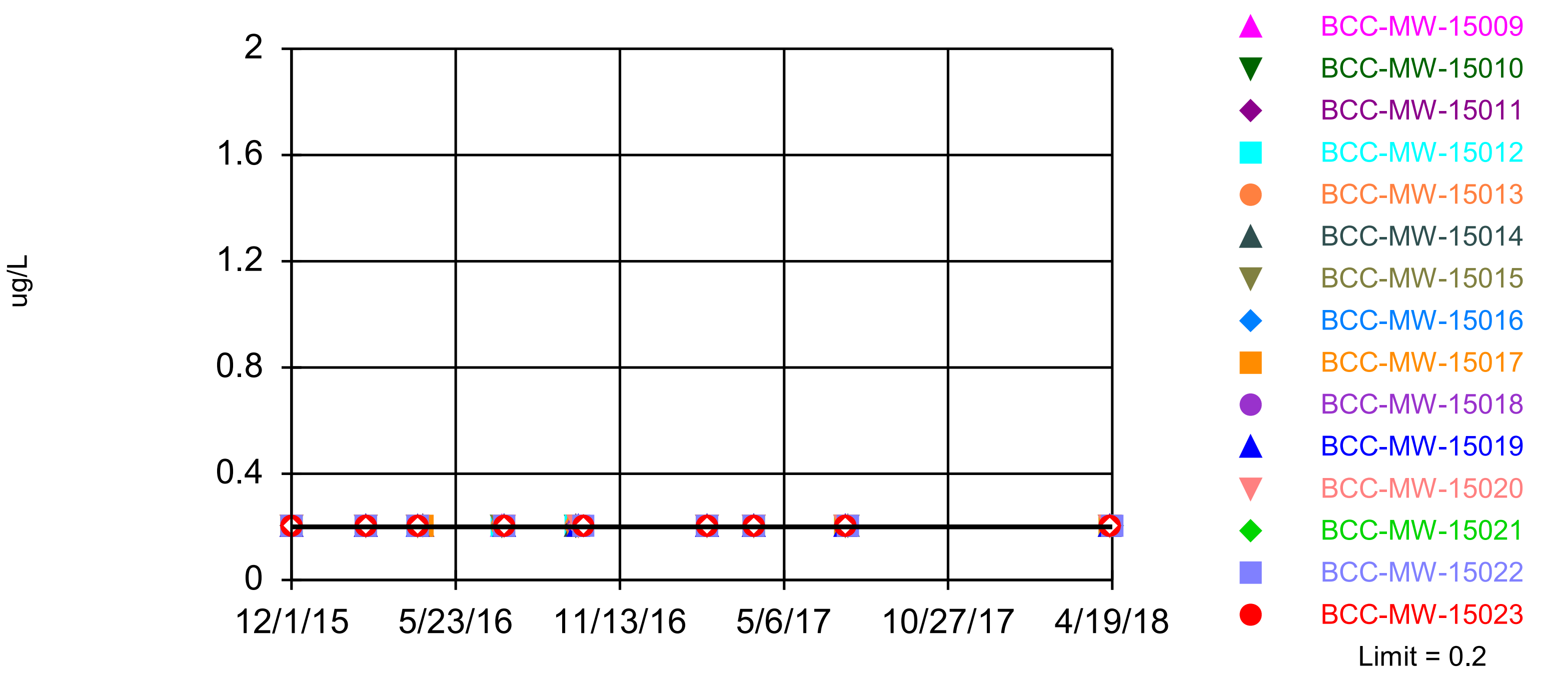
Client: Consumers Energy Data: BCC_Sanitas

Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG
Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Mercury, Total Analysis Run 6/12/2018 11:45 AM

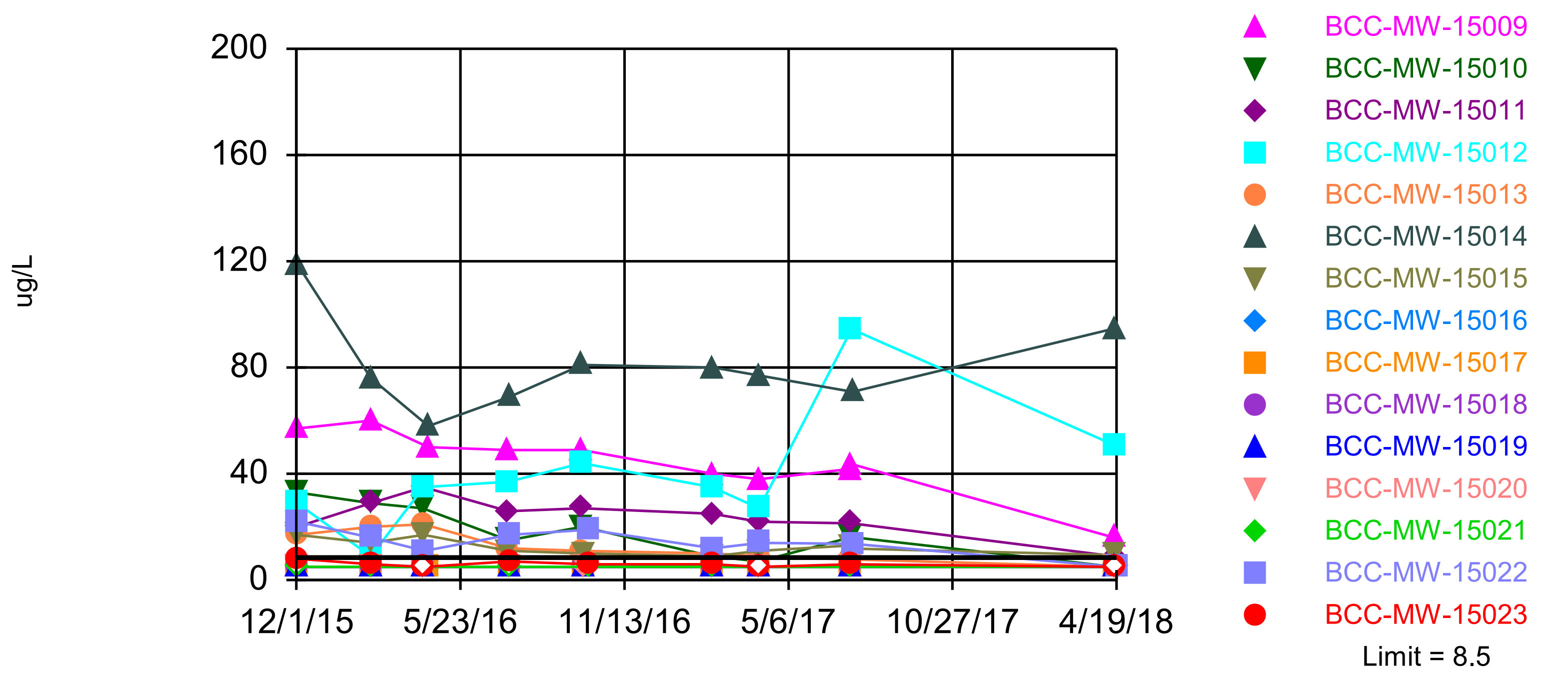
Client: Consumers Energy Data: BCC_Sanitas

Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG
Hollow symbols indicate censored values.

Exceeds Limit: BCC-MW-15009, BCC-MW-15011, BCC-MW-15012, BCC-MW-15014...

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. Limit is highest of 64 background values. 82.81% NDs. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Molybdenum, Total Analysis Run 5/30/2018 8:58 AM

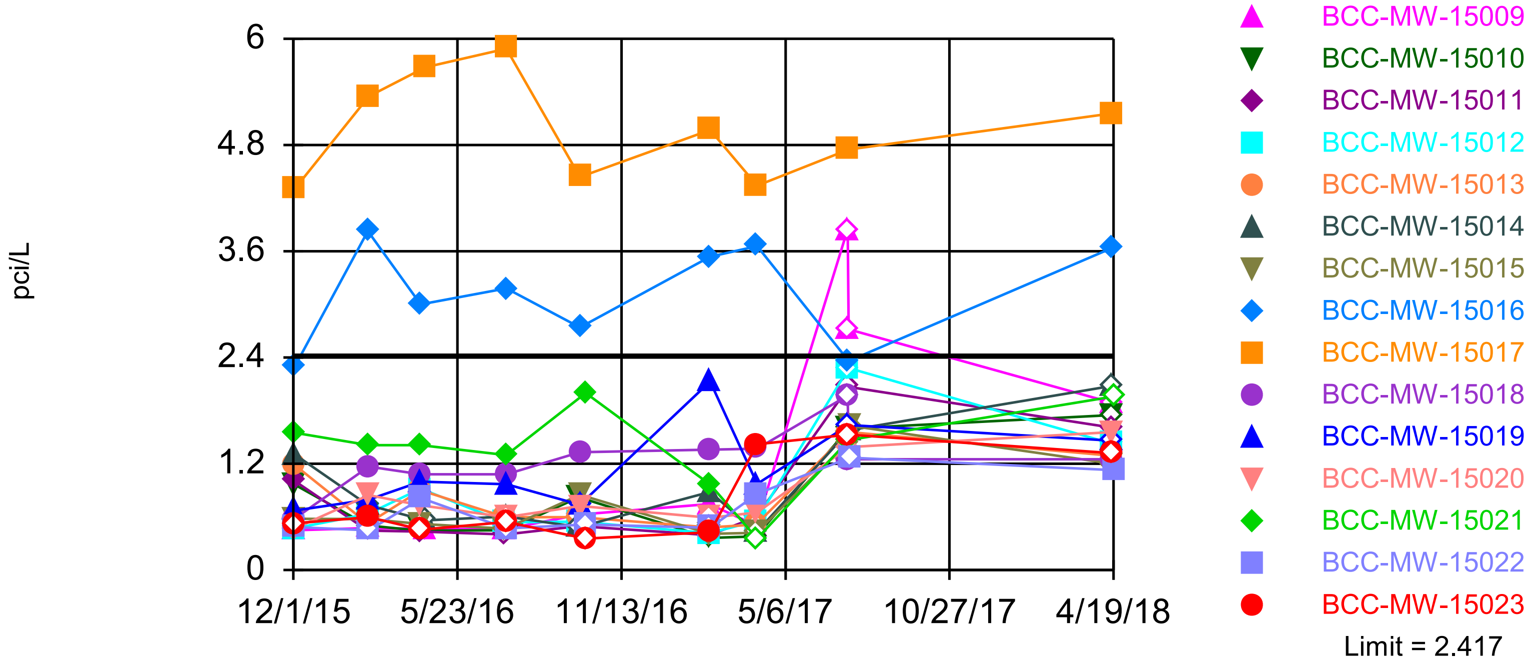
Client: Consumers Energy Data: BCC_Sanitas

Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG
Hollow symbols indicate censored values.

Exceeds Limit: BCC-MW-15016, BCC-MW-15017

Tolerance Limit

Interwell Parametric



95% coverage. Most recent observation is compared with limit. Background Data Summary (after Kaplan-Meier Adjustment): Mean=1.044, Std. Dev.=0.6854, n=64, 35.94% NDs. Normality test: Shapiro Francia @alpha = 0.01, calculated = 0.9487, critical = 0.947. Report alpha = 0.05.

Constituent: Radium-226/228 Analysis Run 5/30/2018 8:59 AM

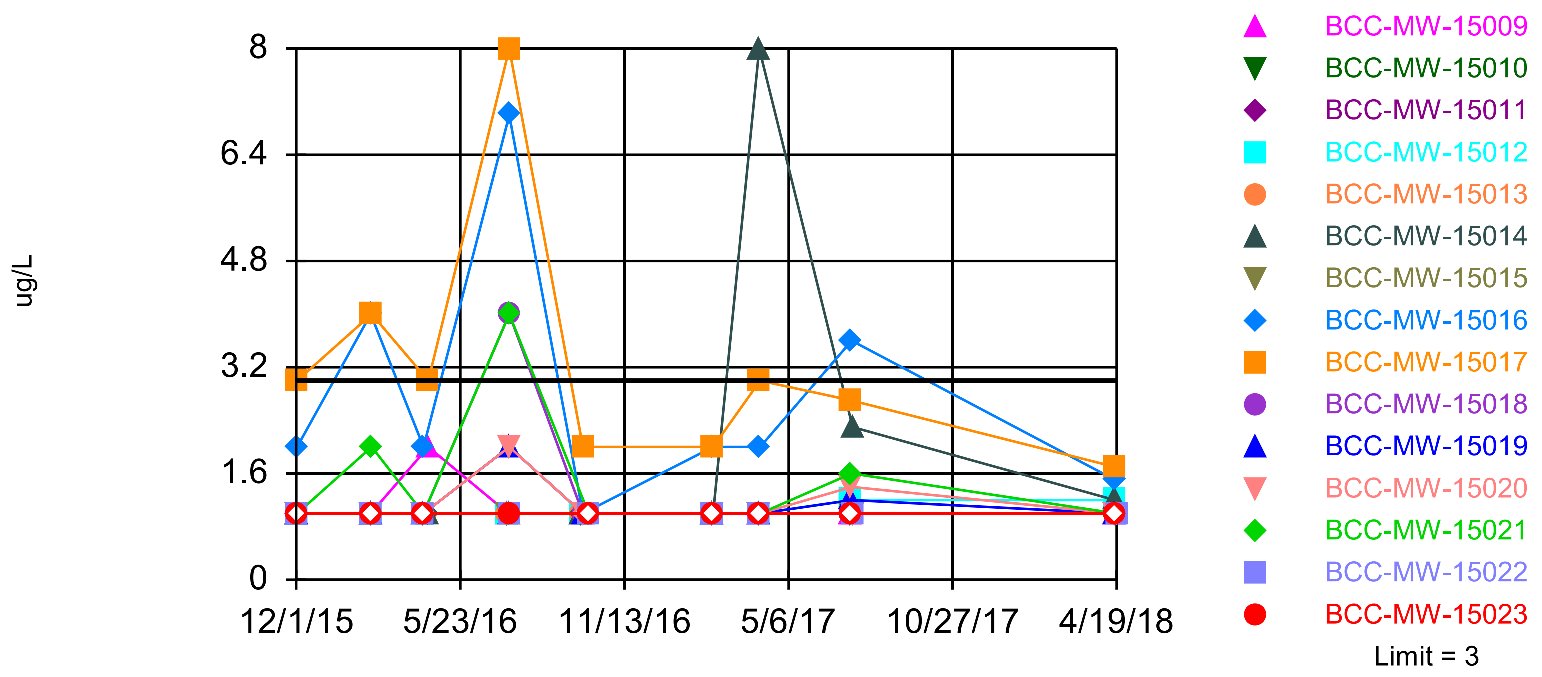
Client: Consumers Energy Data: BCC_Sanitas

Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG
Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. Limit is highest of 64 background values. 67.19% NDs. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Selenium, Total   Analysis Run 5/30/2018 9:00 AM

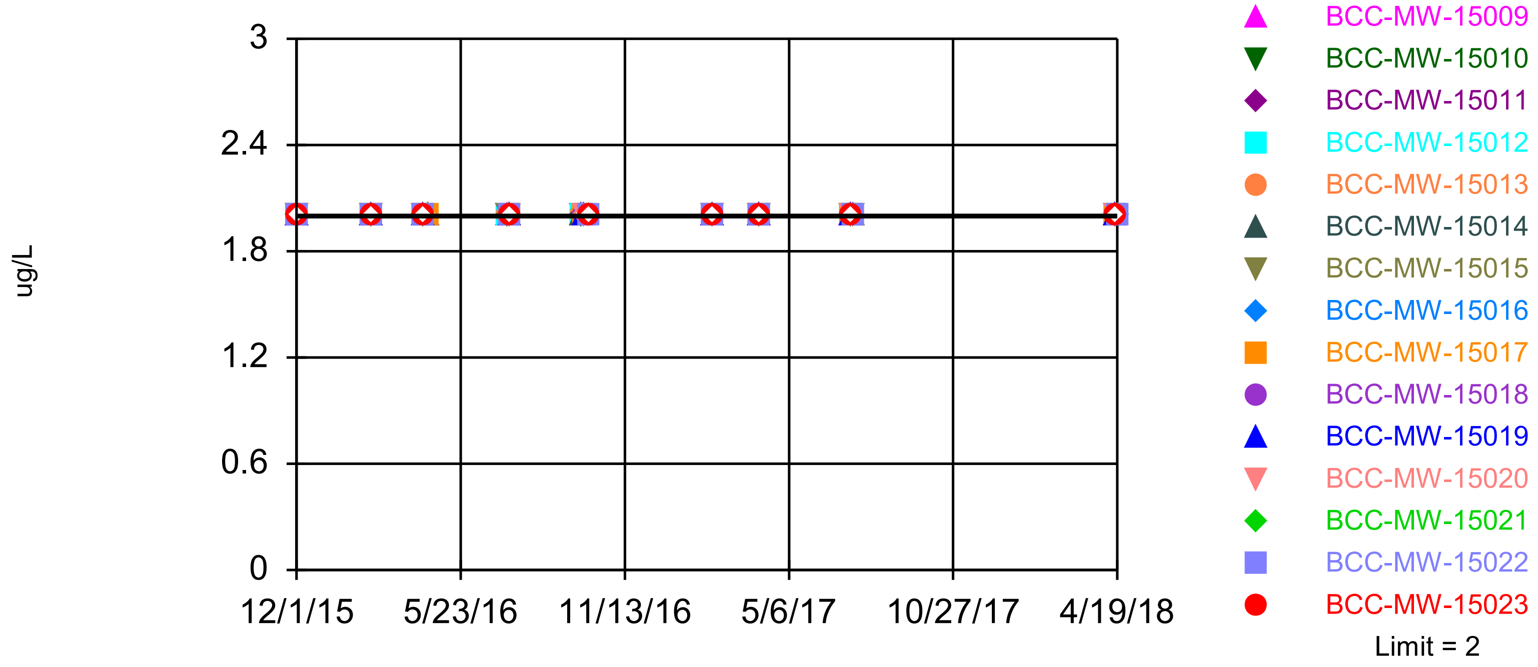
Client: Consumers Energy   Data: BCC_Sanitas

Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG
Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Thallium, Total   Analysis Run 6/12/2018 11:45 AM

Client: Consumers Energy   Data: BCC_Sanitas