

Alternate Source Demonstration of Statistically Significant Levels over Groundwater Protection Standards

for Compliance with the Michigan Rule R
299.4441(8)

Erickson Power Station

Lansing Board of Water & Light

July 22, 2024



Contents

	Page No.
Certification	iv
1.0 Introduction	5
2.0 Background.....	6
3.0 Evidence for an Alternate Source	12
4.0 Alternate Source Identification.....	24
5.0 Summary	33
References.....	35

Tables

Table 1. Construction Details for Erickson MW-16 Series Wells.....	6
Table 2. SSLs over GPS– November 2023.....	6
Table 3. Chloride Concentrations in Select Glacial Aquifer Wells at Erickson Power Station.....	13
Table 4. TDS Concentrations in Select Glacial Aquifer Wells at Erickson Power Station	15
Table 5. Chloride/TDS Ratios in Select Glacial Aquifer Wells at Erickson Power Station	17
Table 6. Boron Concentrations in Bedrock Aquifer Wells at Erickson Power Station	22

Figures

Figure 1. Vicinity Map for Erickson Power Station	7
Figure 2. Erickson Power Station – CCR Units and Monitoring Well Location Map.....	8
Figure 3. Erickson Power Station – Watershed Boundary Topographic Map	9
Figure 4. Erickson Power Station – October 2023 Glacial Aquifer Potentiometric Contour Map	10
Figure 5. Erickson Station – October 2023 Bedrock Aquifer Potentiometric Contour Map	11
Figure 6. Groundwater Contours for Shallow Groundwater Wells on the Adjacent Reith Riley Property demonstrating groundwater flow under that property to be westward towards the wetland and Erickson (Prien & Newhof, 2003).	12
Figure 7. Chloride Concentrations in Select Erickson Glacial Aquifer Wells.....	14
Figure 8. Chloride Concentrations in Select Erickson Glacial Aquifer Wells.....	16
Figure 9. Chloride and TDS Concentration Ratios of Select Erickson Glacial Aquifer Wells	18
Figure 10. Erickson Groundwater Elevations	20
Figure 11. Erickson Groundwater Elevations in Paired Glacial and Bedrock Monitoring Wells	21
Figure 12. Boron Concentrations in Select Erickson Bedrock Aquifer Wells	22
Figure 13. MW-16 Well Vicinity Topographic Map	25
Figure 14. Groundwater chemistry associated with shale bedrock aquifer. The BWL bedrock monitoring wells are completed in a shale dominated bedrock aquifer, and well MW-16D screen is completely in shale.	28

Figure 15. BWL Bedrock Wells, Private Wells, and Glacial Wells MW-3 and MW-7C Piper Diagram .30
Figure 16. Erickson Power Station Bedrock Well Screened Shale Percentages and Boron Concentrations31
Figure 17. Boron Concentrations and Boron Isotope Ratios of Known Impacted and Unimpacted Wells
and Impoundment Ash, Erickson Power Station32

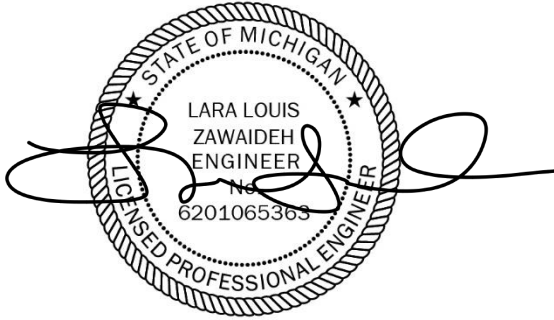
Attachments

- Attachment 1. Boring Logs
- Attachment 2. Laboratory Reports

Certification

Erickson Station, Alternative Source Demonstration

I hereby certify to the best of my knowledge that this Alternative Source Demonstration was prepared to meet the requirements of Michigan Rule R 299.4441(8).



Lara Louis Zawaideh, PE ENV SP

Michigan PE License: 6201065363

License Renewal Date: 02/03/2026

1.0 Introduction

The U.S. Environmental Protection Agency's (EPA's) final Coal Combustion Residuals (CCR) Rule and Michigan's Part 115 Solid Waste Management, of the Natural Resources and Environmental Protection Act, 1994 PA 451 (Part 115), establishes a comprehensive set of requirements for the management and disposal of CCR (or coal ash) in landfills and surface impoundments by electric utilities. Erickson Power Station (Erickson or site), located in Delta Township, Eaton County, Michigan, is owned and operated by the Lansing Board of Water & Light (BWL) (**Figure 1**). Erickson has three CCR impoundments: the Forebay, Retention Basin, and Clear Water Pond. The three CCR impoundments are currently inactive. All CCR and liners were removed in 2023.

On January 31, 2024, BWL documented statistically significant levels (SSLs) above the established groundwater protection standards (GPS) for three constituents of interest (COIs) in two wells within the nested MW-16 series under the State monitoring program. The SSLs were identified after the wells had completed enough sample events to reach statistical significance and were evaluated in accordance with Michigan Rule R 299.4907. The SSLs were for chloride and total dissolved solids (TDS) in well MW-16A, a shallow well completed in the glacial aquifer. There was also an SSL for boron in well MW-16D, a deeper well completed in the bedrock aquifer. Four wells completed at different depths were installed in the MW-16 series as nature and extent wells to evaluate the extent of GPS exceedances originating from the impoundments. Groundwater flow data collected indicates that groundwater originating from under the impoundments does not continue eastward to the MW-16 wells, and instead follows the natural topography east towards the wetland and then north following the Carrier Creek drainage. Wells within the MW-16 series show groundwater at higher elevation than other wells (MW-7 series) at the site indicate that groundwater flows west towards the east property boundary of Erickson Station and then north following the Carrier Creek drainage. Further, this data is corroborated with historical information obtained from groundwater investigations at the adjacent Reith Riley Construction Company property, located east of Erickson between the wetland and Creyts Road. Additionally, there is significant data demonstrating the natural occurrence of boron in the Saginaw bedrock aquifer, where MW-16 bedrock wells are completed.

Per Michigan Rule R299.4441 (8), the objective of this Alternate Source Demonstration (ASD) is to evaluate and demonstrate if the SSLs observed in the two MW-16 wells may be attributed to an alternate, non-CCR, source. However, under the federal CCR Rule groundwater monitoring compliance program, these three COIs are Appendix III screening parameters and therefore GPS are not developed and do not trigger corrective measures; therefore, an ASD is not required under the federal compliance program.

2.0 Background

Groundwater at Erickson is currently being monitored in two aquifers, the uppermost glacial aquifer, and the Saginaw bedrock aquifer below. Additional details regarding the aquifers can be found in the Groundwater Monitoring System Certification for Erickson Station (HDR, 2024).

Several wells are installed around the impoundments at Erickson. The well locations are shown on **Figure 2**. Four monitoring wells for the glacial aquifer (MW-1, MW-4, MW-11, and MW-12) and two monitoring wells for the bedrock aquifer (MW-11B and MW-12B) are located upgradient of the impoundments as shown on the October 2023 contours for the site in **Figures 4 and 5**. Both the glacial and bedrock contours for the site show the groundwater flow direction at Erickson flows eastward from the CCR impoundments to the wetland east of the property, where flow direction follows the natural topography northward with Carrier Creek drainage.

As described in the January 31, 2024 Annual Groundwater Monitoring Report for the site, SSLs over GPS were identified in glacial well MW-16A for chloride and TDS, and an SSL for boron was identified in bedrock well MW-16D. Construction details for the wells in the MW-16 series can be found in **Table 1**, and logs for all constructed wells are present in **Attachment A**. The state GPS and the calculated 95% lower confidence limits (LCLs) for the COIs in the wells that triggered the SSLs are in **Table 2**.

Table 1. Construction Details for Erickson MW-16 Series Wells			
Well	Screen Elevation	Aquifer	Screen Lithology
MW-16A	857-867	Glacial	Lean clay with sand
MW-16B	835-845	Glacial	Silt
MW-16C	811-821	Bedrock	Shale (40%) and sandstone (60%)
MW-16D	752-762	Bedrock	Shale (100%)

Table 2. SSLs over GPS– November 2023				
Constituent (mg/L)		Chloride	Total Dissolved Solids	Boron
Glacial GPS		250	1,169	0.50
Bedrock GPS		250	500	3.52
Monitoring Well Calculated LCL	MW-16A	405	1,285	-
	MW-16D	-	-	4.57

“-“ Denotes the LCL did not exceed the established GPS.

The LCL values were calculated with data obtained from the installation of wells MW-16A and MW-16D in February 2023 through November 2023. The SSLs triggered the completion of this Alternate Source Demonstration (ASD).

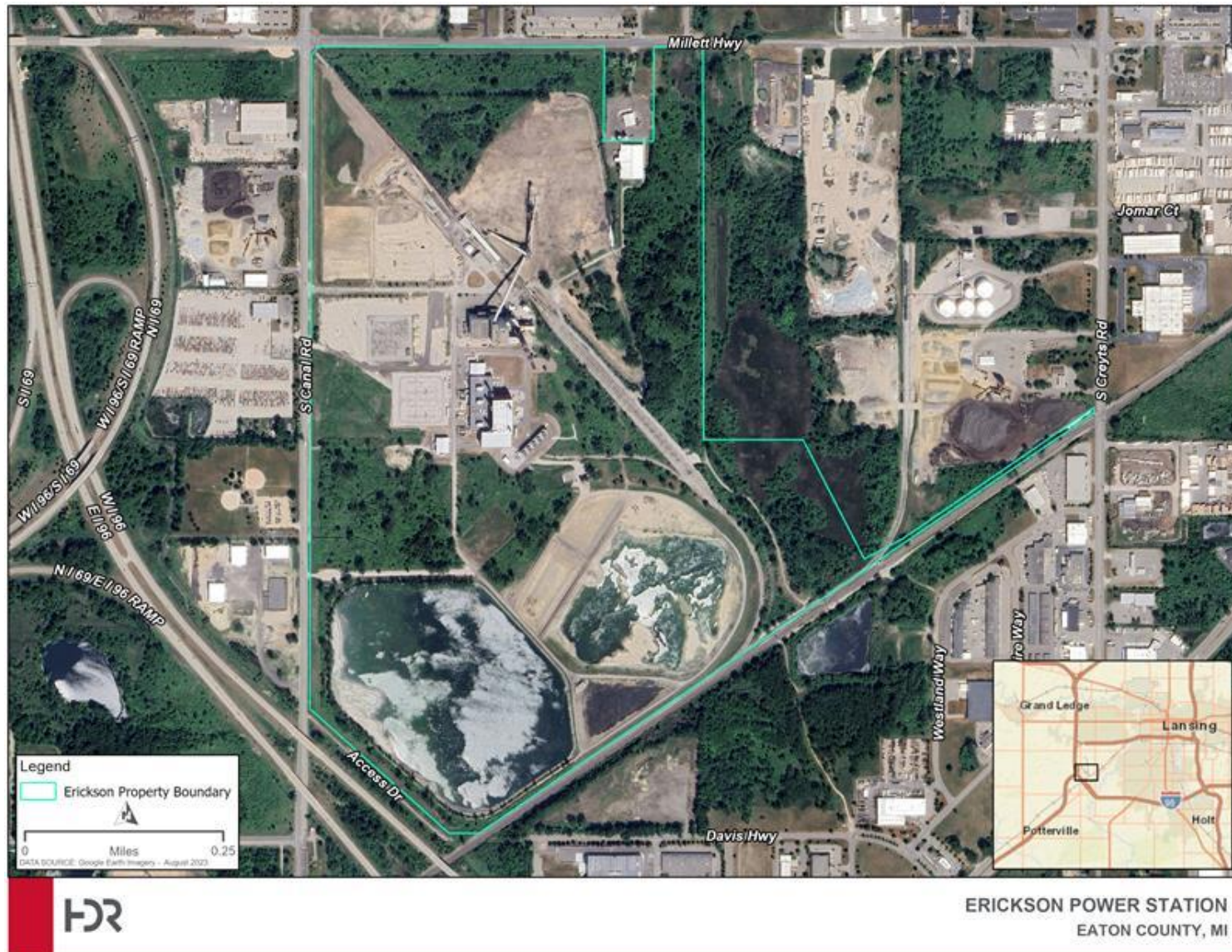


Figure 1. Vicinity Map for Erickson Power Station

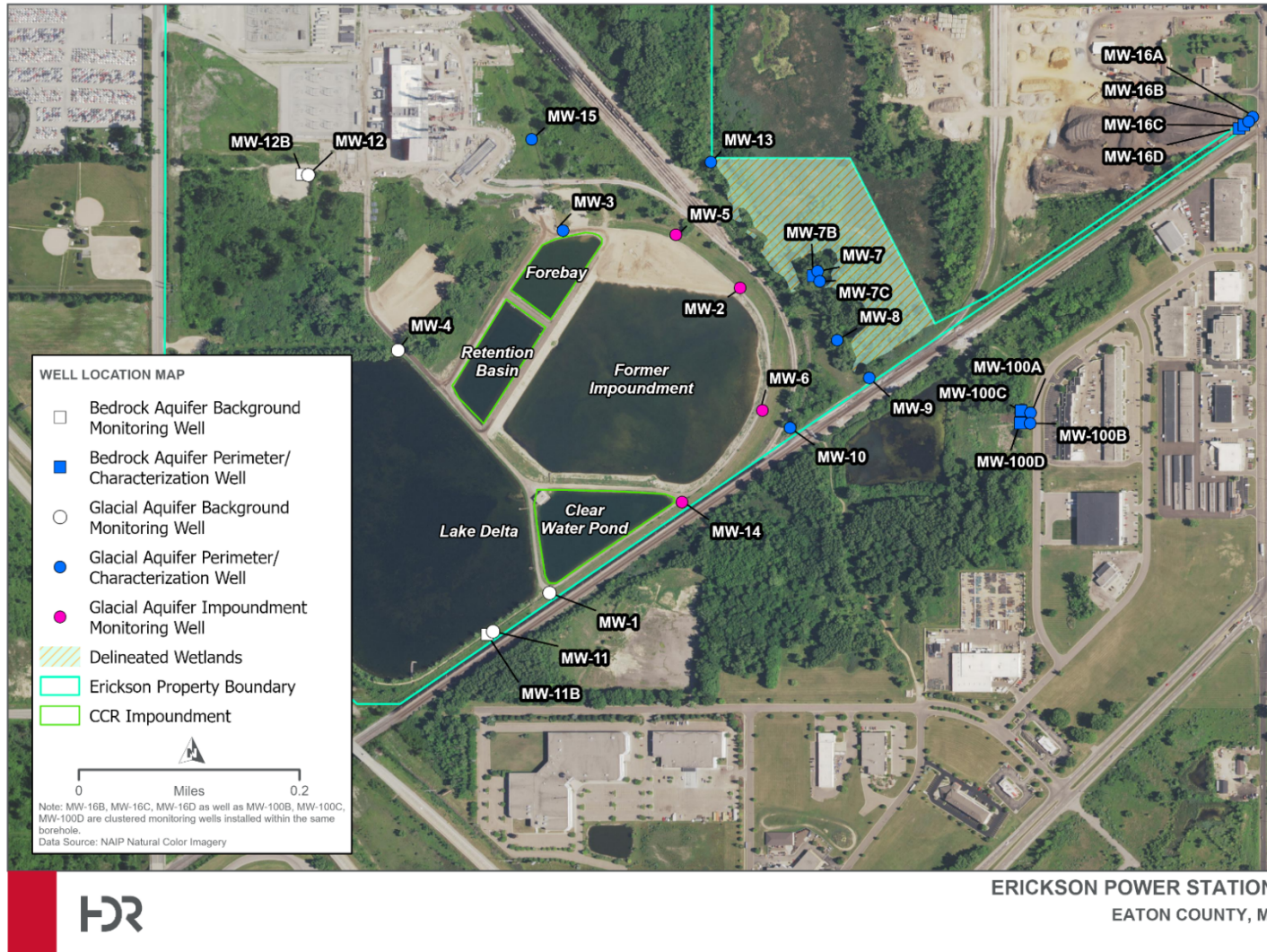


Figure 2. Erickson Power Station – CCR Units and Monitoring Well Location Map

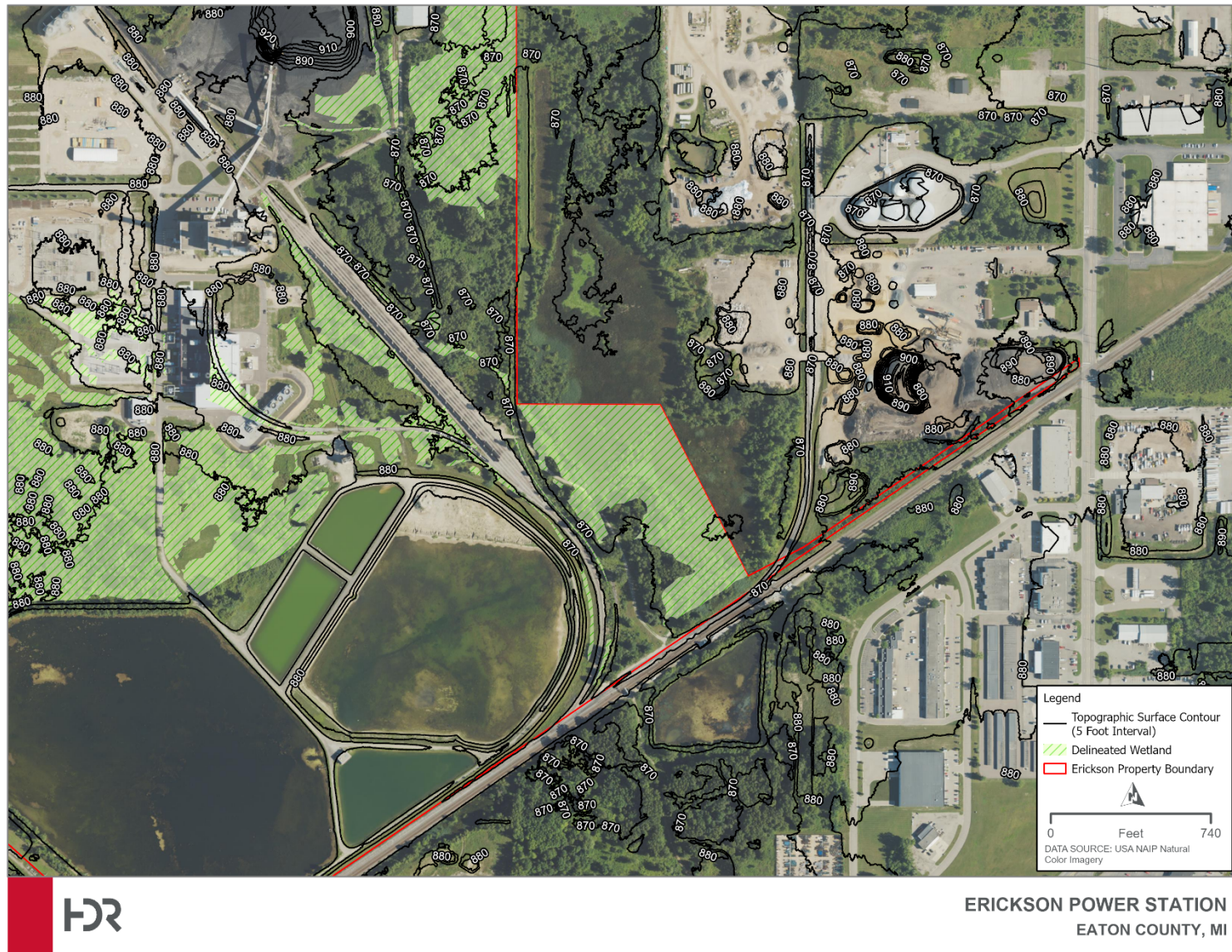


Figure 3. Erickson Power Station – Watershed Boundary Topographic Map

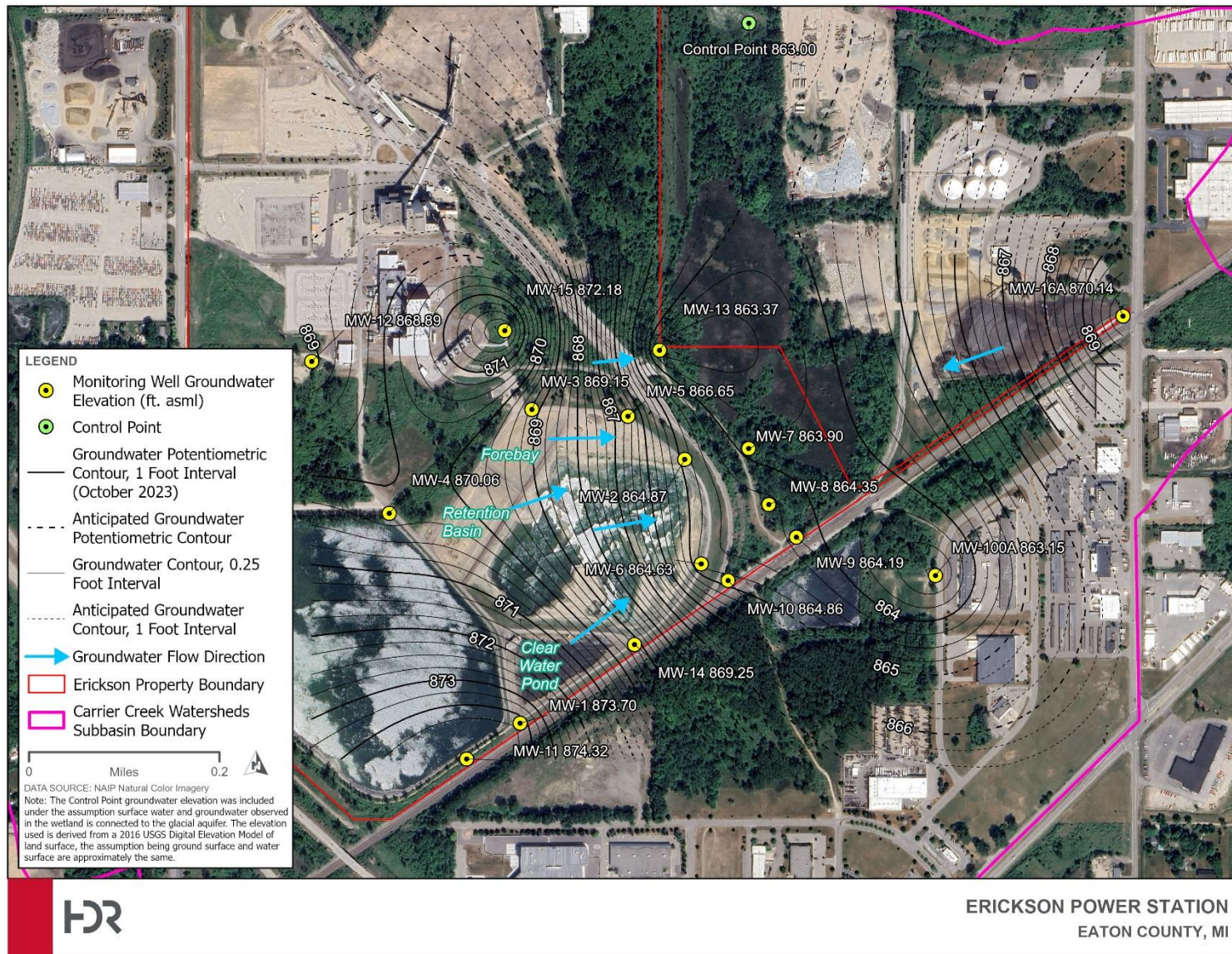


Figure 4. Erickson Power Station – October 2023 Glacial Aquifer Potentiometric Contour Map

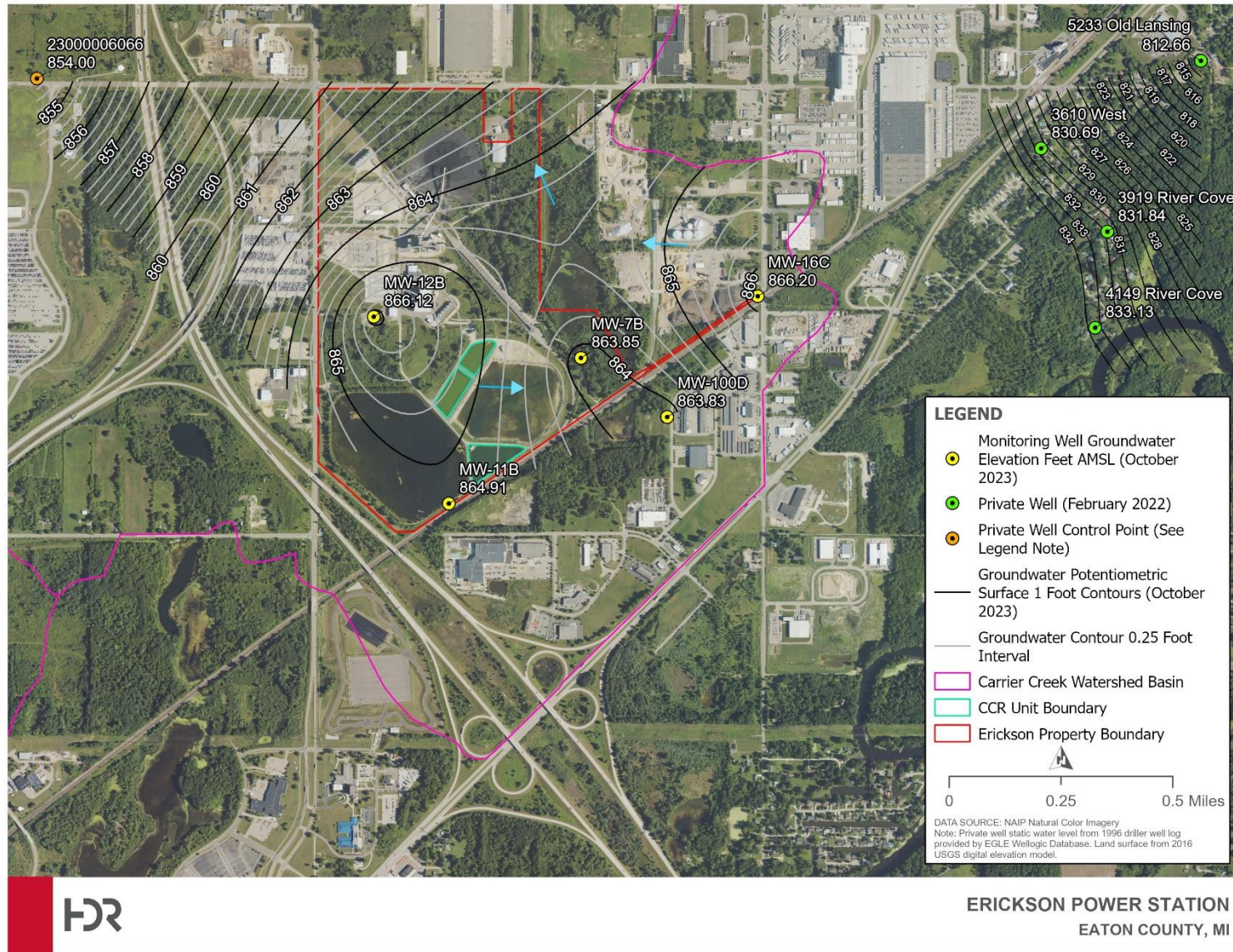


Figure 5. Erickson Station – October 2023 Bedrock Aquifer Potentiometric Contour Map

3.0 Evidence for an Alternate Source

A wetland is present between Erickson Station and the four MW-16 series wells. The wetland is readily observed in aerial photographs of the site (**Figure 1**), the confirmed wetland delineation boundary for the BWL property (**Figure 2**), and a topographic map of the site and surrounding area with the watershed boundary (**Figure 3**).

As shown in **Figure 3** and the October 2023 glacial and bedrock groundwater contour maps for Erickson in **Figures 4 and 5**, respectively, groundwater flow direction mimics this topography in both the glacial and bedrock aquifers east under the impoundments and northward with the flow of Carrier Creek. Further, groundwater contours for shallow groundwater wells on the east adjacent Reith Riley Construction Company property in the vicinity of the MW-16 nested wells also depict flow west towards the Erickson property boundary and the wetland (**Figure 6**). Therefore, it is very unlikely that the COCs at MW-16 could be sourced from the CCR impoundments at Erickson Station because MW-16 is not downgradient of the CCR impoundments.

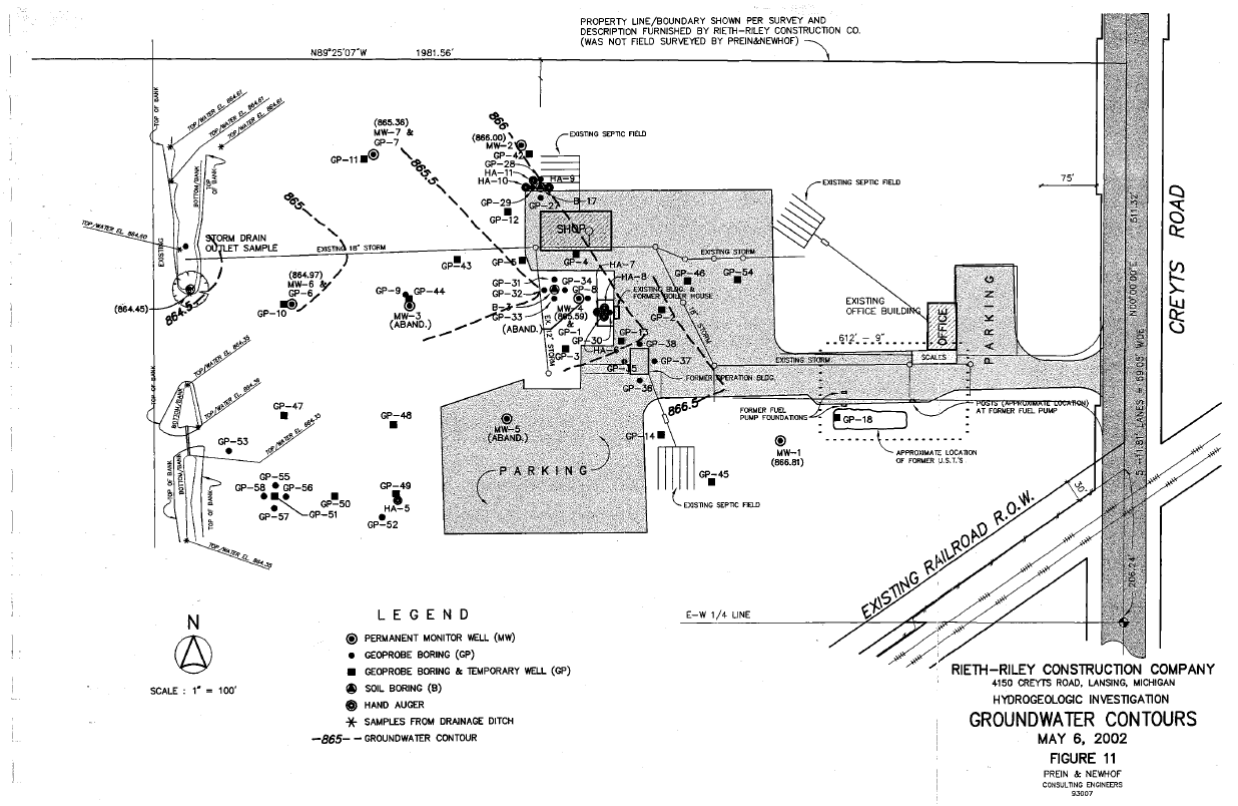


Figure 6. Groundwater Contours for Shallow Groundwater Wells on the Adjacent Reith Riley Property demonstrating groundwater flow under that property to be westward towards the wetland and Erickson (Prien & Newhof, 2003).

MW-16A – Chloride and TDS

As previously stated, groundwater within the glacial aquifer at Erickson Power Station is currently understood to flow from the Erickson impoundments to the east, and from the vicinity

of the MW-16 well series to the west, meeting at the low-lying Carrier Creek drainage where groundwater flows north following the drainage of Carrier Creek. This section provides information to help identify the likely source for the chloride and TDS and MW-16A,

While the groundwater immediately downgradient of the CCR impoundments has exceedances of other COIs, chloride is not a COC that has been identified as exceeding GPS at the CCR Impoundments waste boundary or perimeter wells. Well MW-16A is the only monitored well with concentrations greater than the GPS (**Table 2 and Figure 7**). In addition, a single surface water sample was collected on March 30, 2022, from the wetland at the eastern Erickson property boundary, with a chloride concentration of 72 mg/L. Chloride concentrations at well MW-16A are dissimilar to those observed at Erickson. Additionally, the chloride concentrations greater than GPS are isolated to only the uppermost groundwater as concentrations are low and/or not detected in the deeper glacial well, MW-16B.

Table 3. Chloride Concentrations in Select Glacial Aquifer Wells at Erickson Power Station				
	Monitoring Well	Chloride Glacial Background Value (UTL) (mg/L)	Chloride GPS (mg/L)	95% Calculated LCL – 2024 Annual Report
Erickson Glacial Aquifer Impoundment Wells with GPS Exceedances	MW-2	94.3	250	79.1
	MW-5			64.9
	MW-6			31.4
	MW-7			73.0
	MW-7C			92.1
	MW-14			111
	MW-16A¹			405
	MW-16B			3.70

1) SSL for chloride only is present at well MW-16A.

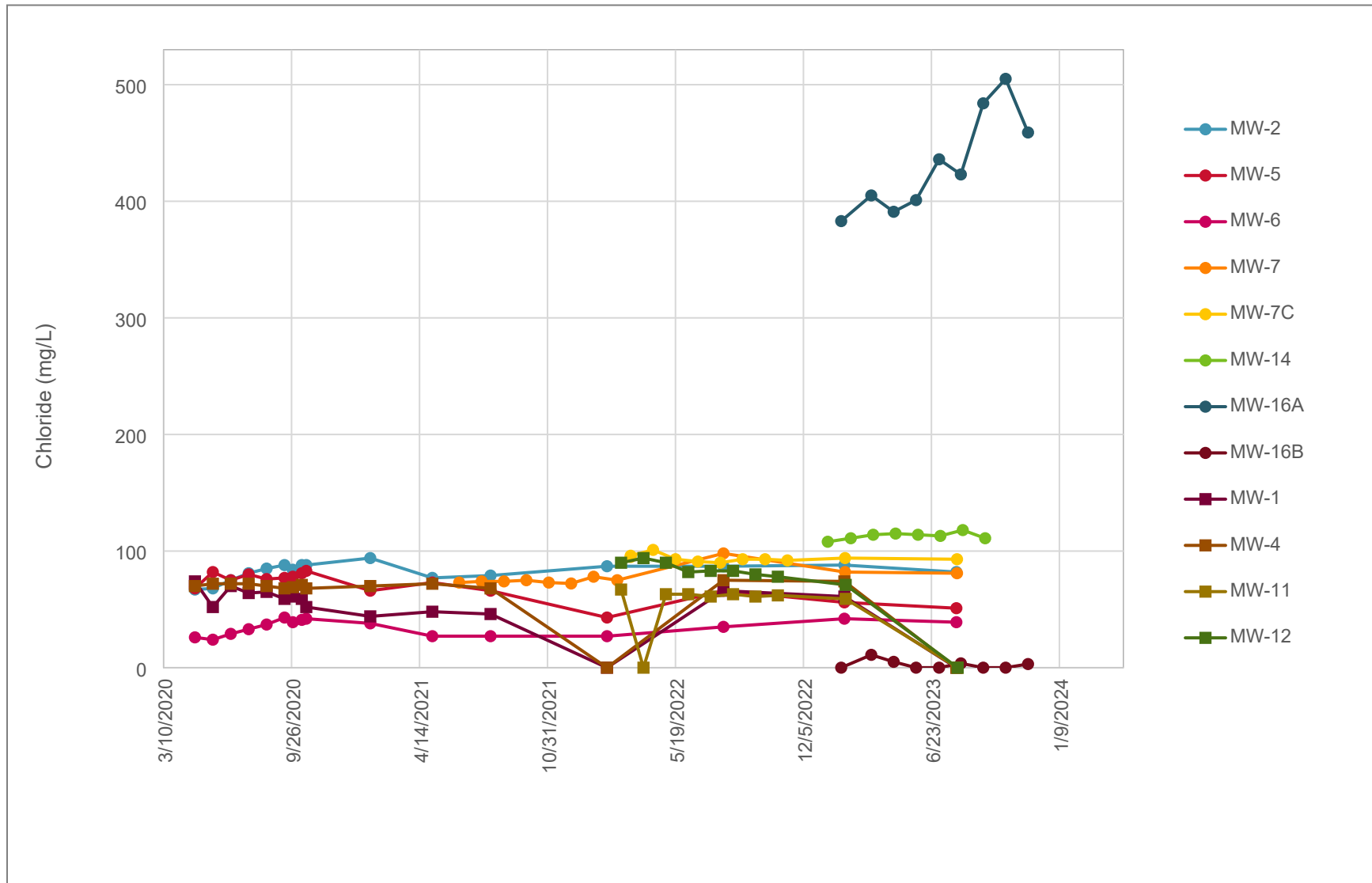


Figure 7. Chloride Concentrations in Select Erickson Glacial Aquifer Wells

If the source of the chloride SSL in the groundwater was the CCR impoundments, the highest concentrations of chloride would be expected to be at the waste boundary wells or at well MW-7. However, this is not observed and the chloride in MW-16A is three to four times greater than the chloride concentrations at wells near the CCR impoundments.

Several SSLs have previously been reported for TDS in wells MW-2, MW-5, and MW-7C. However, TDS in waste boundary wells confirmed to have GPS exceedances are accompanied by other COCs known to occur in the CCR, including boron, calcium, lithium, molybdenum, and sulfate. At MW-16A there is only an exceedance of chloride and TDS. If the TDS in well MW-16A was from the CCR impoundments, we would expect to see elevated levels of boron, calcium, lithium, molybdenum, and/or sulfate.

TDS concentrations from glacial wells with any previously detected GPS exceedance and new wells within the MW-16 clustered well series are in **Table 3**. The TDS concentrations for these wells are also graphed in **Figure 8**. The TDS concentration of the wetland surface water sample collected in March 2022 was 1,510 mg/L. Again, as with the chloride concentrations in MW-16A, TDS concentrations appear to be isolated to the uppermost shallow groundwater because concentrations do not exceed GPS in glacial well MW-16B.

Table 4. TDS Concentrations in Select Glacial Aquifer Wells at Erickson Power Station				
	Monitoring Well	TDS Glacial Background Value (UTL) (mg/L)	TDS GPS (mg/L)	95% Calculated LCL – 2024 Annual Report
Erickson Glacial Aquifer Impoundment Wells with GPS Exceedances	MW-2¹	1,169	1,169	1,198
	MW-5¹			1,233
	MW-6			723
	MW-7			573
	MW-7C¹			1,360
	MW-14			732
	MW-16A¹			1,285
	MW-16B			360

1) SSL for TDS only is present at wells MW-2, MW-5, MW-7C, and MW-16A.

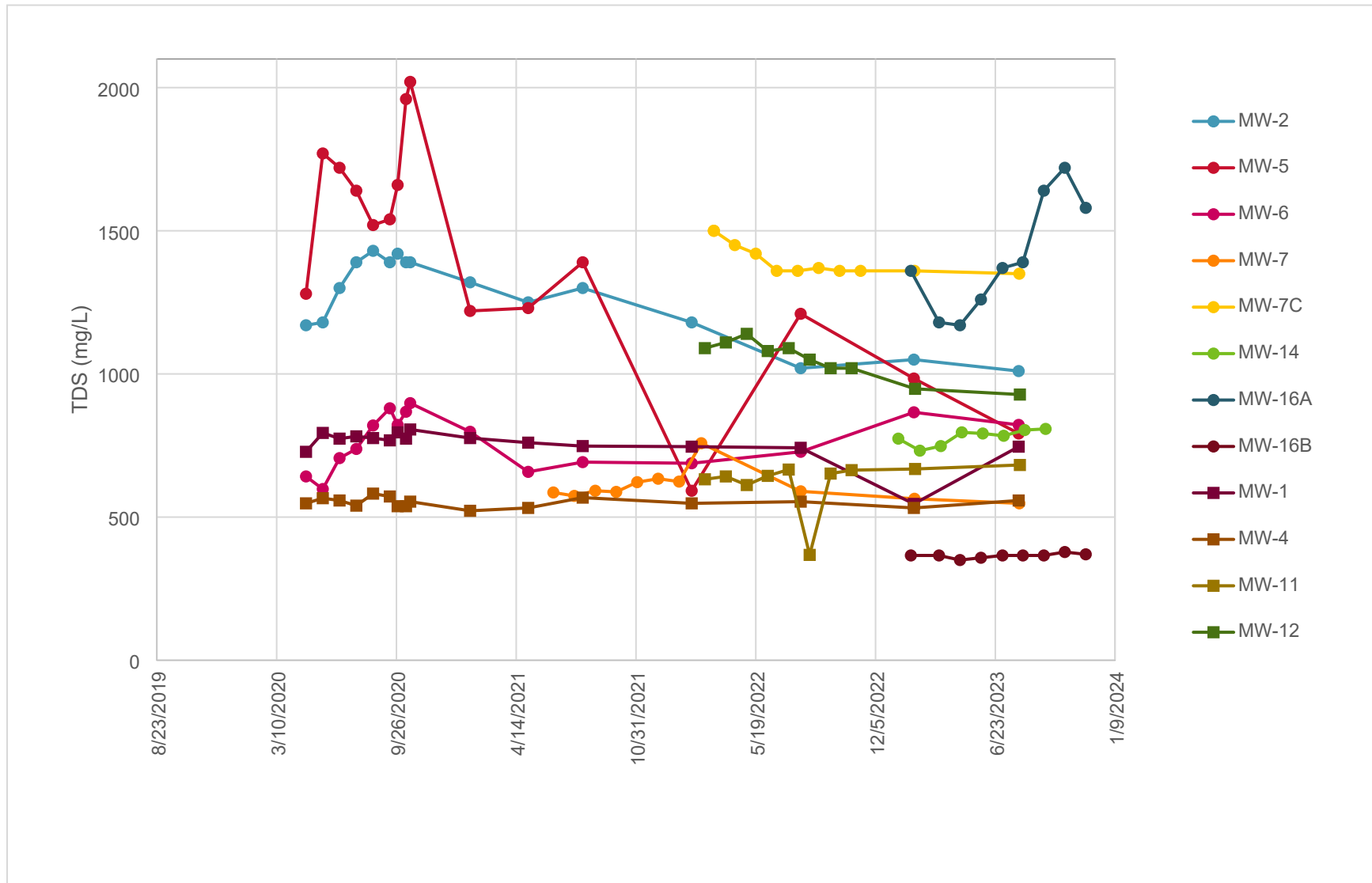


Figure 8. Chloride Concentrations in Select Erickson Glacial Aquifer Wells

To further illustrate that the TDS at well MW-16A is a different make-up of inorganic salts than the makeup of TDS at the wells immediately downgradient of the CCR impoundments, the ratio of the calcium to TDS was reviewed (**Table 4**). Concentrations of chloride in wells sited in the vicinity of the Erickson impoundments (well averages 34 – 113 mg/L) are similar to the concentration of chloride in the surface water sample collected within the wetland (72 mg/L). Yet, TDS concentrations at MW-16A closely mirror conditions observed at other glacial monitoring wells at Erickson. However, ratios of the concentrations of chloride and TDS in MW-16A do not match those originating from those wells within the vicinity of the CCR impoundments. On average, the ratio of chloride to TDS in MW-16A was three to four times greater than that of other wells with TDS SSLs at Erickson and two to fifteen times greater than the chloride to TDS ratio of other wells monitoring the impoundments (**Table 4, Figure 8**). If the concentrations of TDS in MW-16A had originated from the Erickson impoundments, the chloride to TDS ratio would be similar to that of the other glacial monitoring wells.

Table 5. Chloride/TDS Ratios in Select Glacial Aquifer Wells at Erickson Power Station				
	Monitoring Well	Average Chloride Concentration (mg/L)	Average TDS Concentration (mg/L)	Chloride to TDS Ratio
Erickson Glacial Aquifer Wells with GPS Exceedances	MW-2²	82	1262	0.07
	MW-5²	70	1408	0.05
	MW-6	34	764	0.04
	MW-7	78	607	0.13
	MW-7C²	94	1399	0.07
	MW-14	113	780	0.14
Wetland Surface Water Sample	Wet-1	72*	1,510*	0.05
Erickson Glacial Aquifer MW-16 Series Wells	MW-16A¹²	432	1408	0.31
	MW-16B	6	365	0.02
Upgradient Wells for Reference	MW-1	59	754	0.08
	MW-4	71	551	0.13
	MW-11	62	623	0.10
	MW-12	83	1048	0.08

1) SSL for chloride only is present at well MW-16A.

1) SSL for TDS only is present at wells MW-2, MW-5, MW-7C, and MW-16A.

*A single sample was collected from the wetland; therefore, values are single point and not averages as with the monitoring wells.

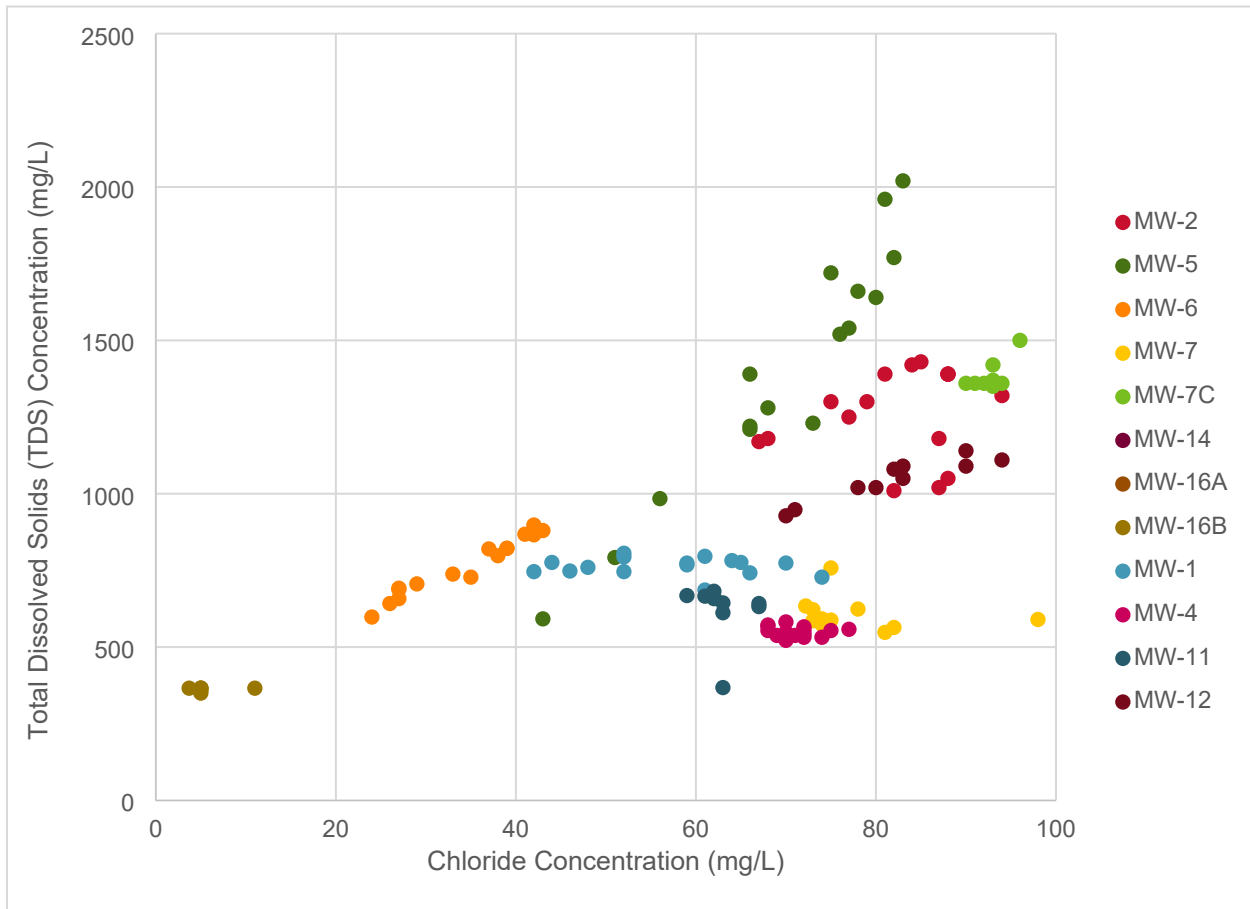


Figure 9. Chloride and TDS Concentration Ratios of Select Erickson Glacial Aquifer Wells

MW-16D – Boron

As stated previously, groundwater within the aquifers at Erickson is currently understood to flow northward at the Carrier Creek drainage instead of flowing eastward to the MW-16 wells. Therefore, COCs detected within the MW-16 well series would not likely have originated from the Erickson CCR impoundments based on groundwater flow direction. Shallow groundwater, measured at two depth levels in the glacial aquifer confirm groundwater at MW-16A and MW-16B are flowing westward such that shallow groundwater at MW-16 would not have come from the CCR impoundments. The upper bedrock groundwater was also evaluated with MW-16C, and groundwater elevations there also show the upper bedrock groundwater at MW-16 is flowing westward such that bedrock groundwater at MW-16 would not have come from the CCR impoundments.

Nevertheless, additional evidence is presented as to why the concentrations of COIs at MW-16D do not originate from the Erickson impoundments.

While most multi-level wells at Erickson Power Station display downward vertical hydraulic gradients, bedrock well MW-16D does not appear to be hydraulically connected to the other wells within its multi-level well series (MW-16A, MW-16B, and MW-16C) or to other wells. As



shown in **Figures 10 and 11**, MW-16D does not demonstrate seasonal fluctuations like those observed at all glacial wells and all other bedrock wells. This Figure demonstrates that all the other wells fluctuate similarly, except for MW-16D. This demonstrates that all the groundwater measured are subject to the same conditions, and therefore are hydraulically connected. Well MW-16D looks drastically different and has a substantially lower groundwater elevation than other wells despite being completed at a similar elevation and lithology as bedrock wells MW-11B, MW-12B, MW-7B, and MW-100D. This demonstrates that MW-16D is not hydraulically connected to the other wells. Therefore, the presence of any GPS exceedance in this well may be attributed to an alternate source because if MW-16D is not hydraulically connected to any other well then groundwater would not be expected to flow to that well. This could be the result of the fractures that are connected to the MW-16D well screen not being connected to the fracture network connecting all the other bedrock wells.

Additionally, shallower bedrock well MW-16C does have groundwater elevations that fluctuate similarly to the glacial well and other bedrock wells onsite but does not contain elevated boron levels observed in well MW-16D (**Figure 11**). Because the CCR contamination in groundwater at Erickson originated very shallow, leaking from the CCR impoundments, any transport of these inorganic contaminants, like boron, are expected to follow typical dispersion patterns. Dispersion is the term in the solute transport equation (Freeze and Cherry, 1979) accounting for dilution or mixing according to concentration gradients. The dispersivity has a longitudinal component (in the flow direction), a transverse component, and a vertical component. The magnitude of the transverse dispersivity controls the transverse spreading of the contaminant. Literature data from field experiments show small transverse dispersivities indicating limited transverse spreading of contaminant plumes. Transverse dispersivity values are commonly assumed to be about a tenth of the longitudinal dispersivity (Adams and Gelhar, 1992; Gelhar et al., 1992; Jensen et al., 1993). Vertical dispersivities are expected to be extremely small, which means very limited vertical spreading due to dispersion. Vertical dispersivity values are commonly assumed to be about a hundredth of the longitudinal dispersivity (Gelhar et al., 1992; Jensen et al., 1993). Therefore, if we assumed typical inorganic dispersion of boron, a plume from the CCR impoundments would be expected to flow horizontally primarily, and vertically to a lesser degree. Therefore, it would not be expected to see increased boron concentration at depth away from the impoundments and not also shallow at that same distance away from the impoundments. Yet, that is the case at MW-16D. The boron GPS exceedance is only at MW-16D and not at shallower wells MW-16A, MW-16B, or MW-16C. Because this is unexpected if the boron was from the CCR impoundment, an alternate source is likely, and as described in Section 1, there is an alternate source of the boron in the shale bedrock. Additionally, shallower groundwater and any boron from the impoundments would be expected to follow the Carrier Creek drainage and not flow towards MW-16.

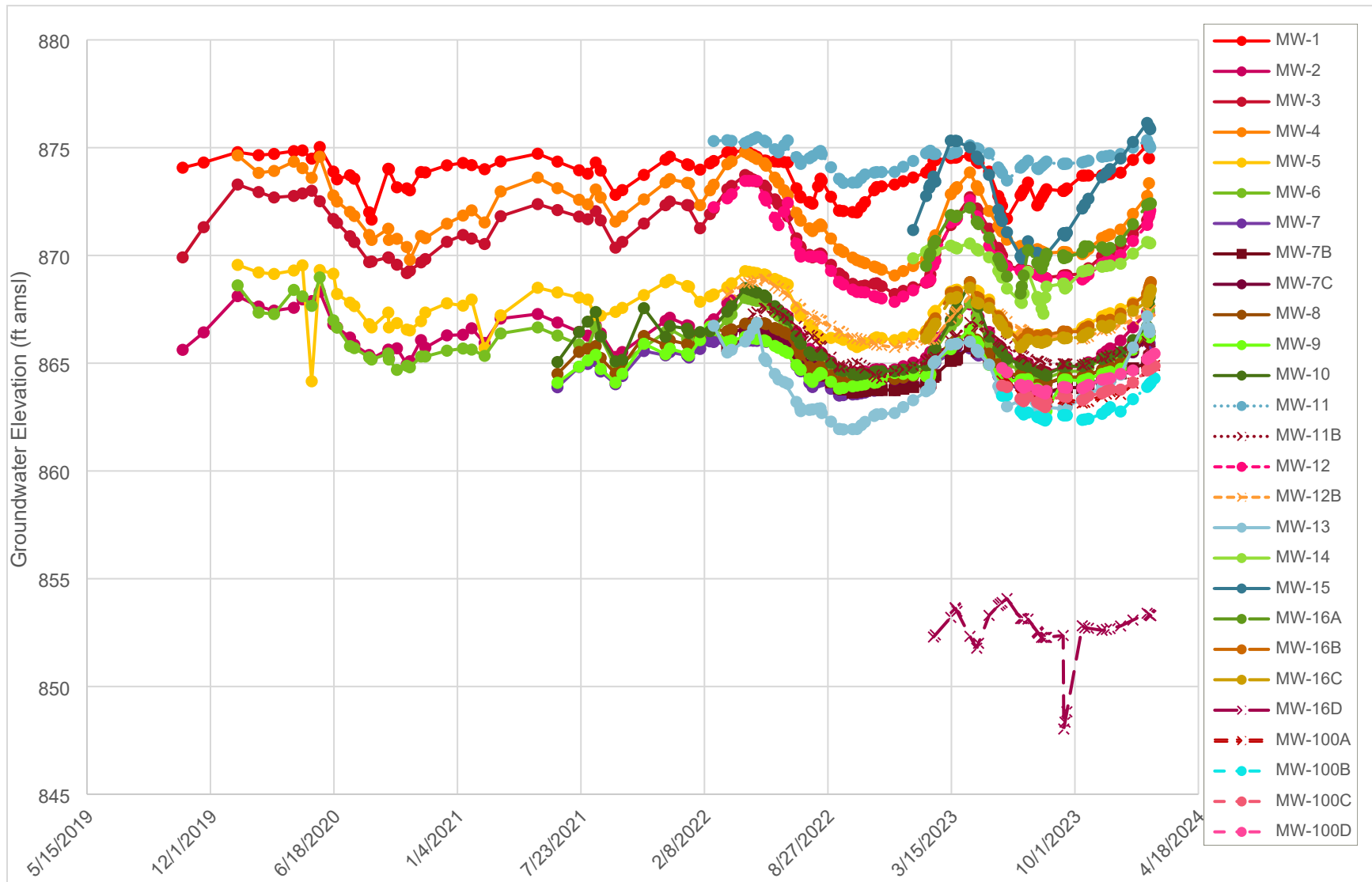


Figure 10. Erickson Groundwater Elevations

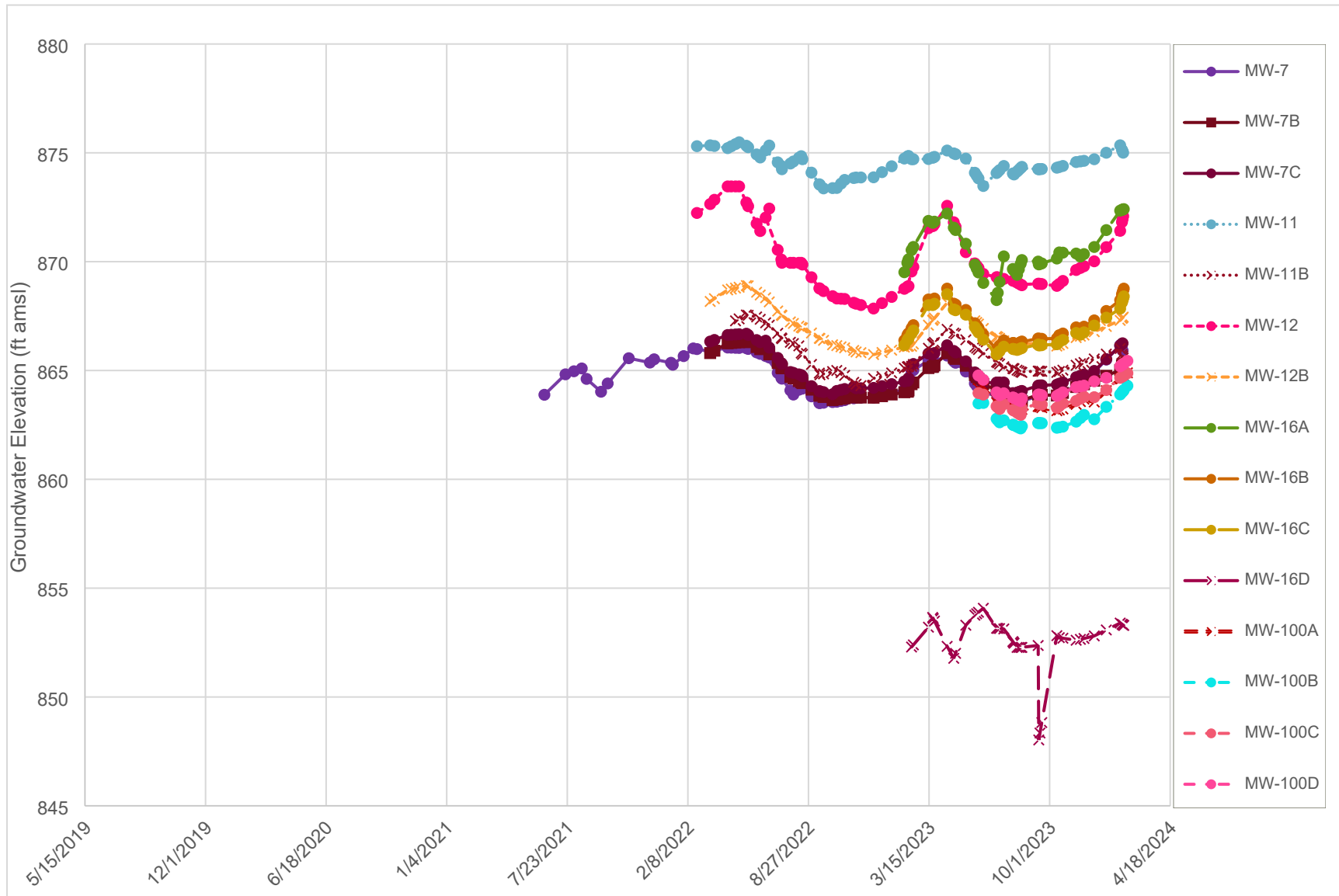


Figure 11. Erickson Groundwater Elevations in Paired Glacial and Bedrock Monitoring Wells

Concentrations of boron in bedrock wells at Erickson Power Station clustered well series are in **Table 5**. The boron concentrations for these wells are also graphed in **Figure 12**.

Table 6. Boron Concentrations in Bedrock Aquifer Wells at Erickson Power Station				
	Monitoring Well	Boron Bedrock Background Value (UTL) (mg/L)	Boron Bedrock GPS (mg/L)	95% Calculated LCL – 2024 Annual Report
Erickson Station Downgradient Bedrock Aquifer Wells	MW-7B	3.52	3.52	79.1
	MW-16C			64.9
	MW-16D			31.4
	MW-100C			NA
	MW-100D			NA

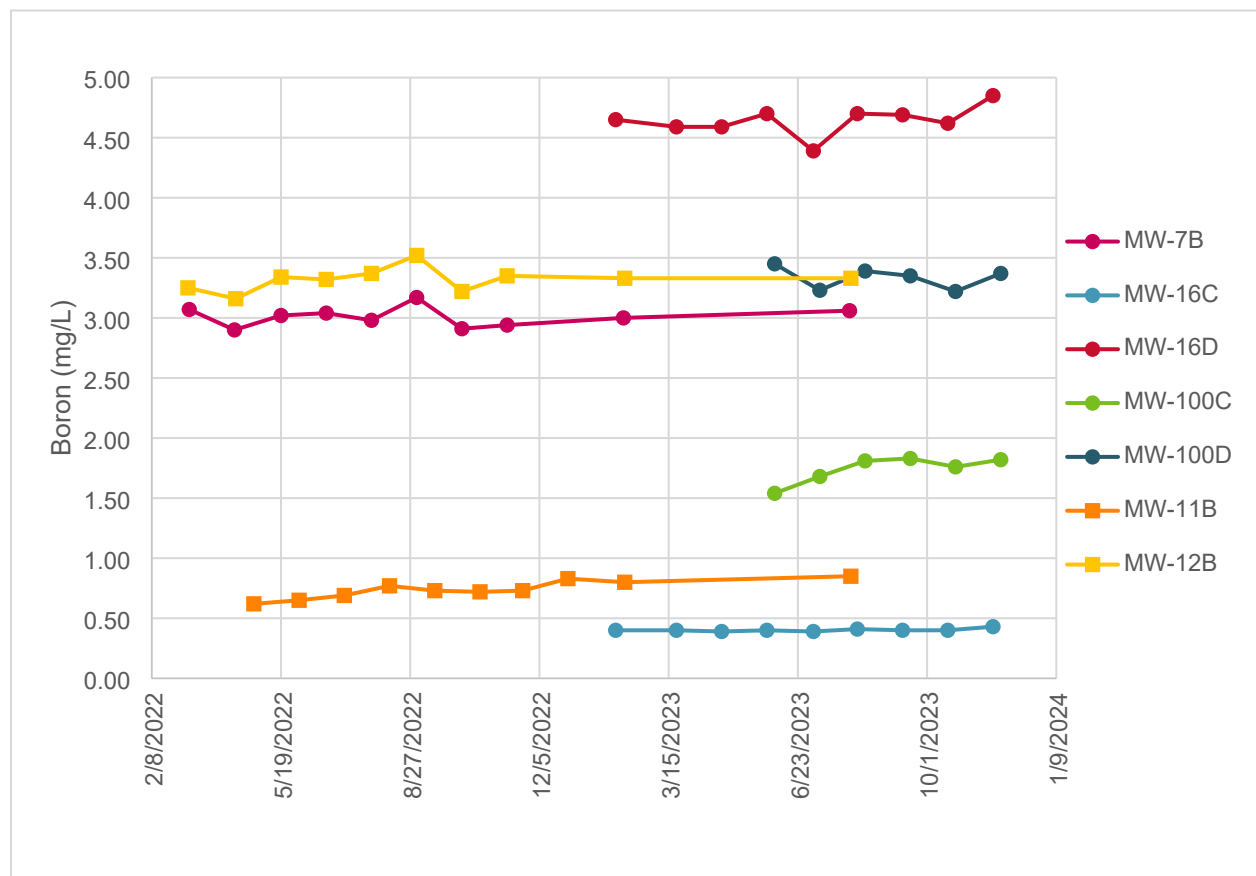


Figure 12. Boron Concentrations in Select Erickson Bedrock Aquifer Wells

A review of the impacted wells closer to the impoundment show a consistent set of parameters that exceed GPS, not solely boron. For example, at glacial wells with SSLs over GPS, the parameters that exceed include calcium, lithium, molybdenum, sulfate, and TDS in addition to the boron. However, at MW-16D bedrock well, only boron exceeds the GPS. If the boron exceedance at MW-16D was from the CCR impoundment, you would expect MW-16D to also have at least one of these other COCs. Additionally, COCs with SSLs over the GPS in other wells at Erickson do not have concentrations at SSLs at MW-16D.

4.0 Alternate Source Identification

Several lines of evidence supported by data collected from Erickson and nearby facilities indicate that concentrations of COCs within the MW-16 wells series did not originate from the CCR impoundments. Most notably, hydrogeologic conditions indicate that groundwater underneath the impoundments does not continue eastward towards MW-16 and instead follows Carrier Creek northward. Therefore, alternate sources for the GPS exceedances at MW-16A and MW-16D have been proposed below.

MW-16A – Chloride and TDS

Wells within the MW-16 well series were installed on Erickson Power Station property in response to SSLs detected in well MW-7, which was installed on the edge of the delineated wetland on the eastern portion of the BWL property. However, due to the protected status of the wetland, additional wells could not be installed at the Erickson Power Station property and repeated attempts to install wells at the adjacent Reith Riley Construction Company property were denied. Therefore, the MW-16 series wells were sited along a portion of the BWL property that extends along a Canadian National railroad. The only suitable location for these wells on the strip of BWL property was in a small depression immediately adjacent to the railway and Creyts Road. At the time the MW-16 wells were installed it was recognized that there was potential to see impacts from the Reith Riley Construction Company at the wells; however, locations for well placement alternatives has been challenging. The exact location of these wells and the topographic gradient in the immediate area are depicted in **Figure 13**.

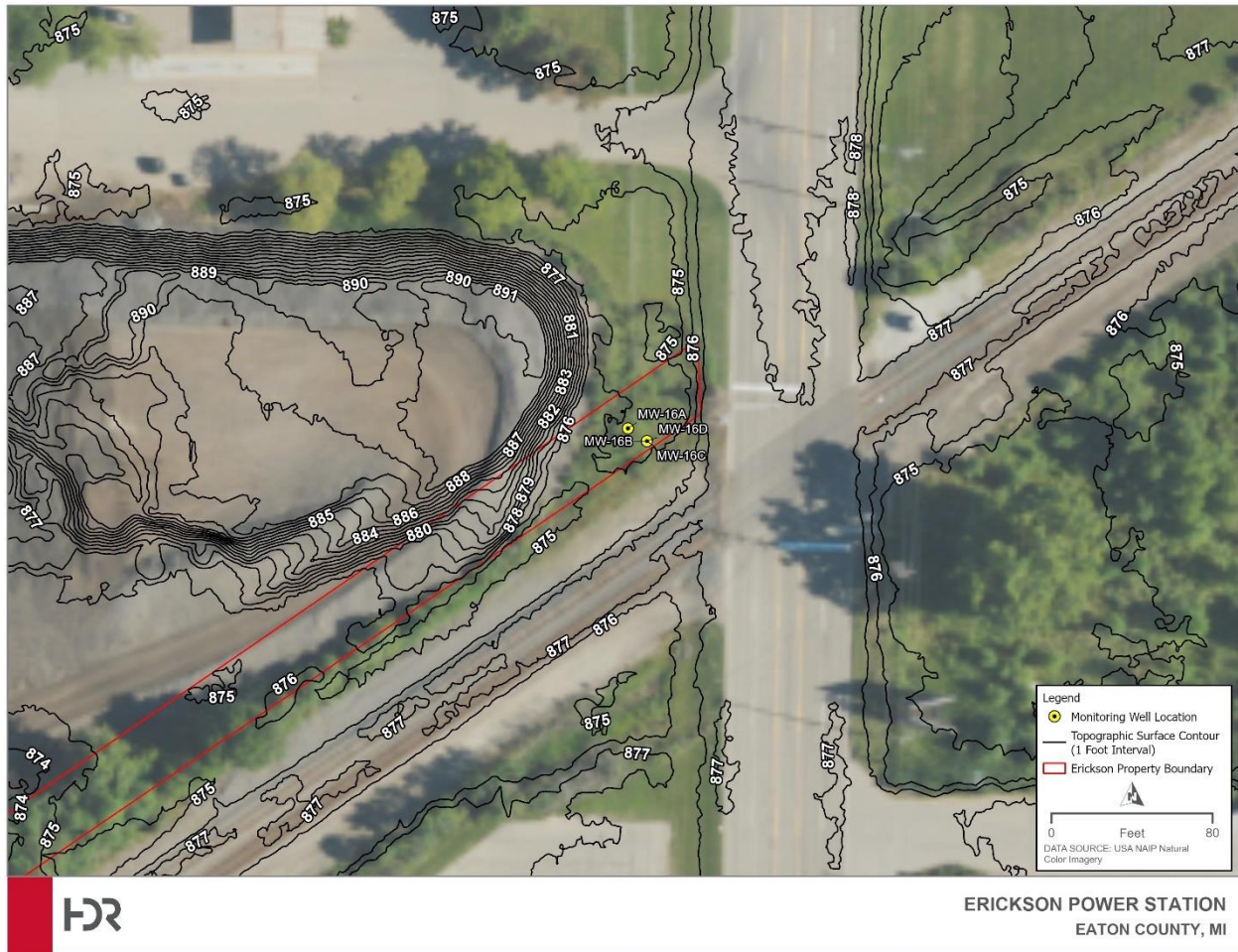


Figure 13. MW-16 Well Vicinity Topographic Map

The MW-16 wells are located in a natural depression that collects and infiltrates stormwater runoff from the nearby asphalt aggregate stockpiles managed at the Reith Riley Construction Company property and also runoff from the adjacent CN railway and adjacent Creyts Road. The runoff ponds and infiltrates, concentrating naturally occurring salts as well as salts applied to the road. These salts, including chloride and TDS, evapo-concentrate in stormwater ponding and infiltration areas and leach into groundwater. The higher concentrations of chloride at MW-16A appear to be the result of long-term management of the adjacent business and transportation infrastructure.

The Michigan Department of Transportation (MDOT) began a study in 1971 to analyze the effects of deicing salts on the chloride levels in water and soil adjacent to roadways. The study took place over four decades, with the initial report issued in 1976, an interim progress report issued in 1993, and a final report issued in 2007. The initial report found that “the roadside ground water chloride levels increase for a few years after the start of winter maintenance on a newly-opened roadway. After the initial increase, a state of equilibrium is reached in which the chloride from roadway deicing is dissipated from the roadside environment at low ground water chloride levels” (MDOT, 1976). However, in most cases, chloride levels in the groundwater



monitored adjacent to these roadways remained elevated throughout the year, with the highest average chloride levels observed in groundwater during the warmer months. Results from the final report in 2007 also indicate that although average chloride concentrations are variable depending on seasonal conditions from year to year, chloride concentrations in the wells adjacent to roadways does not return to levels prior to the application of deicing salts (MDOT, 2007). Therefore, increased chloride concentrations in the shallow groundwater and not deeper groundwater at MW-16 series wells is consistent with the natural depression and runoff from adjacent roads and asphalt aggregate stockpiles. Several studies also indicate that the location of MW-16 series wells is a potential source of chloride to the groundwater:

- The higher chloride concentrations in urban areas and along interstates are consistent with halite [salt, NaCl] as the dominant source applied to roads (Long et al., 2015).
- Soils within stormwater catchments may function as a reservoir. Multiple studies have found that significant amounts of chloride are retained in the soils of catchment areas and therefore have the potential to leach to groundwater (Kincaid and Findlay, 2009).
- "...recent evidence of elevated chloride in ground water beneath the catchments suggests that a significant proportion of the applied salt may be retained in the basin each season and may, therefore, be responsible for the observed degradation in groundwater quality" (Howard and Haynes, 1993).

The natural depression in the vicinity of MW-16 collects and infiltrates stormwater runoff and concentrates naturally occurring salts, salts applied to the nearby road, and salts that could be originating from stockpiles at the adjacent construction company into groundwater. Therefore, the higher concentrations of chloride and TDS at MW-16A appear to be the result of the concentration of surface runoff within this natural depression and subsequent evapo-concentration and infiltration into the localized groundwater.

MW-16D – Boron

After the installation of the MW-16 well series, it was observed that groundwater originating from the CCR impoundments did not flow to the vicinity of the MW-16 series. Additionally, as described in Section 3, there is evidence that well MW-16D is not hydraulically connected to any other wells monitored. Therefore, the boron SSL detected in well MW-16D is not representative of groundwater that has come from under the CCR impoundments. A thorough review of bedrock groundwater conditions has been completed, which indicate that the boron in well MW-16D is natural occurring. These investigations are documented within the semi-annual and annual groundwater monitoring reports for the site, the latest of which was published January 31, 2024 and in the Private Well Sampling Report generated for what was understood at the time to be homeowners with wells downgradient of Erickson (HDR, 2023a; HDR 2023b; HDR 2024a). The data was reviewed using many different technical approaches, all of which were consistent in supporting that the boron in the bedrock aquifer is naturally occurring from the shale bedrock that the Saginaw aquifer flows through. Therefore, the alternate source for the boron concentrations in the groundwater at well MW-16D is the shale bedrock, as summarized below.

In 1999, Rowe published a paper in the Journal of Environmental Health that described groundwater quality from the Saginaw Aquifer in Ingham County that “statistical analysis confirmed the correlation between high levels of boron in groundwater and a higher percentage of shale bedrock in sampled wells”. The bedrock wells at Erickson and MW-16C and MW-16D are completed in the same Saginaw shale and sandstone aquifer as Rowe’s study.

In 2021, Rowe et al. completed a study of groundwater quality in nearby Ingham County. A total of 326 private wells were sampled across the county in 1987, with a secondary sampling event of 262 wells between 2015 and 2020, of which 157 were from the original study. A total of 431 individual wells were sampled in Ingham County in the Saginaw Aquifer. Concentrations of boron in the Ingham County bedrock wells were highly variable, varying from non-detect values to 5.5 mg/l (Rowe et al, 2021). These values are similar to the boron concentrations observed at the bedrock wells installed for monitoring at Erickson Power Station and the private wells samples by BWL (HDR, 2023b).

According to Rowe et al. (2021), the highest boron concentrations were observed in the northeastern part of the county and correlate to wells completed in the shale dominated bedrock:

*“Most wells in Ingham County are located in a predominant sandstone-type bedrock material that produces hard water. Wells with a higher percentage of shale material will often demonstrate **naturally [emphasis added]** softened water chemistry with higher sodium, fluoride, and boron levels. The shale material appears to act like a natural water softener via a membrane filtration mechanism (Slayton, 1982). This type of water chemistry is often seen in the northeast area of Ingham County which includes Williamstown, Wheatfield, Locke, and parts of Meridian, Alaedon, and Vevay Townships.”*

An illustration of this bedrock type and water chemistry connection is shown in **Figure 14**.

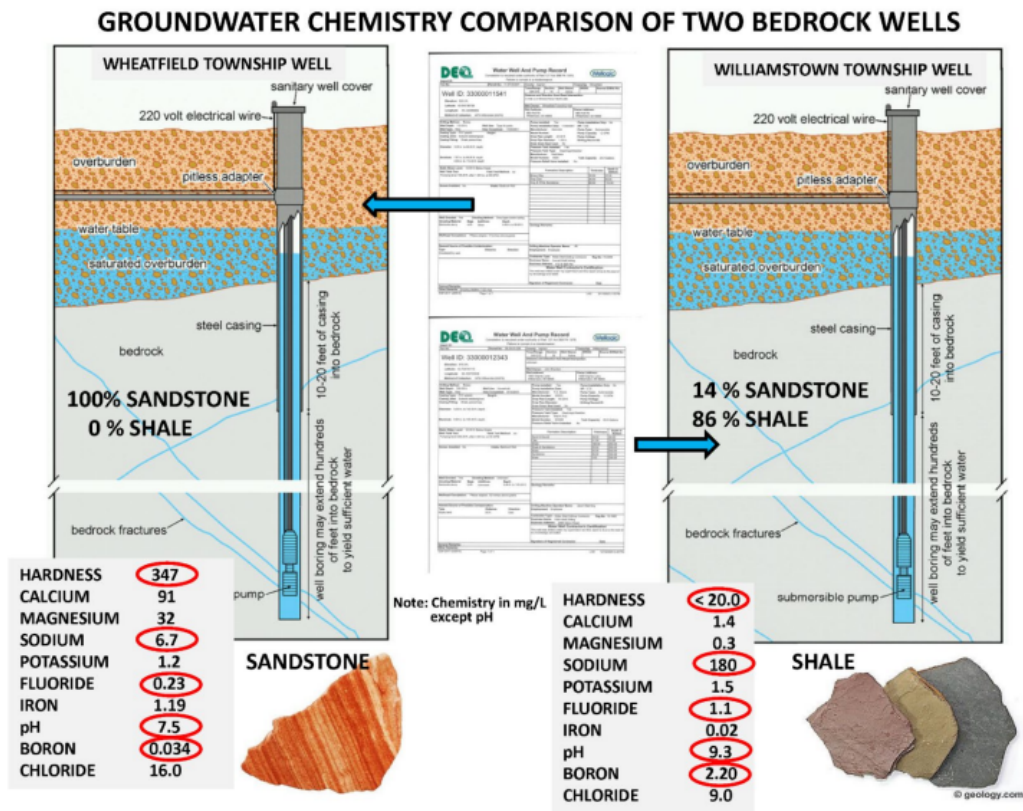


Figure 14. Groundwater chemistry associated with shale bedrock aquifer. The BWL bedrock monitoring wells are completed in a shale dominated bedrock aquifer, and well MW-16D screen is completely in shale.

Rowe (2022) completed a groundwater quality study in Delta Township to sample the aquifer for a baseline water chemistry database for the area. Residents with wells in Delta Township obtain their drinking water from wells completed in the Saginaw bedrock groundwater aquifer. A total of 19 wells were sampled for this Delta Township 2022 study, distributed around the township (Rowe, 2022). Concentrations of boron in the 19 bedrock private wells sampled by Rowe were highly variable, from non-detect to 2.3 mg/L. Four wells sampled had higher boron concentrations than the State non-residential drinking water cleanup criteria (Section 20120a) for groundwater (0.50 mg/L). All four were located in the southern half of the Delta Township area and are located northwest, southwest, east, and northeast of Erickson, such that given groundwater flow direction, it is not possible for all four wells to be impacted by Erickson. This is consistent with the 59 private wells sampled by BWL and consistent with the water quality being controlled by the lithology (wells completed in predominantly shale). Rowe (2022) concluded the boron observed in the wells sampled is naturally occurring (see quote below).

“Four wells had levels of boron above the average level of 0.472 ppm and above what is normally seen in this region, or above 1.00 ppm. One well demonstrated a water chemistry often seen in the Williamstown Township area of Ingham County, where several wells are also testing for boron above 1.0 ppm. These wells usually have a

*naturally softened water chemistry with high sodium levels, very low water hardness, fluoride levels above 1.0 ppm, boron above 1.0 ppm, and pH levels above 8.0, (Rowe, Garry, 1986). The naturally soft water chemistry is due in part to the high percentage of shale bedrock from a process called shale membrane filtration, (Slayton, D.E., 1982), (Long, D.T., and Larson, G. J., 1983). The other 3 wells with high levels of boron did not fit this pattern, but still had a water chemistry similar to other wells in the Township, with an average water hardness of 334 ppm, and a lower pH below 7.5. A similar pattern was also seen in Bath, DeWitt, and Watertown Townships with wells having boron above 1.0 ppm but still having a hard water chemistry. These wells may be considered transition wells between average hard water wells and naturally soft water wells seen in the Williamstown Township area. **The boron levels found in these 4 bedrock wells is considered to be naturally occurring [emphasis added]. ...***

Delta Township is primarily a sandstone type bedrock aquifer area from which hard drinking water is commonly found. Wells with a higher percentage of shale material will often demonstrate naturally softened water chemistry with higher sodium, fluoride and boron levels. The shale material appears to act like a natural water softener or as mentioned in a paper by Slayton, like a membrane filtration mechanism, (Slayton, D.E., 1982)."

The same bedrock lithology and groundwater chemistry correlation and distinction between sandstone dominated wells and shale dominated wells is also observed in bedrock wells at Erickson. Well MW-16D has a well screen that is completely within shale and has low water hardness, high pH, high sodium, and higher boron.

Further, analysis of general water quality parameters from this well on a Piper Diagram suggest the water quality at MW-16D plots similarly to bedrock wells MW-7B, MW-12B, and MW-100D, and plots in a different quadrant as wells MW-16C, MW-11B, and MW-100C, and in a different quadrant than impacted glacial wells MW-3 and MW-7C, indicating they are different types of waters. The water quality groupings of bedrock wells can be observed in the piper diagram in **Figure 15**. The bedrock wells that plot nearest each other on the piper diagram as sodium bicarbonate waters, MW-7B, MW-12B, MW-16D, and MW-100D, are also the same group of bedrock wells that have the higher concentrations of boron (≥ 3.0 mg/L boron), higher sodium, higher pH, low hardness, and the well screens are in almost all shale. The other group of bedrock wells that plot near each other on the piper diagram as calcium bicarbonate waters, MW-11B, MW-16C, and MW-100C, all have lower concentrations of boron (≤ 1.45 mg/L boron), lower sodium, higher water hardness, and lower pH, and the well screens are in less shale and more sandstone.

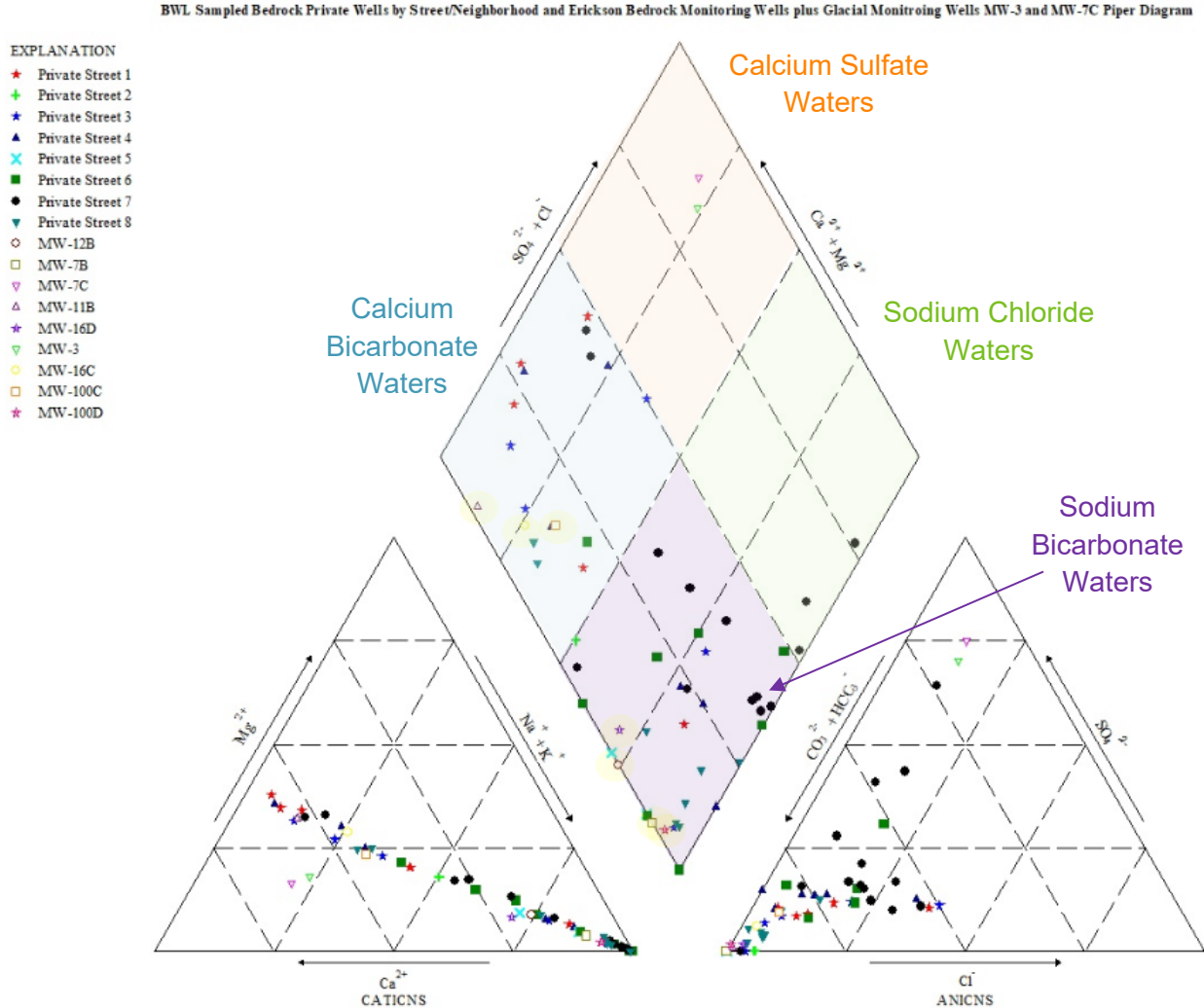


Figure 15. BWL Bedrock Wells, Private Wells, and Glacial Wells MW-3 and MW-7C Piper Diagram

Consistent with Rowe’s findings, as seen in **Figure 16**, there is a correlation between the amount of shale in the screened well interval and the concentration of boron observed in the bedrock wells at Erickson. Where the well is screened across more shale, the groundwater has higher boron, and where the well is screened across more sandstone, the groundwater has lower boron. Well MW-16D is screened across 100% shale and has the highest concentration of boron of any bedrock monitoring well. If the CCR impoundments were the source of the boron in groundwater, the highest concentration of boron would be expected closer to the impoundments, not at the farthest monitoring well.

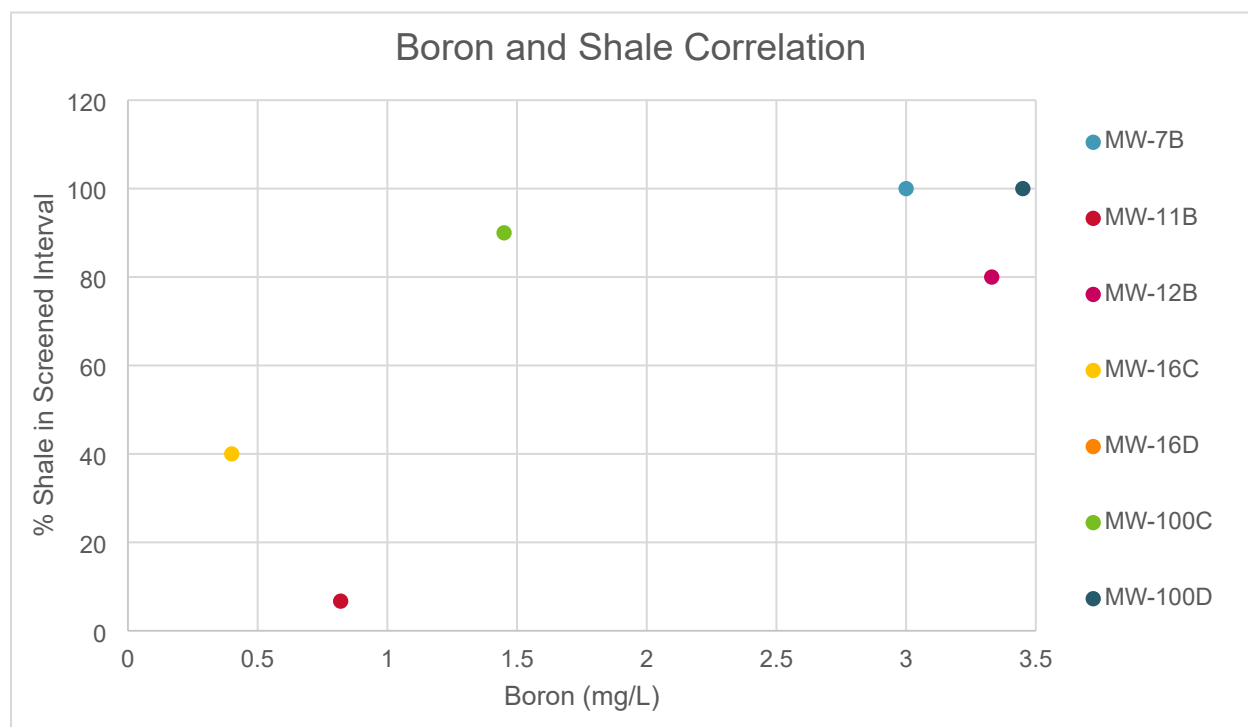


Figure 16. Erickson Power Station Bedrock Well Screened Shale Percentages and Boron Concentrations

BWL also collected samples of ash leachate from the Forebay and CWP CCR impoundments and groundwater from locations that are known to be impacted and unimpacted by CCR and analyzed boron isotopic ratios to evaluate if there was a different isotopic signature of naturally occurring boron in the shale in the Saginaw aquifer versus boron in the CCR. Samples were collected in March 2023 and were reported in the July report. The laboratory report for the isotope analysis is provided in Appendix C. The $\delta^{11}\text{B}$ versus boron concentration of the ash leachate and groundwater are shown in **Figure 8**. Boron ($\delta^{11}\text{B}$) isotope data are reported as the $^{11}\text{B}/^{10}\text{B}$ ratio of the sample using the following formula:

$$\delta^{11}\text{B} = \left\{ \left[\left(\frac{^{11}\text{B}}{^{10}\text{B}} \right)_{\text{sample}} - \left(\frac{^{11}\text{B}}{^{10}\text{B}} \right)_{\text{standard}} \right] / \left(\frac{^{11}\text{B}}{^{10}\text{B}} \right)_{\text{standard}} \right\} * 1000.$$

As shown in **Figure 17**, the four CCR leachate samples had low $\delta^{11}\text{B}$ values (< -10), which is consistent with literature studies on boron isotopic characterization of CCR that showed CCR leachate were lower (Ruhl et al, 2014; Buszka et al, 2007). Also shown in Figure 8, the $\delta^{11}\text{B}$ at glacial wells thought to be impacted by the CCR impoundments (MW-2, MW-7, and MW-7C) are also lower (< -10). Background wells (MW-11, MW-11B, MW-12, and MW-12B) and unimpacted glacial wells (MW-16A and MW-16B) have higher $\delta^{11}\text{B}$ (> -10). Therefore, the data indicate that $\delta^{11}\text{B}$ higher than -10 appear to indicate naturally occurring boron. All of the bedrock wells sampled had $\delta^{11}\text{B}$ greater than -10 and had the highest measured $\delta^{11}\text{B}$ (-2.2 to 17.4) indicating that the ratio of boron isotopes in the bedrock groundwater are more similar to background groundwater and unimpacted groundwater than to ash leachate or impacted groundwater from the ash leachate.

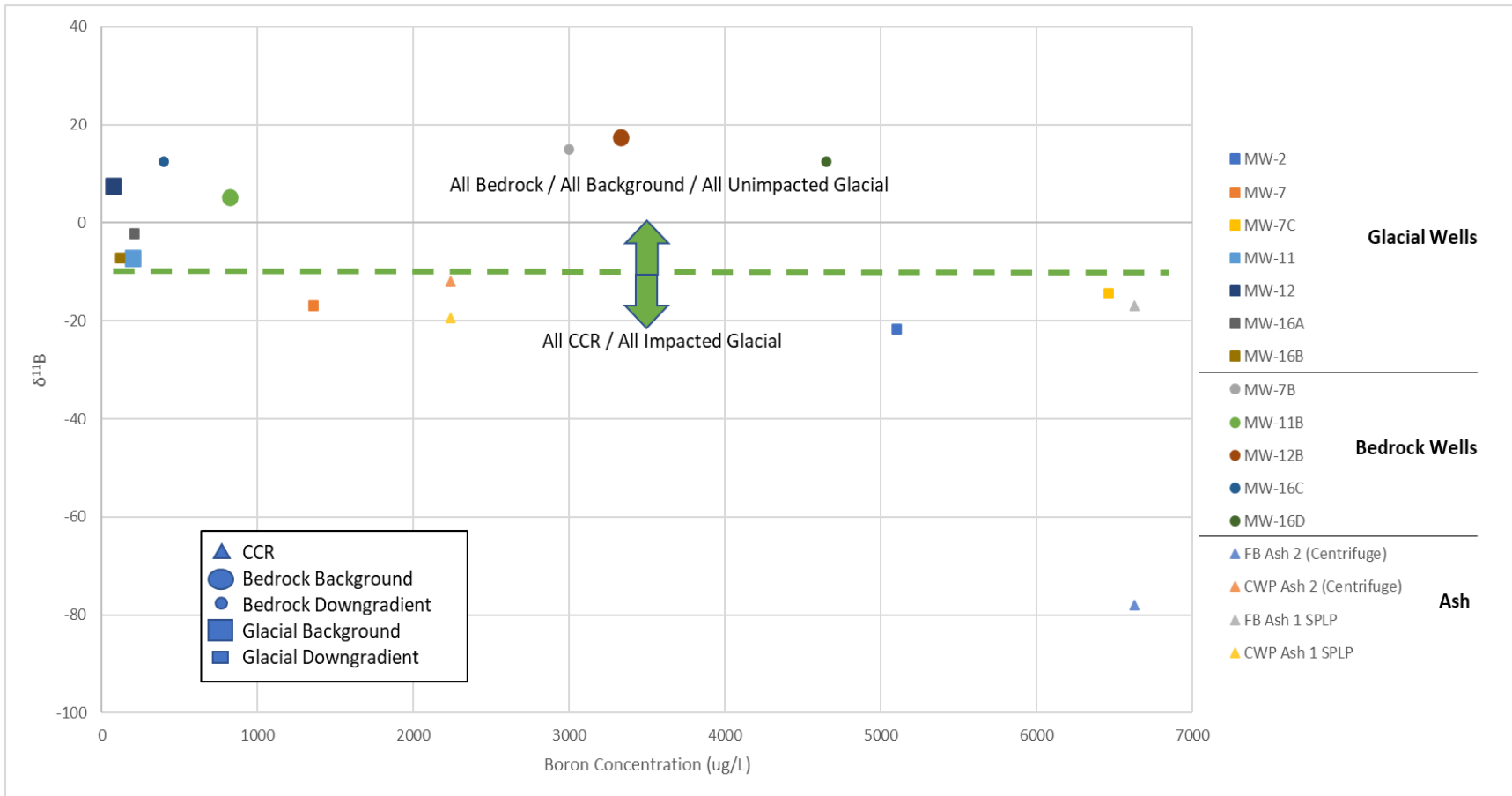


Figure 17. Boron Concentrations and Boron Isotope Ratios of Known Impacted and Unimpacted Wells and Impoundment Ash, Erickson Power Station

5.0 Summary

The 2023 installation of wells within the MW-16 series demonstrated higher groundwater elevations at MW-16 wells, which altered the understanding of the groundwater flow direction downgradient of Erickson. It is now understood that groundwater originating from under the former Erickson CCR impoundments travels eastward until it reaches the vicinity of the Carrier Creek drainage, where it then turns north and follows the Carrier Creek drainage north towards the Grand River. This is consistent with the watershed boundary and with the findings of shallow groundwater flow on the adjacent Reith-Riley property. This new understanding of groundwater flow at the property indicates that the SSLs observed in MW-16A and MW-16D are not attributable to the CCR impoundments because MW-16 is not downgradient of the CCR impoundments. The following list represents the various data presented herein to illustrate that the Erickson CCR impoundments are not the source of the SSLs at MW-16A and MW-16D:

- **Groundwater flow direction** – Groundwater in the vicinity of MW-16 series wells is now understood to flow eastward towards the Carrier Creek drain and wetland area indicating that contamination originating from Erickson does not flow to the wells in the MW-16 series.
- **Boron and shale correlation** – Analysis of the concentrations of boron and the screened lithologies at Erickson indicate that wells containing more shale within the well screen contain higher amounts of boron than those screened across other lithologies.
- **Groundwater chemistry** – Analysis of the chemical makeup of the groundwater sampled from the MW-16 indicate that the waters collected from this well series are classed as sodium bicarbonate waters, different from the class of other impacted wells at Erickson Power Station.
- **Boron isotopes** – Isotopic analysis of groundwater samples collected from indicate that the ratios of boron isotopes present in the groundwater at MW-16 differ from those impacted by the contamination from Erickson Power Station.
- **Boron found to be naturally occurring from shale by others** – Studies completed in similar lithologies within the Delta Township and greater Lansing area demonstrate that wells completed within shale deposits exhibit a higher concentration of naturally occurring boron than those completed in sandstone/siltstone lithologies.
- **Chloride was not an SSL at the impoundment boundary wells** – Analysis of the samples collected from the wells at Erickson indicate that chloride is only present at levels exceeding the established GPS in MW-16. No other wells with SSLs at Erickson contain concentrations of chloride above the established GPS. Additionally, the ratio of chloride to TDS within well MW-16 was shown to be two to fifteen times greater than other wells at Erickson Power Station and three to four times greater than other wells at Erickson with SSLs.
- **Chloride is known to occur in roadside ditches from the application of deicing chemicals** – Multiple studies completed by the Michigan Department of Transportation and others indicate that in the areas immediately adjacent to roadways and/or located in low spots/ditches/catchments have shown to have increased levels of salts due to normal maintenance.



Additional analysis of the chloride and TDS SSLs at MW-16A indicate that these SSLs are not indicative of the site. Chloride has not been identified at SSLs for the site in wells near the impoundments since monitoring began in 2020. If the source of the chloride at MW-16A was the impoundments, chloride would be expected to be present along with the other SSLs observed on the site indicative of groundwater impacts from the Erickson impoundments. TDS has been identified at SSLs in wells MW-2, MW-5, and MW-7C, however it is always identified with concentrations of other constituents known to be present in groundwater affected by the Erickson impoundments. At MW-16A, the TDS is only present with increase concentrations of chloride. Further analysis of the TDS and chloride concentrations at wells monitoring the Erickson impoundments indicate that the ratio of chloride to TDS in MW-16A is two to fifteen times higher than other glacial wells at Erickson and three to four times higher than impacted glacial wells at Erickson.

The occurrence of the natural depression/stormwater infiltration and observed concentrations of chloride and TDS at SSLs are most likely the result of immediately adjacent to sources of surface water runoff from materials stockpiles at the Reith Riley Construction Company, CN railway, and Creyts Road, specifically deicing salts.

Further analysis of the boron SSL at MW-16D indicate that the SSL is also not indicative of contamination originating from the Erickson impoundments. Well MW-16D does not appear to be hydraulically linked to other wells at Erickson Power Station. Additionally, although boron has been identified at SSLs in the glacial aquifer, SSLs have yet to be in other downgradient wells at the property, specifically MW-7B. Similarly to the TDS SSLs in MW-16A, boron SSLs observed in known impacted groundwater at Erickson present with other COIs known to be present in ash. The boron SSL in MW-16D is the only SSL present within this well. Analysis of general water chemistry of bedrock wells at Erickson Power Station indicates that well MW-16D is within a different class of groundwater than the impacted wells at Erickson, or other wells at Erickson with lower boron values.

Boron in well MW-16D is instead proposed to be naturally occurring, as supported by analysis of bedrock wells completed in nearby Ingham County, correlated with the data obtained from installing the bedrock wells at Erickson, and isotopic analysis of the boron constituents present in the Erickson ash compared to the groundwater collected from this well.

The multiple lines of evidence presented in this document provide strong support that the chloride and TDS SSLs in MW-16A and the boron SSL in MW-16D are not indicative of contamination from Erickson. Rather, the observed SSLs are all indicative of naturally occurring processes or a result of nearby anthropogenic activity affecting the landscape. The alternate source of chloride and TDS concentrations at MW-16A are most likely from the evapo-concentration of runoff water as a result of the application of deicing salts to the nearby roadway and Reith-Riley managed asphalt materials stockpiles. The alternate source of the boron concentration observed at MW-16D is likely from the shale.

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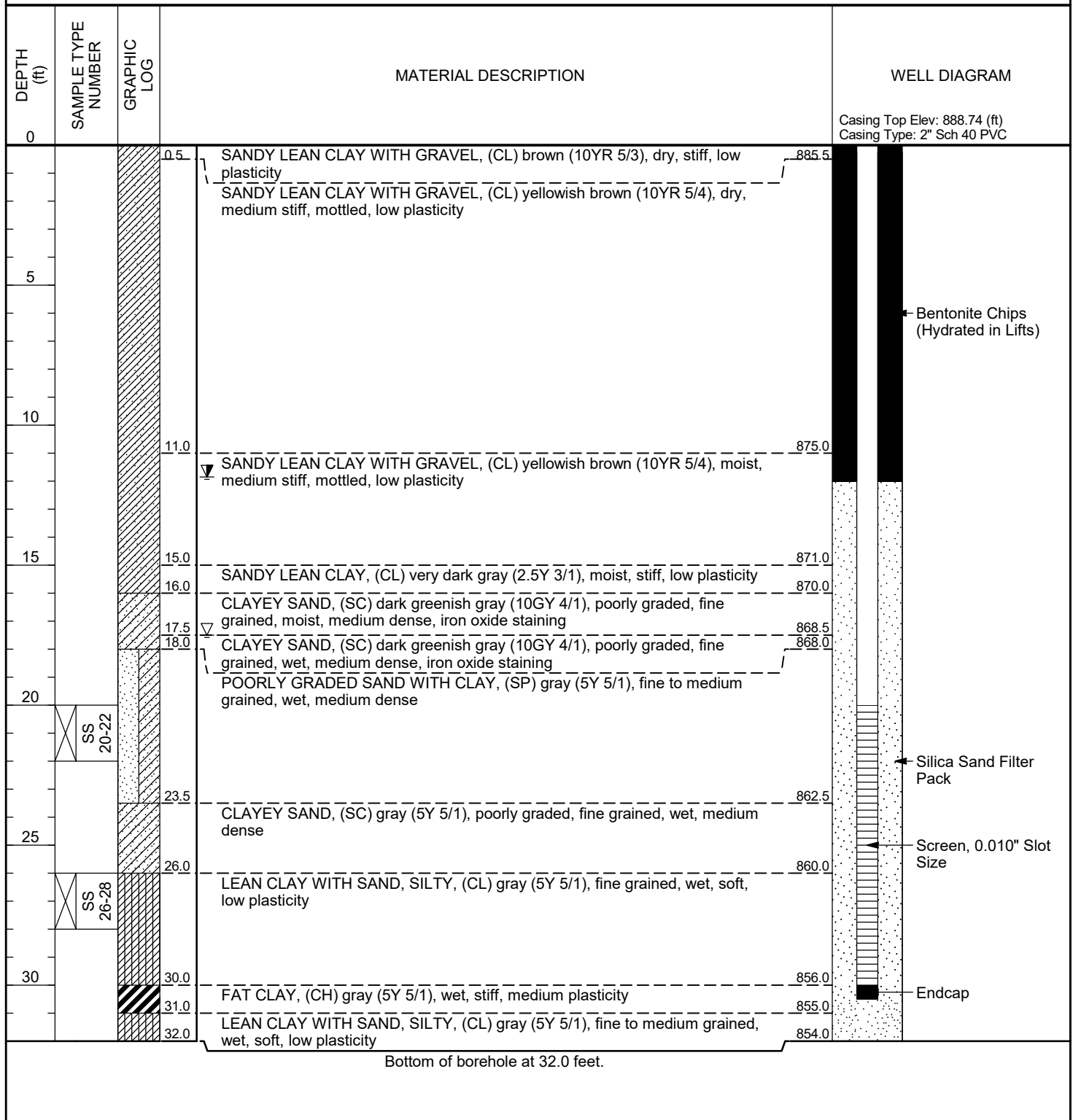
BWL | Erickson Power Station
Alternate Source Demonstration
for Compliance with Michigan Rule R 299.4441(8)

Attachment 1

Boring Logs

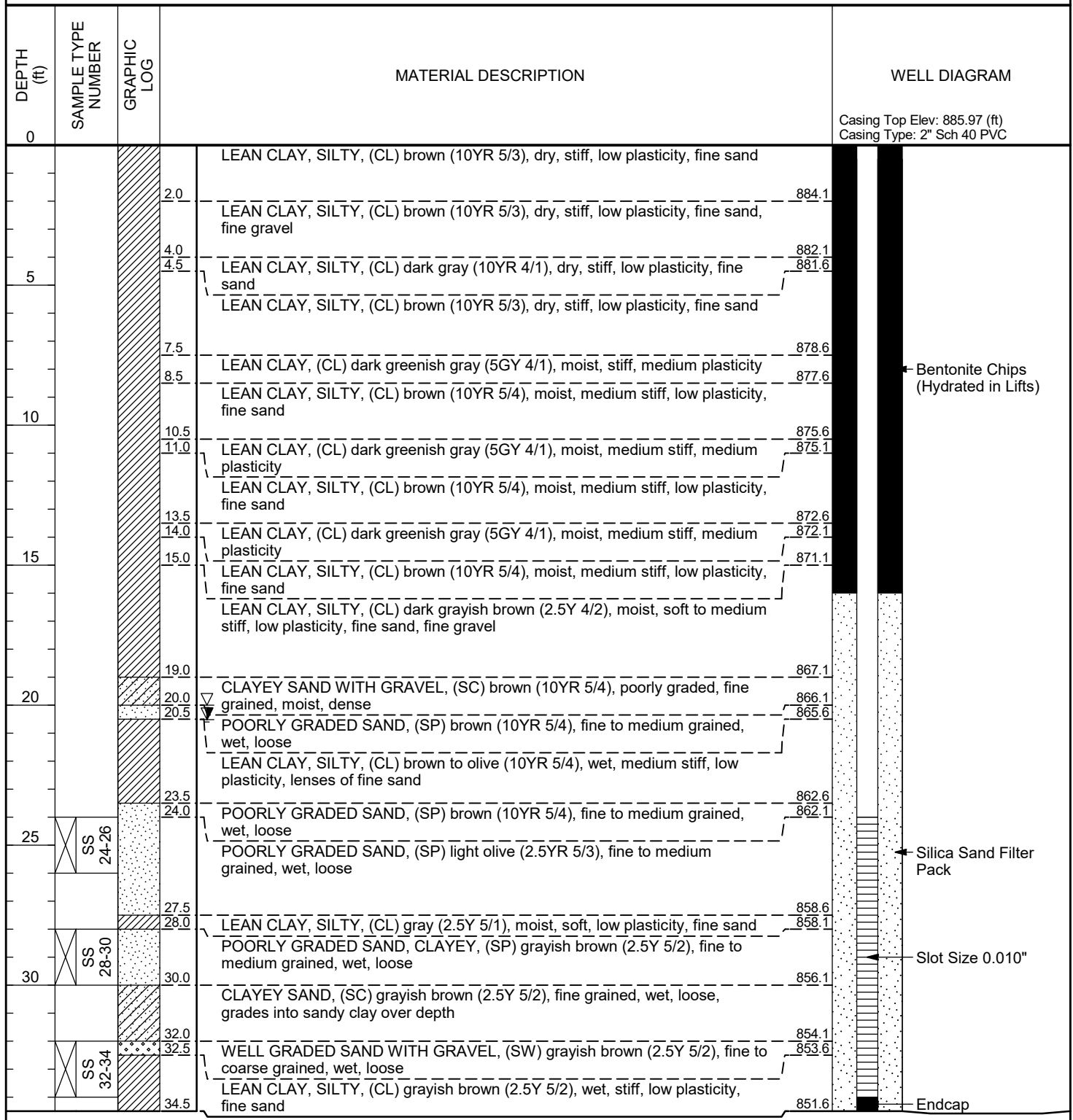


CLIENT Lansing Board of Water & Light PROJECT NAME Erickson Power Station
 PROJECT NUMBER 10173187 PROJECT LOCATION Eaton County, MI
 DATE STARTED 10/15/19 11:00 COMPLETED 10/15/19 12:30 GROUND ELEVATION 885.97 ft MSL HOLE DIAMETER 7"
 DRILLING CONTRACTOR SME DRILLER _____ GROUND WATER LEVELS:
 DRILLING METHOD HSA EQUIPMENT _____ ∇ AT TIME OF DRILLING 17.50 ft / Elev 868.47 ft
 LOGGED BY Emily Munoz CHECKED BY _____ ∇ 75 HRS AFTER DRILLING 11.85 ft / Elev 874.12 ft
 NOTES Sample ID prefix LBWL-MW1-. Driller recorded blow counts on SME logs.





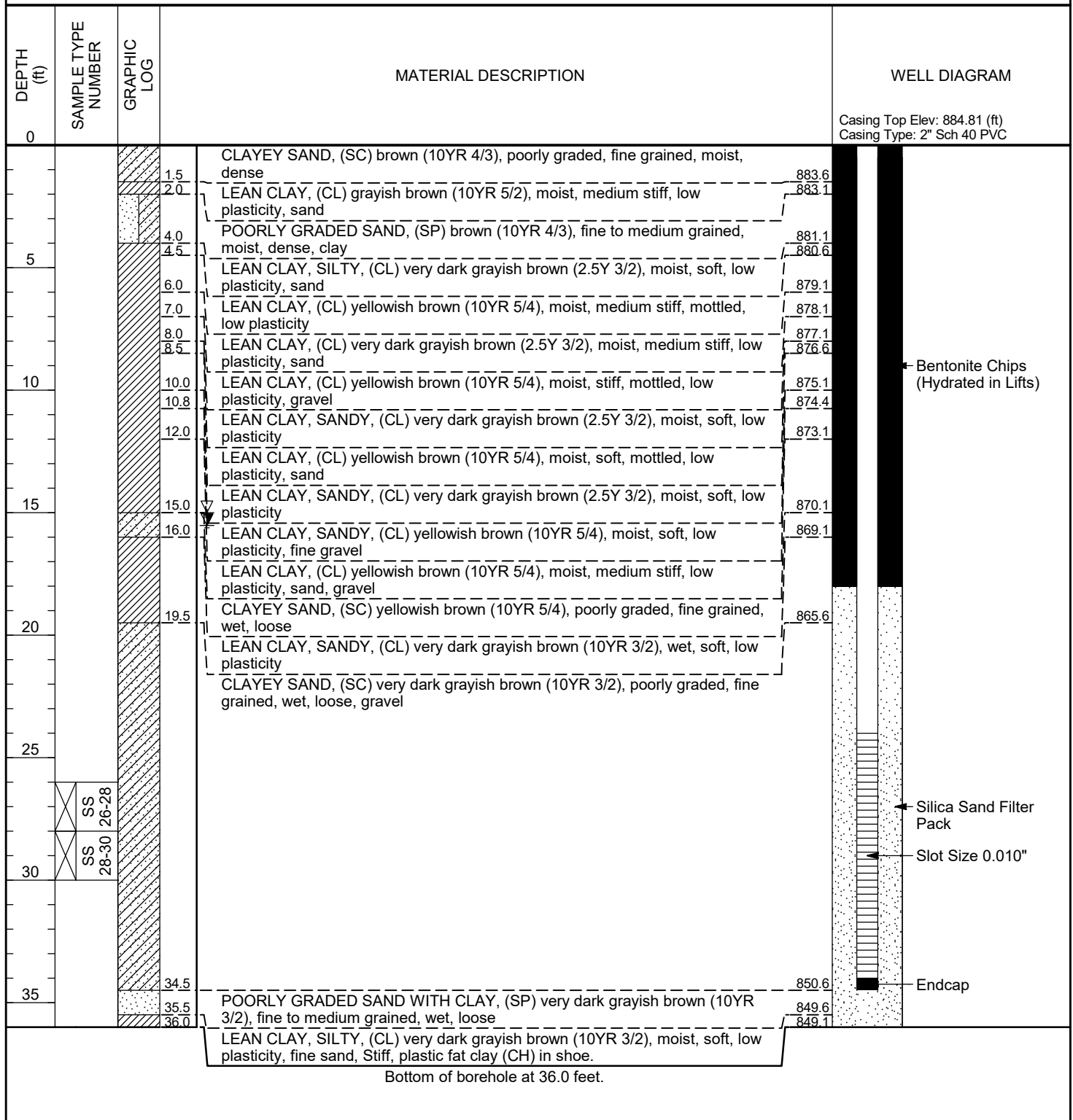
CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station
PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI
DATE STARTED 10/16/19 08:40 **COMPLETED** 10/16/19 10:18 **GROUND ELEVATION** 886.14 ft MSL **HOLE DIAMETER** 8"
DRILLING CONTRACTOR SME **DRILLER** _____ **GROUND WATER LEVELS:**
DRILLING METHOD HSA **EQUIPMENT** _____ **▽ AT TIME OF DRILLING** 20.00 ft / Elev 866.14 ft
LOGGED BY Emily Munoz **CHECKED BY** _____ **▽ 48 HRS AFTER DRILLING** 20.52 ft / Elev 865.62 ft
NOTES Sample ID prefix LBWL-MW2-. Driller recorded blow counts on SME logs.



Bottom of borehole at 34.5 feet.

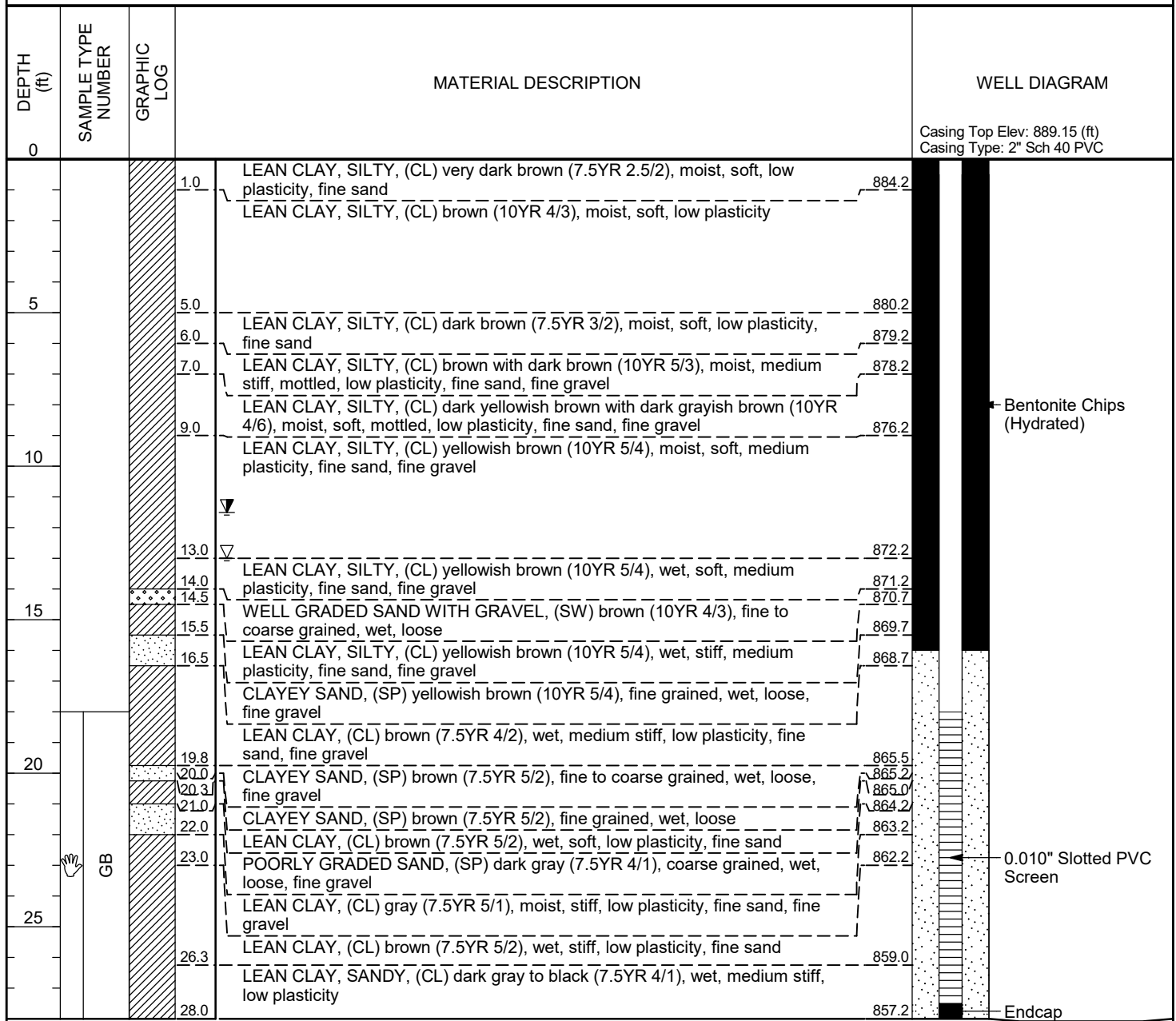


CLIENT Lansing Board of Water & Light PROJECT NAME Erickson Power Station
 PROJECT NUMBER 10173187 PROJECT LOCATION Eaton County, MI
 DATE STARTED 10/15/19 10:36 COMPLETED 10/15/19 12:30 GROUND ELEVATION 885.12 ft MSL HOLE DIAMETER 8"
 DRILLING CONTRACTOR SME DRILLER _____ GROUND WATER LEVELS:
 DRILLING METHOD HSA EQUIPMENT _____ ∇ AT TIME OF DRILLING 15.00 ft / Elev 870.12 ft
 LOGGED BY Emily Munoz CHECKED BY _____ ∇ 72 HRS AFTER DRILLING 15.52 ft / Elev 869.60 ft
 NOTES Sample ID prefix LBWL-MW3-. Driller recorded blow counts on SME logs.





CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station
PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI
DATE STARTED 01/06/20 10:09 **COMPLETED** 01/06/20 11:05 **GROUND ELEVATION** 885.23 ft MSL **HOLE DIAMETER** 8"
DRILLING CONTRACTOR SME **DRILLER** _____ **GROUND WATER LEVELS:**
DRILLING METHOD HSA **EQUIPMENT** _____ ∇ **AT TIME OF DRILLING** 13.00 ft / Elev 872.23 ft
LOGGED BY Emily Munoz **CHECKED BY** _____ ∇ **94.3 HRS AFTER DRILLING** 11.51 ft / Elev 873.72 ft
NOTES _____



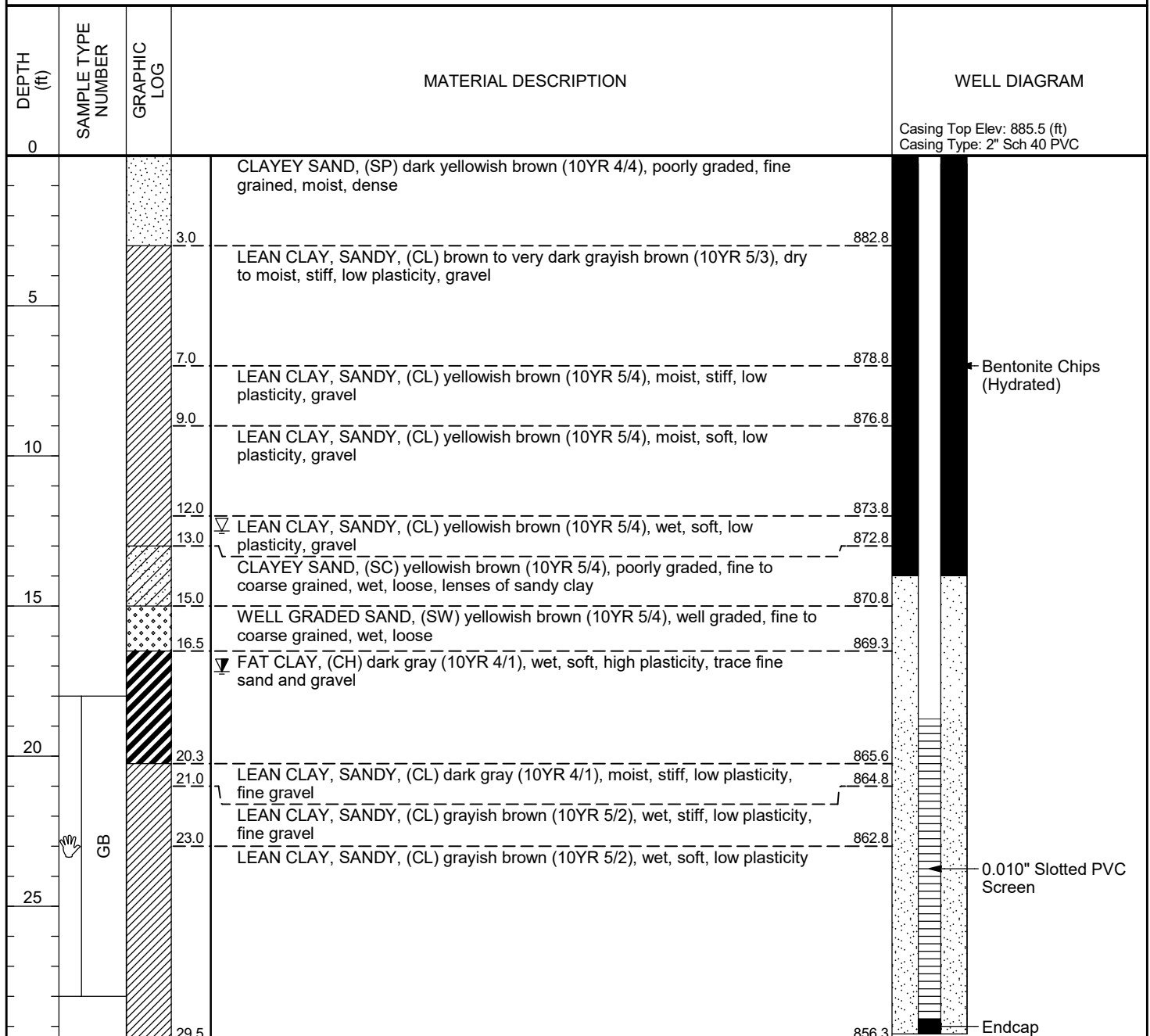
Bottom of borehole at 28.0 feet.



CLIENT Lansing Board of Water & Light
 PROJECT NUMBER 10173187
 DATE STARTED 01/07/20 09:00 COMPLETED 01/07/20 10:35
 DRILLING CONTRACTOR SME DRILLER _____
 DRILLING METHOD HSA EQUIPMENT _____
 LOGGED BY Emily Munoz CHECKED BY _____

PROJECT NAME Erickson Power Station
 PROJECT LOCATION Eaton County, MI
 GROUND ELEVATION 885.81 ft MSL HOLE DIAMETER 8"
 GROUND WATER LEVELS:
 ∇ AT TIME OF DRILLING 12.50 ft / Elev 873.31 ft
 ∇ 71.25 HRS AFTER DRILLING 17.18 ft / Elev 868.63 ft

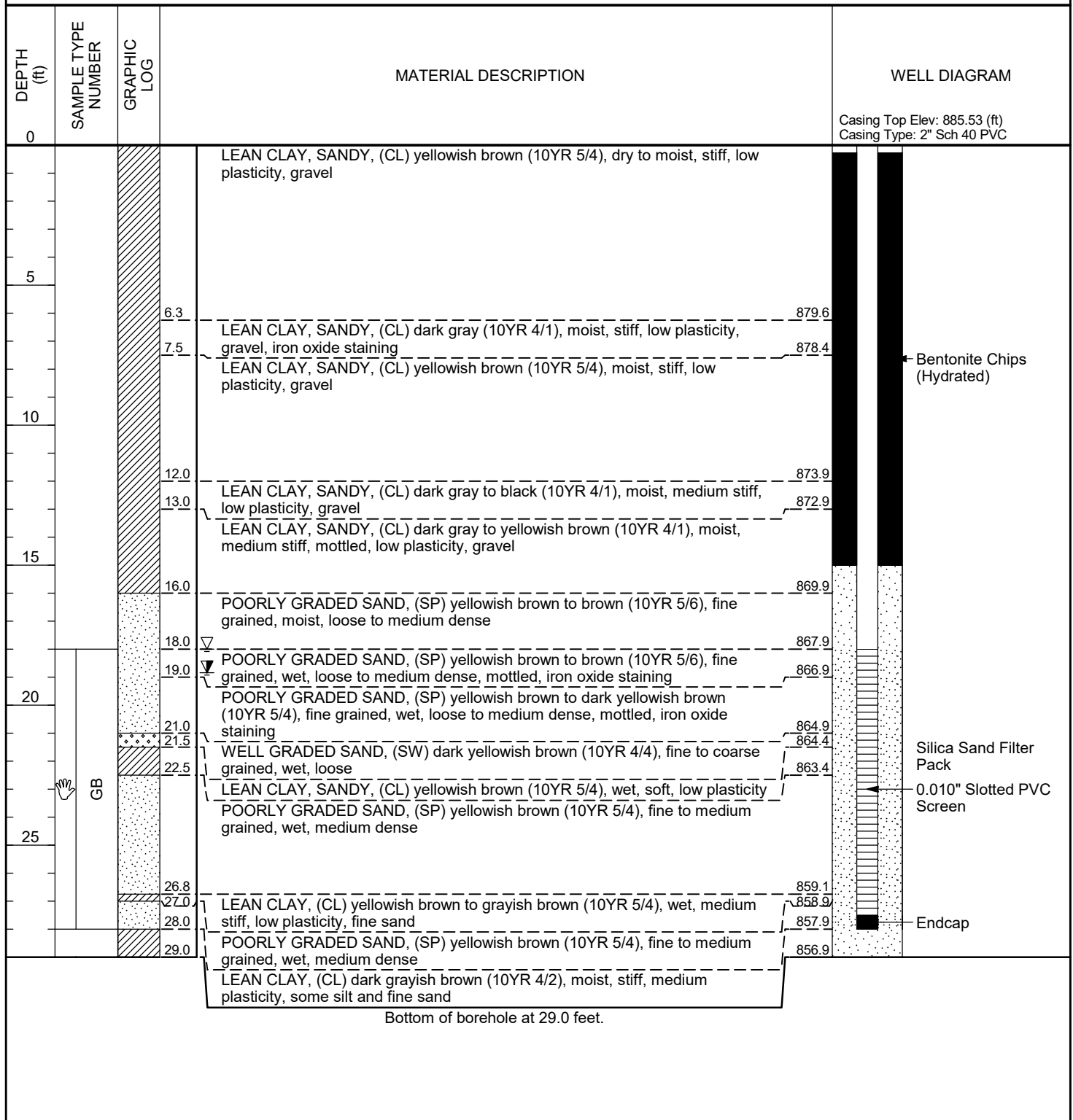
NOTES _____



Bottom of borehole at 29.5 feet.



CLIENT Lansing Board of Water & Light PROJECT NAME Erickson Power Station
 PROJECT NUMBER 10173187 PROJECT LOCATION Eaton County, MI
 DATE STARTED 01/07/20 11:40 COMPLETED 01/07/20 13:00 GROUND ELEVATION 885.86 ft MSL HOLE DIAMETER 8"
 DRILLING CONTRACTOR SME DRILLER _____ GROUND WATER LEVELS:
 DRILLING METHOD HSA EQUIPMENT _____ ∇ AT TIME OF DRILLING 18.00 ft / Elev 867.86 ft
 LOGGED BY Emily Munoz CHECKED BY _____ ∇ 68.8 HRS AFTER DRILLING 18.84 ft / Elev 867.02 ft
 NOTES _____

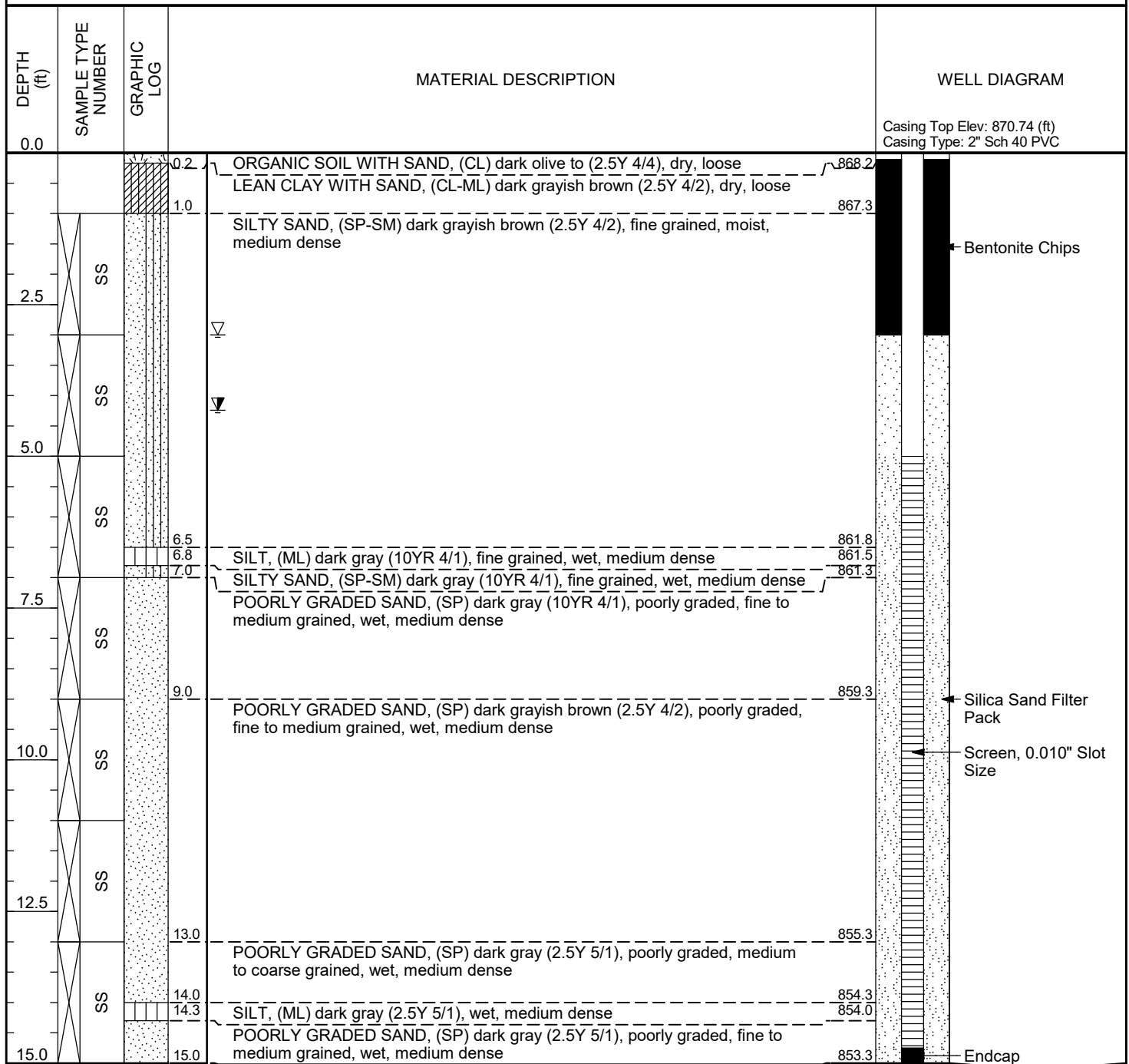




CLIENT Lansing Board of Water & Light
 PROJECT NUMBER 10173187
 DATE STARTED 06/07/21 12:00 COMPLETED 06/07/21 16:00
 DRILLING CONTRACTOR SME DRILLER _____
 DRILLING METHOD HSA EQUIPMENT _____
 LOGGED BY Tanten Buszka CHECKED BY _____

PROJECT NAME Erickson Power Station
 PROJECT LOCATION Eaton County, MI
 GROUND ELEVATION 868.32 ft MSL HOLE DIAMETER 6"
 GROUND WATER LEVELS:
 ▽ AT TIME OF DRILLING 3.00 ft / Elev 865.32 ft
 ▽ 92 HRS AFTER DRILLING 4.24 ft / Elev 864.08 ft

NOTES _____



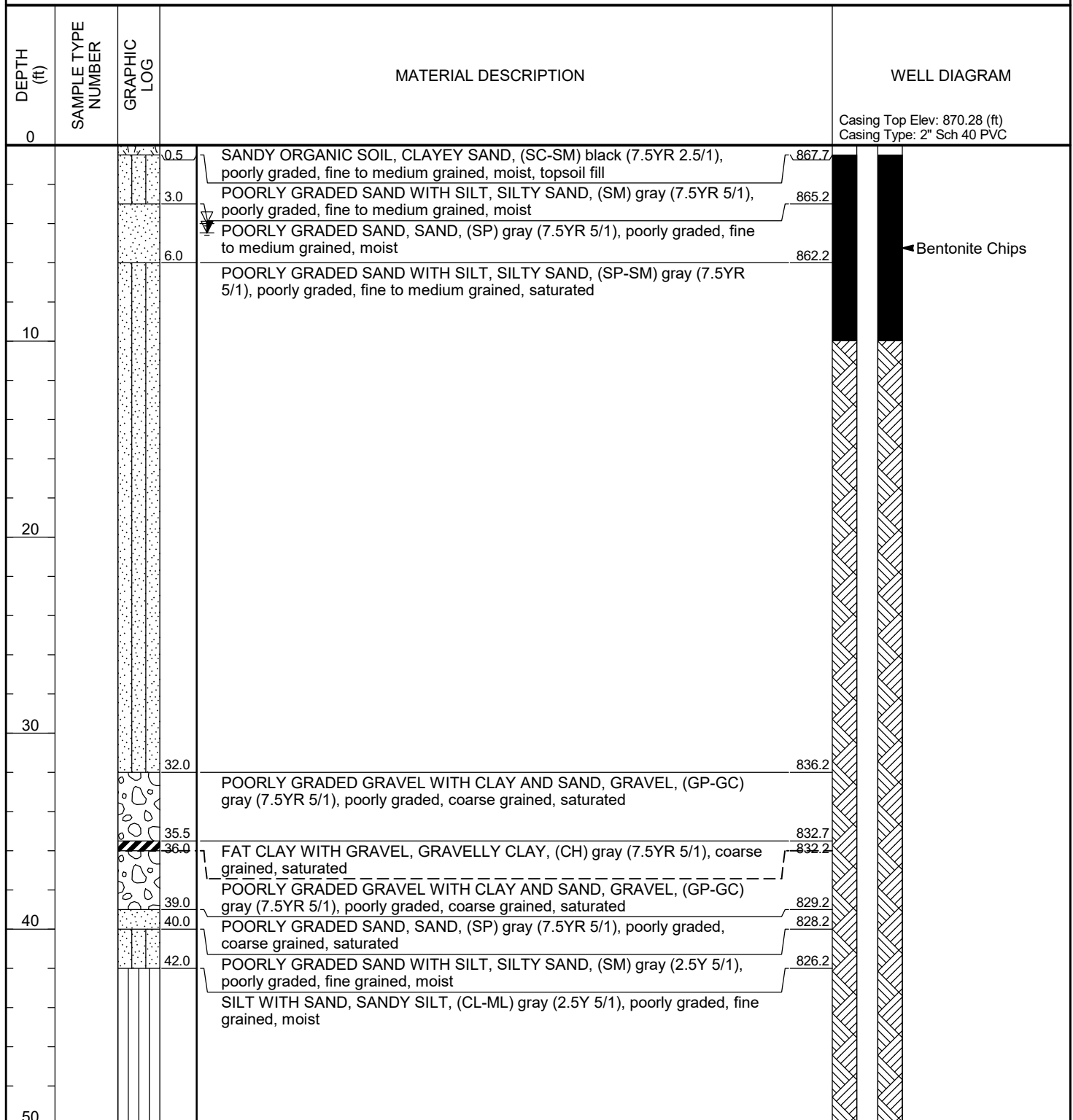
Bottom of borehole at 15.0 feet.



CLIENT Lansing Board of Water & Light
 PROJECT NUMBER 10173187
 DATE STARTED 03/01/22 09:00 COMPLETED 03/03/22 12:00
 DRILLING CONTRACTOR Cascade Driller
 DRILLING METHOD Sonic EQUIPMENT _____
 LOGGED BY Tanten Buszka CHECKED BY _____

PROJECT NAME Erickson Power Station
 PROJECT LOCATION Eaton County, MI
 GROUND ELEVATION 868.16 ft MSL HOLE DIAMETER 8"
 GROUND WATER LEVELS:
 ∇ AT TIME OF DRILLING 4.00 ft / Elev 864.16 ft
 ∇ AFTER DRILLING 4.48 ft / Elev 863.68 ft

NOTES _____



(Continued Next Page)



CLIENT Lansing Board of Water & Light

PROJECT NAME Erickson Power Station

PROJECT NUMBER 10173187

PROJECT LOCATION Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50				
		51.5		816.7
		52.0	POORLY GRADED SAND, SAND, (SP) gray (2.5Y 5/1), poorly graded, fine to medium grained, moist	816.2
			SILT WITH SAND, SANDY SILT, (CL-ML) gray (2.5Y 5/1), poorly graded, fine grained, moist	
60				
		64.0		804.2
		64.5	FAT CLAY, CLAY, (CH) gray (2.5Y 4/1), dry, Shale fragment artifacts	803.7
		66.0	SILT WITH SAND, SANDY SILT, (CL-ML) gray (2.5Y 5/1), poorly graded, fine grained, dry	802.2
70			SHALE, highly weathered, very thinly laminated, light gray (10B 8/1), dry, [Saginaw] Trace angular gravel inclusions. No structure was retained, sample completely broken upon retrieval.	798.2
		70.0	SHALE, moderately weathered, thinly bedded, dark gray (7.5YR 2.5/1), dry, [Saginaw] Alternating beds of consolidated shale and weathered shale.	
		76.0	SHALE, slightly weathered, thinly bedded, dark gray (7.5YR 2.5/1), dry, [Saginaw] Trace angular gravel	792.2
80				
		89.0	SHALE, slightly weathered, thinly interbedded, dark gray with light gray (7.5YR 2.5/1), dry, [Saginaw] Interbedded black shale and sandstone. Unable to differentiate between drilling induced fractures and naturally occurring.	779.2
90				
		100.0	SANDSTONE, unweathered, massive, light gray (7.5YR 5/1), dry, [Saginaw]	768.2
		102.0	SHALE, slightly weathered, thinly bedded, dark gray with light gray (7.5YR 2.5/1), dry, [Saginaw] Interbedded black shale and sandstone	766.2
100		105.0		763.2

Well Casing
Bentonite Cement Slurry

Bentonite Chips



CLIENT Lansing Board of Water & Light

PROJECT NAME Erickson Power Station

PROJECT NUMBER 10173187

PROJECT LOCATION Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
110			<p>SHALE, moderately weathered, thinly interbedded, dark gray with light gray (7.5YR 2.5/1), dry, [Saginaw] Majority black shale interbedded with sandstone. Highly weathered 105-106 with loose gravel. <i>(continued)</i></p> <p>SHALE, highly weathered, thinly interbedded, dark gray with light gray (7.5YR 2.5/1), dry, [Saginaw] Core extremely weathered upon retrieval, clay content within breaks in core, angular/semi angular inclusions. Unable to identify natural fractures due to drilling method.</p>	

Bottom of borehole at 120.0 feet.



CLIENT Lansing Board of Water & Light
PROJECT NUMBER 10173187
DATE STARTED 03/08/22 11:30 COMPLETED 03/08/22 16:00
DRILLING CONTRACTOR Cascade Driller
DRILLING METHOD Sonic EQUIPMENT _____
LOGGED BY Tanten Buszka CHECKED BY _____

PROJECT NAME Erickson Power Station
PROJECT LOCATION Eaton County, MI
GROUND ELEVATION 869 ft MSL HOLE DIAMETER 8"
GROUND WATER LEVELS:
▽ AT TIME OF DRILLING 5.00 ft / Elev 864.00 ft
▽ AFTER DRILLING 5.20 ft / Elev 863.80 ft

NOTES _____

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0				Casing Top Elev: 871.53 (ft) Casing Type: 2" Sch 40 PVC
0.5			POORLY GRADED SAND WITH CLAY, CLAYEY SAND, (SC) dark brown (7.5YR 2.5/2), fine grained, dry, topsoil fill	868.5
2.0			POORLY GRADED SAND WITH CLAY, CLAYEY SAND, (SC-SM) brown (7.5YR 4/3), poorly graded, fine to medium grained, moist	867.0
5			POORLY GRADED SAND WITH SILT, SILTY SAND, (SP-SM) brown (7.5YR 4/3), poorly graded, fine to medium grained, moist	863.0
6.0			POORLY GRADED SAND, SAND, (SP) gray (7.5YR 5/1), poorly graded, fine to medium grained, saturated	863.0
15			POORLY GRADED SAND, SAND, (SP) gray (7.5YR 5/1), poorly graded, medium to coarse grained, saturated	854.0
16.0			POORLY GRADED SAND, SAND, (SP) gray (7.5YR 5/1), poorly graded, fine to medium grained, saturated	853.0
25			POORLY GRADED SAND, SAND, (SP) gray (7.5YR 5/1), poorly graded, fine to medium grained, saturated, Trace clay and gravel within sample	844.0
30				
35				

← Bentonite Cement Slurry
← Well Casing



CLIENT Lansing Board of Water & Light

PROJECT NAME Erickson Power Station

PROJECT NUMBER 10173187

PROJECT LOCATION Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35				
40		40.0	POORLY GRADED SAND, SAND, (SP) gray (7.5YR 5/1), poorly graded, fine to medium grained, saturated, Trace clay and gravel within sample (<i>continued</i>)	829.0
		42.0	POORLY GRADED GRAVEL WITH SAND, SAND, (GP) gray (7.5YR 5/1), poorly graded, medium to coarse grained, saturated	827.0
45			SILT, SILT, (ML) gray (7.5YR 5/1), dry, dense, non plastic, Trace sand and gravel	
50				
55				Filter Pack Well Screen
60		60.0		809.0

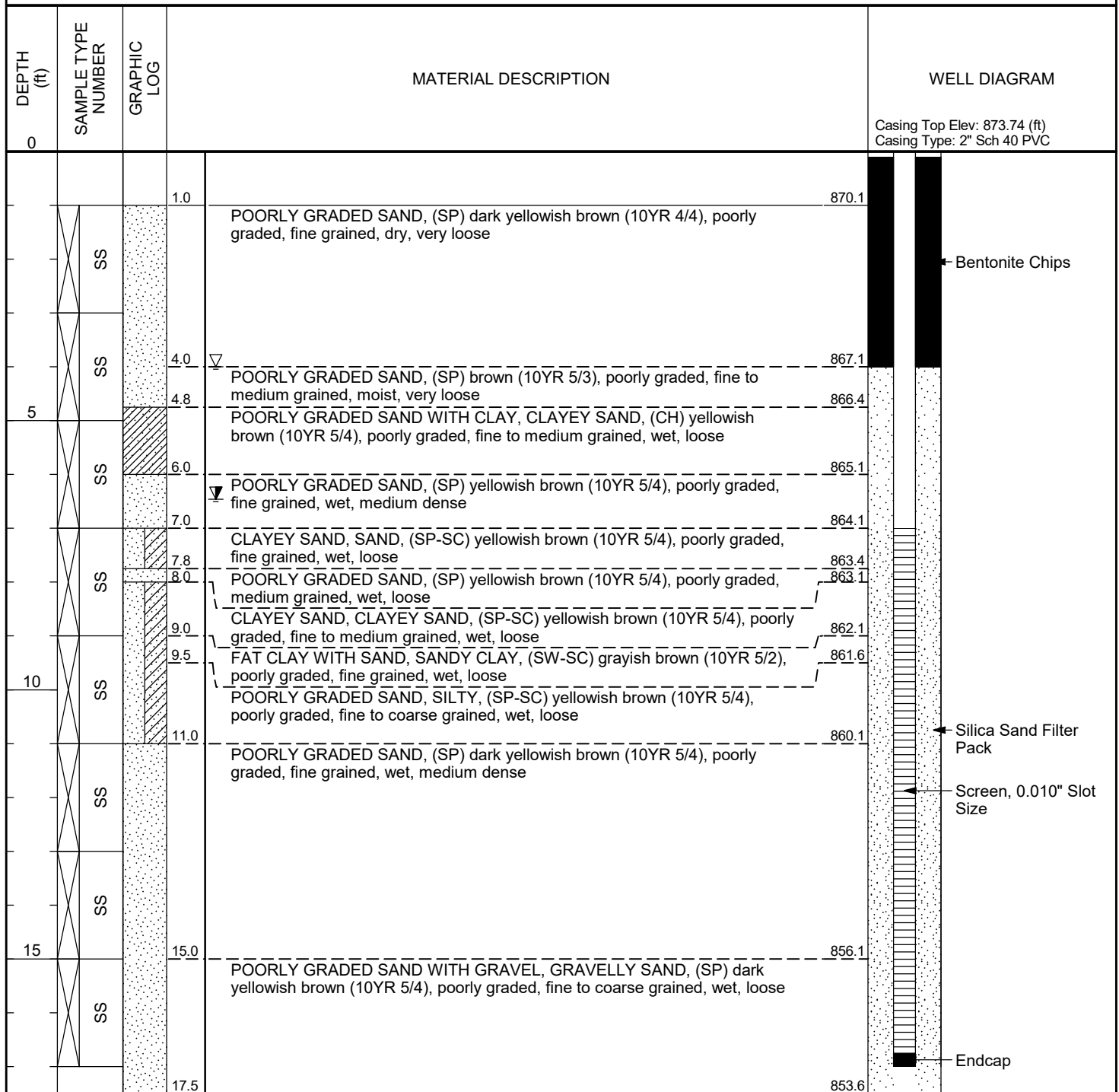
Bottom of borehole at 60.0 feet.



CLIENT Lansing Board of Water & Light
 PROJECT NUMBER 10173187
 DATE STARTED 06/08/21 08:30 COMPLETED 06/08/21 09:45
 DRILLING CONTRACTOR SME DRILLER _____
 DRILLING METHOD HSA EQUIPMENT _____
 LOGGED BY Tanten Buszka CHECKED BY _____

PROJECT NAME Erickson Power Station
 PROJECT LOCATION Eaton County, MI
 GROUND ELEVATION 871.14 ft MSL HOLE DIAMETER 6"
 GROUND WATER LEVELS:
 ∇ AT TIME OF DRILLING 4.00 ft / Elev 867.14 ft
 ∇ 92 HRS AFTER DRILLING 6.46 ft / Elev 864.68 ft

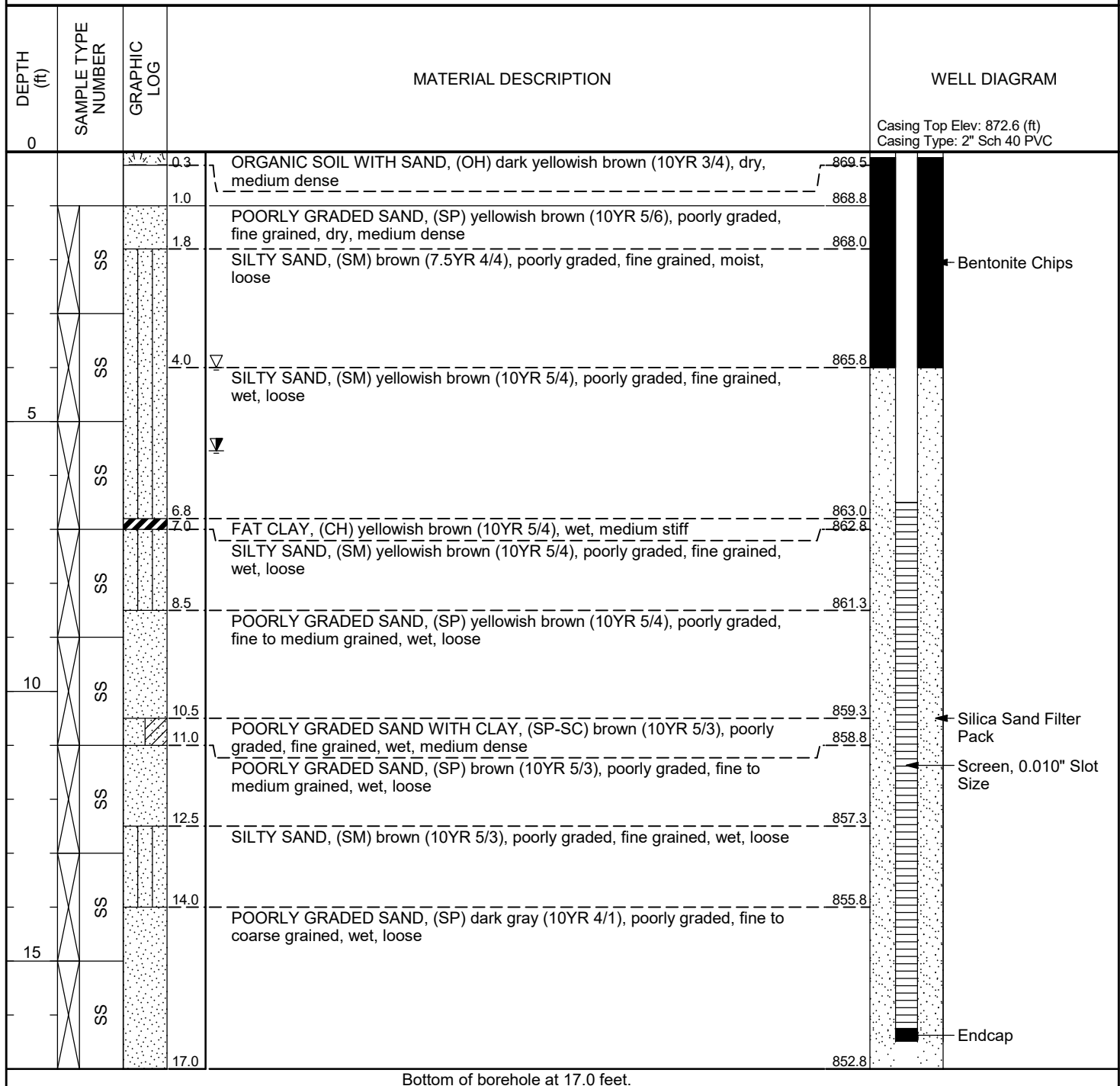
NOTES _____



Bottom of borehole at 17.5 feet.

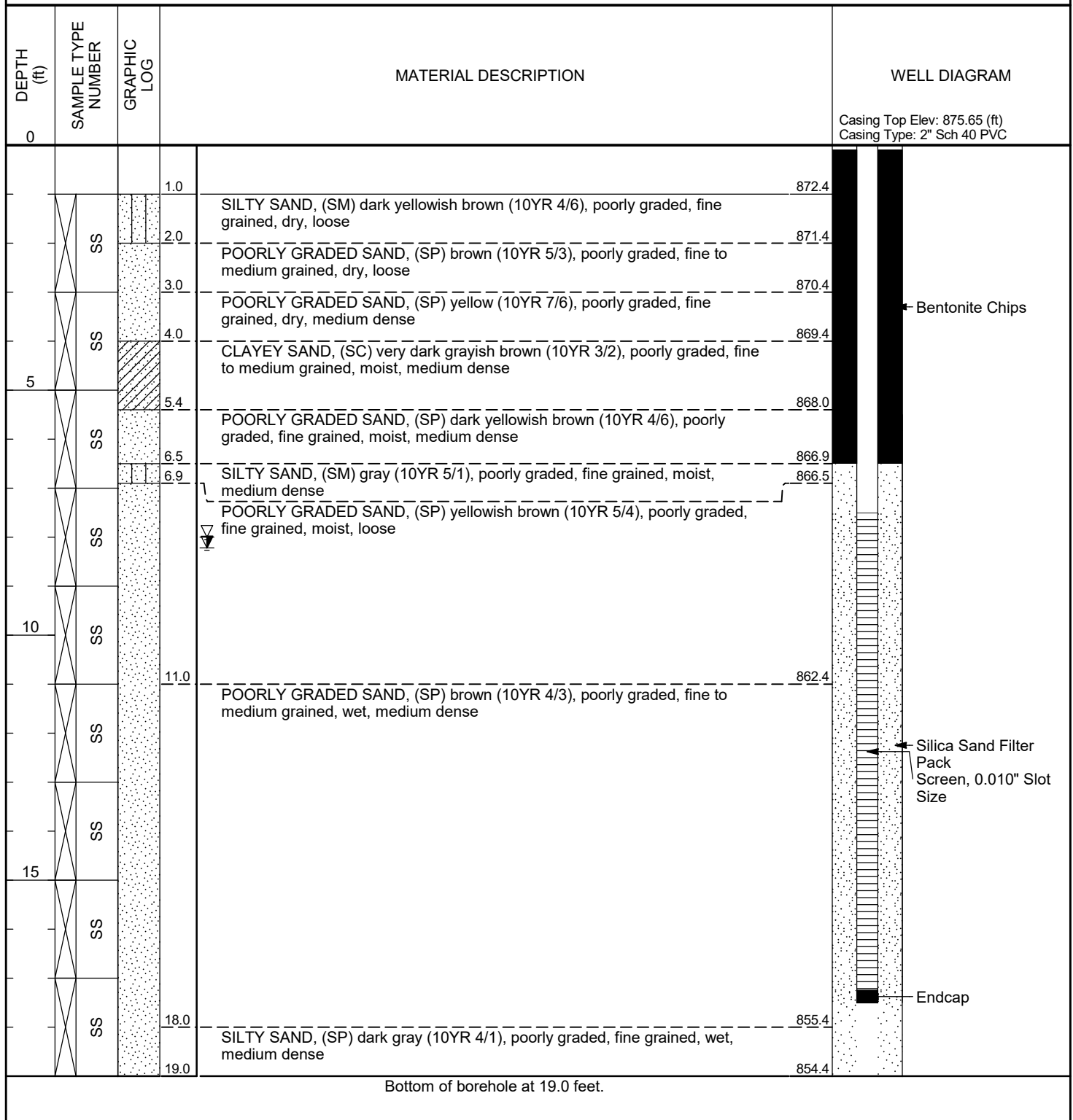


CLIENT Lansing Board of Water & Light PROJECT NAME Erickson Power Station
 PROJECT NUMBER 10173187 PROJECT LOCATION Eaton County, MI
 DATE STARTED 06/08/21 10:00 COMPLETED 06/08/21 11:00 GROUND ELEVATION 869.78 ft MSL HOLE DIAMETER 6"
 DRILLING CONTRACTOR SME DRILLER _____ GROUND WATER LEVELS:
 DRILLING METHOD HSA EQUIPMENT _____ ∇ AT TIME OF DRILLING 4.00 ft / Elev 865.78 ft
 LOGGED BY Tanten Buszka CHECKED BY _____ ∇ 96 HRS AFTER DRILLING 5.54 ft / Elev 864.24 ft
 NOTES _____



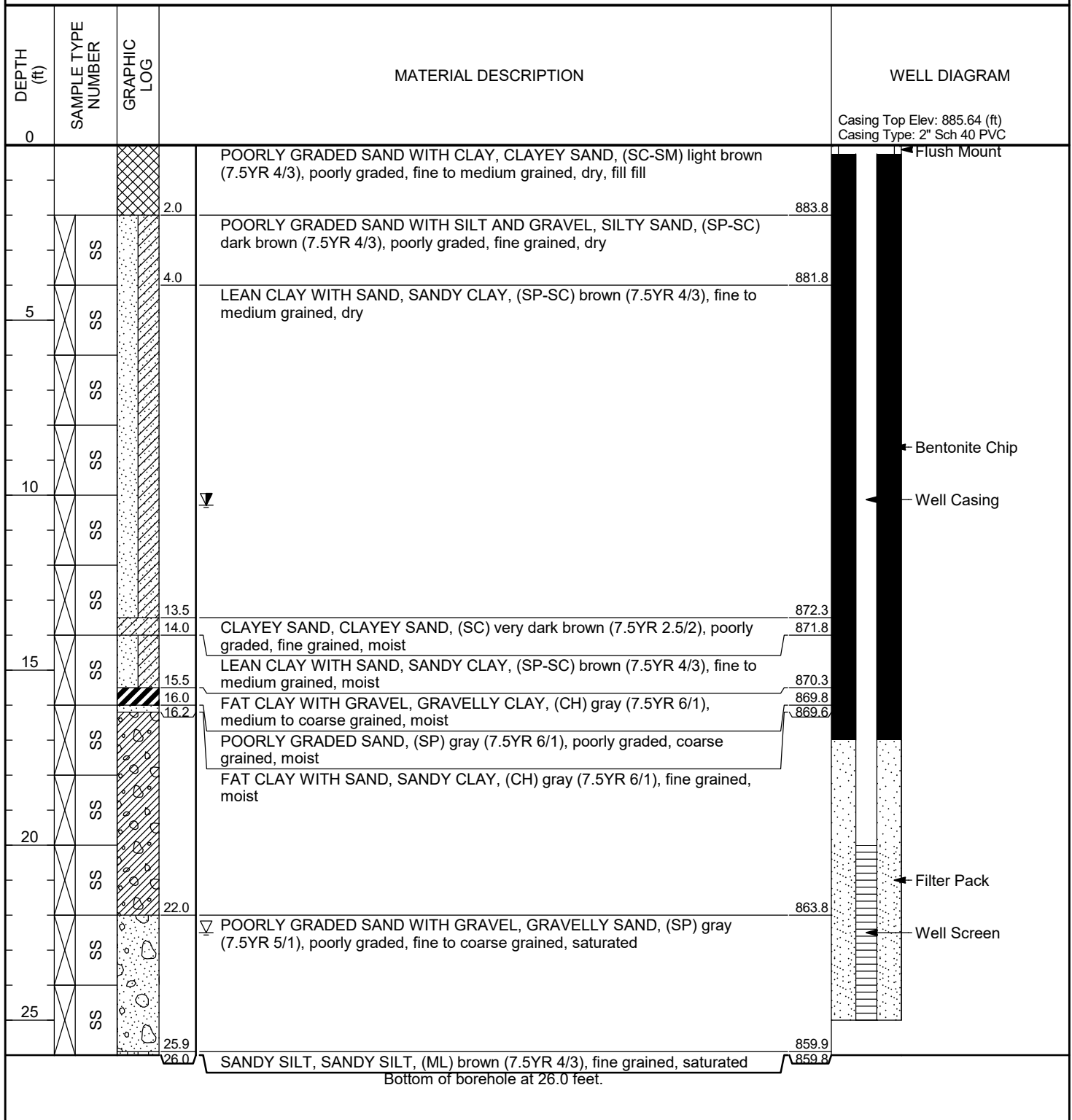


CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station
PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI
DATE STARTED 06/08/21 11:30 **COMPLETED** 08/09/21 12:30 **GROUND ELEVATION** 873.43 ft MSL **HOLE DIAMETER** 6"
DRILLING CONTRACTOR SME **DRILLER** _____ **GROUND WATER LEVELS:**
DRILLING METHOD HSA **EQUIPMENT** _____ ∇ **AT TIME OF DRILLING** 8.00 ft / Elev 865.43 ft
LOGGED BY Tanten Buszka **CHECKED BY** _____ ∇ **96 HRS AFTER DRILLING** 8.22 ft / Elev 865.21 ft
NOTES _____





CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station
PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI
DATE STARTED 02/17/22 12:00 **COMPLETED** 02/17/22 14:00 **GROUND ELEVATION** 885.77 ft MSL **HOLE DIAMETER** 6"
DRILLING CONTRACTOR SME **DRILLER** _____ **GROUND WATER LEVELS:**
DRILLING METHOD HSA **EQUIPMENT** _____ ∇ **AT TIME OF DRILLING** 22.50 ft / Elev 863.27 ft
LOGGED BY Tanten Buszka **CHECKED BY** _____ ∇ **AFTER DRILLING** 10.29 ft / Elev 875.48 ft
NOTES _____





CLIENT Lansing Board of Water & Light
PROJECT NUMBER 10173187
DATE STARTED 04/22/22 10:00 COMPLETED 04/26/22 14:00
DRILLING CONTRACTOR Cascade Driller
DRILLING METHOD Sonic/PQ Core
LOGGED BY Tanten Buszka CHECKED BY _____

PROJECT NAME Erickson Power Station
PROJECT LOCATION Eaton County, MI
GROUND ELEVATION 885.77 ft MSL HOLE DIAMETER 8"
GROUND WATER LEVELS:
▽ AT TIME OF DRILLING 22.00 ft / Elev 863.77 ft
▽ AFTER DRILLING 18.01 ft / Elev 867.76 ft

NOTES _____

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0				Casing Top Elev: 885.58 (ft) Casing Type: 2" Sch 40 PVC
			CLAYEY SAND, (SC) brown (7.5YR 4/4), poorly graded, fine to medium grained, dry	
10			10.5 875.3	
			SANDY FAT CLAY, (CH) brown (7.5YR 4/4), fine to medium grained, dry	
			12.0 873.8	
			CLAYEY SAND, (SC) dark brown (7.5YR 3/2), poorly graded, fine to medium grained, dry	
			15.0 870.8	
			GRAVELLY FAT CLAY WITH SAND, (CL) gray (7.5YR 4/1), poorly graded, fine to coarse grained, dry	
20			▽	
			22.0 863.8	
			POORLY GRADED SAND, (SP) gray (10YR 5/1), poorly graded, medium to coarse grained, saturated	
			28.0 857.8	
30			POORLY GRADED SAND WITH SILT, (SM) gray (10YR 5/1), poorly graded, medium to coarse grained, saturated	
			34.0 851.8	
			SILTY SAND WITH GRAVEL, (SM) gray (10YR 5/1), poorly graded, fine grained, saturated	
40				
50				



CLIENT Lansing Board of Water & Light

PROJECT NAME Erickson Power Station

PROJECT NUMBER 10173187

PROJECT LOCATION Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
50				
			SILTY SAND WITH GRAVEL, (SM) gray (10YR 5/1), poorly graded, fine grained, saturated (continued)	
			53.0 832.8	
			CLAYEY SAND, (CH) dark gray (10YR 4/1), poorly graded, fine to coarse grained, saturated	
			57.0 828.8	
			POORLY GRADED SAND WITH SILT, (SM) dark gray (10YR 4/1), poorly graded, fine to coarse grained, saturated	
60			61.0 824.8	
			GRAVELLY SILT, (ML) black (10YR 3/1), dry, Coal seam at 61'	
			65.0 820.8	
			(ML) SHALE, moderately weathered, light gray, dry	
70			70.0 815.8	
			SHALE, slightly weathered, dark gray, dry, Interbedded with light grey sandstone (1mm > thickness)	
			72.0 813.8	
			72.2 813.6	
			73.5 812.3	
			SANDSTONE, light gray, dry, Interbedded with dark grey/black shale, mostly Sandstone	
			73.9 811.9	
			74.5 811.3	
			SHALE, unweathered, dark gray, dry, No observable beds, trace light grey sandstone beds (1mm > thickness)	
			74.9 810.9	
			SANDSTONE, light gray, dry, Interbedded with shale, laminations are dipping.	
			SHALE, laminated, dark gray, dry	
			SANDSTONE, light gray, dry, Trace dark grey/black shale, pyrite deposit	
80			SHALE, moderately weathered, dark gray and light gray, dry, Transition from dark grey to light grey with depth, drop stone inclusions, brittle. Dipping fracture observed at 80' bgs.	
			83.0 802.8	
			83.5 802.3	
			SANDSTONE, light gray, dry, Interbedded with dark grey/black shale, variable bed thickness (1mm - 30mm)	
			86.0 799.8	
			SHALE, highly weathered, light gray, soft, damp	
			87.0 798.8	
			SHALE, unweathered, massive, dark gray, hard, dry	
90			SHALE, interbedded, dark gray and light gray, dry, Highly variable bed thickness (1mm - 30mm), approximately 50/50 shale and sandstone, inclusions at 88'	
			92.5 793.3	
			SANDSTONE, unweathered, light gray, dry, Trace dark grey/black shale laminations	
			96.0 789.8	
			96.5 789.3	
			SHALE, unweathered, dark gray, hard, damp, Pyrite deposit observed at 96'	
			SHALE, laminated, dark gray and light gray, dry, Observed inclusions and pyrite deposit at 99' and 106'	
100				
			107.0 778.8	

← Bentonite Seal
← Well Casing



CLIENT Lansing Board of Water & Light

PROJECT NAME Erickson Power Station

PROJECT NUMBER 10173187

PROJECT LOCATION Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
110			SHALE, completely weathered, black, soft, damp, Clayey silt with shale fragments, coal deposit (<i>continued</i>)	
			SHALE, unweathered, black, hard, dry	
120			SANDSTONE, dark gray and light gray, damp, Interbedded with shale, iron staining at 109', 110', 111', inclusions. Closed fracture observed at 111' bgs.	
			SHALE, completely weathered, gray, soft, dry, Brittle	
			SANDSTONE, light gray, fine, hard, damp, Well cemented, trace black shale beds	
			SHALE, completely weathered, dark gray, dry, Clayey silt with shale fragments	
130			SANDSTONE, light gray, fine, hard, damp, Trace black shale beds, poorly cemented sandstone at 123'	
			SHALE, unweathered, massive, black, hard, dry, Coal seam observed at 126'	
			SANDSTONE, light gray, fine, hard, damp, Trace black shale beds, well cemented, pyrite deposit at 127.5'	
			SANDSTONE, light gray, dry, Interbedded with black shale, approximatly 50/50 sandstone and shale	
			SHALE, massive, black, hard, dry	

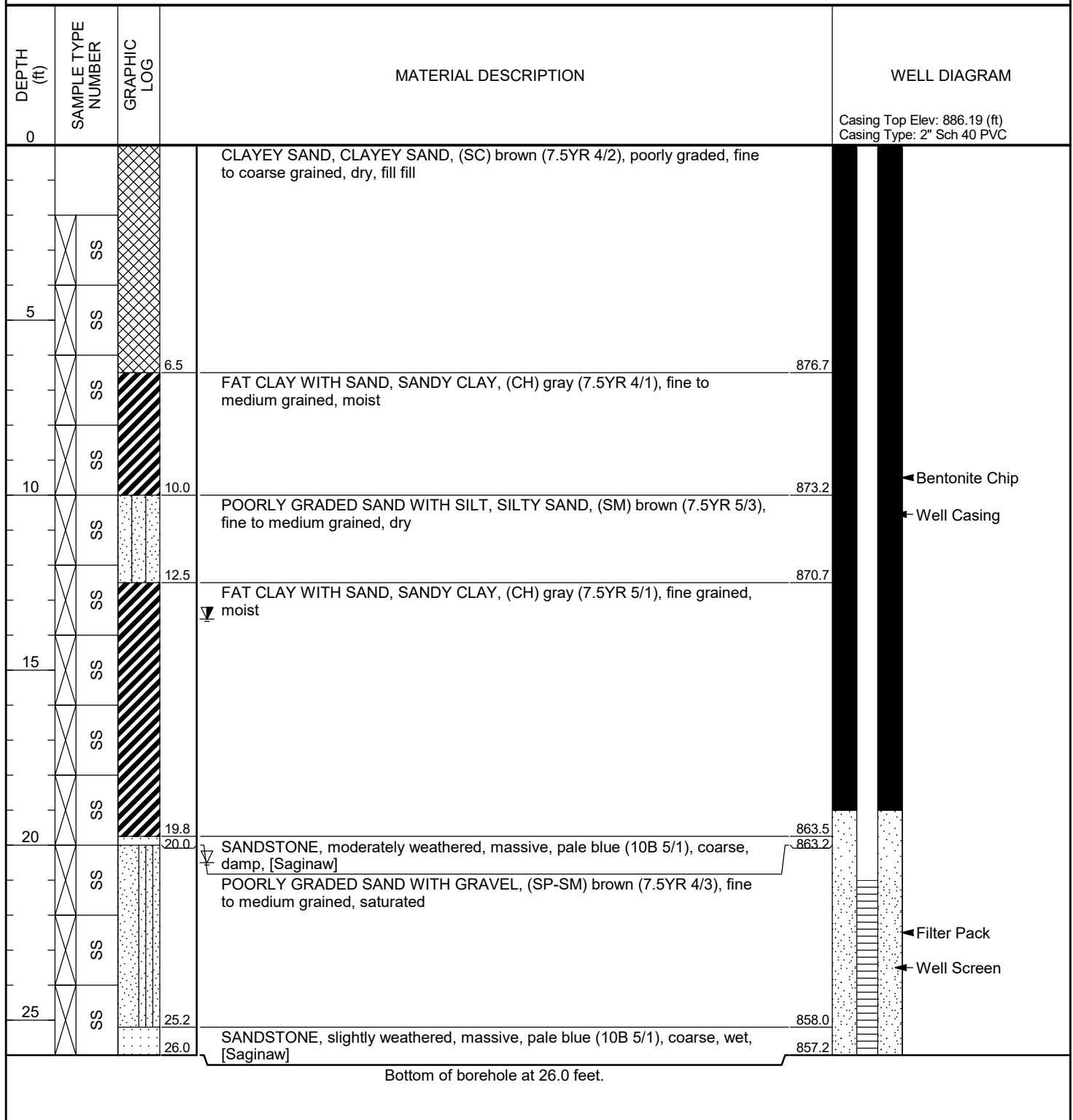
Bottom of borehole at 136.0 feet.



CLIENT Lansing Board of Water & Light
 PROJECT NUMBER 10173187
 DATE STARTED 02/17/22 13:30 COMPLETED 02/17/22 18:00
 DRILLING CONTRACTOR SME DRILLER _____
 DRILLING METHOD HSA EQUIPMENT _____
 LOGGED BY Tanten Buszka CHECKED BY _____

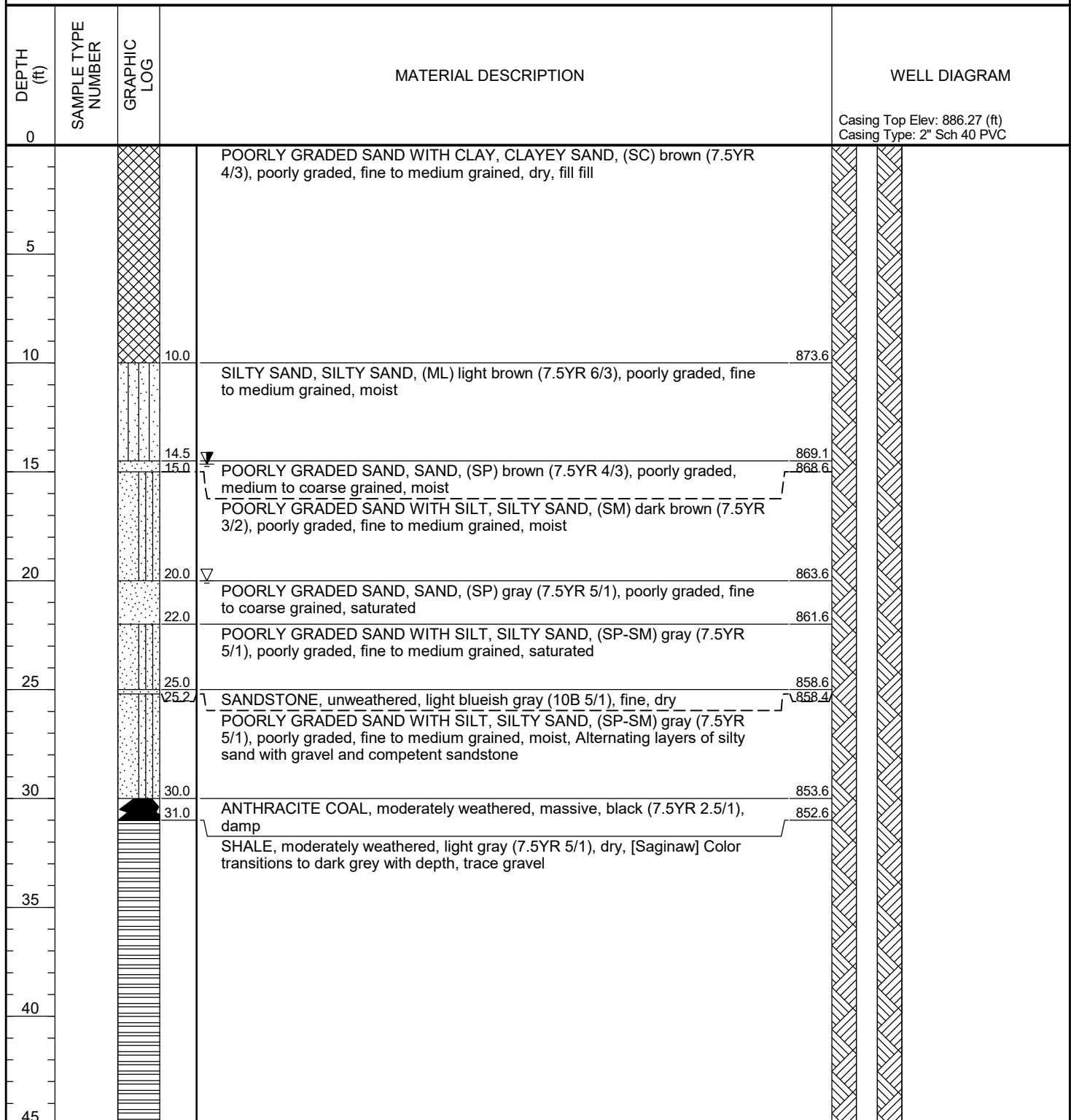
PROJECT NAME Erickson Power Station
 PROJECT LOCATION Eaton County, MI
 GROUND ELEVATION 883.21 ft MSL HOLE DIAMETER 6"
 GROUND WATER LEVELS:
 ∇ AT TIME OF DRILLING 20.50 ft / Elev 862.71 ft
 ∇ AFTER DRILLING 13.54 ft / Elev 869.67 ft

NOTES _____





CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station
PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI
DATE STARTED 03/03/22 14:00 **COMPLETED** 03/04/22 15:00 **GROUND ELEVATION** 883.6 ft MSL **HOLE DIAMETER** 8"
DRILLING CONTRACTOR Cascade **DRILLER** _____ **GROUND WATER LEVELS:**
DRILLING METHOD Sonic **EQUIPMENT** _____ ∇ **AT TIME OF DRILLING** 20.00 ft / Elev 863.60 ft
LOGGED BY Tanten Buszka **CHECKED BY** _____ ∇ **AFTER DRILLING** 14.65 ft / Elev 868.95 ft
NOTES _____



(Continued Next Page)



CLIENT Lansing Board of Water & Light

PROJECT NAME Erickson Power Station

PROJECT NUMBER 10173187

PROJECT LOCATION Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
45				
50			SHALE, moderately weathered, light gray (7.5YR 5/1), dry, [Saginaw] Color transitions to dark grey with depth, trace gravel (continued)	
		51.0		832.6
		53.0	SHALE, highly weathered, dark gray (7.5YR 4/1), damp, [Saginaw] Higher clay content, trace angular gravel and shale fragments.	830.6
55			SHALE, moderately weathered, bedded, light gray (7.5YR 7/1), dry, [Saginaw] 60-68' core washed out during initial extraction.	
60				
65				
		68.0		815.6
70			SHALE, moderately weathered, massive, light gray (7.5YR 7/1), dry, [Saginaw] Sample was competent with no observable bedding.	
		72.0		811.6
		75.0	SHALE, highly weathered, light gray (7.5YR 5/1), dry, [Saginaw] Sample coated clay derived from drilling process, black shale fragments within.	808.6
75			SHALE, moderately weathered, laminated, gray (7.5YR 5/1), damp, [Saginaw] Unable to identify natural moisture due to drilling process	
80		80.0		803.6
		82.0	80-90' sample was not recovered on the first attempt. Second attempt recovered 8' of sample consisting of drilling process derived clays and gravel.	801.6
85			SHALE, moderately weathered, laminated, light gray (7.5YR 5/1), damp, [Saginaw] Moisture content unknown due to drilling process. Horizontal breaks in core, unable to differentiate between natural breaks or drilling induced.	
90				
95				

← Bentonite Cement Slurry
← Well Casing



CLIENT Lansing Board of Water & Light

PROJECT NAME Erickson Power Station

PROJECT NUMBER 10173187

PROJECT LOCATION Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
100		98.0 100.0	SHALE, highly weathered, light gray (7.5YR 5/1), dry, [Saginaw] Degree of weathering unknown due to drilling method, sample was recovered in extremely weathered state.	785.6 783.6
105			SHALE, No competent sample recovered on first attempt, upon second retrieval attempt black shale fragments and pieces of interbedded black shale and sandstone were recovered. The driller noted indicate loss of drilling water at depth.	
110				
115		115.0 116.0	SHALE, slightly weathered, laminated, black (7.5YR 2.5/1), dry, [Saginaw]	768.6 767.6
			SANDSTONE, unweathered, light gray (10B 5/1), medium, dry, [Saginaw]	
		118.0		
120		120.0	SHALE, unweathered, bedded, light gray with black (10B 5/1), medium, Interbedded sandstone and shale, varved pattern	765.6 763.6
			SHALE, moderately weathered, laminated, light gray (7.5YR 5/1), dry, [Saginaw]	
		124.0		
125		125.0	SANDSTONE, unweathered, light blueish gray (10B 5/1), fine, dry, [Saginaw] Sample structure was not retained during retrieval. Sandstone fragments were brittle and poorly cemented.	759.6 758.6
Bottom of borehole at 125.0 feet.				





CLIENT Lansing Board of Water & Light PROJECT NAME Erickson Power Station
 PROJECT NUMBER 10173187 PROJECT LOCATION Eaton County, MI
 DATE STARTED 02/14/22 11:30 COMPLETED 02/14/22 13:00 GROUND ELEVATION 869.09 ft MSL HOLE DIAMETER 6"
 DRILLING CONTRACTOR SME DRILLER _____ GROUND WATER LEVELS:
 DRILLING METHOD HSA EQUIPMENT _____ ∇ AT TIME OF DRILLING 7.00 ft / Elev 862.09 ft
 LOGGED BY Tanten Buszka CHECKED BY _____ ∇ AFTER DRILLING 6.30 ft / Elev 862.79 ft

NOTES _____

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0.0				Casing Top Elev: 871.8 (ft) Casing Type: 2" Sch 40 PVC
0.8			ORGANIC SOIL WITH SAND, CLAYEY SAND, (SC) blackish brown, dry, topsoil fill	
2.5	SS		POORLY GRADED SAND WITH SILT, SILTY SAND, (SP-SM) dark brown (7.5YR 2.5/1), poorly graded, fine grained, dry	
3.5	SS		FAT CLAY WITH SAND, SANDY CLAY, (CL) gray (5Y 5/1), fine grained, moist	Bentonite Chip Well Casing
5.0	SS		POORLY GRADED SAND, GRAVELLY SAND, (SP) brown (7.5YR 5/4), poorly graded, fine to coarse grained, saturated	
7.5	SS		POORLY GRADED GRAVEL, SANDY FAT CLAY, (GP) brown (7.5YR 5/4), poorly graded, coarse grained, saturated	
10.0	SS		POORLY GRADED SAND, SAND, (SP) brown (7.5YR 5/4), poorly graded, fine to medium grained, saturated	Filter Pack Well Screen
10.5			SILT WITH SAND, SANDY SILT, (SM) gray (7.5YR 5/1), poorly graded, fine grained, saturated	
12.0				
12.5				
13.0				

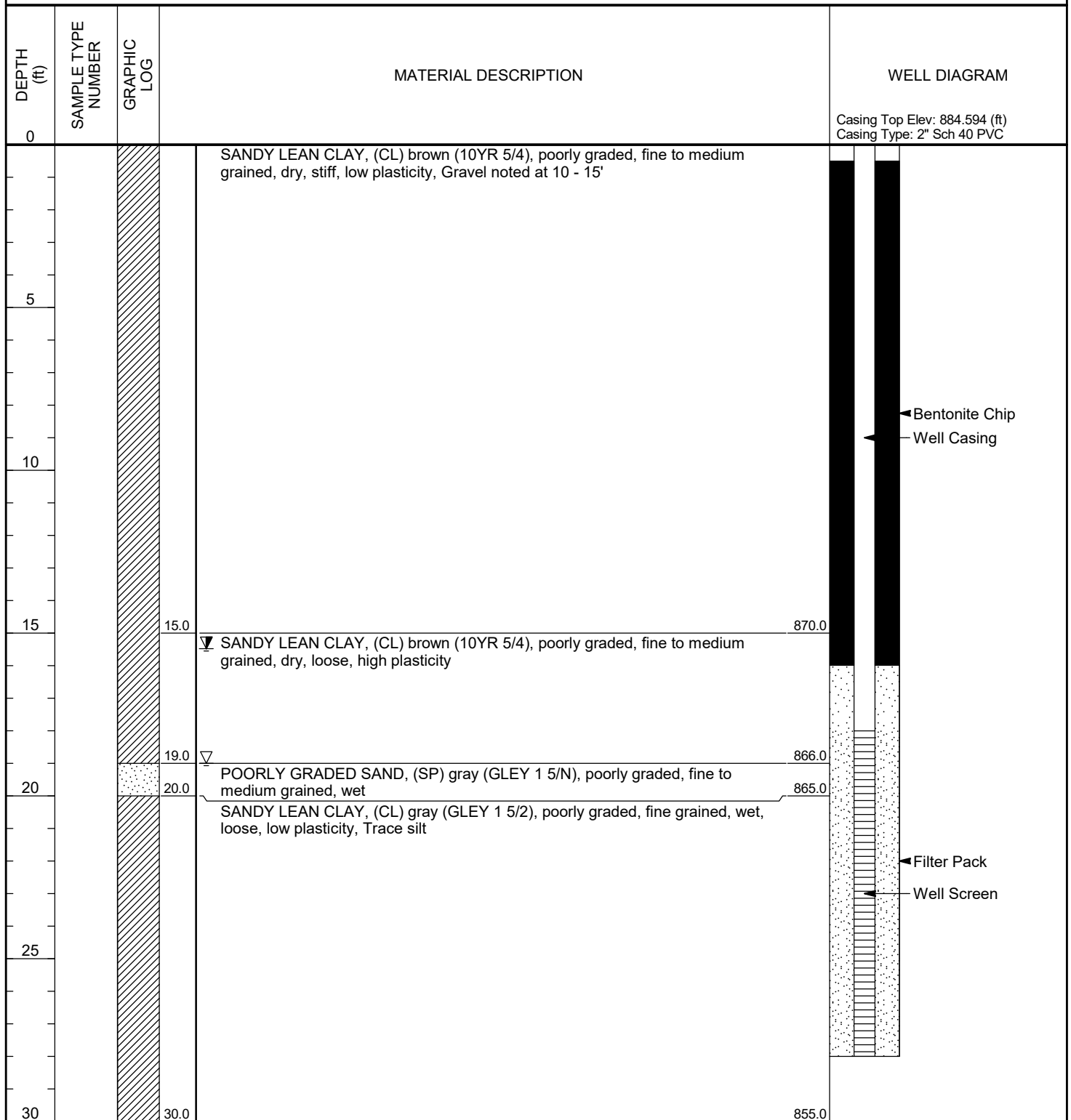
Bottom of borehole at 13.0 feet.



CLIENT Lansing Board of Water & Light
PROJECT NUMBER 10173187
DATE STARTED 01/09/23 08:00 COMPLETED 01/09/23 13:00
DRILLING CONTRACTOR Cascade Driller
DRILLING METHOD Sonic EQUIPMENT _____
LOGGED BY Tanten Buszka CHECKED BY _____

PROJECT NAME Erickson Power Station
PROJECT LOCATION Eaton County, MI
GROUND ELEVATION 885.028 ft MSL HOLE DIAMETER 6"
GROUND WATER LEVELS:
▽ AT TIME OF DRILLING 19.00 ft / Elev 866.03 ft
▽ AFTER DRILLING 15.48 ft / Elev 869.55 ft

NOTES _____



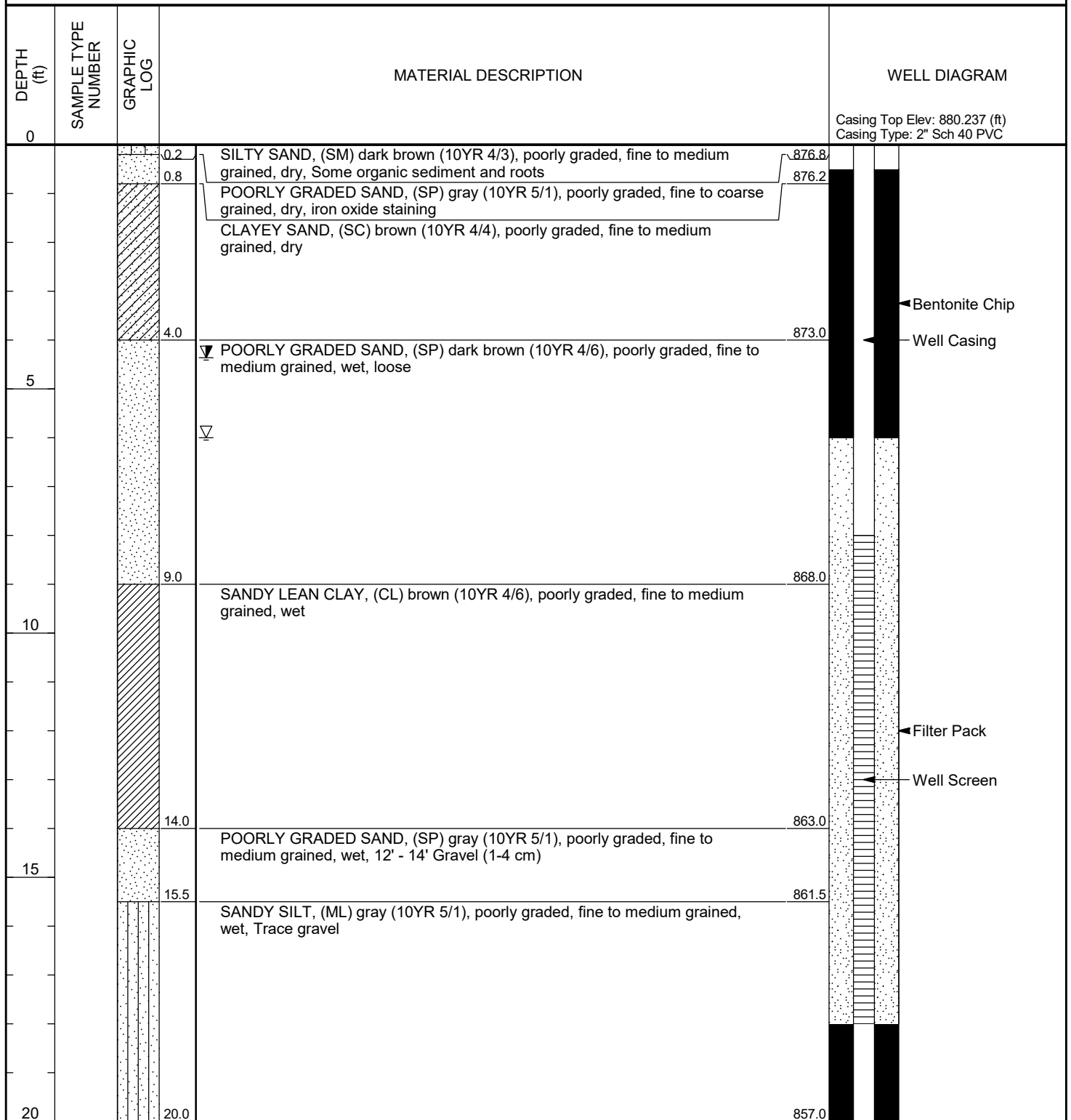
Bottom of borehole at 30.0 feet.



CLIENT Lansing Board of Water & Light
PROJECT NUMBER 10173187
DATE STARTED 01/09/23 14:30 COMPLETED 01/09/23 18:00
DRILLING CONTRACTOR Cascade Driller
DRILLING METHOD Sonic EQUIPMENT _____
LOGGED BY Tanten Buszka CHECKED BY _____

PROJECT NAME Erickson Power Station
PROJECT LOCATION Eaton County, MI
GROUND ELEVATION 877.037 ft MSL HOLE DIAMETER 6"
GROUND WATER LEVELS:
▽ AT TIME OF DRILLING 6.00 ft / Elev 871.04 ft
▽ AFTER DRILLING 4.36 ft / Elev 872.68 ft

NOTES _____



Bottom of borehole at 20.0 feet.



CLIENT Lansing Board of Water & Light PROJECT NAME Erickson Power Station
 PROJECT NUMBER 10173187 PROJECT LOCATION Eaton County, MI
 DATE STARTED 01/24/23 08:00 COMPLETED 01/25/23 16:00 GROUND ELEVATION 874.538 ft MSL HOLE DIAMETER 6"
 DRILLING CONTRACTOR Cascade DRILLER _____ GROUND WATER LEVELS:
 DRILLING METHOD Sonic EQUIPMENT _____ AT TIME OF DRILLING ---
 LOGGED BY Andrew Byks CHECKED BY TB AFTER DRILLING ---
 NOTES _____

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0				Casing Top Elev: 877.484 (ft) Casing Type: 2" Sch 40 PVC
5			LEAN CLAY WITH SAND, (CL) brown (10YR 5/4), fine to medium grained, dry, stiff, Trace gravel	Bentonite Chip Well Casing
10				
15		15.0	LEAN CLAY WITH SAND, (CL) brown (10YR 5/4), fine to medium grained, moist, loose	859.5 Filter Pack Well Screen
20		19.0	POORLY GRADED SAND, (SP) gray (GLE Y 1 5/N), fine to medium grained, wet	855.5
		20.0	SANDY LEAN CLAY, (CL) gray (GLE Y 1 5/2), fine grained, wet, loose, Trace silt	854.5
		22.0		852.5

Bottom of borehole at 22.0 feet.



CLIENT Lansing Board of Water & Light PROJECT NAME Erickson Power Station
 PROJECT NUMBER 10173187 PROJECT LOCATION Eaton County, MI
 DATE STARTED 01/17/23 08:00 COMPLETED 01/25/23 12:00 GROUND ELEVATION 874.538 ft MSL HOLE DIAMETER 8"
 DRILLING CONTRACTOR Cascade DRILLER _____ GROUND WATER LEVELS:
 DRILLING METHOD Sonic EQUIPMENT _____ AT TIME OF DRILLING ---
 LOGGED BY Tanten Buszka CHECKED BY AB AFTER DRILLING ---
 NOTES Borehole drilled telescopically - Initial borehole was 6" and reamed to 8" to accommodate additional well materials.

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0				Casing Top Elev: 877.492 (ft) Casing Type: 2" Sch 40 PVC
			0.5 SANDY ORGANIC SOIL, (OL) fine to medium grained, moist 874.0 LEAN CLAY, (CL) brown (10YR 5/4), poorly graded, fine to medium grained, saturated, loose, with Sand and Gravel	<p>← Bentonite Chip ← Well Casing</p>
5			8.0 866.5 8.5 POORLY GRADED SAND, (SP) brown (10YR 5/4), poorly graded, fine to medium grained, saturated, with Gravel 866.0 LEAN CLAY, (CL) brown (10YR 6/4), poorly graded, fine to medium grained, saturated, hard	
10			10.5 864.0 12.0 POORLY GRADED SAND, (SP) gray (10YR 6/1), poorly graded, fine to medium grained, saturated 862.5 LEAN CLAY, (CL) gray (10YR 7/1), poorly graded, fine grained, dry, hard, with Gravel	
15			17.0 857.5 LEAN CLAY, (CL) gray (10YR 7/1), well graded, fine to medium grained, saturated, loose, graded from top to bottom, gravel at 28'	
20				
25				



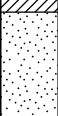
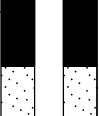

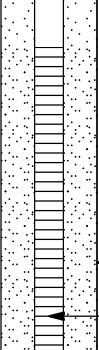



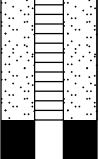


CLIENT Lansing Board of Water & Light

PROJECT NAME Erickson Power Station

PROJECT NUMBER 10173187

PROJECT LOCATION Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
25				
			LEAN CLAY, (CL) gray (10YR 7/1), well graded, fine to medium grained, saturated, loose, graded from top to bottom, gravel at 28' (continued)	
		29.0		845.5
30			POORLY GRADED SAND, (SP) gray (10YR 7/1), poorly graded, fine to medium grained, saturated, with trace clay and gravel	
		31.0		843.5
			SILT, (ML) gray (7.5YR 5/1), moist, hard, with fine sand.	
35				
			Coal seam	
40				
			SILT, (ML) gray (7.5YR 5/1), dry, dense, with fine sand and gravel	
		43.0		831.5

Bottom of borehole at 43.0 feet.

Filter Pack
Well Screen



CLIENT Lansing Board of Water & Light PROJECT NAME Erickson Power Station
 PROJECT NUMBER 10173187 PROJECT LOCATION Eaton County, MI
 DATE STARTED 01/17/23 08:00 COMPLETED 01/25/23 12:00 GROUND ELEVATION 874.538 ft MSL HOLE DIAMETER 7"
 DRILLING CONTRACTOR Cascade Driller GROUND WATER LEVELS:
 DRILLING METHOD Sonic/PQ Core EQUIPMENT _____ AT TIME OF DRILLING ---
 LOGGED BY Tanten Buszka CHECKED BY AB AFTER DRILLING ---
 NOTES Borehole drilled telescopically - 8" borehole to 44' and 7" borehole to 67'. Bedrock was initially PQ cored then reamed out to 6".

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0				Casing Top Elev: 877.485 (ft) Casing Type: 2" Sch 40 PVC
0.5			SANDY ORGANIC SOIL, (OL) fine to medium grained, moist	874.0
			LEAN CLAY, (CL) brown (10YR 5/4), poorly graded, fine to medium grained, saturated, loose, with Sand and Gravel	
5				
8.0			POORLY GRADED SAND, (SP) brown (10YR 5/4), poorly graded, fine to medium grained, saturated, with Gravel	866.5
8.5				866.0
10			LEAN CLAY, (CL) brown (10YR 6/4), poorly graded, fine to medium grained, saturated, hard	864.0
10.5			POORLY GRADED SAND, (SP) gray (10YR 6/1), poorly graded, fine to medium grained, saturated	862.5
12.0			LEAN CLAY, (CL) gray (10YR 7/1), poorly graded, fine grained, dry, hard, with Gravel	
15				
17.0			LEAN CLAY, (CL) gray (10YR 7/1), well graded, fine to medium grained, saturated, loose, graded from top to bottom, gravel at 28'	857.5
20				
25				
29.0			POORLY GRADED SAND, (SP) gray (10YR 7/1), poorly graded, fine to medium grained, saturated, with trace clay and gravel	845.5
30				
31.0			SILT, (ML) gray (7.5YR 5/1), moist, hard, with fine sand.	843.5
35				

← Bentonite Chip
 ← Well Casing



CLIENT Lansing Board of Water & Light

PROJECT NAME Erickson Power Station

PROJECT NUMBER 10173187

PROJECT LOCATION Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35			SILT, (ML) gray (7.5YR 5/1), moist, hard, with fine sand. <i>(continued)</i>	
		38.0		836.5
		40.0	Coal seam	834.5
40		43.0	SILT, (ML) gray (7.5YR 5/1), dry, dense, with fine sand and gravel SHALE, moderately weathered, laminated, black (7.5YR 2.5/1), dry, contained coal fragments	831.5
		44.0	SHALE, moderately weathered, laminated, black (10YR 3/1), dry, contained coal fragments	830.5
45			SHALE, highly weathered, laminated, light gray (10YR 5/1), wet, fractured	
50		52.0	SHALE, moderately weathered, laminated, dark gray	822.5
		54.0	Coal Seam	820.5
55		56.0	SANDSTONE, moderately weathered, bedded, gray, wet, fractured	818.5
60		61.0	SHALE, highly weathered, interbedded, dark gray, wet, fractured. 1-3mm beds of sandstone	813.5
		64.0	SHALE, unweathered, bedded, black (7.5YR 2.5/1), dry	810.5
65		66.0		808.5

Filter Pack
Well Screen

Bottom of borehole at 66.0 feet.



CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station
PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI
DATE STARTED 01/17/23 08:00 **COMPLETED** 01/25/23 12:00 **GROUND ELEVATION** 874.538 ft MSL **HOLE DIAMETER** 6"
DRILLING CONTRACTOR Cascade Driller **GROUND WATER LEVELS:**
DRILLING METHOD Sonic/PQ Core **EQUIPMENT** _____ **AT TIME OF DRILLING** ---
LOGGED BY Tanten Buszka **CHECKED BY** AB **AFTER DRILLING** ---
NOTES Borehole drilled telescopically - 8" borehole to 44', 7" borehole to 67', 6" borehole to 129'. Bedrock was initially PQ cored then reamed out to 6".

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0				Casing Top Elev: 877.526 (ft) Casing Type: 2" Sch 40 PVC
0.5			SANDY ORGANIC SOIL, (OL) fine to medium grained, moist	874.0
5			LEAN CLAY, (CL) brown (10YR 5/4), poorly graded, fine to medium grained, saturated, loose, with Sand and Gravel	
8.0				866.5
8.5			POORLY GRADED SAND, (SP) brown (10YR 5/4), poorly graded, fine to medium grained, saturated, with Gravel	866.0
10			LEAN CLAY, (CL) brown (10YR 6/4), poorly graded, fine to medium grained, saturated, hard	864.0
10.5				862.5
12.0			POORLY GRADED SAND, (SP) gray (10YR 6/1), poorly graded, fine to medium grained, saturated	
15			LEAN CLAY, (CL) gray (10YR 7/1), poorly graded, fine grained, dry, hard, with Gravel	
17.0				857.5
20			LEAN CLAY, (CL) gray (10YR 7/1), well graded, fine to medium grained, saturated, loose, graded from top to bottom, gravel at 28'	
25				
29.0				845.5
30			POORLY GRADED SAND, (SP) gray (10YR 7/1), poorly graded, fine to medium grained, saturated, with trace clay and gravel	
31.0			SILT, (ML) gray (7.5YR 5/1), moist, hard, with fine sand.	843.5
35				
38.0				836.5
40			Coal seam	
40.0				834.5
			SILT, (ML) gray (7.5YR 5/1), dry, dense, with fine sand and gravel	
43.0				831.5
44.0			SHALE, moderately weathered, laminated, black (7.5YR 2.5/1), dry, contained coal fragments	830.5
45				

(Continued Next Page)



CLIENT Lansing Board of Water & Light

PROJECT NAME Erickson Power Station

PROJECT NUMBER 10173187

PROJECT LOCATION Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
45				
			SHALE, highly weathered, laminated, light gray (7.5YR 5/1), wet, fractured (continued)	
50				
			52.0 822.5	
			SHALE, moderately weathered, laminated, dark gray (7.5YR 4/1)	
			54.0 820.5	
55			Coal seam	
			56.0 818.5	
			SANDSTONE, moderately weathered, bedded, gray (7.5YR 4/1), wet, fractured	
60			61.0 813.5	Well Casing Bentonite Chip
			SHALE, highly weathered, interbedded, dark gray (7.5YR 4/1), wet, fractured. 1-3mm beds of sandstone	
			64.0 810.5	
65			SHALE, unweathered, bedded, black (7.5YR 2.5/1), dry	
			67.0 807.5	
			67.3 807.2	
70			SHALE, highly weathered, bedded, dark gray (7.5YR 4/1), wet, vertical fractures, 70-71 interbedded with sandstone	
			71.0 803.5	
			SANDSTONE, unweathered, massive, light gray (7.5YR 5/1), wet	
75			75.0 799.5	
			SHALE, unweathered, interbedded, dark gray (7.5YR 4/1), wet	
			78.0 796.5	
80			SHALE, moderately weathered, laminated, black (7.5YR 2.5/1), wet, fractured, pyrite deposits	
			81.0 793.5	
			81.2 793.3	
85			SHALE, unweathered, bedded, light gray (7.5YR 5/1), dry, alternating light and dark grey beds	
			87.0 787.5	
90			SHALE, slightly weathered, laminated, black (7.5YR 2.5/1), wet, stone inclusions, packer test confirms presence of fractures, pyrite deposit (100')	
95				

(Continued Next Page)



CLIENT Lansing Board of Water & Light

PROJECT NAME Erickson Power Station

PROJECT NUMBER 10173187

PROJECT LOCATION Eaton County, MI

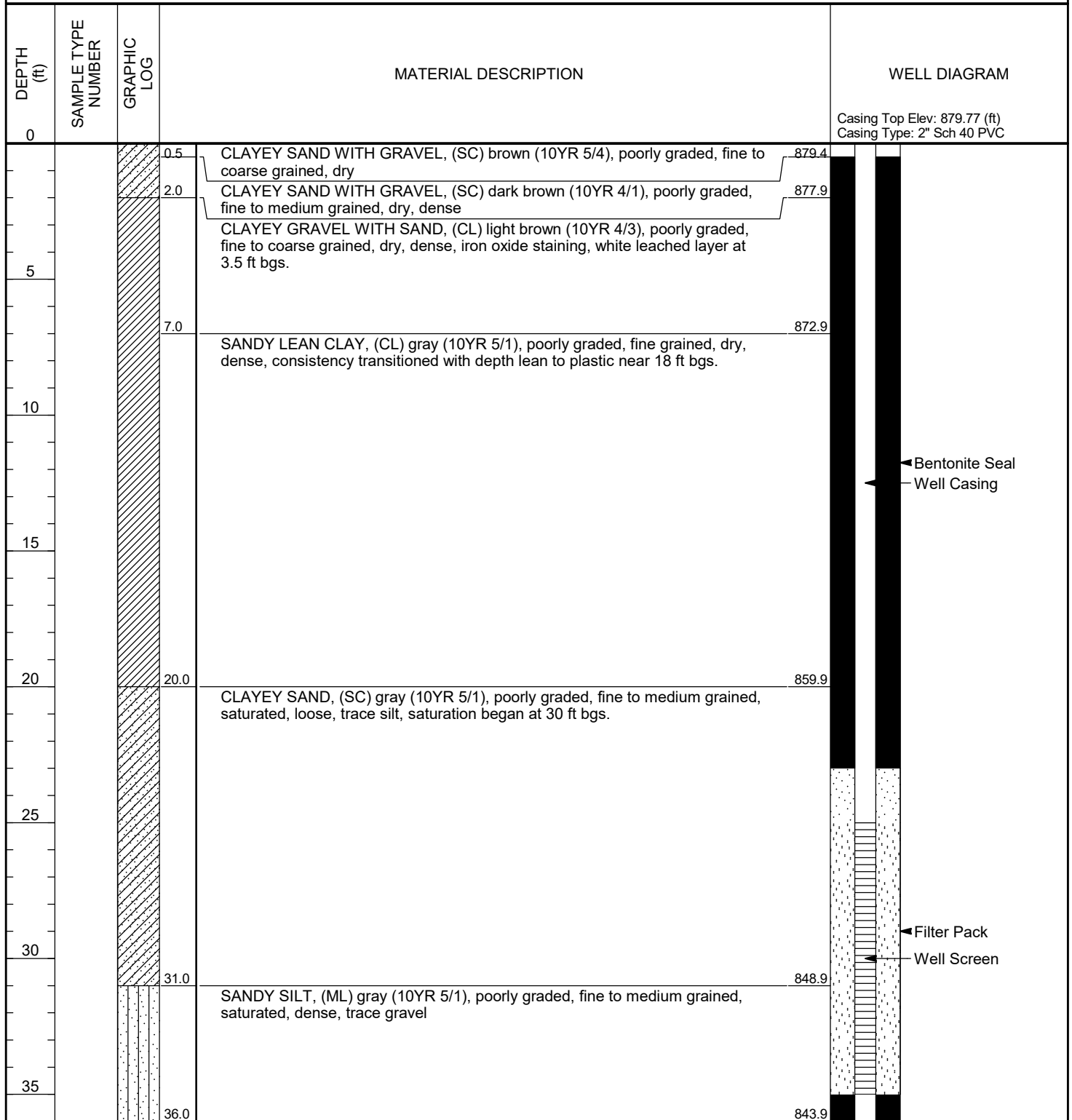
DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
100			SHALE, slightly weathered, laminated, black (7.5YR 2.5/1), wet, stone inclusions, packer test confirms presence of fractures, pyrite deposite (100') <i>(continued)</i>	
105				
110				
115				
119.0				
120			SHALE, highly weathered, bedded, light gray (7.5YR 5/1), wet, alternating light and dark grey shale	
122.0				
123.0			SHALE, slightly weathered, laminated, dark gray (7.5YR 4/1), wet, fractured	
125			SHALE, moderately weathered, laminated, black (7.5YR 2.5/1), wet, fractured, pyrite deposit (126 to 127, and 128.5 to 129)	
129.0				

Bottom of borehole at 129.0 feet.



CLIENT Lansing Board of Water & Light PROJECT NAME Erickson Power Station
 PROJECT NUMBER 10173187 PROJECT LOCATION Eaton County, MI
 DATE STARTED 05/08/23 00:00 COMPLETED 05/15/23 00:00 GROUND ELEVATION 879.939 ft MSL HOLE DIAMETER 6"
 DRILLING CONTRACTOR Cascade DRILLER _____ GROUND WATER LEVELS:
 DRILLING METHOD Sonic EQUIPMENT _____ AT TIME OF DRILLING ---
 LOGGED BY Tanten Buszka CHECKED BY AB AFTER DRILLING ---

NOTES _____



Bottom of borehole at 36.0 feet.



CLIENT Lansing Board of Water & Light PROJECT NAME Erickson Power Station
 PROJECT NUMBER 10173187 PROJECT LOCATION Eaton County, MI
 DATE STARTED 05/08/23 00:00 COMPLETED 05/15/23 00:00 GROUND ELEVATION 879.939 ft MSL HOLE DIAMETER 8"
 DRILLING CONTRACTOR Cascade DRILLER _____ GROUND WATER LEVELS:
 DRILLING METHOD Sonic EQUIPMENT _____ AT TIME OF DRILLING ---
 LOGGED BY Tanten Buszka CHECKED BY AB AFTER DRILLING ---
 NOTES Borehole drilled telescopically - Initial borehole was 6" and reamed to 8" to accommodate additional well materials.

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0				Casing Top Elev: 879.74 (ft) Casing Type: 2" Sch 40 PVC
		0.5	CLAYEY SAND WITH GRAVEL, (SC) brown (10YR 5/4), poorly graded, fine to coarse grained, dry	
		2.0	CLAYEY SAND WITH GRAVEL, (SC) dark brown (10YR 4/1), poorly graded, fine to medium grained, dry, dense	
5			CLAYEY GRAVEL WITH SAND, (CL) light brown (10YR 4/3), poorly graded, fine to coarse grained, dry, dense, iron oxide staining, white leached layer at 3.5 ft bgs.	
		7.0		
10			SANDY LEAN CLAY, (CL) gray (10YR 5/1), poorly graded, fine grained, dry, dense, consistency transitioned with depth lean to plastic near 18 ft bgs.	
15				
20		20.0	CLAYEY SAND, (SC) gray (10YR 5/1), poorly graded, fine to medium grained, saturated, loose, trace silt, saturation began at 30 ft bgs.	← Bentonite Seal ← Well Casing
25				



CLIENT Lansing Board of Water & Light

PROJECT NAME Erickson Power Station

PROJECT NUMBER 10173187

PROJECT LOCATION Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
25				
			CLAYEY SAND, (SC) gray (10YR 5/1), poorly graded, fine to medium grained, saturated, loose, trace silt, saturation began at 30 ft bgs. <i>(continued)</i>	
30				
		31.0		848.9
			SANDY SILT, (ML) gray (10YR 5/1), poorly graded, fine to medium grained, saturated, dense, trace gravel	
35				
		39.0		840.9
			POORLY GRADED SAND, (SP) brown (10YR 4/2), poorly graded, fine to coarse grained, saturated, loose	
40				
		41.0		838.9
			SILT WITH SAND, (ML) gray (10YR 5/1), poorly graded, fine to coarse grained, saturated, dense, trace gravel (2-6 mm)	
		43.0		836.9
			CLAYEY SAND, (SC) gray (10YR 5/1), poorly graded, fine to coarse grained, saturated, loose, Coal seam at 47 ft bgs	Filter Pack Well Screen
45				
		47.0		832.9

Bottom of borehole at 47.0 feet.



CLIENT Lansing Board of Water & Light PROJECT NAME Erickson Power Station
 PROJECT NUMBER 10173187 PROJECT LOCATION Eaton County, MI
 DATE STARTED 05/08/23 00:00 COMPLETED 05/15/23 00:00 GROUND ELEVATION 879.939 ft MSL HOLE DIAMETER 7"
 DRILLING CONTRACTOR Cascade DRILLER _____ GROUND WATER LEVELS:
 DRILLING METHOD Sonic/PQ Core EQUIPMENT _____ AT TIME OF DRILLING ---
 LOGGED BY Tanten Buszka CHECKED BY AB AFTER DRILLING ---
 NOTES Borehole drilled telescopically - 8" borehole to 44' and 7" borehole to 67'. Bedrock was initially PQ cored then reamed out to 6".

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0				Casing Top Elev: 879.72 (ft) Casing Type: 2" Sch 40 PVC
0.5			CLAYEY SAND WITH GRAVEL, (SC) brown (10YR 5/4), poorly graded, fine to coarse grained, dry	879.4
2.0			CLAYEY SAND WITH GRAVEL, (SC) dark brown (10YR 4/1), poorly graded, fine to medium grained, dry, dense	877.9
5			CLAYEY GRAVEL WITH SAND, (CL) light brown (10YR 4/3), poorly graded, fine to coarse grained, dry, dense, iron oxide staining, white leached layer at 3.5 ft bgs.	
7.0				872.9
10			SANDY LEAN CLAY, (CL) gray (10YR 5/1), poorly graded, fine grained, dry, dense, consistency transitioned with depth lean to plastic near 18 ft bgs.	
15				
20				
20.0			CLAYEY SAND, (SC) gray (10YR 5/1), poorly graded, fine to medium grained, saturated, loose, trace silt, saturation began at 30 ft bgs.	859.9
25				
30				
31.0			SANDY SILT, (ML) gray (10YR 5/1), poorly graded, fine to medium grained, saturated, dense, trace gravel	848.9
35				



CLIENT Lansing Board of Water & Light

PROJECT NAME Erickson Power Station

PROJECT NUMBER 10173187

PROJECT LOCATION Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35				
			SANDY SILT, (ML) gray (10YR 5/1), poorly graded, fine to medium grained, saturated, dense, trace gravel (<i>continued</i>)	
			840.9	
40			POORLY GRADED SAND, (SP) brown (10YR 4/2), poorly graded, fine to coarse grained, saturated, loose	
			838.9	
			SILT WITH SAND, (ML) gray (10YR 5/1), poorly graded, fine to coarse grained, saturated, dense, trace gravel (2-6 mm)	
			836.9	
45			CLAYEY SAND, (SC) gray (10YR 5/1), poorly graded, fine to coarse grained, saturated, loose, Coal seam at 47 ft bgs	
			832.9	
			SILT WITH SAND, (ML) gray (10YR 5/1), poorly graded, fine to coarse grained, dry, dense, some gravel	
50			829.9	
			SHALE, highly weathered, gray, dry, top 5 feet were drilled with sonic, structure is unknown.	
55				
			822.9	
			SHALE, moderately weathered, light gray, dry, 3" sandstone layer at 57 ft bgs. Large stones (2-6 inches) observed at 58 ft bgs.	
60			819.9	
			SHALE, moderately weathered, dark gray, dry, Weathered zones between 60 and 65 ft bgs contained water.	
65				
			812.9	

Filter Pack
Well Screen

Bottom of borehole at 67.0 feet.



CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station
PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI
DATE STARTED 05/08/23 00:00 **COMPLETED** 05/15/23 00:00 **GROUND ELEVATION** 879.939 ft MSL **HOLE DIAMETER** 6"
DRILLING CONTRACTOR Cascade **DRILLER** _____ **GROUND WATER LEVELS:**
DRILLING METHOD Sonic/PQ Core **EQUIPMENT** _____ **AT TIME OF DRILLING** ---
LOGGED BY Tanten Buszka **CHECKED BY** AB **AFTER DRILLING** ---
NOTES Borehole drilled telescopically - 8" borehole to 44', 7" borehole to 67', 6" borehole to 129'. Bedrock was initially PQ cored then reamed out to 6".

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0				Casing Top Elev: 879.7 (ft) Casing Type: 2" Sch 40 PVC
0.5			CLAYEY SAND WITH GRAVEL, (SC) brown (10YR 5/4), poorly graded, fine to coarse grained, dry	
2.0			CLAYEY SAND WITH GRAVEL, (SC) dark brown (10YR 4/1), poorly graded, fine to medium grained, dry, dense	
			CLAYEY GRAVEL WITH SAND, (CL) light brown (10YR 4/3), poorly graded, fine to coarse grained, dry, dense, iron oxide staining, white leached layer at 3.5 ft bgs.	
5				
7.0			SANDY LEAN CLAY, (CL) gray (10YR 5/1), poorly graded, fine grained, dry, dense, consistency transitioned with depth lean to plastic near 18 ft bgs.	
10				
15				
20				
20.0			CLAYEY SAND, (SC) gray (10YR 5/1), poorly graded, fine to medium grained, saturated, loose, trace silt, saturation began at 30 ft bgs.	
25				
30				



CLIENT Lansing Board of Water & Light

PROJECT NAME Erickson Power Station

PROJECT NUMBER 10173187

PROJECT LOCATION Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
30				
		31.0	848.9 SANDY SILT, (ML) gray (10YR 5/1), poorly graded, fine to medium grained, saturated, dense, trace gravel	<p>◀ Bentonite Seal Well Casing</p>
35		39.0	840.9 POORLY GRADED SAND, (SP) brown (10YR 4/2), poorly graded, fine to coarse grained, saturated, loose	
40		41.0	838.9 SILT WITH SAND, (ML) gray (10YR 5/1), poorly graded, fine to coarse grained, saturated, dense, trace gravel (2-6 mm)	
		43.0	836.9 CLAYEY SAND, (SC) gray (10YR 5/1), poorly graded, fine to coarse grained, saturated, loose, Coal seam at 47 ft bgs	
45		47.0	832.9 SILT WITH SAND, (ML) gray (10YR 5/1), poorly graded, fine to coarse grained, dry, dense, some gravel	
50		50.0	829.9 SHALE, highly weathered, gray, dry, top 5 feet were drilled with sonic, structure is unknown.	
55		57.0	822.9 SHALE, moderately weathered, light gray, dry, 3" sandstone layer at 57 ft bgs. Large stones (2-6 inches) observed at 58 ft bgs.	
60		60.0	819.9 SHALE, moderately weathered, dark gray, dry, Weathered zones between 60 and 65 ft bgs contained water.	

(Continued Next Page)



CLIENT Lansing Board of Water & Light

PROJECT NAME Erickson Power Station

PROJECT NUMBER 10173187

PROJECT LOCATION Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
65			SHALE, moderately weathered, dark gray, dry, Weathered zones between 60 and 65 ft bgs contained water. (continued)	
70	70.5		809.4	
75	77.0		802.9	
80	81.0		798.9	
85	84.0		795.9	
90	90.0		789.9	
	92.5		787.4	
95	94.5		785.4	
	96.0		783.9	

(Continued Next Page)



CLIENT Lansing Board of Water & Light

PROJECT NAME Erickson Power Station

PROJECT NUMBER 10173187

PROJECT LOCATION Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
100			SHALE, unweathered, laminated, black, dry, fractures observed 97-100 feet bgs, moisture in fractured zone (<i>continued</i>)	
		100.0	779.9	
105			SHALE, unweathered, laminated, black, dry, fractures observed 104-106 feet bgs, moisture and pyrite deposits observed in fractured zone	
		106.0	773.9	
110			SHALE, unweathered, laminated, black, dry, 112-117 feet bgs was cored twice, unable to identify natural fractures	
		117.0	762.9	
120			SHALE, moderately weathered, laminated, light gray, dry, material between 119-121 feet bgs is soft and weak, moisture observed in fractured zone	Filter Pack Well Screen
		121.0	758.9	
125			SHALE, slightly weathered, laminated, light gray, dry	
		125.0	754.9	
130			SHALE, moderately weathered, laminated, black, dry, fractures with moisture observed over entire interval	
		130.0	749.9	

Bottom of borehole at 130.0 feet.



BWL | Erickson Power Station
Alternate Source Demonstration
for Compliance with Michigan Rule R 299.4441(8)

Attachment 2

Laboratory Reports



Hometown People. Hometown Power.

Lansing Board of Water and Light
Environmental Services Laboratory (MI00079)

Cert ID:3760

1232 Haco Dr.

Lansing, Michigan 48901

27 December 2023

BWL - Erickson Station

Attn: Cheryl Loudon

3725 S. Canal

Lansing, MI 48917

Project: Erickson AM MI

Dear Cheryl Loudon,

Enclosed is a copy of the laboratory report for the following work order(s) received by Lansing Board of Water and Light Environmental Services Laboratory:

Work Order

L311201

Received

11/22/2023 7:40:00AM

Account Number

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A handwritten signature in blue ink that reads "Jennifer Caporale".

Jennifer Caporale, Supervisor



Analytical Report

Client: BWL - Erickson Station
Address: 3725 S. Canal
 Lansing MI, 48917

Client Project Manager: Cheryl Louden

Report Date: 12/27/2023

Sample Name: MW-16A

Lab #: L311201-01 Ground Water

Collected: 21-Nov-23 11:26

By: Marc Wahrer

Analyte	Reporting			Dilution	Regulatory Limit	Analysis Date/Time	By	Method	Notes
	Result	Limit	Units						
Conductivity	2400	1.0	uS/cm	1		21-Nov-23 11:26	maw	FIELD	
Dissolved oxygen	ND	0.100	mg/L	1		21-Nov-23 11:26	maw	FIELD	
Milliliters Purged	200		ml/min	1		21-Nov-23 11:26	maw	FIELD	
Oxidation Reduction Potential	-43.90	-999.0	mV	1		21-Nov-23 11:26	maw	FIELD	
pH	6.8	7.0	pH Units	1		21-Nov-23 11:26	maw	FIELD	
Temperature	14		°C	1		21-Nov-23 11:26	maw	FIELD	
Turbidity	4.4	0.10	NTU	1		21-Nov-23 11:26	maw	FIELD	

Sample Name: MW-16B

Lab #: L311201-02 Ground Water

Collected: 21-Nov-23 13:41

By: Marc Wahrer

Analyte	Reporting			Dilution	Regulatory Limit	Analysis Date/Time	By	Method	Notes
	Result	Limit	Units						
Conductivity	620	1.0	uS/cm	1		21-Nov-23 13:41	maw	FIELD	
Dissolved oxygen	ND	0.100	mg/L	1		21-Nov-23 13:41	maw	FIELD	
Milliliters Purged	230		ml/min	1		21-Nov-23 13:41	maw	FIELD	
Oxidation Reduction Potential	-127.7	-999.0	mV	1		21-Nov-23 13:41	maw	FIELD	
pH	7.5	7.0	pH Units	1		21-Nov-23 13:41	maw	FIELD	
Temperature	13		°C	1		21-Nov-23 13:41	maw	FIELD	
Turbidity	6.3	0.10	NTU	1		21-Nov-23 13:41	maw	FIELD	

Sample Name: MW-16C

Lab #: L311201-03 Ground Water

Collected: 21-Nov-23 14:56

By: Marc Wahrer

Analyte	Reporting			Dilution	Regulatory Limit	Analysis Date/Time	By	Method	Notes
	Result	Limit	Units						
Conductivity	590	1.0	uS/cm	1		21-Nov-23 14:56	maw	FIELD	
Dissolved oxygen	ND	0.100	mg/L	1		21-Nov-23 14:56	maw	FIELD	
Milliliters Purged	230		ml/min	1		21-Nov-23 14:56	maw	FIELD	
Oxidation Reduction Potential	-145.6	-999.0	mV	1		21-Nov-23 14:56	maw	FIELD	
pH	7.4	7.0	pH Units	1		21-Nov-23 14:56	maw	FIELD	
Temperature	13		°C	1		21-Nov-23 14:56	maw	FIELD	
Turbidity	6.0	0.10	NTU	1		21-Nov-23 14:56	maw	FIELD	



Analytical Report

Client: BWL - Erickson Station
Address: 3725 S. Canal
Lansing MI, 48917

Client Project Manager: Cheryl Louden

Report Date: 12/27/2023

Sample Name: MW-16D

Lab #: L311201-04 Ground Water

Collected: 21-Nov-23 12:34

By: Marc Wahrer

Analyte	Reporting			Dilution	Regulatory Limit	Analysis Date/Time	By	Method	Notes
	Result	Limit	Units						
Conductivity	600	1.0	uS/cm	1		21-Nov-23 12:34	maw	FIELD	
Dissolved oxygen	ND	0.100	mg/L	1		21-Nov-23 12:34	maw	FIELD	
Milliliters Purged	50.0		ml/90sec	1		21-Nov-23 12:34	maw	FIELD	
Oxidation Reduction Potential	-122.4	-999.0	mV	1		21-Nov-23 12:34	maw	FIELD	
pH	7.4	7.0	pH Units	1		21-Nov-23 12:34	maw	FIELD	
Temperature	11		°C	1		21-Nov-23 12:34	maw	FIELD	
Turbidity	6.0	0.10	NTU	1		21-Nov-23 12:34	maw	FIELD	



Analytical Report

Client: BWL - Erickson Station

Client Project Manager: Cheryl Louden

Report Date: 12/27/2023

Address: 3725 S. Canal
Lansing MI, 48917

Approved By:

Jennifer Caporale

Notes and Definitions

- AL Action Level (Action Level = Regulatory Limit)
 - MCL Maximum Contaminant Level
 - PEL Permissible Exposure Limit (Permissible Exposure Limit = Regulatory Limit)
 - RPD Relative Percent Difference
 - OT Odor Threshold
 - ND Non Detect is less than the reporting limit value
- All drinking water regulatory limits are MCL's with the exception of Lead and Copper unless otherwise noted.



Report ID: S56029.01(02)
Generated on 12/27/2023
Replaces report S56029.01(01) generated on 11/28/2023

Report to
Attention: Jennifer Caporale
Board of Water & Light
P.O. Box 13007
Lansing, MI 48901

Phone: 517-702-6372 FAX:
Email: Environmental_Laboratory@LBWL.com

Report produced by
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John Lavery (johnlavery@meritlabs.com)
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Report Summary
Lab Sample ID(s): S56029.01-S56029.06
Project: Erickson AM MI Wells 16A-16D
Collected Date(s): 11/21/2023
Submitted Date/Time: 11/22/2023 08:08
Sampled by: Marc Wahrer
P.O. #:

Table of Contents
Cover Page (Page 1)
General Report Notes (Page 2)
Report Narrative (Page 2)
Laboratory Accreditations (Page 3)
Qualifier Descriptions (Page 3)
Glossary of Abbreviations (Page 3)
Method Summary (Page 4)
Sample Summary (Page 5)

Maya Murshak
Technical Director



General Report Notes

Analytical results relate only to the samples tested, in the condition received by the laboratory.

Methods may be modified for improved performance.

Results reported on a dry weight basis where applicable.

'Not detected' indicates that parameter was not found at a level equal to or greater than the reporting limit (RL).

When MDL results are provided, then 'Not detected' indicates that parameter was not found at a level equal to or greater than the MDL.

40 CFR Part 136 Table II Required Containers, Preservation Techniques and Holding Times for the Clean Water Act specify that samples for acrolein and acrylonitrile, and 2-chloroethylvinyl ether need to be preserved at a pH in the range of 4 to 5 or if not preserved, analyzed within 3 days of sampling.

QA/QC corresponding to this analytical report is a separate document with the same Merit ID reference and is available upon request.

Starred (*) analytes are not NY NELAP accredited.

Samples are held by the lab for 30 days from the final report date unless a written request to hold longer is provided by the client.

Report shall not be reproduced except in full, without the written approval of Merit Laboratories, Inc.

Limits for drinking water samples, are listed as the MCL Limits (Maximum Contaminant Level Concentrations)

PFAS requirement: Section 9.3.8 of U.S. EPA Method 537.1 states "If the method analyte(s) found in the Field Sample is present in the

FRB at a concentration greater than 1/3 the MRL, then all samples collected with that FRB are invalid and must be recollected and reanalyzed."

Samples submitted without an accompanying FRB may not be acceptable for compliance purposes.

Wisconsin PFAs analysis: MDL = LOD; RL = LOQ. LOD and LOQ are adjusted for dilution.

All accreditations/certifications held by this laboratory are listed on page 3. Not all accreditations/certifications are applicable to this report.

For a specific list of accredited analytes, please feel free to contact the laboratory or visit <https://www.meritlabs.com/certifications>.

Report Narrative

All analyses completed

Laboratory Accreditations (For Reference Only)

Authority	Accreditation ID
Michigan DEQ	#9956
DOD ELAP & ISO/IEC 17025:2017	#69699 PJLA Testing
WBENC	#2005110032
Ohio VAP	#CL0002
Indiana DOH	#C-MI-07
New York NELAC	#11814
North Carolina DENR	#680
North Carolina DOH	#26702
Pennsylvania DEP	#68-05884
Wisconsin DNR	FID# 399147320

Qualifier Descriptions

Qualifier	Description
!	Result is outside of stated limit criteria
B	Compound also found in associated method blank
E	Concentration exceeds calibration range
F	Analysis run outside of holding time
G	Estimated result due to extraction run outside of holding time
H	Sample submitted and run outside of holding time
I	Matrix interference with internal standard
J	Estimated value less than reporting limit, but greater than MDL
L	Elevated reporting limit due to low sample amount
M	Result reported to MDL not RDL
O	Analysis performed by outside laboratory. See attached report.
R	Preliminary result
S	Surrogate recovery outside of control limits
T	No correction for total solids
X	Elevated reporting limit due to matrix interference
Y	Elevated reporting limit due to high target concentration
b	Value detected less than reporting limit, but greater than MDL
e	Reported value estimated due to interference
j	Analyte also found in associated method blank
p	Benzo(b)Fluoranthene and Benzo(k)Fluoranthene integrated as one peak.
x	Preserved from bulk sample

Glossary of Abbreviations

Abbreviation	Description
RL/RDL	Reporting Limit
MDL	Method Detection Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
SW	EPA SW 846 (Soil and Wastewater) Methods
E	EPA Methods
SM	Standard Methods
LN	Linear
BR	Branched



Method Summary

Method	Version
E200.8	EPA Method 200.8 Revision 5.4
E245.1	EPA Method 245.1 Revision 3.0
E300.0	EPA Method 300.0 Revision 2.1 (1993)
SM2320B	Standard Method 2320 B 2011
SM2340C	Standard Method 2340 C 2011
SM2540C	Standard Method 2540 C 2015
SM2540D	Standard Method 2540 D 2015
SW3015A	SW 846 Method 3015A Revision 1 February 2007



Sample Summary (6 samples)

Sample ID	Sample Tag	Matrix	Collected Date/Time
S56029.01	MW-16A L311201-01	Groundwater	11/21/23 11:26
S56029.02	MW-16B L311201-02	Groundwater	11/21/23 13:41
S56029.03	MW-16C L311201-03	Groundwater	11/21/23 14:56
S56029.04	MW-16-D L311201-04	Groundwater	11/21/23 12:34
S56029.05	MWT-16A L311201-05	Groundwater	11/21/23 11:26
S56029.06	Field Blank L311201-06	Water	11/21/23 09:25



Analytical Laboratory Report

Supplemental Report

Lab Sample ID: S56029.01

Sample Tag: MW-16A L311201-01

Collected Date/Time: 11/21/2023 11:26

Matrix: Groundwater

COC Reference:

Sample Containers

#	Type	Preservative(s)	Refrigerated?	Arrival Temp. (C)	Thermometer #
2	1L Plastic	HNO3	Yes	1.8	IR
2	1L Plastic	None	Yes	1.8	IR
1	250ml Plastic	HNO3	Yes	1.8	IR

Extraction / Prep.

Parameter	Result	Method	Run Date	Analyst	Flags
Mercury Digestion	Completed	E245.1	11/27/23 13:57	CTV	
Metal Digestion	Completed	SW3015A	11/22/23 10:10	CCM	

Inorganics

Method: E300.0, Run Date: 11/22/23 12:40, Analyst: ASB

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Fluoride (Undistilled)	Not detected	1.0	0.13	mg/L	5	16984-48-8	

Method: E300.0, Run Date: 11/22/23 14:04, Analyst: ASB

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Chloride	459	50	0.80	mg/L	50	16887-00-6	
Sulfate	264	50	3.0	mg/L	50	14808-79-8	

Method: SM2320B, Run Date: 11/22/23 14:36, Analyst: JKB

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Bicarbonate*	510	10	0.504	mg/L	1	71-52-3	
Carbonate*	Not detected	10		mg/L	1	3812-32-6	

Method: SM2340C, Run Date: 11/22/23 13:08, Analyst: JKB

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Hardness	754	20	4.76	mg/L	20		

Method: SM2540C, Run Date: 11/22/23 13:58, Analyst: MDG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Total Dissolved Solids	1,580	50	6	mg/L	2		

Method: SM2540D, Run Date: 11/22/23 13:58, Analyst: MDG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Total Suspended Solids	1.2	3	1	mg/L	1		

Metals

Method: E200.8, Run Date: 11/22/23 13:59, Analyst: CCM

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Sodium	312	2.5	0.545	mg/L	25	7440-23-5	

Method: E200.8, Run Date: 11/22/23 11:52, Analyst: CCM

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Antimony*	Not detected	0.005	0.00225	mg/L	5	7440-36-0	
Arsenic	0.004	0.002	0.00145	mg/L	5	7440-38-2	
Barium	0.163	0.005	0.000900	mg/L	5	7440-39-3	



Analytical Laboratory Report

Supplemental Report

Lab Sample ID: S56029.01 (continued)

Sample Tag: MW-16A L311201-01

Method: E200.8, Run Date: 11/22/23 11:52, Analyst: CCM (continued)

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Beryllium	Not detected	0.001	0.000200	mg/L	5	7440-41-7	
Boron	0.19	0.04	0.0159	mg/L	5	7440-42-8	
Cadmium	Not detected	0.0005	0.000350	mg/L	5	7440-43-9	
Chromium	Not detected	0.005	0.000750	mg/L	5	7440-47-3	
Cobalt	Not detected	0.005	0.000450	mg/L	5	7440-48-4	
Copper	Not detected	0.005	0.000800	mg/L	5	7440-50-8	
Iron	3.08	0.02	0.0142	mg/L	5	7439-89-6	
Lead	Not detected	0.003	0.000450	mg/L	5	7439-92-1	
Lithium*	Not detected	0.005	0.00135	mg/L	5	7439-93-2	
Molybdenum	Not detected	0.005	0.00420	mg/L	5	7439-98-7	
Nickel	Not detected	0.005	0.00115	mg/L	5	7440-02-0	
Selenium	Not detected	0.005	0.00435	mg/L	5	7782-49-2	
Silver	Not detected	0.0005	0.000250	mg/L	5	7440-22-4	
Thallium	Not detected	0.002	0.000350	mg/L	5	7440-28-0	
Vanadium	Not detected	0.005	0.00205	mg/L	5	7440-62-2	
Zinc	Not detected	0.005	0.00325	mg/L	5	7440-66-6	

Method: E200.8, Run Date: 11/22/23 14:00, Analyst: CCM

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Calcium*	210	0.50	0.218	mg/L	5	7440-70-2	
Magnesium	52.4	0.50	0.0579	mg/L	5	7439-95-4	
Potassium	1.49	0.50	0.119	mg/L	5	7440-09-7	

Method: E245.1, Run Date: 11/27/23 15:10, Analyst: CTV

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Mercury	Not detected	0.0002	0.0000160	mg/L	1	7439-97-6	

Other / Misc.

Method: , Run Date: 12/19/23 14:58, Analyst: GEL

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Radiological Analyses*	Completed				1		O

O-Analysis performed by outside laboratory. See attached report.

**Lab Sample ID: S56029.02**

Sample Tag: MW-16B L311201-02

Collected Date/Time: 11/21/2023 13:41

Matrix: Groundwater

COC Reference:

Sample Containers

#	Type	Preservative(s)	Refrigerated?	Arrival Temp. (C)	Thermometer #
2	1L Plastic	HNO3	Yes	1.8	IR
2	1L Plastic	None	Yes	1.8	IR
1	250ml Plastic	HNO3	Yes	1.8	IR

Extraction / Prep.

Parameter	Result	Method	Run Date	Analyst	Flags
Mercury Digestion	Completed	E245.1	11/27/23 13:57	CTV	
Metal Digestion	Completed	SW3015A	11/22/23 10:10	CCM	

Inorganics**Method: E300.0, Run Date: 11/22/23 12:53, Analyst: ASB**

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Chloride	3.1	5	0.08	mg/L	5	16887-00-6	b
Fluoride (Undistilled)	0.58	1.0	0.13	mg/L	5	16984-48-8	b
Sulfate	17.8	5	0.30	mg/L	5	14808-79-8	

Method: SM2320B, Run Date: 11/22/23 14:40, Analyst: JKB

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Bicarbonate*	400	10	0.504	mg/L	1	71-52-3	
Carbonate*	Not detected	10		mg/L	1	3812-32-6	

Method: SM2340C, Run Date: 11/22/23 13:12, Analyst: JKB

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Hardness	355	10	2.38	mg/L	10		

Method: SM2540C, Run Date: 11/22/23 13:58, Analyst: MDG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Total Dissolved Solids	370	50	6	mg/L	2		

Method: SM2540D, Run Date: 11/22/23 13:58, Analyst: MDG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Total Suspended Solids	Not detected	3	1	mg/L	1		

Metals**Method: E200.8, Run Date: 11/22/23 11:55, Analyst: CCM**

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Antimony*	Not detected	0.005	0.00225	mg/L	5	7440-36-0	
Arsenic	Not detected	0.002	0.00145	mg/L	5	7440-38-2	
Barium	0.091	0.005	0.000900	mg/L	5	7440-39-3	
Beryllium	Not detected	0.001	0.000200	mg/L	5	7440-41-7	
Boron	0.12	0.04	0.0159	mg/L	5	7440-42-8	
Cadmium	Not detected	0.0005	0.000350	mg/L	5	7440-43-9	
Chromium	Not detected	0.005	0.000750	mg/L	5	7440-47-3	
Cobalt	Not detected	0.005	0.000450	mg/L	5	7440-48-4	
Copper	Not detected	0.005	0.000800	mg/L	5	7440-50-8	

b-Value detected less than reporting limit, but greater than MDL



Analytical Laboratory Report

Supplemental Report

Lab Sample ID: S56029.02 (continued)

Sample Tag: MW-16B L311201-02

Method: E200.8, Run Date: 11/22/23 11:55, Analyst: CCM (continued)

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Iron	0.39	0.02	0.0142	mg/L	5	7439-89-6	
Lead	Not detected	0.003	0.000450	mg/L	5	7439-92-1	
Lithium*	0.021	0.005	0.00135	mg/L	5	7439-93-2	
Molybdenum	0.006	0.005	0.00420	mg/L	5	7439-98-7	
Nickel	Not detected	0.005	0.00115	mg/L	5	7440-02-0	
Selenium	Not detected	0.005	0.00435	mg/L	5	7782-49-2	
Silver	Not detected	0.0005	0.000250	mg/L	5	7440-22-4	
Thallium	Not detected	0.002	0.000350	mg/L	5	7440-28-0	
Vanadium	Not detected	0.005	0.00205	mg/L	5	7440-62-2	
Zinc	Not detected	0.005	0.00325	mg/L	5	7440-66-6	

Method: E200.8, Run Date: 11/22/23 14:04, Analyst: CCM

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Calcium*	83.9	0.50	0.218	mg/L	5	7440-70-2	
Magnesium	36.4	0.50	0.0579	mg/L	5	7439-95-4	
Potassium	3.02	0.50	0.119	mg/L	5	7440-09-7	
Sodium	11.0	0.50	0.109	mg/L	5	7440-23-5	

Method: E245.1, Run Date: 11/27/23 15:13, Analyst: CTV

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Mercury	Not detected	0.0002	0.0000160	mg/L	1	7439-97-6	

Other / Misc.

Method: , Run Date: 12/19/23 14:58, Analyst: GEL

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Radiological Analyses*	Completed				1		O

O-Analysis performed by outside laboratory. See attached report.



Lab Sample ID: S56029.03

Sample Tag: MW-16C L311201-03

Collected Date/Time: 11/21/2023 14:56

Matrix: Groundwater

COC Reference:

Sample Containers

#	Type	Preservative(s)	Refrigerated?	Arrival Temp. (C)	Thermometer #
2	1L Plastic	HNO3	Yes	1.8	IR
2	1L Plastic	None	Yes	1.8	IR
1	250ml Plastic	HNO3	Yes	1.8	IR

Extraction / Prep.

Parameter	Result	Method	Run Date	Analyst	Flags
Mercury Digestion	Completed	E245.1	11/27/23 13:57	CTV	
Metal Digestion	Completed	SW3015A	11/22/23 10:10	CCM	

Inorganics

Method: E300.0, Run Date: 11/22/23 13:06, Analyst: ASB

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Chloride	2.2	5	0.08	mg/L	5	16887-00-6	b
Fluoride (Undistilled)	0.20	1.0	0.13	mg/L	5	16984-48-8	b
Sulfate	7.90	5	0.30	mg/L	5	14808-79-8	

Method: SM2320B, Run Date: 11/22/23 14:46, Analyst: JKB

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Bicarbonate*	390	10	0.504	mg/L	1	71-52-3	
Carbonate*	Not detected	10		mg/L	1	3812-32-6	

Method: SM2340C, Run Date: 11/22/23 13:18, Analyst: JKB

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Hardness	318	10	2.38	mg/L	10		

Method: SM2540C, Run Date: 11/22/23 13:58, Analyst: MDG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Total Dissolved Solids	340	50	6	mg/L	2		

Method: SM2540D, Run Date: 11/22/23 13:58, Analyst: MDG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Total Suspended Solids	Not detected	3	1	mg/L	1		

Metals

Method: E200.8, Run Date: 11/22/23 11:59, Analyst: CCM

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Antimony*	Not detected	0.005	0.00225	mg/L	5	7440-36-0	
Arsenic	Not detected	0.002	0.00145	mg/L	5	7440-38-2	
Barium	0.030	0.005	0.000900	mg/L	5	7440-39-3	
Beryllium	Not detected	0.001	0.000200	mg/L	5	7440-41-7	
Boron	0.43	0.04	0.0159	mg/L	5	7440-42-8	
Cadmium	Not detected	0.0005	0.000350	mg/L	5	7440-43-9	
Chromium	Not detected	0.005	0.000750	mg/L	5	7440-47-3	
Cobalt	Not detected	0.005	0.000450	mg/L	5	7440-48-4	
Copper	Not detected	0.005	0.000800	mg/L	5	7440-50-8	

b-Value detected less than reporting limit, but greater than MDL



Lab Sample ID: S56029.03 (continued)

Sample Tag: MW-16C L311201-03

Method: E200.8, Run Date: 11/22/23 11:59, Analyst: CCM (continued)

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Iron	0.45	0.02	0.0142	mg/L	5	7439-89-6	
Lead	Not detected	0.003	0.000450	mg/L	5	7439-92-1	
Lithium*	0.029	0.005	0.00135	mg/L	5	7439-93-2	
Molybdenum	Not detected	0.005	0.00420	mg/L	5	7439-98-7	
Nickel	Not detected	0.005	0.00115	mg/L	5	7440-02-0	
Selenium	Not detected	0.005	0.00435	mg/L	5	7782-49-2	
Silver	Not detected	0.0005	0.000250	mg/L	5	7440-22-4	
Thallium	Not detected	0.002	0.000350	mg/L	5	7440-28-0	
Vanadium	Not detected	0.005	0.00205	mg/L	5	7440-62-2	
Zinc	Not detected	0.005	0.00325	mg/L	5	7440-66-6	

Method: E200.8, Run Date: 11/22/23 14:06, Analyst: CCM

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Calcium*	76.8	0.50	0.218	mg/L	5	7440-70-2	
Magnesium	31.4	0.50	0.0579	mg/L	5	7439-95-4	
Potassium	5.11	0.50	0.119	mg/L	5	7440-09-7	
Sodium	15.7	0.50	0.109	mg/L	5	7440-23-5	

Method: E245.1, Run Date: 11/27/23 15:16, Analyst: CTV

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Mercury	Not detected	0.0002	0.0000160	mg/L	1	7439-97-6	

Other / Misc.

Method: , Run Date: 12/19/23 14:58, Analyst: GEL

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Radiological Analyses*	Completed				1		O

O-Analysis performed by outside laboratory. See attached report.

**Lab Sample ID: S56029.04**

Sample Tag: MW-16-D L311201-04

Collected Date/Time: 11/21/2023 12:34

Matrix: Groundwater

COC Reference:

Sample Containers

#	Type	Preservative(s)	Refrigerated?	Arrival Temp. (C)	Thermometer #
2	1L Plastic	HNO3	Yes	1.8	IR
2	1L Plastic	None	Yes	1.8	IR
1	250ml Plastic	HNO3	Yes	1.8	IR

Extraction / Prep.

Parameter	Result	Method	Run Date	Analyst	Flags
Mercury Digestion	Completed	E245.1	11/27/23 13:57	CTV	
Metal Digestion	Completed	SW3015A	11/22/23 10:10	CCM	

Inorganics**Method: E300.0, Run Date: 11/22/23 13:19, Analyst: ASB**

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Chloride	7.25	5	0.08	mg/L	5	16887-00-6	
Fluoride (Undistilled)	0.36	1.0	0.13	mg/L	5	16984-48-8	b
Sulfate	4.47	5	0.30	mg/L	5	14808-79-8	b

Method: SM2320B, Run Date: 11/22/23 14:48, Analyst: JKB

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Bicarbonate*	400	10	0.504	mg/L	1	71-52-3	
Carbonate*	Not detected	10		mg/L	1	3812-32-6	

Method: SM2340C, Run Date: 11/22/23 13:20, Analyst: JKB

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Hardness	118	10	2.38	mg/L	10		

Method: SM2540C, Run Date: 11/22/23 13:58, Analyst: MDG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Total Dissolved Solids	372	50	6	mg/L	2		

Method: SM2540D, Run Date: 11/22/23 13:58, Analyst: MDG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Total Suspended Solids	2.0	3	1	mg/L	1		

Metals**Method: E200.8, Run Date: 11/22/23 12:02, Analyst: CCM**

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Antimony*	Not detected	0.005	0.00225	mg/L	5	7440-36-0	
Arsenic	0.003	0.002	0.00145	mg/L	5	7440-38-2	
Barium	0.035	0.005	0.000900	mg/L	5	7440-39-3	
Beryllium	Not detected	0.001	0.000200	mg/L	5	7440-41-7	
Boron	4.85	0.04	0.0159	mg/L	5	7440-42-8	
Cadmium	Not detected	0.0005	0.000350	mg/L	5	7440-43-9	
Chromium	Not detected	0.005	0.000750	mg/L	5	7440-47-3	
Cobalt	Not detected	0.005	0.000450	mg/L	5	7440-48-4	
Copper	Not detected	0.005	0.000800	mg/L	5	7440-50-8	

b-Value detected less than reporting limit, but greater than MDL



Lab Sample ID: S56029.04 (continued)

Sample Tag: MW-16-D L311201-04

Method: E200.8, Run Date: 11/22/23 12:02, Analyst: CCM (continued)

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Iron	0.28	0.02	0.0142	mg/L	5	7439-89-6	
Lead	Not detected	0.003	0.000450	mg/L	5	7439-92-1	
Lithium*	0.031	0.005	0.00135	mg/L	5	7439-93-2	
Molybdenum	0.010	0.005	0.00420	mg/L	5	7439-98-7	
Nickel	Not detected	0.005	0.00115	mg/L	5	7440-02-0	
Selenium	Not detected	0.005	0.00435	mg/L	5	7782-49-2	
Silver	Not detected	0.0005	0.000250	mg/L	5	7440-22-4	
Thallium	Not detected	0.002	0.000350	mg/L	5	7440-28-0	
Vanadium	Not detected	0.005	0.00205	mg/L	5	7440-62-2	
Zinc	0.014	0.005	0.00325	mg/L	5	7440-66-6	

Method: E200.8, Run Date: 11/22/23 14:09, Analyst: CCM

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Calcium*	30.0	0.50	0.218	mg/L	5	7440-70-2	
Magnesium	7.68	0.50	0.0579	mg/L	5	7439-95-4	
Potassium	9.83	0.50	0.119	mg/L	5	7440-09-7	
Sodium	114	0.50	0.109	mg/L	5	7440-23-5	

Method: E245.1, Run Date: 11/27/23 15:20, Analyst: CTV

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Mercury	Not detected	0.0002	0.0000160	mg/L	1	7439-97-6	

Other / Misc.

Method: , Run Date: 12/19/23 14:58, Analyst: GEL

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Radiological Analyses*	Completed				1		O

O-Analysis performed by outside laboratory. See attached report.

**Lab Sample ID: S56029.05**

Sample Tag: MWT-16A L311201-05

Collected Date/Time: 11/21/2023 11:26

Matrix: Groundwater

COC Reference:

Sample Containers

#	Type	Preservative(s)	Refrigerated?	Arrival Temp. (C)	Thermometer #
2	1L Plastic	HNO3	Yes	1.8	IR
2	1L Plastic	None	Yes	1.8	IR
1	250ml Plastic	HNO3	Yes	1.8	IR

Extraction / Prep.

Parameter	Result	Method	Run Date	Analyst	Flags
Mercury Digestion	Completed	E245.1	11/27/23 13:57	CTV	
Metal Digestion	Completed	SW3015A	11/22/23 10:10	CCM	

Inorganics**Method: E300.0, Run Date: 11/22/23 13:32, Analyst: ASB**

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Fluoride (Undistilled)	Not detected	1.0	0.13	mg/L	5	16984-48-8	

Method: E300.0, Run Date: 11/22/23 14:17, Analyst: ASB

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Chloride	455	50	0.80	mg/L	50	16887-00-6	
Sulfate	257	50	3.0	mg/L	50	14808-79-8	

Method: SM2320B, Run Date: 11/22/23 14:50, Analyst: JKB

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Bicarbonate*	510	10	0.504	mg/L	1	71-52-3	
Carbonate*	Not detected	10		mg/L	1	3812-32-6	

Method: SM2340C, Run Date: 11/22/23 13:22, Analyst: JKB

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Hardness	766	20	4.76	mg/L	20		

Method: SM2540C, Run Date: 11/22/23 13:58, Analyst: MDG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Total Dissolved Solids	1,590	50	6	mg/L	2		

Method: SM2540D, Run Date: 11/22/23 13:58, Analyst: MDG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Total Suspended Solids	Not detected	3	1	mg/L	1		

Metals**Method: E200.8, Run Date: 11/22/23 14:14, Analyst: CCM**

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Sodium	294	5.0	1.09	mg/L	50	7440-23-5	

Method: E200.8, Run Date: 11/22/23 12:06, Analyst: CCM

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Antimony*	Not detected	0.005	0.00225	mg/L	5	7440-36-0	
Arsenic	0.003	0.002	0.00145	mg/L	5	7440-38-2	
Barium	0.166	0.005	0.000900	mg/L	5	7440-39-3	



Analytical Laboratory Report

Supplemental Report

Lab Sample ID: S56029.05 (continued)

Sample Tag: MWT-16A L311201-05

Method: E200.8, Run Date: 11/22/23 12:06, Analyst: CCM (continued)

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Beryllium	Not detected	0.001	0.000200	mg/L	5	7440-41-7	
Boron	0.20	0.04	0.0159	mg/L	5	7440-42-8	
Cadmium	Not detected	0.0005	0.000350	mg/L	5	7440-43-9	
Chromium	Not detected	0.005	0.000750	mg/L	5	7440-47-3	
Cobalt	Not detected	0.005	0.000450	mg/L	5	7440-48-4	
Copper	Not detected	0.005	0.000800	mg/L	5	7440-50-8	
Iron	3.04	0.02	0.0142	mg/L	5	7439-89-6	
Lead	Not detected	0.003	0.000450	mg/L	5	7439-92-1	
Lithium*	Not detected	0.005	0.00135	mg/L	5	7439-93-2	
Molybdenum	Not detected	0.005	0.00420	mg/L	5	7439-98-7	
Nickel	Not detected	0.005	0.00115	mg/L	5	7440-02-0	
Selenium	Not detected	0.005	0.00435	mg/L	5	7782-49-2	
Silver	Not detected	0.0005	0.000250	mg/L	5	7440-22-4	
Thallium	Not detected	0.002	0.000350	mg/L	5	7440-28-0	
Vanadium	Not detected	0.005	0.00205	mg/L	5	7440-62-2	
Zinc	Not detected	0.005	0.00325	mg/L	5	7440-66-6	

Method: E200.8, Run Date: 11/22/23 14:10, Analyst: CCM

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Calcium*	211	0.50	0.218	mg/L	5	7440-70-2	
Magnesium	52.1	0.50	0.0579	mg/L	5	7439-95-4	
Potassium	1.49	0.50	0.119	mg/L	5	7440-09-7	

Method: E245.1, Run Date: 11/27/23 15:23, Analyst: CTV

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Mercury	Not detected	0.0002	0.0000160	mg/L	1	7439-97-6	

Other / Misc.

Method: , Run Date: 12/19/23 14:58, Analyst: GEL

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Radiological Analyses*	Completed				1		O

O-Analysis performed by outside laboratory. See attached report.

**Lab Sample ID: S56029.06**

Sample Tag: Field Blank L311201-06
 Collected Date/Time: 11/21/2023 09:25
 Matrix: Water
 COC Reference:

Sample Containers

#	Type	Preservative(s)	Refrigerated?	Arrival Temp. (C)	Thermometer #
2	1L Plastic	HNO3	Yes	1.8	IR
2	1L Plastic	None	Yes	1.8	IR
1	250ml Plastic	HNO3	Yes	1.8	IR

Extraction / Prep.

Parameter	Result	Method	Run Date	Analyst	Flags
Mercury Digestion	Completed	E245.1	11/27/23 13:57	CTV	
Metal Digestion	Completed	SW3015A	11/22/23 10:10	CCM	

Inorganics**Method: E300.0, Run Date: 11/22/23 13:45, Analyst: ASB**

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Chloride	Not detected	5	0.08	mg/L	5	16887-00-6	
Fluoride (Undistilled)	Not detected	1.0	0.13	mg/L	5	16984-48-8	
Sulfate	Not detected	5	0.30	mg/L	5	14808-79-8	

Method: SM2320B, Run Date: 11/22/23 14:52, Analyst: JKB

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Bicarbonate*	Not detected	10	0.504	mg/L	1	71-52-3	
Carbonate*	Not detected	10		mg/L	1	3812-32-6	

Method: SM2340C, Run Date: 11/22/23 13:24, Analyst: JKB

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Hardness	Not detected	10	2.38	mg/L	10		

Method: SM2540C, Run Date: 11/22/23 13:58, Analyst: MDG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Total Dissolved Solids	Not detected	50	6	mg/L	2		

Method: SM2540D, Run Date: 11/22/23 13:58, Analyst: MDG

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Total Suspended Solids	Not detected	3	1	mg/L	1		

Metals**Method: E200.8, Run Date: 11/22/23 11:34, Analyst: CCM**

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Antimony*	Not detected	0.005	0.000900	mg/L	2	7440-36-0	
Arsenic	Not detected	0.002	0.000580	mg/L	2	7440-38-2	
Barium	Not detected	0.005	0.000360	mg/L	2	7440-39-3	
Beryllium	Not detected	0.001	0.0000800	mg/L	2	7440-41-7	
Boron	Not detected	0.04	0.00636	mg/L	2	7440-42-8	
Cadmium	Not detected	0.0005	0.000140	mg/L	2	7440-43-9	
Chromium	Not detected	0.005	0.000300	mg/L	2	7440-47-3	
Cobalt	Not detected	0.005	0.000180	mg/L	2	7440-48-4	
Copper	Not detected	0.005	0.000320	mg/L	2	7440-50-8	
Iron	Not detected	0.02	0.00568	mg/L	2	7439-89-6	



Analytical Laboratory Report

Supplemental Report

Lab Sample ID: S56029.06 (continued)

Sample Tag: Field Blank L311201-06

Method: E200.8, Run Date: 11/22/23 11:34, Analyst: CCM (continued)

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Lead	Not detected	0.003	0.000180	mg/L	2	7439-92-1	
Lithium*	Not detected	0.005	0.000540	mg/L	2	7439-93-2	
Molybdenum	Not detected	0.005	0.00168	mg/L	2	7439-98-7	
Nickel	Not detected	0.005	0.000460	mg/L	2	7440-02-0	
Selenium	Not detected	0.005	0.00174	mg/L	2	7782-49-2	
Silver	Not detected	0.0005	0.000100	mg/L	2	7440-22-4	
Thallium	Not detected	0.002	0.000140	mg/L	2	7440-28-0	
Vanadium	Not detected	0.005	0.000820	mg/L	2	7440-62-2	
Zinc	Not detected	0.005	0.00130	mg/L	2	7440-66-6	

Method: E200.8, Run Date: 11/22/23 13:58, Analyst: CCM

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Calcium*	Not detected	0.50	0.0874	mg/L	2	7440-70-2	
Magnesium	Not detected	0.50	0.0231	mg/L	2	7439-95-4	
Potassium	Not detected	0.50	0.0479	mg/L	2	7440-09-7	
Sodium	Not detected	0.50	0.0436	mg/L	2	7440-23-5	

Method: E245.1, Run Date: 11/27/23 15:26, Analyst: CTV

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Mercury	Not detected	0.0002	0.0000160	mg/L	1	7439-97-6	

Other / Misc.

Method: , Run Date: 12/19/23 14:58, Analyst: GEL

Parameter	Result	RL	MDL	Units	Dilution	CAS#	Flags
Radiological Analyses*	Completed				1		O

O-Analysis performed by outside laboratory. See attached report.

Merit Laboratories Login Checklist

Lab Set ID:S56029

Client:BWL01 (Board of Water & Light)

Project: Erickson AM MI Wells 16A-16D

Submitted: 11/22/2023 08:08 Login User: MMC

Attention: Jennifer Caporale

Address: Board of Water & Light

P.O. Box 13007

Lansing, MI 48901

Phone: 517-702-6372

FAX:

Email: Environmental_Laboratory@LBWL.com

Selection	Description	Note
Sample Receiving		
01.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	Samples are received at 4C +/- 2C Thermometer # IR 1.8
02.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Received on ice/ cooling process begun
03.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	Samples shipped
04.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	Samples left in 24 hr. drop box
05.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	Are there custody seals/tape or is the drop box locked
Chain of Custody		
06.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	COC adequately filled out
07.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	COC signed and relinquished to the lab
08.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Sample tag on bottles match COC
09.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Subcontracting needed? Subcontracted to: GEL
Preservation		
10.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Do sample have correct chemical preservation
11.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Completed pH checks on preserved samples? (no VOAs)
12.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	Did any samples need to be preserved in the lab?
Bottle Conditions		
13.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	All bottles intact
14.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Appropriate analytical bottles are used
15.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Merit bottles used
16.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Sufficient sample volume received
17.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	Samples require laboratory filtration
18.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Samples submitted within holding time
19.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	Do water VOC or TOX bottles contain headspace

Corrective action for all exceptions is to call the client and to notify the project manager.

Client Review By: _____ Date: _____

Merit Laboratories Bottle Preservation Check

Lab Set ID: S56029 Submitted: 11/22/2023 08:08

Client: BWL01 (Board of Water & Light)

Project: Erickson AM MI Wells 16A-16D

Attention: Jennifer Caporale
Address: Board of Water & Light
P.O. Box 13007
Lansing, MI 48901

Initial Preservation Check: 11/22/2023 08:52 MMC

Preservation Recheck (E200.8): N/A

Phone: 517-702-6372 FAX:
Email: Environmental_Laboratory@LBWL.com

Sample ID	Bottle / Preservation	pH (Orig)	Add ml	pH (New)	Notes
S56029.01	1L Plastic HNO3	<2			
S56029.01	1L Plastic HNO3	<2			
S56029.01	250ml Plastic HNO3	<2			
S56029.02	1L Plastic HNO3	<2			
S56029.02	1L Plastic HNO3	<2			
S56029.02	250ml Plastic HNO3	<2			
S56029.03	1L Plastic HNO3	<2			
S56029.03	1L Plastic HNO3	<2			
S56029.03	250ml Plastic HNO3	<2			
S56029.04	1L Plastic HNO3	<2			
S56029.04	1L Plastic HNO3	<2			
S56029.04	250ml Plastic HNO3	<2			
S56029.05	1L Plastic HNO3	<2			
S56029.05	1L Plastic HNO3	<2			
S56029.05	250ml Plastic HNO3	<2			
S56029.06	1L Plastic HNO3	<2			
S56029.06	1L Plastic HNO3	<2			
S56029.06	250ml Plastic HNO3	<2			



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C.O.C. PAGE # 1 OF 1

REPORT TO

CHAIN OF CUSTODY RECORD

INVOICE TO

CONTACT NAME **Jennifer Caporale**
 COMPANY **Lansing Board of Water and Light**
 ADDRESS **PO Box 13007 48901-3007**
 CITY **Lansing** STATE **Mi** ZIP CODE **48901**
 PHONE NO. **517-702-6372** FAX NO. P.O. NO.
 E-MAIL ADDRESS **Environmental_Laboratory@lbwl.com** QUOTE NO.

CONTACT NAME **Beth Zimpfer** SAME
 COMPANY
 ADDRESS
 CITY STATE ZIP CODE
 PHONE NO. E-MAIL ADDRESS **Beth.Zimpfer@lbwl.com**

PROJECT NO./NAME **Erickson AM MI Wells 16A-16D** SAMPLER(S) - PLEASE PRINT/SIGN NAME **Marc Wahrer**
 TURNAROUND TIME REQUIRED 1 DAY 2 DAYS 3 DAYS STANDARD OTHER **ASAP**
 DELIVERABLES REQUIRED STD LEVEL II LEVEL III LEVEL IV EDD OTHER

MATRIX CODE: GW=GROUNDWATER WW=WASTEWATER S=SOIL L=LIQUID SD=SOLID
 SL=SLUDGE DW=DRINKING WATER O=OIL WP=WIFE A=AIR W=WASTE
 # Containers & Preservatives

MERIT LAB NO. <small>FOR LAB USE ONLY</small>	YEAR		SAMPLE TAG IDENTIFICATION-DESCRIPTION	MATRIX	# OF BOTTLES	NONE	HCl	HNO ₃	H ₂ SO ₄	NaOH	MeOH	OTHER	Total Metals	F- undissilted, Cl-, SO ₄ , TDS	Radium 226	Radium 228	TSS	HCO ₃ , CO ₃ , Hardness	Certifications		Project Locations		Special Instructions
	DATE	TIME																	<input type="checkbox"/> OHIO VAP	<input type="checkbox"/> Drinking Water	<input type="checkbox"/> DoD	<input checked="" type="checkbox"/> NPDES	
56029.01	11.21.23	1126	MW-16A L311201-01	GW	5	2	3						✓	✓	✓	✓	✓	✓					Metals to analyse: Na, Mg, K
.02		1341	MW-16B -02	GW	5	2	3						✓	✓	✓	✓	✓	✓					B, Ca, Sb, As, Ba, Be, Cd, Cr,
.03		1456	MW-16C -03	GW	5	2	3						✓	✓	✓	✓	✓	✓					Co, Li, Hg, Mo, Pb, Se, Tl,
.04		1234	MW16-D -04	GW	5	2	3						✓	✓	✓	✓	✓	✓					Fe, Cu, Ni, Ag, V, Zn
.05		1126	MWT- 16A -05	GW	5	2	3						✓	✓	✓	✓	✓	✓					Please send a preliminary report
.06		0925	Field Blank -06	DI	5	2	3						✓	✓	✓	✓	✓	✓					

RELINQUISHED BY: **Sampler** DATE **11-22-23** TIME **0808**
 RECEIVED BY: **M. Ailcock** DATE **11/22/23** TIME **0808**
 SIGNATURE/ORGANIZATION
 RELINQUISHED BY: DATE TIME
 RECEIVED BY: DATE TIME

RELINQUISHED BY: SIGNATURE/ORGANIZATION DATE TIME
 RECEIVED BY: SIGNATURE/ORGANIZATION DATE TIME
 SEAL NO. SEAL INTACT INITIALS
 YES NO
 SEAL NO. SEAL INTACT INITIALS
 YES NO
 NOTES: TEMP. ON ARRIVAL **1.8**

PLEASE NOTE: SIGNING ACKNOWLEDGES ADHERENCE TO MERIT'S SAMPLE ACCEPTANCE POLICY ON REVERSE SIDE

Reporting Limits to go to Merit with COC

Sb, total	Antimony	250 mL plastic	mg/L	Nitric Acid	200.7	6 mos	0.005
As, total	Arsenic	250 mL plastic	mg/L	Nitric Acid	200.8	6 mos	0.002
Ba, total		250 mL plastic	mg/L	Nitric Acid	200.8	6 mos	0.150
Be, total	Beryllium	250 mL plastic	mg/L	Nitric Acid	200.8	6 mos	0.001
B, total	Boron	250 mL plastic	mg/L	Nitric Acid	200.8	6 mos	0.04
Cd, total	Cadmium	250 mL plastic	mg/L	Nitric Acid	200.8	6 mos	0.0005
Ca	Calcium	250 mL plastic	mg/L	Nitric Acid	200.8	6 mos	2.5
Cl	Chloride	250 mL plastic	mg/L	Chill	300.0	28 d	10
Cr, total	Chromium	250 mL plastic	mg/L	Nitric Acid	200.8	6 mos	0.005
Co, total	Cobalt	250 mL plastic	mg/L	Nitric Acid	200.8	6 mos	0.005
Cu, total	Copper	250 mL plastic	mg/L	Nitric Acid	200.8	6 mos	0.005
F	Fluoride	250 mL plastic	mg/L	None	9056	28 d	1.0
Fe, total	Iron	250 mL plastic	mg/L	Nitric Acid	300.0	6 mos	0.02
Pb, total	Lead	250 mL plastic	mg/L	Nitric Acid	200.8	6 mos	0.003
Li, total	Lithium	250 mL plastic	mg/L	Nitric Acid	200.8	6 mos	0.005
Hg, total	Mercury	250 mL plastic	mg/L	HNO3	245.1	28 d	0.0002
Mo, total	Molybdenum	250 mL plastic	mg/L	Nitric Acid	200.8	6 mos	0.005
Ni, total	Nickel	250 mL plastic	mg/L	Nitric Acid	200.8	6 mos	0.005
RA226/228	Radium 226 and 228 combined	(2) 1 L plastic	pCi/L	HNO3	SM 7500	6 mos	2.0 combined
Se, total	Selenium	250 mL plastic	mg/L	Nitric Acid	200.8	6 mos	0.005
Ag, total	Silver	250 mL plastic	mg/L	Nitric Acid	200.8	6 mos	0.0005
SO4	Sulfate	250 mL plastic	mg/L	Chill	300.0	28 d	10
Tl, total	Thallium	250 mL plastic	mg/L	Nitric Acid	200.8	6 mos	0.002
TDS	Total Dissolved Solids	1 L plastic	mg/L	None	SM 2540C	NA	20
TSS	Total Suspended Solids	1 L plastic	mg/L	None	SM 2540D	NA	3
V, total	Vanadium	250 mL plastic	mg/L	Nitric Acid	200.8	6 mos	0.005
Zn, total	Zinc	250 mL plastic	mg/L	Nitric Acid	200.8	6 mos	0.005

December 19, 2023

John Laverty
Merit Laboratories Inc.
2680 East Lansing Drive
East Lansing, Michigan 48823

Re: Routine Analysis
Work Order: 646851
SDG: S56029

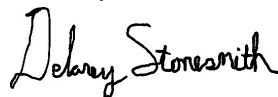
Dear John Laverty:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on November 29, 2023. This original data report has been prepared and reviewed in accordance with GEL's standard operating procedures.

Test results for NELAP or ISO 17025 accredited tests are verified to meet the requirements of those standards, with any exceptions noted. The results reported relate only to the items tested and to the sample as received by the laboratory. These results may not be reproduced except as full reports without approval by the laboratory. Copies of GEL's accreditations and certifications can be found on our website at www.gel.com.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 1614.

Sincerely,



Delaney Stonesmith
Project Manager

Purchase Order: GELP20-0018
Enclosures



Table of Contents

Case Narrative.....	1
Chain of Custody and Supporting Documentation.	4
Laboratory Certifications.....	7
Radiological Analysis.....	9
Case Narrative.....	10
Sample Data Summary.....	14
Quality Control Data.....	21
Gas Flow Raw Data.....	24
Continuing Calibration Data.....	33
Runlogs.....	35
Lucas Cell Raw Data.....	37
Continuing Calibration Data.....	43
Runlogs.....	45

Case Narrative

**Receipt Narrative
for
Merit Laboratories, Inc.
SDG: S56029
Work Order: 646851**

December 19, 2023

Laboratory Identification:

GEL Laboratories LLC
2040 Savage Road
Charleston, South Carolina 29407
(843) 556-8171

Summary:

Sample receipt: The samples arrived at GEL Laboratories LLC, Charleston, South Carolina on November 29, 2023 for analysis. The samples were delivered with proper chain of custody documentation and signatures. All sample containers arrived without any visible signs of tampering or breakage. There are no additional comments concerning sample receipt.

Sample Identification: The laboratory received the following samples:

<u>Laboratory ID</u>	<u>Client ID</u>
646851001	S56029.01
646851002	S56029.02
646851003	S56029.03
646851004	S56029.04
646851005	S56029.05
646851006	S56029.06 Field Blank

Case Narrative:

Sample analyses were conducted using methodology as outlined in GEL's Standard Operating Procedures. Any technical or administrative problems during analysis, data review, and reduction are contained in the analytical case narratives in the enclosed data package.

The enclosed data package contains the following sections: Case Narrative, Chain of Custody, Cooler Receipt Checklist, Data Package Qualifier Definitions and data from the following fractions: Radiochemistry.

A handwritten signature in black ink that reads "Delaney Stonesmith". The signature is written in a cursive style with a large initial 'D'.

Delaney Stonesmith
Project Manager

Chain of Custody and Supporting Documentation

SAMPLE RECEIPT & REVIEW FORM

Client: MEKI		SDG/AR/COC/Work Order: 64685		DS	
Received By: Thyasia Tatum		Date Received: 11-29-23			
Carrier and Tracking Number		Circle Applicable: FedEx Express FedEx Ground UPS Field Services Courier Other 1246604770301859866			
Suspected Hazard Information		Yes	No	*If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.	
A) Shipped as a DOT Hazardous?			<input checked="" type="checkbox"/>	Hazard Class Shipped: _____ UN#: _____ If UN2910, Is the Radioactive Shipment Survey Compliant? Yes ___ No ___	
B) Did the client designate the samples are to be received as radioactive?			<input checked="" type="checkbox"/>	COC notation on radioactive stickers on containers equal client designation	
C) Did the RSO classify the samples as radioactive?			<input checked="" type="checkbox"/>	Maximum Net Counts Observed* (Observed Counts - Area Background Counts): <u>0</u> CPM / mR/hr Classified as: Rad 1 Rad 2 Rad 3	
D) Did the client designate samples are hazardous?			<input checked="" type="checkbox"/>	COC notation on hazardous labels on containers equal client designation	
E) Did the RSO identify possible hazards?			<input checked="" type="checkbox"/>	If D or E is yes, select Hazards below. PCB's Flammable Foreign Soil RCRA Asbestos Beryllium Other: _____	
Sample Receipt Criteria		Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2	Chain of custody documents included with shipment?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Circle Applicable: Client contacted and provided COC COC created upon receipt
3	Samples requiring cold preservation within (0 ≤ deg. C)?*	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Preservation Method: Wet Ice Ice Packs Dry ice None Other: _____ *all temperatures are recorded in Celsius TEMP: 10°C
4	Daily check performed and passed on IR temperature gun?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Temperature Device Serial #: IR2-23 Secondary Temperature Device Serial # (If Applicable): _____
5	Sample containers intact and sealed?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
6	Samples requiring chemical preservation at proper pH?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Sample ID's and Containers Affected: If Preservation added, Lot#: _____
7	Do any samples require Volatile Analysis?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	If Yes, are Encores or Soil Kits present for solids? Yes ___ No ___ NA ___ (If yes, take to VOA Freezer)
					Do liquid VOA vials contain acid preservation? Yes ___ No ___ NA ___ (If unknown, select No)
					Are liquid VOA vials free of headspace? Yes ___ No ___ NA ___
8	Samples received within holding time?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ID's and tests affected:
9	Sample ID's on COC match ID's on bottles?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ID's and containers affected:
10	Date & time on COC match date & time on bottles?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Circle Applicable: No dates on containers No times on containers COC missing info Other (describe)
11	Number of containers received match number indicated on COC?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Circle Applicable: No container count on COC Other (describe)
12	Are sample containers identifiable as GEL provided by use of GEL labels?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
13	COC form is properly signed in relinquished/received sections?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Circle Applicable: Not relinquished Other (describe)
Comments (Use Continuation Form if needed):					

PM (or PMA) review: Initials **OO** Date **11/30/23** Page **1** of **1**
11/30/23

Laboratory Certifications

List of current GEL Certifications as of 19 December 2023

State	Certification
Alabama	42200
Alaska	17-018
Alaska Drinking Water	SC00012
Arkansas	88-00651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330-15-00283, P330-15-00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	KY90129
Kentucky Wastewater	KY90129
Louisiana Drinking Water	LA024
Louisiana NELAP	03046 (AI33904)
Maine	2023019
Maryland	270
Massachusetts	M-SC012
Massachusetts PFAS Approv	Letter
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122024-05
New Hampshire NELAP	2054
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	2023-152
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
Sanitation Districts of L	9255651
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-23-21
Utah NELAP	SC000122023-38
Vermont	VT87156
Virginia NELAP	460202
Washington	C780

Radiological Analysis

Case Narrative

**Radiochemistry
Technical Case Narrative
Merit Laboratories, Inc.
SDG #: S56029
Work Order #: 646851**

Product: GFPC Ra228, Liquid

Analytical Method: EPA 904.0/SW846 9320 Modified

Analytical Procedure: GL-RAD-A-063 REV# 5

Analytical Batch: 2533748

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
646851001	S56029.01
646851002	S56029.02
646851003	S56029.03
646851004	S56029.04
646851005	S56029.05
646851006	S56029.06 Field Blank
1205589429	Method Blank (MB)
1205589430	646851001(S56029.01) Sample Duplicate (DUP)
1205589431	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

Product: Lucas Cell, Ra226, Liquid

Analytical Method: EPA 903.1 Modified

Analytical Procedure: GL-RAD-A-008 REV# 15

Analytical Batch: 2532924

The following samples were analyzed using the above methods and analytical procedure(s).

<u>GEL Sample ID#</u>	<u>Client Sample Identification</u>
646851001	S56029.01
646851002	S56029.02
646851003	S56029.03
646851004	S56029.04
646851005	S56029.05
646851006	S56029.06 Field Blank
1205588134	Method Blank (MB)
1205588135	646878001(NonSDG) Sample Duplicate (DUP)
1205588136	646878001(NonSDG) Matrix Spike (MS)
1205588137	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Miscellaneous Information**Additional Comments**

The matrix spike, 1205588136 (Non SDG 646878001MS), aliquot was reduced to conserve sample volume.

Certification Statement

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Qualifier Definition Report for

MERI001 Merit Laboratories, Inc.

Client SDG: S56029 GEL Work Order: 646851

The Qualifiers in this report are defined as follows:

- * A quality control analyte recovery is outside of specified acceptance criteria
- ** Analyte is a Tracer compound
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Review/Validation

GEL requires all analytical data to be verified by a qualified data reviewer. In addition, all CLP-like deliverables receive a third level review of the fractional data package.

The following data validator verified the information presented in this data report:

Signature:



Name: Theresa Austin

Date: 27 DEC 2023

Title: Analyst III - Data Validator

Sample Data Summary

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: December 27, 2023

Company : Merit Laboratories Inc.
Address : 2680 East Lansing Drive

East Lansing, Michigan 48823

Contact: John Lavery
Project: Routine Analysis

Client Sample ID: S56029.01 Project: MERI00120
Sample ID: 646851001 Client ID: MERI001
Matrix: Ground Water
Collect Date: 21-NOV-23 11:26
Receive Date: 29-NOV-23
Collector: Client

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gas Flow Proportional Counting													
GFPC Ra228, Liquid "As Received"													
Radium-228	U	0.548	+/-0.887	1.55	3.00	pCi/L		JE1	12/13/23	0837	2533748		1
Radium-226+Radium-228 Calculation "See Parent Products"													
Radium-226+228 Sum		2.80	+/-1.13			pCi/L		NXL1	12/19/23	1458	2533998		2
Rad Radium-226													
Lucas Cell, Ra226, Liquid "As Received"													
Radium-226		2.26	+/-0.698	0.411	1.00	pCi/L		LXP1	12/10/23	0845	2532924		3

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 904.0/SW846 9320 Modified	
2	Calculation	
3	EPA 903.1 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC Ra228, Liquid "As Received"			90.5	(15%-125%)

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor Lc/LC: Critical Level
DL: Detection Limit PF: Prep Factor
MDA: Minimum Detectable Activity RL: Reporting Limit
MDC: Minimum Detectable Concentration SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: December 27, 2023

Company : Merit Laboratories Inc.
Address : 2680 East Lansing Drive

East Lansing, Michigan 48823

Contact: John Lavery
Project: Routine Analysis

Client Sample ID: S56029.02 Project: MERI00120
Sample ID: 646851002 Client ID: MERI001
Matrix: Ground Water
Collect Date: 21-NOV-23 13:41
Receive Date: 29-NOV-23
Collector: Client

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gas Flow Proportional Counting													
GFPC Ra228, Liquid "As Received"													
Radium-228	U	0.831	+/-0.946	1.59	3.00	pCi/L		JE1	12/13/23	0837	2533748		1
Radium-226+Radium-228 Calculation "See Parent Products"													
Radium-226+228 Sum		1.63	+/-1.02			pCi/L		NXL1	12/19/23	1458	2533998		2
Rad Radium-226													
Lucas Cell, Ra226, Liquid "As Received"													
Radium-226		0.804	+/-0.380	0.324	1.00	pCi/L		LXP1	12/10/23	0918	2532924		3

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 904.0/SW846 9320 Modified	
2	Calculation	
3	EPA 903.1 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC Ra228, Liquid "As Received"			93.3	(15%-125%)

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor Lc/LC: Critical Level
DL: Detection Limit PF: Prep Factor
MDA: Minimum Detectable Activity RL: Reporting Limit
MDC: Minimum Detectable Concentration SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

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Certificate of Analysis

Report Date: December 27, 2023

Company : Merit Laboratories Inc.
Address : 2680 East Lansing Drive

East Lansing, Michigan 48823

Contact: John Laverty
Project: Routine Analysis

Client Sample ID: S56029.03 Project: MERI00120
Sample ID: 646851003 Client ID: MERI001
Matrix: Ground Water
Collect Date: 21-NOV-23 14:56
Receive Date: 29-NOV-23
Collector: Client

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gas Flow Proportional Counting													
GFPC Ra228, Liquid "As Received"													
Radium-228	U	0.480	+/-0.908	1.60	3.00	pCi/L		JE1	12/13/23	0837	2533748		1
Radium-226+Radium-228 Calculation "See Parent Products"													
Radium-226+228 Sum		1.30	+/-1.05			pCi/L		NXL1	12/19/23	1458	2533998		2
Rad Radium-226													
Lucas Cell, Ra226, Liquid "As Received"													
Radium-226		0.821	+/-0.527	0.739	1.00	pCi/L		LXP1	12/10/23	0918	2532924		3

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 904.0/SW846 9320 Modified	
2	Calculation	
3	EPA 903.1 Modified	

Surrogate/Tracer	Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Barium-133 Tracer		GFPC Ra228, Liquid "As Received"			87.8	(15%-125%)

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor Lc/LC: Critical Level
DL: Detection Limit PF: Prep Factor
MDA: Minimum Detectable Activity RL: Reporting Limit
MDC: Minimum Detectable Concentration SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: December 27, 2023

Company : Merit Laboratories Inc.
Address : 2680 East Lansing Drive

East Lansing, Michigan 48823

Contact: John Laverty
Project: Routine Analysis

Client Sample ID: S56029.04 Project: MERI00120
Sample ID: 646851004 Client ID: MERI001
Matrix: Ground Water
Collect Date: 21-NOV-23 12:34
Receive Date: 29-NOV-23
Collector: Client

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time Batch	Method
Rad Gas Flow Proportional Counting												
GFPC Ra228, Liquid "As Received"												
Radium-228	U	1.34	+/-0.989	1.55	3.00	pCi/L		JE1	12/13/23	0837	2533748	1
Radium-226+Radium-228 Calculation "See Parent Products"												
Radium-226+228 Sum		1.84	+/-1.05			pCi/L		NXL1	12/19/23	1458	2533998	2
Rad Radium-226												
Lucas Cell, Ra226, Liquid "As Received"												
Radium-226		0.500	+/-0.366	0.479	1.00	pCi/L		LXP1	12/10/23	0918	2532924	3

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 904.0/SW846 9320 Modified	
2	Calculation	
3	EPA 903.1 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC Ra228, Liquid "As Received"			87.8	(15%-125%)

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor Lc/LC: Critical Level
DL: Detection Limit PF: Prep Factor
MDA: Minimum Detectable Activity RL: Reporting Limit
MDC: Minimum Detectable Concentration SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: December 27, 2023

Company : Merit Laboratories Inc.
 Address : 2680 East Lansing Drive

 East Lansing, Michigan 48823
 Contact: John Laverty
 Project: Routine Analysis

Client Sample ID: S56029.05	Project: MERI00120
Sample ID: 646851005	Client ID: MERI001
Matrix: Ground Water	
Collect Date: 21-NOV-23 11:26	
Receive Date: 29-NOV-23	
Collector: Client	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time	Batch	Method
Rad Gas Flow Proportional Counting													
GFPC Ra228, Liquid "As Received"													
Radium-228	U	1.23	+/-1.12	1.83	3.00	pCi/L		JE1	12/13/23	0837	2533748		1
Radium-226+Radium-228 Calculation "See Parent Products"													
Radium-226+228 Sum		3.01	+/-1.27			pCi/L		NXL1	12/19/23	1458	2533998		2
Rad Radium-226													
Lucas Cell, Ra226, Liquid "As Received"													
Radium-226		1.78	+/-0.606	0.389	1.00	pCi/L		LXP1	12/10/23	0918	2532924		3

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 904.0/SW846 9320 Modified	
2	Calculation	
3	EPA 903.1 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC Ra228, Liquid "As Received"			88.9	(15%-125%)

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Lc/LC: Critical Level
DL: Detection Limit	PF: Prep Factor
MDA: Minimum Detectable Activity	RL: Reporting Limit
MDC: Minimum Detectable Concentration	SQL: Sample Quantitation Limit

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Report Date: December 27, 2023

Company : Merit Laboratories Inc.
 Address : 2680 East Lansing Drive

 East Lansing, Michigan 48823
 Contact: John Laverty
 Project: Routine Analysis

Client Sample ID: S56029.06 Field Blank	Project: MERI00120
Sample ID: 646851006	Client ID: MERI001
Matrix: Ground Water	
Collect Date: 21-NOV-23 09:25	
Receive Date: 29-NOV-23	
Collector: Client	

Parameter	Qualifier	Result	Uncertainty	MDC	RL	Units	PF	DF	Analyst	Date	Time Batch	Method
Rad Gas Flow Proportional Counting												
GFPC Ra228, Liquid "As Received"												
Radium-228	U	0.915	+/-0.771	1.23	3.00	pCi/L		JE1	12/13/23	0837	2533748	1
Radium-226+Radium-228 Calculation "See Parent Products"												
Radium-226+228 Sum		1.05	+/-0.860			pCi/L		NXL1	12/19/23	1458	2533998	2
Rad Radium-226												
Lucas Cell, Ra226, Liquid "As Received"												
Radium-226	U	0.134	+/-0.382	0.722	1.00	pCi/L		LXP1	12/10/23	0918	2532924	3

The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 904.0/SW846 9320 Modified	
2	Calculation	
3	EPA 903.1 Modified	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
Barium-133 Tracer	GFPC Ra228, Liquid "As Received"			92.1	(15%-125%)

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor	Lc/LC: Critical Level
DL: Detection Limit	PF: Prep Factor
MDA: Minimum Detectable Activity	RL: Reporting Limit
MDC: Minimum Detectable Concentration	SQL: Sample Quantitation Limit

Quality Control Data

GEL LABORATORIES LLC

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

QC Summary

Report Date: December 27, 2023

Page 1 of 2

Merit Laboratories Inc.
2680 East Lansing Drive
East Lansing, Michigan

Contact: John Laverty

Workorder: 646851

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Rad Gas Flow											
Batch	2533748										
QC1205589430	646851001	DUP									
Radium-228	U	0.548	U	0.655	pCi/L	N/A		N/A	JE1	12/13/23	08:38
	Uncertainty	+/-0.887		+/-0.711							
QC1205589431	LCS										
Radium-228	74.6			72.0	pCi/L		96.5	(75%-125%)		12/13/23	08:38
	Uncertainty			+/-4.10							
QC1205589429	MB										
Radium-228			U	-0.200	pCi/L					12/13/23	08:38
	Uncertainty			+/-0.516							
Rad Ra-226											
Batch	2532924										
QC1205588135	646878001	DUP									
Radium-226				0.727	pCi/L	29.5		(0% - 100%)	LXP1	12/10/23	09:50
	Uncertainty			+/-0.366							
QC1205588137	LCS										
Radium-226	26.9			32.7	pCi/L		122	(75%-125%)		12/10/23	09:50
	Uncertainty			+/-2.40							
QC1205588134	MB										
Radium-226			U	0.330	pCi/L					12/10/23	09:50
	Uncertainty			+/-0.432							
QC1205588136	646878001	MS									
Radium-226	132			0.727	pCi/L		79.7	(75%-125%)		12/10/23	09:50
	Uncertainty			+/-0.366							

Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

The Qualifiers in this report are defined as follows:

- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
- J Value is estimated
- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- H Analytical holding time was exceeded
- < Result is less than value reported
- > Result is greater than value reported

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QC Summary

Workorder: 646851

Page 2 of 2

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
UI											
BD											
h											
R											
^											
N/A											
ND											
M											
NJ											
FA											
UJ											
Q											
K											
UL											
L											
NI											
Y											
**											
M											
J											

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.

^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

Gas Flow Raw Data

Batch 2533748 Check-list

This check-list was completed on 13-DEC-23 by Rhonda Birch

This batch was reviewed by Kenshalla Oston on 13-DEC-23 and Rhonda Birch on 13-DEC-23.

Batch ID:
2533748

Product:
GFC28RAL

Description: Gas Flow Radium 228
GL-RAD-A-063

#	Criteria	Yes	No	Comments
Preparation Information				
1	Were all of the samples homogenous? Include sample description if not homogenous	Yes		
2	Was the preservation correct for this analysis?	Yes		
Internal Checklist Information				
3	Are instrument source checks within limits?	Yes		
4	Has an Aliquot Correction been completed for this batch?		No	
5	Have sample historical results been reviewed for this batch?	Yes		
Technical Information				
6	Were all the samples prepared/analyzed within the required holding time period?	Yes		
7	Are any sample results more negative than 3xTPU?		No	
Quality Control (QC) Information				
8	Was the method blank (MB) within the acceptance criteria?	Yes		
9	Were all tracer/carrier recoveries within the required acceptance limits?			
10	Were the laboratory control sample (LCS/LCSD) recoveries within the acceptance limits?	Yes		
11	Were the relative percent differences and/or error (RPD/RER) between the sample and its duplicate within acceptable limits?	Yes		
12	Has the method required detection limit been met?	Yes		
Miscellaneous Information				
13	Are sample-specific MDA/MDC calculated and reported?	Yes		

Prep Logbook

Radium-228 in Liquid

Batch ID: 2533748
Analyst: Jacqueline Winston (JE1)
Method: EPA 904.0/SW846 9320 Modified
Lab SOP: GL-RAD-A-063 REV# 5
Instrument: SP-C018367602

Due Dates for Lab: 25-DEC-2023			Package: 27-DEC-2023		SDG: 28-DEC-2023	
Type	Sample Id	Description	Serial Number	Spike Amount	Spike Units	
LCS	1205589431	Radium 228	2051-D	.1	mL	

#	Sample ID	Prep Date	Min RDL (pCi/L)	Unadjusted Aliquot (g)	Aliquot (mL)	Ac-228 Ingrow (date)	Ac-228 Separation (date)
1	646851001	04-DEC-2023	3	302.3	302.3	12/05/23 13:01	12/13/23 06:48
2	646851002	04-DEC-2023	3	309.4	309.4	12/05/23 13:01	12/13/23 06:48
3	646851003	04-DEC-2023	3	300.9	300.9	12/05/23 13:01	12/13/23 06:48
4	646851004	04-DEC-2023	3	300.8	300.8	12/05/23 13:01	12/13/23 06:48
5	646851005	04-DEC-2023	3	307.6	307.6	12/05/23 13:01	12/13/23 06:48
6	646851006	04-DEC-2023	3	301.3	301.3	12/05/23 13:01	12/13/23 06:48
7	646993001	04-DEC-2023	3	301	301	12/05/23 13:01	12/13/23 06:48
8	646993002	04-DEC-2023	3	312.3	312.3	12/05/23 13:01	12/13/23 06:48
9	646993003	04-DEC-2023	3	301.2	301.2	12/05/23 13:01	12/13/23 06:48
10	646993004	04-DEC-2023	3	306.5	306.5	12/05/23 13:01	12/13/23 06:48
11	646993005	04-DEC-2023	3	304.8	304.8	12/05/23 13:01	12/13/23 06:48
12	646993006	04-DEC-2023	3	302.3	302.3	12/05/23 13:01	12/13/23 06:48
13	1205589429 MB	04-DEC-2023	3		312.3	12/05/23 13:01	12/13/23 06:48
14	1205589430 DUP (646851001)	04-DEC-2023	3	302.9	302.9	12/05/23 13:01	12/13/23 06:48
15	1205589431 LCS	04-DEC-2023	3		312.3	12/05/23 13:01	12/13/23 06:48

Reagent/Solvent Lot ID	Description	Amount	Comments:
WORK 2097-B	Ba-133 Tracer	.1 mL	Pipet Id: RAD-GFC-1795419 Data Entry Date2: 04-DEC-2023 00:00
REGNT 4067319	RGF-1.5M Ammonium Sulfate	10 mL	
REGNT 3956035	Barium Carrier Ra228 REG	1 mL	
REGNT 4067327	RGF-1M Citric Acid	5 mL	
REGNT 4063205	2M HCl	20 mL	
REGNT 4059822	RGF-50% Potassium Carbonate	2 mL	
REGNT 4067876	RGF-7M Nitric Acid	25 mL	
REGNT 3973438.3	Acetic Acid Glacial ACS Poly Coated Bottle	10 mL	
REGNT 4048362.6	RGF-Hydrofluoric Acid	4 mL	
REGNT 3963747	500 mg/mL Neodymium Carrier	.2 mL	
REGNT 4061618	RGF-Neodymium Substrate	5 mL	
REGNT 4059505.9	Nitric Acid	5 mL	
REGNT DGA110623	2517569	2 g	

Radium-228 Liquid

Filename : RA228.XLS
 File type : Excel
 Version # : 1.4.3

Tracer S/N : 2097-B
 Tracer Exp Date : 7/12/2024
 Tracer Volume Added: 0.10

Batch : 2533748
 Analyst : JAC02417
 Prep Date : 12/4/2023
 Ra-228 Method Uncertainty : 0.1268

Procedure Code : GFC28RAL
 Parmname : Radium-228
 Required MDA : 3 pCi/L
 Ra-228 Abundance : 1.00
 Halflife of Ra-228 : 5.75 years
 Halflife of Ac-228 : 6.15 hours

Geometry: 25mm Filter

Sample Characteristics					Tracer Calculations		Tracer Samp.		Tracer	
Pos.	Sample ID	Sample Aliquot L	Sample Aliquot StDev. L	Sample Date/Time	Tracer Ref. Activity (CPM)	Tracer Ref. Count Uncertainty (%)	Tracer Samp. Activity (CPM)	Tracer Samp. Count Uncertainty (%)	Tracer Aliquot (mL)	Tracer Aliquot StDev. (mL)
1	646851001.1	0.3023	1.8498E-05	11/21/2023 11:26	757.6	2.10%	685.6	2.21%	0.1	0.000200
2	646851002.1	0.3094	1.8614E-05	11/21/2023 13:41	757.6	2.10%	706.9	2.17%	0.1	0.000200
3	646851003.1	0.3009	1.8474E-05	11/21/2023 14:56	757.6	2.10%	665.5	2.24%	0.1	0.000200
4	646851004.1	0.3008	1.8473E-05	11/21/2023 12:34	757.6	2.10%	664.8	2.24%	0.1	0.000200
5	646851005.1	0.3076	1.8585E-05	11/21/2023 11:26	757.6	2.10%	673.4	2.23%	0.1	0.000200
6	646851006.1	0.3013	1.8481E-05	11/21/2023 9:25	757.6	2.10%	698.1	2.19%	0.1	0.000200
7	646993001.1	0.3010	1.8476E-05	11/27/2023 15:33	757.6	2.10%	566.6	2.43%	0.1	0.000200
8	646993002.1	0.3123	1.8660E-05	11/27/2023 11:54	757.6	2.10%	660.1	2.25%	0.1	0.000200
9	646993003.1	0.3012	1.8479E-05	11/27/2023 13:16	757.6	2.10%	681.6	2.21%	0.1	0.000200
10	646993004.1	0.3065	1.8567E-05	11/27/2023 14:58	757.6	2.10%	617.4	2.32%	0.1	0.000200
11	646993005.1	0.3048	1.8539E-05	11/27/2023 13:16	757.6	2.10%	714.7	2.16%	0.1	0.000200
12	646993006.1	0.3023	1.8498E-05	11/27/2023 10:05	757.6	2.10%	680.6	2.21%	0.1	0.000200
13	1205589429.1	0.3123	1.8660E-05	12/4/2023 0:00	757.6	2.10%	703.9	2.18%	0.1	0.000200
14	1205589430.1	0.3029	1.8508E-05	11/21/2023 11:26	757.6	2.10%	668.2	2.23%	0.1	0.000200
15	1205589431.1	0.3123	1.8660E-05	12/4/2023 0:00	757.6	2.10%	661.5	2.25%	0.1	0.000200

Pipet, 0.1 ml Stdev : +/- 0.000200 ml
 Pipet, 0.5 ml Stdev : +/- 0.001000 ml
 Pipet, 1 ml Stdev : +/- 0.002000 ml

Analytical SOP: GL-RAD-A-063
 Instrument SOP: GL-RAD-I-016

Count raw Data													Calculated	Sample
Pos.	Detector ID	Counting Time (min.)	Gross Counts		Beta cpm	Count Start Date/Time	Ac-228 Ingrowth Date/Time	Ac-228 Decay Date/Time	Ra-228 Decay	Ac-228 Decay	Ac-228 Ingrowth	Ac-228 Count Correction	Recovery %	Sample Recovery Error %
			Alpha	Beta										
1	1A	60	13	41	0.683	12/13/2023 8:37	12/5/2023 13:01	12/13/2023 6:48	0.993	0.814	1.000	1.057	90.5%	3.06%
2	1C	60	12	68	1.133	12/13/2023 8:37	12/5/2023 13:01	12/13/2023 6:48	0.993	0.814	1.000	1.057	93.3%	3.03%
3	1D	60	12	52	0.867	12/13/2023 8:37	12/5/2023 13:01	12/13/2023 6:48	0.993	0.814	1.000	1.057	87.8%	3.08%
4	2A	60	18	63	1.050	12/13/2023 8:37	12/5/2023 13:01	12/13/2023 6:48	0.993	0.814	1.000	1.057	87.8%	3.08%
5	2D	60	15	89	1.483	12/13/2023 8:37	12/5/2023 13:01	12/13/2023 6:48	0.993	0.814	1.000	1.057	88.9%	3.08%
6	3B	60	5	45	0.750	12/13/2023 8:37	12/5/2023 13:01	12/13/2023 6:48	0.993	0.814	1.000	1.057	92.1%	3.05%
7	3C	60	1	27	0.450	12/13/2023 8:37	12/5/2023 13:01	12/13/2023 6:48	0.995	0.814	1.000	1.057	74.8%	3.22%
8	3D	60	9	36	0.600	12/13/2023 8:37	12/5/2023 13:01	12/13/2023 6:48	0.995	0.813	1.000	1.057	87.1%	3.09%
9	4C	60	16	42	0.700	12/13/2023 8:38	12/5/2023 13:01	12/13/2023 6:48	0.995	0.813	1.000	1.057	90.0%	3.06%
10	4D	60	27	53	0.883	12/13/2023 8:38	12/5/2023 13:01	12/13/2023 6:48	0.995	0.813	1.000	1.057	81.5%	3.14%
11	5D	60	10	51	0.850	12/13/2023 8:38	12/5/2023 13:01	12/13/2023 6:48	0.995	0.812	1.000	1.057	94.3%	3.03%
12	6C	60	6	81	1.350	12/13/2023 8:38	12/5/2023 13:01	12/13/2023 6:48	0.995	0.813	1.000	1.057	89.8%	3.06%
13	7B	60	7	22	0.367	12/13/2023 8:38	12/5/2023 13:01	12/13/2023 6:48	0.997	0.813	1.000	1.057	92.9%	3.04%
14	7D	60	7	35	0.583	12/13/2023 8:38	12/5/2023 13:01	12/13/2023 6:48	0.993	0.813	1.000	1.057	88.2%	3.08%
15	8B	60	8	1325	22.083	12/13/2023 8:38	12/5/2023 13:01	12/13/2023 6:48	0.997	0.813	1.000	1.057	87.3%	3.09%

Calibration Data								
Pos.	Counted on	Calibration Date	Calibration Due Date	Detector Efficiency (cpm/dpm)	Detector Efficiency Error (cpm/dpm)	Bkg cpm	Weekly Bkg Count Start Date/Time	Bkg Count Time (min.)
1	PIC	6/1/2023	5/31/2024	0.5320	0.00738	0.548	12/8/2023 16:59	500
2	PIC	6/1/2023	5/31/2024	0.6077	0.00847	0.886	12/8/2023 16:59	500
3	PIC	6/1/2023	5/31/2024	0.6071	0.00692	0.736	12/8/2023 16:59	500
4	PIC	6/1/2023	5/31/2024	0.6083	0.01914	0.686	12/8/2023 16:59	500
5	PIC	6/1/2023	5/31/2024	0.6206	0.00745	1.130	12/8/2023 17:00	500
6	PIC	6/1/2023	5/31/2024	0.6266	0.01614	0.480	12/8/2023 17:00	500
7	PIC	6/1/2023	5/31/2024	0.6245	0.00988	0.436	12/8/2023 17:00	500
8	PIC	6/1/2023	5/31/2024	0.5677	0.02297	0.350	12/8/2023 17:00	500
9	PIC	6/1/2023	5/31/2024	0.6376	0.00889	0.786	12/8/2023 17:00	500
10	PIC	6/1/2023	5/31/2024	0.6412	0.00773	1.132	12/8/2023 17:00	500
11	PIC	6/1/2023	5/31/2024	0.6566	0.00925	0.560	12/8/2023 17:00	500
12	PIC	6/1/2023	5/31/2024	0.6167	0.01970	1.446	12/8/2023 16:58	500
13	PIC	6/1/2023	5/31/2024	0.6423	0.00627	0.430	12/8/2023 16:58	500
14	PIC	6/1/2023	5/31/2024	0.6247	0.01113	0.398	12/8/2023 16:58	500
15	PIC	6/1/2023	5/31/2024	0.6270	0.02148	1.126	12/8/2023 16:59	500

Notes:

- 1 - Results are decay corrected to Sample Date/Time
- 2 - Reference date for Spike Activity (dpm/ml) is the batch Prep Date
- 3 - Spike Nominals are decay corrected to Sample Date/Time

Spike S/N : N/A
Spike Exp Date : N/A
Spike Activity (dpm/ml): N/A
Spike Volume Added: N/A

* - RPD changed to 0% due to sample & dup activity below MDA

LCS S/N : 2051-D
LCS Exp Date : 7/12/2024
LCS Activity (dpm/ml): 517.50
LCS Volume Added: 0.10

Results														2 SIGMA		2 SIGMA	
Pos.	Decision Level pCi/L	Critical Level pCi/L	Required MDA pCi/L	Sample Act. MDA pCi/L	Sample Act. Conc. pCi/L	Sample Act. Error %	Net Count Rate CPM	Net Count Rate Error CPM	Counting Uncertainty pCi/L	Total Prop. Uncertainty pCi/L	Sample QC	Sample Type	RPD	RER	Nominal pCi/L	Recovery	
1	0.9543	0.6737	3	1.5499	0.5480	82.62%	0.1353	0.1117	0.8868	0.8979		SAMPLE					
2	1.0067	0.7107	3	1.5894	0.8309	58.20%	0.2473	0.1437	0.9465	0.9701		SAMPLE					
3	1.0032	0.7083	3	1.6003	0.4800	96.60%	0.1307	0.1262	0.9084	0.9166		SAMPLE					
4	0.9681	0.6835	3	1.5505	1.3365	37.91%	0.3640	0.1374	0.9886	1.0473		SAMPLE					
5	1.1759	0.8302	3	1.8341	1.2278	46.60%	0.3533	0.1643	1.1187	1.1621		SAMPLE					
6	0.7476	0.5278	3	1.2251	0.9152	43.11%	0.2700	0.1160	0.7708	0.8060		SAMPLE					
7	0.8800	0.6213	3	1.4519	0.0586	653.57%	0.0140	0.0915	0.7508	0.7510		SAMPLE					
8	0.7177	0.5067	3	1.2039	0.9527	41.56%	0.2500	0.1034	0.7726	0.8112		SAMPLE					
9	0.9616	0.6789	3	1.5282	-0.2930	133.83%	-0.0860	0.1151	0.7684	0.7685		SAMPLE					
10	1.2450	0.8790	3	1.9418	-0.9141	52.51%	-0.2487	0.1303	0.9390	0.9392		SAMPLE					
11	0.7439	0.5252	3	1.2065	0.9055	42.75%	0.2900	0.1236	0.7567	0.7915		SAMPLE					
12	1.3465	0.9506	3	2.0772	-0.3377	166.03%	-0.0960	0.1593	1.0986	1.0987		SAMPLE					
13	0.6582	0.4647	3	1.0871	-0.1997	131.87%	-0.0633	0.0835	0.5160	0.5162		MB					
14	0.7101	0.5013	3	1.1795	0.6553	55.43%	0.1853	0.1026	0.7108	0.7304	646851001.1	DUP	* 0.0%				
15	1.1612	0.8198	3	1.8115	72.0432	4.75%	20.9573	0.6085	4.1001	19.1217		LCS			74.6429	96.5%	

SampleID	Instr	Time (min.)	Alpha Counts	Beta Counts	Count Start Time	Count End Time	Machine	Batch ID
646851001	1A	60	13	41	12/13/2023 8:37	12/13/2023 9:37	PIC	2533748
646851002	1C	60	12	68	12/13/2023 8:37	12/13/2023 9:37	PIC	2533748
646851003	1D	60	12	52	12/13/2023 8:37	12/13/2023 9:37	PIC	2533748
646851004	2A	60	18	63	12/13/2023 8:37	12/13/2023 9:37	PIC	2533748
646851005	2D	60	15	89	12/13/2023 8:37	12/13/2023 9:37	PIC	2533748
646851006	3B	60	5	45	12/13/2023 8:37	12/13/2023 9:37	PIC	2533748
646993001	3C	60	1	27	12/13/2023 8:37	12/13/2023 9:37	PIC	2533748
646993002	3D	60	9	36	12/13/2023 8:37	12/13/2023 9:37	PIC	2533748
646993003	4C	60	16	42	12/13/2023 8:38	12/13/2023 9:38	PIC	2533748
646993004	4D	60	27	53	12/13/2023 8:38	12/13/2023 9:38	PIC	2533748
646993005	5D	60	10	51	12/13/2023 8:38	12/13/2023 9:38	PIC	2533748
646993006	6C	60	6	81	12/13/2023 8:38	12/13/2023 9:38	PIC	2533748
1205589429	7B	60	7	22	12/13/2023 8:38	12/13/2023 9:38	PIC	2533748
1205589430	7D	60	7	35	12/13/2023 8:38	12/13/2023 9:38	PIC	2533748
1205589431	8B	60	8	1325	12/13/2023 8:38	12/13/2023 9:38	PIC	2533748

ASSAY 13-Dec-23 7:14:41
 Wizard 1480 s/n 4800440
 Protocol id 8 228_REC
 Time limit 180
 Count limit 50000
 Isotope Ba-133
 Protocol date 10-Jan-20 14:21:10
 Run id. 19

Samp_ID	POS	RACK	BATCH	TIME	COUNTS	CPM	ERROR	% RECOVERY	COUNT TIME
REF		1	98	1	180	2272	757.6	2.1	07:14:48
646851001	2	98	2	180	2056	685.6	2.21	90.50	07:18:00
646851002	3	98	3	180	2120	706.9	2.17	93.31	07:21:11
646851003	4	98	4	180	1996	665.5	2.24	87.84	07:24:22
646851004	5	98	5	180	1994	664.8	2.24	87.75	07:27:34
646851005	6	51	6	180	2020	673.4	2.23	88.89	07:30:58
646851006	7	51	7	180	2094	698.1	2.19	92.15	07:34:10
646993001	8	51	8	180	1700	566.6	2.43	74.79	07:37:21
646993002	9	51	9	180	1980	660.1	2.25	87.13	07:40:33
646993003	10	51	10	180	2044	681.6	2.21	89.97	07:43:44
646993004	11	36	11	180	1852	617.4	2.32	81.49	07:47:09
646993005	12	36	12	180	2144	714.7	2.16	94.34	07:50:20
646993006	13	36	13	180	2041	680.6	2.21	89.84	07:53:32
1205589429	14	36	14	180	2111	703.9	2.18	92.91	07:56:43
1205589430	15	36	15	180	2004	668.2	2.23	88.20	07:59:54
1205589431	16	72	16	180	1984	661.5	2.25	87.32	08:03:19

END OF ASSAY

Continuing Calibration Data

Runlogs

Instrument Run Log

Instrument Type: GFPC

Batch ID: 2533748

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
646851001	SAMPLE	JE1	PIC1A	DEC-13-23 08:37:33	DONE	25mm Filter	01-JUN-23 00:00
646851002	SAMPLE	JE1	PIC1C	DEC-13-23 08:37:37	DONE	25mm Filter	01-JUN-23 00:00
646851003	SAMPLE	JE1	PIC1D	DEC-13-23 08:37:39	DONE	25mm Filter	01-JUN-23 00:00
646851004	SAMPLE	JE1	PIC2A	DEC-13-23 08:37:43	DONE	25mm Filter	01-JUN-23 00:00
646851005	SAMPLE	JE1	PIC2D	DEC-13-23 08:37:46	DONE	25mm Filter	01-JUN-23 00:00
646851006	SAMPLE	JE1	PIC3B	DEC-13-23 08:37:49	DONE	25mm Filter	01-JUN-23 00:00
646993001	SAMPLE	JE1	PIC3C	DEC-13-23 08:37:52	DONE	25mm Filter	01-JUN-23 00:00
646993002	SAMPLE	JE1	PIC3D	DEC-13-23 08:37:56	DONE	25mm Filter	01-JUN-23 00:00
646993003	SAMPLE	JE1	PIC4C	DEC-13-23 08:38:00	DONE	25mm Filter	01-JUN-23 00:00
646993004	SAMPLE	JE1	PIC4D	DEC-13-23 08:38:04	DONE	25mm Filter	01-JUN-23 00:00
1205589429	MB	JE1	PIC7B	DEC-13-23 08:38:09	DONE	25mm Filter	01-JUN-23 00:00
1205589430	DUP	JE1	PIC7D	DEC-13-23 08:38:14	DONE	25mm Filter	01-JUN-23 00:00
1205589431	LCS	JE1	PIC8B	DEC-13-23 08:38:18	DONE	25mm Filter	01-JUN-23 00:00
646993006	SAMPLE	JE1	PIC6C	DEC-13-23 08:38:23	DONE	25mm Filter	01-JUN-23 00:00
646993005	SAMPLE	JE1	PIC5D	DEC-13-23 08:38:44	DONE	25mm Filter	01-JUN-23 00:00

Lucas Cell Raw Data

Batch 2532924 Check-list

This check-list was completed on 11-DEC-23 by Lyndsey Pace

This batch was reviewed by Lyndsey Pace on 11-DEC-23 and Elizabeth Krouse on 14-DEC-23.

Batch ID:
2532924

Product:
LUC26RAL

Description: Lucas Cell Radium 226
GL-RAD-A-008

#	Criteria	Yes	No	Comments
Preparation Information				
1	Were all of the samples homogenous? Include sample description if not homogenous	Yes		
2	Was the preservation correct for this analysis?	Yes		
Internal Checklist Information				
3	Are instrument source checks within limits?	Yes		
4	Has an Aliquot Correction been completed for this batch?		No	
5	Have sample historical results been reviewed for this batch?	Yes		
Technical Information				
6	Were all the samples prepared/analyzed within the required holding time period?	Yes		
7	Are any sample results more negative than 3xTPU?		No	
Quality Control (QC) Information				
8	Was the method blank (MB) within the acceptance criteria?	Yes		
9	Were the laboratory control sample (LCS/LCSD) recoveries within the acceptance limits?	Yes		
10	Were the matrix spike (MS/MSD) recoveries within the acceptance limits?	Yes		
11	Were the relative percent differences and/or error (RPD/RER) between the sample and its duplicate within acceptable limits?	Yes		
12	Has the method required detection limit been met?	Yes		
Miscellaneous Information				
13	Are sample-specific MDA/MDC calculated and reported?	Yes		

Prep Logbook

Radium-226 in Liquid

Batch ID: 2532924
Analyst: Lyndsey Pace (LXP1)
Method: EPA 903.1 Modified
Lab SOP: GL-RAD-A-008 REV# 15
Instrument: LUCAS-C202389980

Due Dates for Lab: 25-DEC-2023			Package: 27-DEC-2023		SDG: 28-DEC-2023	
Type	Sample Id	Description	Serial Number	Spike Amount	Spike Units	
LCS	1205588137	Ra-226 emanation spike	1715-I	.1	mL	
MS	1205588136	Ra-226 emanation spike	1715-I	.1	mL	

#	Sample ID	Prep Date	Min RDL (pCi/L)	Unadjusted Aliquot (g)	Aliquot (mL)	End Degas (date)	CELL #	End Transfer (date)	Start Count Time (date)	Background Counts	Total Counts
1	646851001	06-DEC-2023	1	509.61	509.61	12/07/23 11:00	801	12/10/23 05:45	12/10/23 08:45	1	43
2	646851002	06-DEC-2023	1	504.92	504.92	12/07/23 11:00	101	12/10/23 06:10	12/10/23 09:18	1	20
3	646851003	06-DEC-2023	1	504.84	504.84	12/07/23 11:00	206	12/10/23 06:10	12/10/23 09:18	7	24
4	646851004	06-DEC-2023	1	504.06	504.06	12/07/23 11:00	303	12/10/23 06:10	12/10/23 09:18	2	12
5	646851005	06-DEC-2023	1	508.16	508.16	12/07/23 11:00	402	12/10/23 06:10	12/10/23 09:18	1	36
6	646851006	06-DEC-2023	1	505.12	505.12	12/07/23 11:00	501	12/10/23 06:10	12/10/23 09:18	8	11
7	646878001	06-DEC-2023	.999	509.66	509.66	12/07/23 11:00	607	12/10/23 06:10	12/10/23 09:18	1	18
8	646993001	06-DEC-2023	1	504.37	504.37	12/07/23 11:00	708	12/10/23 06:10	12/10/23 09:18	1	23
9	646993002	06-DEC-2023	1	506.25	506.25	12/07/23 11:00	807	12/10/23 06:10	12/10/23 09:18	2	25
10	646993003	06-DEC-2023	1	506.46	506.46	12/07/23 11:00	102	12/10/23 06:40	12/10/23 09:50	1	34
11	646993004	06-DEC-2023	1	503.31	503.31	12/07/23 11:00	208	12/10/23 06:40	12/10/23 09:50	2	22
12	646993005	06-DEC-2023	1	504.19	504.19	12/07/23 11:00	305	12/10/23 06:40	12/10/23 09:50	1	10
13	646993006	06-DEC-2023	1	508.78	508.78	12/07/23 11:00	407	12/10/23 06:40	12/10/23 09:50	1	35
14	1205588134 MB	06-DEC-2023	.999		509.66	12/07/23 11:00	504	12/10/23 06:40	12/10/23 09:50	5	11
15	1205588135 DUP (646878001)	06-DEC-2023	.999	500.1	500.1	12/07/23 11:00	604	12/10/23 06:40	12/10/23 09:50	3	25
16	1205588136 MS (646878001)	06-DEC-2023	.999	103.84	103.84	12/07/23 11:00	702	12/10/23 06:40	12/10/23 09:50	1	481
17	1205588137 LCS	06-DEC-2023	.999		509.66	12/07/23 11:00	806	12/10/23 06:40	12/10/23 09:50	3	720

Reagent/Solvent Lot ID	Description	Amount	Comments:
			Data Entry Date2: 06-DEC-2023 00:00

Radium-226 Liquid

Filename : RA226.XLS
 File type : Excel
 Version # : 1.3.2

Procedure Code : LUC26RAL
 Parmname : Radium-226
 Required MDA : 1 pCi/L
 Halflife of Ra-226 : 1600 years
 Ra-226 Abundance : 1.00
 Halflife of Rn-222 : 3.8235 days

Batch : 2532924
 Analyst : LIN01615
 Prep Date : 12/6/2023
 Ra-226 Method Uncertainty : 0.073648

Batch counted on : LUCAS CELL DETECTOR
 BKG Count time : 30 min

Sample Characteristics					Count Raw Data						Background	
Pos.	Sample ID	Sample Aliquot L	Sample Aliquot StDev. L	Sample Date/Time	Cell Number	Counting Time (min.)	Gross Counts	Gross CPM	Background Counts	Background CPM	Background Count Time (min.)	Cell Efficiency (cpm/dpm)
2	646851002.1	0.5049	2.0276E-05	11/21/2023 13:41	101	30	20	0.667	1	0.033	30	1.8120
3	646851003.1	0.5048	2.0276E-05	11/21/2023 14:56	206	30	24	0.800	7	0.233	30	1.5880
4	646851004.1	0.5041	2.0272E-05	11/21/2023 12:34	303	30	12	0.400	2	0.067	30	1.5370
5	646851005.1	0.5082	2.0289E-05	11/21/2023 11:26	402	30	36	1.200	1	0.033	30	1.4980
6	646851006.1	0.5051	2.0277E-05	11/21/2023 9:25	501	30	11	0.367	8	0.267	30	1.7160
7	646878001.1	0.5097	2.0295E-05	11/15/2023 13:45	607	30	18	0.600	1	0.033	30	1.7750
8	646993001.1	0.5044	2.0274E-05	11/27/2023 15:33	708	30	23	0.767	1	0.033	30	1.5430
9	646993002.1	0.5063	2.0281E-05	11/27/2023 11:54	807	30	25	0.833	2	0.067	30	2.0260
10	646993003.1	0.5065	2.0282E-05	11/27/2023 13:16	102	30	34	1.133	1	0.033	30	1.4860
11	646993004.1	0.5033	2.0269E-05	11/27/2023 14:58	208	30	22	0.733	2	0.067	30	1.7130
12	646993005.1	0.5042	2.0273E-05	11/27/2023 13:16	305	30	10	0.333	1	0.033	30	1.5280
13	646993006.1	0.5088	2.0291E-05	11/27/2023 10:05	407	30	35	1.167	1	0.033	30	1.4390
14	1205588134.1	0.5097	2.0295E-05	12/6/2023 0:00	504	30	11	0.367	5	0.167	30	1.3720
15	1205588135.1	0.5001	2.0256E-05	11/15/2023 13:45	604	30	25	0.833	3	0.100	30	1.7290
16	1205588136.1	0.1038	1.1603E-05	11/15/2023 13:45	702	30	481	16.033	1	0.033	30	1.6810
17	1205588137.1	0.5097	2.0295E-05	12/6/2023 0:00	806	30	720	24.000	3	0.100	30	1.6560

Pipet, 0.1 ml Stdev : +/- 0.000200 ml
 Pipet, 0.5 ml Stdev : +/- 0.001000 ml
 Pipet, 1 ml Stdev : +/- 0.002000 ml

Analytical SOP: GL-RAD-A-008
 Instrument SOP: GL-RAD-I-007

Cell Efficiency Error (%)	Cell Calibration Date	Cell Calibration Due Date	De-Gas Date/Time	Rn-222 Ingrow End Date/Time	Count Start Date/Time	Rn-222 Corrections			Ra-226 Decay
						De-Gas to Ingrowth	Ingrowth to Count	During Count	
3.200%	4/8/2023	3/31/2024	12/7/2023 11:00	12/10/2023 5:45	12/10/2023 8:45	0.396	0.978	1.002	1.000
4.500%	5/1/2023	4/30/2024	12/7/2023 11:00	12/10/2023 6:10	12/10/2023 9:18	0.398	0.977	1.002	1.000
8.600%	8/1/2023	7/31/2024	12/7/2023 11:00	12/10/2023 6:10	12/10/2023 9:18	0.398	0.977	1.002	1.000
6.800%	11/1/2023	10/31/2024	12/7/2023 11:00	12/10/2023 6:10	12/10/2023 9:18	0.398	0.977	1.002	1.000
5.300%	2/1/2023	1/31/2024	12/7/2023 11:00	12/10/2023 6:10	12/10/2023 9:18	0.398	0.977	1.002	1.000
5.500%	6/1/2023	5/31/2024	12/7/2023 11:00	12/10/2023 6:10	12/10/2023 9:18	0.398	0.977	1.002	1.000
6.800%	7/1/2023	6/30/2024	12/7/2023 11:00	12/10/2023 6:10	12/10/2023 9:18	0.398	0.977	1.002	1.000
5.200%	11/1/2023	10/31/2024	12/7/2023 11:00	12/10/2023 6:10	12/10/2023 9:18	0.398	0.977	1.002	1.000
9.200%	10/10/2023	3/31/2024	12/7/2023 11:00	12/10/2023 6:10	12/10/2023 9:18	0.398	0.977	1.002	1.000
2.300%	5/1/2023	4/30/2024	12/7/2023 11:00	12/10/2023 6:40	12/10/2023 9:50	0.400	0.976	1.002	1.000
4.400%	8/1/2023	7/31/2024	12/7/2023 11:00	12/10/2023 6:40	12/10/2023 9:50	0.400	0.976	1.002	1.000
7.000%	11/1/2023	10/31/2024	12/7/2023 11:00	12/10/2023 6:40	12/10/2023 9:50	0.400	0.976	1.002	1.000
5.800%	2/1/2023	1/31/2024	12/7/2023 11:00	12/10/2023 6:40	12/10/2023 9:50	0.400	0.976	1.002	1.000
1.100%	10/10/2023	5/31/2024	12/7/2023 11:00	12/10/2023 6:40	12/10/2023 9:50	0.400	0.976	1.002	1.000
2.300%	7/1/2023	6/30/2024	12/7/2023 11:00	12/10/2023 6:40	12/10/2023 9:50	0.400	0.976	1.002	1.000
2.000%	11/1/2023	10/31/2024	12/7/2023 11:00	12/10/2023 6:40	12/10/2023 9:50	0.400	0.976	1.002	1.000
1.900%	4/8/2023	3/31/2024	12/7/2023 11:00	12/10/2023 6:40	12/10/2023 9:50	0.400	0.976	1.002	1.000

Notes:

- 1 - Results are decay corrected to Sample Date/Time
- 2 - Reference date for Spike Activity (dpm/ml) is the batch Prep Date
- 3 - Spike Nominals are decay corrected to Sample Date/Time

Spike S/N : 1715-I
Spike Exp Date : 8/29/2024
Spike Activity (dpm/ml): 304.18
Spike Volume Added: 0.10


LCS S/N : 1715-I
LCS Exp Date : 8/29/2024
LCS Activity (dpm/ml): 304.18
LCS Volume Added: 0.10

Results																
Pos.	Decision Level pCi/L	Critical Level pCi/L	Required MDA pCi/L	MDA pCi/L	Sample Act. Conc. pCi/L	Sample Act. Error %	Net Count Rate CPM	Net Count Rate Error CPM	2 SIGMA Counting Uncertainty pCi/L	2 SIGMA Total Prop. Uncertainty pCi/L	Sample QC	Sample Type	RPD	RER	Nominal pCi/L	Recovery
1	0.1769	0.1249	1	0.4109	2.2553	16.11%	1.4000	0.2211	0.6981	0.7832		SAMPLE				
2	0.1394	0.0984	1	0.3238	0.8039	24.54%	0.6333	0.1528	0.3800	0.4036		SAMPLE				
3	0.4210	0.2972	1	0.7393	0.8209	33.86%	0.5667	0.1856	0.5270	0.5576		SAMPLE				
4	0.2329	0.1644	1	0.4787	0.4997	38.03%	0.3333	0.1247	0.3664	0.3794		SAMPLE				
5	0.1676	0.1183	1	0.3892	1.7799	18.17%	1.1667	0.2028	0.6063	0.6840		SAMPLE				
6	0.4162	0.2939	1	0.7217	0.1340	145.40%	0.1000	0.1453	0.3816	0.3823		SAMPLE				
7	0.1410	0.0996	1	0.3275	0.7275	26.53%	0.5667	0.1453	0.3656	0.3925		SAMPLE				
8	0.1639	0.1157	1	0.3807	1.0943	22.87%	0.7333	0.1633	0.4776	0.5153		SAMPLE				
9	0.1759	0.1242	1	0.3616	0.8681	24.39%	0.7667	0.1732	0.3844	0.4335		SAMPLE				
10	0.1686	0.1190	1	0.3915	1.6882	18.07%	1.1000	0.1972	0.5932	0.6458		SAMPLE				
11	0.2081	0.1469	1	0.4278	0.8931	24.89%	0.6667	0.1633	0.4288	0.4543		SAMPLE				
12	0.1647	0.1163	1	0.3825	0.4498	37.51%	0.3000	0.1106	0.3249	0.3370		SAMPLE				
13	0.1733	0.1223	1	0.4024	1.7880	18.58%	1.1333	0.2000	0.6184	0.7003		SAMPLE				
14	0.4057	0.2864	1	0.7380	0.3304	66.68%	0.2000	0.1333	0.4317	0.4344		MB				
15	0.2541	0.1794	1	0.4924	0.9796	24.16%	0.7333	0.1764	0.4618	0.4850	646878001.1	DUP	29.5%			
16	0.7268	0.5131	1	1.6880	105.8762	4.99%	16.0000	0.7318	9.4915	18.4633	646878001.1	MS			131.9524	79.7%
17	0.2604	0.1838	1	0.5045	32.7082	4.20%	23.9000	0.8963	2.4042	5.4365		LCS			26.8838	121.7%

Continuing Calibration Data

Ludlum Alpha Scintillation Counter Checks for 10-DEC-2023

Short Name	Parmname	Run Time	Count Time	Counts	CPM	Stdev	Status	Comments
LUCAS1	EFF	07:17	1	1.12E+05	112073	-2.52		
LUCAS2	EFF	07:15	1	1.30E+05	130189	-0.38		
LUCAS3	EFF	07:11	1	90965	90965	-1.17		
LUCAS4	EFF	07:10	1	1.26E+05	126251	-1.48		
LUCAS5	EFF	07:09	1	1.29E+05	129068	-2.13		
LUCAS6	EFF	07:08	1	1.29E+05	128958	-0.39		
LUCAS7	EFF	07:06	1	1.30E+05	130493	-1.27		
LUCAS8	EFF	07:04	1	1.13E+05	112703	-1.2		

Reviewed by: 
Lyndsey Pace

Date: 10-DEC-23

GEL Laboratories LLC

Runlogs

Instrument Run Log

Instrument Type: LUCAS CELL DETECTOR

Batch ID: 2532924

Sample ID	Sample Type	Analyst	Instrument	Run Date	Status	Geometry	Calibration Date
646851001	SAMPLE	LXP1	LUCAS8	DEC-10-23 08:45:00	DONE	Lucas Cell	08-APR-23 00:00
646851002	SAMPLE	LXP1	LUCAS1	DEC-10-23 09:18:00	DONE	Lucas Cell	01-MAY-23 00:00
646851003	SAMPLE	LXP1	LUCAS2	DEC-10-23 09:18:00	DONE	Lucas Cell	01-AUG-23 00:00
646851004	SAMPLE	LXP1	LUCAS3	DEC-10-23 09:18:00	DONE	Lucas Cell	01-NOV-23 00:00
646851005	SAMPLE	LXP1	LUCAS4	DEC-10-23 09:18:00	DONE	Lucas Cell	01-FEB-23 00:00
646851006	SAMPLE	LXP1	LUCAS5	DEC-10-23 09:18:00	DONE	Lucas Cell	01-JUN-23 00:00
646878001	SAMPLE	LXP1	LUCAS6	DEC-10-23 09:18:00	DONE	Lucas Cell	01-JUL-23 00:00
646993001	SAMPLE	LXP1	LUCAS7	DEC-10-23 09:18:00	DONE	Lucas Cell	01-NOV-23 00:00
646993002	SAMPLE	LXP1	LUCAS8	DEC-10-23 09:18:00	DONE	Lucas Cell	08-APR-23 00:00
646993003	SAMPLE	LXP1	LUCAS1	DEC-10-23 09:50:00	DONE	Lucas Cell	01-MAY-23 00:00
646993004	SAMPLE	LXP1	LUCAS2	DEC-10-23 09:50:00	DONE	Lucas Cell	01-AUG-23 00:00
646993005	SAMPLE	LXP1	LUCAS3	DEC-10-23 09:50:00	DONE	Lucas Cell	01-NOV-23 00:00
646993006	SAMPLE	LXP1	LUCAS4	DEC-10-23 09:50:00	DONE	Lucas Cell	01-FEB-23 00:00
1205588134	MB	LXP1	LUCAS5	DEC-10-23 09:50:00	DONE	Lucas Cell	01-JUN-23 00:00
1205588135	DUP	LXP1	LUCAS6	DEC-10-23 09:50:00	DONE	Lucas Cell	01-JUL-23 00:00
1205588136	MS	LXP1	LUCAS7	DEC-10-23 09:50:00	DONE	Lucas Cell	01-NOV-23 00:00
1205588137	LCS	LXP1	LUCAS8	DEC-10-23 09:50:00	DONE	Lucas Cell	08-APR-23 00:00



Environmental Laboratory
1232 Haco Drive
Lansing
Michigan, 48910

CHAIN OF CUSTODY

Phone: (517)702-6372

Lab Work Order Number L311201

Client Name BWL - Erickson Station		Project Name Erickson AM MI Wells 16A-D		Requested Analyses								Requested Turn Around		
Client Contact Cheryl Loudon		Project Number [none]		Ag:: As:: B:: Ba:: Be:: Ca:: Cd:: Cr:: Co:: Cu:: Fe:: Hg:: Li:: Mo:: Ni:: Pb:: Sb:: Se:: Si:: Tl:: V:: Zn:: Na:: K:: Mg	TSS, HCO3, CO3, Hardness	Cl-IC:: F-ISE:: SO4:: TDS	Radium 226 and Radium 228							Rush requests subject to additional charge. Rush requests subject to lab approval.
Address 3725 S. Canal		Project Description												
City Lansing		PO Number 30926 10021												
State/Zip MI, 48917		Shipped By												
Phone (517) 702-6396	Fax (517) 702-6373	Tracking Number												
Sampler Marc Wahrer														

Sample Name or Field ID	Sampled Date	Sampled Time	Sample Type Grab/Composite	Matrix Code	Container Count	Preservation Code								Sample	Comments
						b	a	a	b						
MW-16A	11-21-23	1126	G	GW	5	1	1	1	2						
MW-16B	↓	1341	G	GW	5	1	1	1	2						
MW-16C		1456	G	GW	5	1	1	1	2						
MW-16D		1254	G	GW	5	1	1	1	2						
MWT-16A		1126	G	GW	5	1	1	1	2						
Field Blank		0925	G	DI	5	1	1	1	2						

Relinquished By 	Date/Time 11-21-23 1600	Received By Dawn Williams	Date/Time 11-22-23 0740	
Relinquished By	Date/Time	Received By	Date/Time	Comments
Relinquished By	Date/Time	Received By	Date/Time	
Cooler Numbers and Temperatures E0716 1.6°C				

Matrix Codes: DI=Deionized Water, GW=Ground Water Preserv. Codes: a=None, b=0.5% HNO3