2018 Annual Groundwater Monitoring Report

DTE Electric Company
River Rouge Power Plant Bottom Ash Basin
Coal Combustion Residual Unit

1 Belanger Park Drive
River Rouge, Michigan

January 2019

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Prepared For
DTE Electric Company

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Executive Summary

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule), as amended July 30, 2018. The CCR Rule, which became effective on October 19, 2015 (amendment effective August 29, 2018), applies to the DTE Electric Company (DTE Electric) River Rouge Power Plant (RRPP) Bottom Ash Basin (BAB) CCR unit. Pursuant to the CCR Rule, no later than January 31, 2018, and annually thereafter, the owner or operator of a CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with §257.90(e). On behalf of DTE Electric, TRC Engineers Michigan, Inc., the engineering entity of TRC Environmental Corporation (TRC), has prepared this Annual Report for calendar year 2018 activities at the RRPP BAB CCR unit.

DTE Electric proactively constructed and has been operating a groundwater collection system since March 2, 2018 to mitigate any potential risk of migration of any water from the BAB. We will continue to operate this groundwater collection system while we proceed with the prescribed steps per the CCR Rule to follow the assessment of corrective measures process described below.

In the January 31, 2018 *Annual Groundwater Monitoring Report for the River Rouge Power Plant*, covering calendar year 2017 activities, DTE Electric noted that boron, fluoride, and pH were observed within groundwater at one or more downgradient monitoring wells with statistically significant increases (SSIs) above background limits. Therefore, in April 2018, DTE Electric initiated an assessment monitoring program for the RRPP BAB CCR unit pursuant to §257.95 of the CCR Rule that included sampling and analyzing groundwater within the groundwater monitoring system for all constituents listed in Appendix IV.

The results from the initial assessment monitoring sampling event were used to establish groundwater protection standards (GWPSs) for the Appendix IV constituents in accordance with §257.95(h), as presented in the October 15, 2018 *Assessment Monitoring Data Summary and Statistical Evaluation*. The monitoring system was subsequently sampled for the Appendix III and Appendix IV constituents in May 2018, within 90 days from the initial Appendix IV sampling event, and in October 2018. Assessment monitoring data that has been collected and evaluated in 2018 are presented in this report.

Results were reported above GWPSs for arsenic and lithium in one or more downgradient wells during the initial assessment monitoring event for the groundwater samples collected in May 2018, and for arsenic in one downgradient well during the subsequent assessment monitoring event for the groundwater samples collected in October 2018. DTE Electric placed a notification of the initial assessment monitoring event exceedance into the operating record on November 14, 2018 as required in §257.95(g) and within the timeframe required by §257.105(h)(8). Nature and extent groundwater sampling defined the extent of the potential release of CCR to be well within the radius of influence of the existing groundwater extraction system that has been in operation since March 2, 2018.

According to §257.95(g)(3), in the event that the facility determines, pursuant to §257.93(h), that a result is reported above GWPSs for one or more of the Appendix IV constituents, the facility will, within 90 days of performing the statistical analysis, initiate an assessment of corrective measures.

Although DTE Electric proceeded with initiating assessment of corrective measures per the CCR Rule by January 14, 2019, DTE Electric is proactively managing the potential migration pathway. DTE Electric's selected management strategy is to operate a groundwater extraction system to mitigate any risk of migration from the RRPP BAB to groundwater. This system was constructed during January and February 2018, began operation in early March 2018, is currently operational and is effectively capturing groundwater in the vicinity of the RRPP BAB.

Per §257.96(b) DTE Electric will continue semiannual assessment groundwater monitoring as specified in §257.95. The next assessment monitoring event is scheduled to be conducted in the second calendar quarter of 2019.

Section 1
Introduction

1.1 Program Summary

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule), as amended July 30, 2018. The CCR Rule, which became effective on October 19, 2015 (amendment effective August 29, 2018), applies to the DTE Electric Company (DTE Electric) River Rouge Power Plant (RRPP) Bottom Ash Basin (BAB). Pursuant to the CCR Rule, no later than January 31, 2018, and annually thereafter, the owner or operator of a CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with §257.90(e). On behalf of DTE Electric, TRC Engineers Michigan, Inc., the engineering entity of TRC Environmental Corporation (TRC), has prepared this Annual Report for calendar year 2018 activities at the RRPP BAB CCR unit (2018 Annual Report).

In the January 31, 2018 *Annual Groundwater Monitoring Report for the River Rouge Power Plant*, covering calendar year 2017 activities (2017 Annual Report), DTE Electric noted that boron, fluoride, and pH were observed within groundwater at one or more downgradient monitoring wells with statistically significant increases (SSIs) above background limits. Therefore, DTE Electric initiated an assessment monitoring program for the RRPP BAB CCR unit pursuant to §257.95 of the CCR Rule that included sampling and analyzing groundwater within the groundwater monitoring system for all constituents listed in Appendix IV of the CCR Rule.

The results from the initial assessment monitoring sampling event were used to establish groundwater protection standards (GWPSs) for the Appendix IV constituents in accordance with §257.95(h), as presented in the October 15, 2018 *Assessment Monitoring Data Summary and Statistical Evaluation*. The monitoring system was subsequently sampled for the Appendix III and Appendix IV constituents in May 2018 within 90 days from the initial Appendix IV sampling event, and in October 2018. Assessment monitoring data that has been collected and evaluated in 2018 are presented in this report.

Given the uncertainty around the potential hydraulic connection between the RRPP BAB CCR unit and the uppermost aquifer, the detected arsenic concentrations above the generic Michigan Part 201 drinking water and groundwater surface water interface criteria within the groundwater in the uppermost aquifer around the RRPP BAB CCR unit during background sampling, and the proximity of the RRPP BAB to the Rouge River, DTE Electric is proactively managing this potential migration pathway. DTE Electric's selected management strategy is to operate a groundwater extraction system as a presumptive remedy to mitigate any risk of migration from the RRPP BAB to groundwater. This groundwater extraction system was constructed during January and February 2018, began operation in early March 2018, and is currently operational and effectively capturing groundwater in the vicinity of the RRPP BAB.

This 2018 Annual Report presents the monitoring results and the statistical evaluation of the assessment monitoring parameters (Appendix IV to Part 257 of the CCR Rule) for the April, May and October 2018 assessment groundwater monitoring events for the RRPP BAB CCR unit. Assessment monitoring for these events was performed in accordance with the *CCR Groundwater Monitoring and Quality Assurance Project Plan – DTE Electric Company River Rouge Power Plant Bottom Ash Basin* (the QAPP) (TRC, July 2016; revised August 2017) and statistically evaluated per the *Groundwater Statistical Evaluation Plan – DTE Electric Company River Rouge Power Plant Coal Combustion Residual Bottom Ash Basin* (Stats Plan) (TRC, October 2017). As part of the statistical evaluation, the data collected during assessment monitoring events are evaluated to identify SSIs of assessment monitoring parameters compared to background levels. In addition, nature and extent groundwater sampling data from existing monitoring wells around the BAB that was performed in October 2018 are presented.

1.2 Site Overview

The RRPP BAB is located at 1 Belanger Park Drive, within the City of River Rouge in Wayne County, Michigan. The RRPP, including the BAB CCR unit, was originally constructed in the early 1950s, just northeast of the DTE Electric RRPP. The power plant property is located at the confluence of the Rouge River and the Detroit River.

The RRPP BAB is a sedimentation basin that is an incised CCR surface impoundment. The impoundment is sheet-piled around the perimeters to approximately 30 feet below ground surface (ft bgs) into the native soil. The BAB is used for receiving sluiced bottom ash and other process flow effluent pumped from the power plant to the eastern end of the BAB. There is a sheet pile weir near the middle of the BAB that maintains the water elevation in the eastern portion to approximately 577.5 feet through gravity flow. The water in the western portion of the BAB is maintained at an elevation of no higher than 577 feet before being recirculated back to the RRPP and/or is discharged into the Detroit River in accordance with a National Pollution Discharge Elimination System (NPDES) permit.

1.3 Geology/Hydrogeology

The RRPP BAB CCR unit is located immediately adjacent to the Rouge River to the northeast near the intersection of the Rouge River and Detroit River (Figure 1). The RRPP CCR unit is underlain initially by approximately 10 feet of surficial fill of various composition (gravel, sand, silt and clay, brick and/or concrete fragments). The fill is partially saturated in some areas, but is not continuously saturated across the RRPP, does not represent a significant, usable source of water, and is, therefore, not an aquifer. An organic layer is often encountered beneath the surficial fill that is then underlain by a silt/clay-rich unit that ranges from 3 to about 8 feet thick in the area of the BAB. Beneath the silt/clay-rich unit, there is a saturated sand and gravel unit that often coarsens from sand to gravel with depth. This coarse-grained sand and gravel unit is present from as shallow as 15 ft bgs to as deep as 25.5 ft bgs. This same coarse-grained unit is observed in most of the historical boring logs across the RRPP and appears to be a relatively continuous unit across the RRPP. Based on this information, this coarse-grained sand and gravel unit represents the uppermost aquifer present at the RRPP BAB CCR unit.

The coarse-grained sand and gravel uppermost aquifer is underlain by a more than 60-foot-thick contiguous silty clay-rich deposit that serves as a natural lower confining hydraulic barrier that isolates the uppermost aquifer from the underlying Dundee limestone that represents the next aquifer. There is no apparent hydraulic connection between the uppermost aquifer and the Dundee limestone aquifer, and the limestone aquifer is artesian.

Historically, a definitive groundwater flow direction to the northeast with an average gradient of 0.00067 foot/foot (using data from June 2016 through September 2017) within the uppermost aquifer is evident around the RRPP BAB CCR unit, with potential groundwater flow rates within the uppermost aquifer ranging from approximately 5.8 to 73 feet/year. Due to the installation and continuous operation of the eleven extraction wells within the groundwater extraction system since March 2, 2018, the current groundwater flow regime is significantly different from previous monitoring events. The series of eleven groundwater extraction wells surrounding the basin creates an inward gradient that extends to the edge of the Rouge River. The radius of influence extends beyond all CCR monitoring wells, with the exception of the upgradient monitoring well MW-17-07 that is a background well located more than 1,500 feet up hydraulic gradient of the RRPP BAB CCR unit. Additionally, there is an eastern groundwater flow component on the southeast edge of the site toward the Detroit River (from MW-17-07 to the Detroit River). The groundwater extraction system well layout is shown on Figure 2 and soil boring logs and well construction diagrams are provided in Appendix A.

Section 2
Groundwater Monitoring

2.1 Monitoring Well Network

A groundwater monitoring system has been established for the RRPP BAB CCR unit as detailed in the *Groundwater Monitoring System Summary Report – DTE Electric Company River Rouge Power Plant Bottom Ash Basin Coal Combustion Residual Unit* (GWMS Report) (TRC, October 2017). The monitoring well network for the BAB CCR unit currently consists of five monitoring wells that are screened in the uppermost aquifer. The monitoring well locations are shown on Figure 2. Monitoring wells MW-17-06 and MW-17-07 are located south-southwest of the RRPP BAB and provide data on background groundwater quality that has not been affected by the CCR unit (total of two background wells). Monitoring wells MW-16-01 through MW-16-03 are located north-northeast, downgradient of the RRPP BAB CCR unit (total of three downgradient monitoring wells).

As shown on Figure 2, monitoring well MW-16-04S is used for water level measurements only. MW-16-04S had originally been installed as a potential background monitoring well; however, based on concentrations of several Appendix III parameters, the proximity of the well to the BAB and the hydrogeology of the area, monitoring well MW-16-04S does not appear to be representative of background groundwater conditions; therefore, this well was excluded from the background monitoring network. As such, in June 2017, two additional monitoring wells (MW-17-06 and MW-17-07) were installed in the uppermost aquifer further upgradient on the southwest side of the RRPP main building for use as background wells (Figure 2).

In addition, eleven groundwater recovery wells were installed as part of a groundwater extraction system (Figure 2, Appendix A) and additional monitoring wells were added to evaluate the groundwater extraction system groundwater capture (Figure 5, Appendix A). Although the groundwater extraction system has changed groundwater flow significantly in the RRPP BAB CCR unit, the three downgradient monitoring wells (MW-16-01 through MW-16-03) are appropriately positioned to evaluate groundwater quality in the vicinity of the RRPP BAB CCR unit. However, while the groundwater extraction system is operational, inward hydraulic gradients are maintained toward the extraction wells and the RRPP BAB CCR unit, and the monitoring wells (MW-16-01 through MW-16-03) are not immediately downgradient from the RRPP BAB CCR unit, rather they are on the upgradient edge of the groundwater capture zone on the downgradient side of the RRPP BAB CCR unit adjacent to the Rouge River (Figures 3 through 5).

2.2 Preliminary Assessment Monitoring

DTE Electric reported in the 2018 Annual Report that boron, fluoride, and pH were observed within groundwater in one or more downgradient monitoring well(s) with SSIs above background concentration levels. Therefore, DTE Electric initiated an Assessment Monitoring Program for the RRPP BAB CCR unit pursuant to §257.95 of the CCR Rule that included sampling and analyzing groundwater within the groundwater monitoring system for all constituents listed in Appendix IV. The monitoring was performed in accordance with the QAPP.

2.2.1 Data Summary

The preliminary Appendix IV only assessment monitoring event (per §257.95(b)) was performed on April 6, 2018. Downgradient monitoring wells MW-16-01 through MW-16-03 and background monitoring wells MW-17-06 and MW-17-07 were sampled during this event.

Static water elevation measurements were collected from all the CCR groundwater monitoring system monitoring well locations, in addition to surface water measuring points MP-01 through MP-04 established along the Rouge River and Detroit River (Figure 2). Static water elevation data are summarized in Table 1 and groundwater elevation data are shown on Figure 3. Monitoring wells were purged with peristaltic or dedicated submersible pumps utilizing low-flow sampling methodology. Field parameters were stabilized at each monitoring well prior to collecting groundwater samples in accordance with the QAPP. Field parameters are summarized in Table 2.

The groundwater samples were analyzed by TestAmerica Laboratories (TestAmerica) for Appendix IV parameters during the preliminary assessment monitoring event in accordance with the QAPP. The analytical results for each event are summarized in Table 3.

2.2.2 Data Quality Review

Data from the preliminary Appendix IV only assessment monitoring event were evaluated for completeness, overall quality and usability, method-specified sample holding times, precision and accuracy, and potential sample contamination. The data were found to be complete and usable for the purposes of the CCR monitoring program. Data quality reviews are summarized in Appendix B.

2.2.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected during the preliminary event shows that groundwater within the uppermost aquifer in the vicinity of the RRPP BAB is being captured by the recently installed groundwater extraction well system. The series of eleven extraction wells surrounding the basin creates an inward gradient that extends to the edge of the river. The radius of influence extends beyond all CCR monitoring wells with the exception of MW-17-07. Additionally, there is an eastern groundwater flow component on the southeast edge of the site toward the Detroit River (from MW-17-07 to the Detroit River). Groundwater elevations measured across the Site during the April 2018 sampling event are provided on Table 1 and were used to construct the groundwater contour map provided in Figure 3.

The figure shows that, due to the installation of the groundwater extraction system, the current groundwater flow is significantly different from previous monitoring events. The average hydraulic gradient throughout the RRPP BAB CCR unit during the April 2018 event is estimated at 0.008 ft/ft (significantly greater than the average hydraulic gradient prior to the groundwater extraction system beginning operation). The gradient was calculated using the following well pairs: MW-17-06/MW-16-04S and MW-17-07/MW-17-06. Using the low hydraulic conductivity of 9.5 feet/day and high hydraulic conductivity of 120 feet/day presented in the GWMS Report, and an assumed effective porosity of 0.4, the estimated seepage velocity ranges from approximately 0.2 feet/day (approximately 70 feet/year) to approximately 2.5 feet/day (approximately 910 feet/year) for the April 2018 event.

2.3 Semiannual Assessment Groundwater Monitoring

Per §257.95(d), within 90 days of the preliminary assessment monitoring event and semiannually thereafter, all wells must be resampled and analyzed for the indicator parameters from Appendix III and detected Appendix IV parameters of the CCR Rule. In addition to the Appendix III and IV indicator parameters, field parameters including pH, dissolved oxygen, oxidation reduction potential, specific conductivity, temperature, and turbidity were collected at each well. Samples were collected and analyzed in accordance with the QAPP.

2.3.1 Data Summary

The first semiannual groundwater assessment monitoring event for 2018 was performed during May 30 and 31, 2018 by TRC personnel and samples were analyzed by TestAmerica in accordance with the QAPP. Static water elevation data were collected at all monitoring well locations in addition to surface water measuring points MP-01 through MP-04 established along the Rouge River and Detroit River (Figure 2). Groundwater samples were collected from the two background monitoring wells and three downgradient monitoring wells for the Appendix III and detected Appendix IV indicator parameters and field parameters. A summary of the groundwater data collected during the May 2018 event is provided on Table 1 (static groundwater elevation data), Table 2 (field data), and Table 3 (analytical results).

The second semiannual groundwater assessment monitoring event for 2018 was performed on October 15 and 16, 2018 by TRC personnel and samples were analyzed by TestAmerica in accordance with the QAPP. Static water elevation data were collected at all the CCR groundwater monitoring system monitoring well locations in addition to surface water measuring points MP-01 through MP-04 established along the Rouge River and Detroit River (Figure 2). Groundwater samples were collected from the two background monitoring wells and three downgradient monitoring wells for the Appendix III and detected Appendix IV indicator parameters and field parameters. A summary of the groundwater data collected during the October 2018 event is provided on Table 1 (static groundwater elevation data), Table 2 (field data), and Table 3 (analytical results).

2.3.2 Data Quality Review

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

2.3.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected during the May and October 2018 sampling events show that groundwater within the uppermost aquifer in the vicinity of the RRPP BAB is being captured by the recently installed groundwater extraction well system. Similar to the April 2018 event, the series of eleven extraction wells surrounding the basin creates an inward gradient that extends to the edge of the river. The radius of influence extends beyond all CCR monitoring wells with the exception of MW-17-07 that is a background well located more than 1,500 feet up hydraulic gradient of the RRPP BAB CCR unit. Additionally, there is an eastern groundwater flow component on the southeast edge of the site toward the Detroit River (from MW-17-07 to the Detroit River). Groundwater elevations measured across the Site during the May and October 2018 sampling events are provided on Table 1 and were used to construct groundwater contour maps (Figures 4 and 5, respectively).

The figures show that, due to the installation of the groundwater extraction system, the current groundwater flow is significantly different from previous monitoring events before the groundwater extraction system was operational. The average hydraulic gradients throughout the RRPP BAB CCR unit during the May and October 2018 events were very consistent with the April 2018 event, and show a hydraulic gradient of approximately 0.008 ft/ft is being maintained (significantly greater than the average hydraulic gradient prior to the groundwater extraction system beginning operation). The gradients were calculated using the same well pairs as above (MW-17-06/MW-16-04S and MW-17-07/MW-17-06). Using the aforementioned low hydraulic conductivity of 9.5 feet/day and high hydraulic conductivity of 120 feet/day, and an assumed effective porosity of 0.4, the estimated seepage velocity ranges from approximately 0.2 feet/day (approximately 70 feet/year) to approximately 2.5 feet/day (approximately 920 feet/year) for the May and October 2018 events as it did in April 2018.

Section 3
Statistical Evaluation

3.1 Establishing Groundwater Protection Standards

In accordance with §257.95(h) and the Stats Plan, groundwater protection standards (GWPSs) were established for the Appendix IV indicator parameters following the preliminary assessment monitoring event using nine rounds of data collected from the background monitoring wells MW-17-06 and MW-17-07 (July 2017 through April 2018). The calculation of the GWPSs is documented in the *Assessment Monitoring Data Summary and Statistical Evaluation* (Initial Assessment Monitoring Statistical Evaluation Memo) (TRC, October 2018a). The GWPS is established as the higher of the USEPA Maximum Contaminant Level (MCL) or statistically derived background level for constituents with MCLs and the higher of the USEPA Regional Screening Levels (RSLs) or background level for constituents with RSLs. The Appendix IV GWPSs will be used to determine whether groundwater has been impacted from the RRPP BAB CCR unit by statistically comparing concentrations in the assessment monitoring wells to their respective GWPS for each Appendix IV indicator parameter.

3.2 Initial Assessment Monitoring Statistical Evaluation (May 2018)

Following the initial and subsequent assessment monitoring sampling events (April and May 2018), the compliance well groundwater concentrations for Appendix IV parameters were compared to the GWPSs to determine if a statistically significant exceedance had occurred in accordance with §257.93. Consistent with the *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (Unified Guidance) (USEPA, 2009), the preferred method for comparisons to a fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS. Confidence intervals were established per the statistical methods detailed in the *Assessment Monitoring Statistical Evaluation* technical memorandum for the May 2018 assessment monitoring event provided in Appendix C (TRC, October 2018b).

For each detected constituent, the concentrations for each well were first compared directly to the GWPS. Parameter-well combinations that included a direct exceedance of the GWPS were retained for further statistical analysis using confidence limits as detailed in the Appendix C technical memorandum. The calculated upper and lower confidence limits and comparison of the lower confidence limits to the GWPSs are provided in Table 4 for the May 2018 event.

The statistical evaluation of the May 2018 Appendix IV indicator parameters shows statistical exceedances of the GWPSs for:

- Arsenic at MW-16-01; and
- Lithium at MW-16-01 and MW-16-02.

There were no exceedances compared to background for the remaining Appendix IV indicator parameters during the initial May 2018 assessment monitoring event.

Results from the initial assessment monitoring event for arsenic and lithium were above GWPSs. DTE Electric placed a notification of the statistical exceedances into the operating record on November 14, 2018 as required in §257.95(g) and within the timeframe required by §257.105(h)(8). In addition, as required in §257.95(g)(1), nature and extent groundwater sampling was conducted as detailed in Section 4 of this report.

3.3 Data Comparison to Background Limits – Second Semiannual Event (October 2018)

Given the timing of the GWPS calculations by October 15, 2018 (TRC, October 2018a) and the semiannual sampling schedule, the second semiannual sampling event was performed in October 2018, concurrent with the initial assessment monitoring statistical evaluation and subsequent next steps related to the initial exceedances of the GWPSs. Statistical analysis for the second semiannual monitoring event was performed using the same approach as the initial assessment monitoring statistical evaluation as discussed in the *October 2018 Appendix IV Assessment Monitoring Statistical Evaluation* technical memorandum provided in Appendix D (TRC, January 2019). The calculated upper and lower confidence limits and comparison of the lower confidence limits to the GWPSs for the October 2018 event are provided in Table 5.

The statistical evaluation of the October 2018 Appendix IV indicator parameters shows continued results above GWPSs for:

- Arsenic at MW-16-01

There were no other results reported above GWPSs for the remaining Appendix IV indicator parameters.

Section 4
Nature and Extent Groundwater Evaluation

4.1 Nature and Extent Groundwater Sampling

Per §257.95(g)(1), in the event that the facility determines, pursuant to §257.93(h), that there is a statistical exceedance of the GWPSs for one or more of the Appendix IV constituents, the facility must characterize the nature and extent of the release of CCR as well as any site conditions that may affect the remedy selected. As such, nature and extent groundwater sampling was completed on October 15 and 16, 2018, by TRC personnel from monitoring wells previously installed in conjunction with the installation of the presumptive remedy and/or other existing site monitoring wells. The soil boring logs and well construction diagrams for the additional monitoring wells utilized for the nature and extent groundwater sampling are included in Appendix A.

Groundwater elevation data were collected at all site monitoring wells shown on Figure 5. Groundwater samples were collected at monitoring wells MW-16-04s, MW-17-05, MW-17-13 through MW-17-15, MW-17-18, and MW-17-20. Field parameters were stabilized at each monitoring well prior to collecting groundwater samples. Field parameters are summarized in Table 2. Groundwater samples were analyzed by TestAmerica for the Appendix III and detected Appendix IV parameters. A summary of the analytical groundwater data collected during the October 2018 nature and extent sampling event is provided on Table 6.

Concentrations of arsenic and lithium above the GWPSs were observed in monitoring wells MW-17-14 and MW-17-15. These monitoring wells are located within the radius of influence of the groundwater extraction system as shown on Figure 5. Concentrations of the Appendix IV indicator parameters were below the GWPSs in other wells located farther away from the RRPP BAB CCR unit (e.g., MW-16-04S, MW-17-05, MW-17-13, MW-17-18 and MW-17-20), delineating the extent of the potential CCR groundwater release to be within the capture zone of the groundwater extraction system that has been operational since March 2, 2018. Therefore, as long as the groundwater extraction system is in operation there is no potential for affected groundwater to migrate off site. In addition, all the land that overlies the potentially affected groundwater is owned by DTE Electric.

Section 5
Conclusions and Recommendations

Results above GWPSs were reported for arsenic and lithium in one or more downgradient wells during the initial assessment monitoring event for the groundwater samples collected in May 2018 and for arsenic in one downgradient well during the subsequent assessment monitoring event for the groundwater samples collected in October 2018. DTE Electric placed a notification of the initial assessment monitoring event into the operating record on November 14, 2018 as required in §257.95(g) and within the timeframe required by §257.105(h)(8). Nature and extent groundwater sampling defined the extent of the potential release of CCR to be well within the radius of influence of the existing groundwater extraction system that has been in operation since March 2, 2018.

According to §257.95(g)(3), in the event that the facility determines, pursuant to §257.93(h), that there is a SSI above the GWPSs for one or more of the Appendix IV constituents, the facility will, within 90 days of performing the statistical analysis, initiate an assessment of corrective measures. Per §257.96(b) DTE Electric will continue semiannual assessment groundwater monitoring as specified in §257.95. The next assessment monitoring event is scheduled to be conducted in the second calendar quarter of 2019.

Although DTE Electric proceeded with initiating assessment of corrective measures per §257.96 by January 14, 2019, DTE Electric is currently operating a presumptive remedy groundwater extraction system to maintain hydraulic control around the RRPP BAB to mitigate any risk of migration from the RRPP BAB to groundwater. This system effectively captures groundwater in the vicinity of the RRPP BAB CCR unit and eliminates the potential for Appendix III and Appendix IV parameters to migrate off-site from the RRPP BAB CCR unit.

Section 6
Groundwater Monitoring Report Certification

The U.S. EPA's Disposal of Coal Combustion Residuals from Electric Utilities Final Rule Title 40 CFR Part 257 §257.90(e) requires that the owner or operator of an existing CCR unit prepare an annual groundwater monitoring and corrective action report.

Annual Groundwater Monitoring Report Certification
River Rouge Power Plant Bottom Ash Basin
River Rouge, Michigan

CERTIFICATION

I hereby certify that the annual groundwater and corrective action report presented within this document for the RRPP BAB CCR unit has been prepared to meet the requirements of Title 40 CFR §257.90(e) of the Federal CCR Rule. This document is accurate and has been prepared in accordance with good engineering practices, including the consideration of applicable industry standards, and with the requirements of Title 40 CFR §257.90(e).

Name: David B. McKenzie, P.E.	Expiration Date: October 31, 2019	State of Michigan David B. McKenzie Engineer No. 42332 Licensed Professional Engineer Stamp
Company: TRC Engineers Michigan, Inc.	Date: January 31, 2019	

Section 7
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Tables

Table 1
Summary of Groundwater Elevation Data – April & October 2018
River Rouge Power Plant Bottom Ash Basins – RCRA CCR Monitoring Program
River Rouge, Michigan

Well ID	MW-16-01		MW-16-02		MW-16-03		MW-16-04S		MW-17-06		MW-17-07		MP-01		MP-02		MP-03		MP-04	
Date Installed	6/13/2016		6/13/2016		6/10/2016		3/17/2016		6/7/2017		6/14/2017		6/23/2016		6/23/2016		6/20/2017		6/20/2017	
TOC Elevation	583.02		582.79		582.75		582.41		583.01		583.05		579.25(1)		579.15(1)		578.42(1)		579.17(1)	
Geologic Unit of Screened Interval	Sand/Silty Clay/Gravel		Silty Sand/Sand/ Clay/Gravel		Sand with Gravel		Sand and Gravel		Silty Sand/ Gravel with Sand		Silt with Sand/Clay		NA		NA		NA		NA	
Screened Interval Elevation	562.0 to 557.0		561.4 to 556.4		561.4 to 556.4		561.2 to 556.2		559.9 to 554.9		564.0 to 559.0		NA		NA		NA		NA	
Unit	ft BTOC	ft	ft BTOC	ft	ft BTOC	ft	ft BTOC	ft	ft BTOC	ft	ft BTOC	ft	ft BTOC	ft	ft BTOC	ft	ft BTOC	ft	ft BTOC	ft
Measurement Date	Depth to Water	GW Elevation	Depth to Water	GW Elevation	Depth to Water	GW Elevation	Depth to Water	GW Elevation	Depth to Water	GW Elevation	Depth to Water	GW Elevation	Depth to Water	GW Elevation	Depth to Water	GW Elevation	Depth to Water	GW Elevation	Depth to Water	GW Elevation
4/6/2018	16.45	566.57	11.76	571.03	15.42	567.33	16.94	565.47	8.90	574.11	5.73	577.32	2.18	577.07	4.44	574.71	3.73	574.69	4.41	574.76
5/30/2018	15.55	567.47	9.74	573.05	13.14	569.61	17.00	565.41	8.94	574.07	5.72	577.33	2.30	576.95	3.58	575.57	2.67	575.75	3.44	575.73
10/15/2018	16.79	566.23	11.99	570.80	14.95	567.80	17.82	564.59	9.57	573.44	6.43	576.62	2.31	576.94	4.51	574.64	3.75	574.67	4.80	574.37

Notes:

Elevations are reported in feet relative to the North American Vertical Datum of 1988.

ft BTOC - feet below top of casing
NA - not applicable

1) Elevation represents the point of reference used to collect surface water level measurements.

Table 2
Summary of Field Data – April & October 2018
River Rouge Power Plant Bottom Ash Basins – RCRA CCR Monitoring Program
River Rouge, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (deg C)	Turbidity (NTU)
Background							
MW-17-06	4/6/2018	0.16	-28.3	6.7	2,347	13.03	7.78
	5/30/2018	0.19	-38.6	6.7	2,743	15.88	14.6
	10/15/2018	0.41	-33.8	6.8	2,313	16.52	3.04
MW-17-07	4/6/2018	0.19	-11.6	6.7	9,273	10.35	28.4
	5/30/2018	0.29	-31.6	6.6	8,796	16.50	35.6
	10/15/2018	0.42	-26.3	6.7	8,583	13.87	11.5
Downgradient							
MW-16-01	4/6/2018	0.18	-71.5	7.5	880	11.18	2.52
	5/30/2018	0.14	-89.3	7.4	679	12.13	3.37
	10/16/2018	0.43	4.5	7.3	617	14.64	2.85
MW-16-02	4/6/2018	0.20	-84.9	7.4	1,312	11.27	1.89
	5/30/2018	0.16	-70.7	7.4	737	10.94	1.25
	10/16/2018	0.40	34.0	7.5	401	16.49	2.48
MW-16-03	4/6/2018	0.16	-51.2	7.4	768	8.30	1.13
	5/30/2018	0.18	-21.1	7.3	678	10.97	0.85
	10/16/2018	0.78	63.0	7.5	406	17.40	1.42

Notes:

mg/L - milligrams per liter.

mV - milliVolt.

SU - standard unit.

umhos/cm - micro-mhos per centimeter.

deg C - degrees celcius.

NTU - nephelometric turbidity units.

Table 2
Summary of Field Data – April & October 2018
River Rouge Power Plant Bottom Ash Basins – RCRA CCR Monitoring Program
River Rouge, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (deg C)	Turbidity (NTU)
N&E Wells							
MW-16-04S	4/6/2018	0.19	-61.9	7.2	2,006	11.21	3.17
	5/30/2018	0.13	-33.1	6.8	2,707	12.16	0.70
	10/16/2018	0.51	16.8	6.9	3,102	11.96	2.59
MW-17-05	10/15/2018	0.19	-55.3	7.2	782	16.48	4.53
MW-17-08	10/16/2018	0.22	-68.9	7.0	1,114	14.52	1.15
MW-17-12	10/16/2018	0.30	22.4	6.5	4,449	14.81	1.82
MW-17-13	10/16/2018	0.21	-49.9	6.9	1,369	13.57	4.79
MW-17-14	10/16/2018	0.21	-79.7	6.9	1,126	15.47	1.95
MW-17-15	10/16/2018	0.23	-69.1	6.9	1,448	14.14	3.57
MW-17-18	10/15/2018	0.21	-57.7	6.8	2,784	14.62	2.88
MW-17-19	10/15/2018	0.19	-117.8	7.1	2,887	14.22	3.79
MW-17-20	10/16/2018	0.41	7.8	6.7	3,436	14.76	2.54

Notes:

mg/L - milligrams per liter.

mV - milliVolt.

SU - standard unit.

umhos/cm - micro-mhos per centimeter.

deg C - degrees celcius.

NTU - nephelometric turbidity units.

Table 3
Summary of Groundwater Analytical Data - April & October 2018
River Rouge Power Plant Bottom Ash Basin – RCRA CCR Monitoring Program
River Rouge, Michigan

					Sample Location:	**MW-17-06**			**MW-17-07**			**MW-16-01**		
					Sample Date:	4/6/2018	5/30/2018	10/15/2018	4/6/2018	5/30/2018	10/15/2018	4/6/2018	5/30/2018	10/16/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	Background						downgradient		
Appendix III														
Boron	ug/L	NC	NA	NA	NA	--	340	320	--	640	610	--	4,200	3,300
Calcium	ug/L	NC	NA	NA	NA	--	230,000	200,000	--	380,000	340,000	--	78,000	69,000
Chloride	mg/L	250*	NA	NA	NA	--	480	330	--	2,200	2,200	--	50	47
Fluoride	mg/L	4	NA	NA	NA	0.43	< 0.50	0.43	0.45	< 1.3	0.36	2.0	2.0	2.0
pH, Field	SU	6.5 - 8.5*	NA	NA	NA	6.71	6.65	6.79	6.67	6.58	6.72	7.45	7.39	7.29
Sulfate	mg/L	250*	NA	NA	NA	--	280	330	--	1,100	1,100	--	71	63
Total Dissolved Solids	mg/L	500*	NA	NA	NA	--	1,700	1400	--	6,100	4,800	--	440	400
Appendix IV														
Antimony	ug/L	6	NA	2.0	6	< 2.0	--	--	< 2.0	--	--	< 2.0	--	--
Arsenic	ug/L	10	NA	32	**32**	10	12	9	16	19	21	**160**	**170**	**160**
Barium	ug/L	2,000	NA	150	2,000	58	74	58	30	31	29	55	67	100
Beryllium	ug/L	4	NA	1.0	4	< 1.0	--	--	< 1.0	--	--	< 1.0	--	--
Cadmium	ug/L	5	NA	1.0	5	< 1.0	--	--	< 1.0	--	--	< 1.0	--	--
Chromium	ug/L	100	NA	2.0	100	< 2.0	--	--	< 2.0	--	--	< 2.0	--	--
Cobalt	ug/L	NC	6	23	23	< 1.0	< 1.0	< 1.0	11	9.5	8.8	< 1.0	< 1.0	< 1.0
Fluoride	mg/L	4	NA	1.3	4	0.43	< 0.50	0.43	0.45	< 1.3	0.36	2.0	2.0	2.0
Lead	ug/L	NC	15	1.0	15	< 1.0	--	--	< 1.0	--	--	< 1.0	--	--
Lithium	ug/L	NC	40	34	**40**	15	14	16	25	26	27	**49**	**51**	**59**
Mercury	ug/L	2	NA	0.20	2	< 0.20	--	--	< 0.20	--	--	< 0.20	--	--
Molybdenum	ug/L	NC	100	22	100	6.8	8.5	7.4	14	14	14	11	18	13
Radium-226	pCi/L	NC	NA	NA	NA	0.567	0.600	0.733	0.326	0.56	0.482	0.17	0.223	0.653
Radium-226/228	pCi/L	5	NA	2.83	5	1.44	1.08	1.63	0.844	1.09	1.92	0.65	0.643	1.04
Radium-228	pCi/L	NC	NA	NA	NA	0.875	< 0.479	0.896	0.518	< 0.534	1.44	0.48	< 0.434	< 0.494
Selenium	ug/L	50	NA	5.0	50	< 5.0	--	--	< 5.0	--	--	< 5.0	--	--
Thallium	ug/L	2	NA	1.0	2	< 1.0	--	--	< 1.0	--	--	< 1.0	--	--

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

NC - no criteria.

-- - not analyzed.

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

RSL - Regional Screening Level from 83 FR 36435.

UTL - Upper Tolerance Limit (95%) of the background data set.

GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL.

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

Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.

Table 3
Summary of Groundwater Analytical Data - April & October 2018
River Rouge Power Plant Bottom Ash Basin – RCRA CCR Monitoring Program
River Rouge, Michigan

					Sample Location:	**MW-16-02**			**MW-16-03**		
					Sample Date:	4/6/2018	5/30/2018	10/16/2018	4/6/2018	5/30/2018	10/16/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	downgradient					
Appendix III											
Boron	ug/L	NC	NA	NA	NA	--	2,100	1,100	--	260	140
Calcium	ug/L	NC	NA	NA	NA	--	74,000	44,000	--	64,000	40,000
Chloride	mg/L	250*	NA	NA	NA	--	59	29	--	63	35
Fluoride	mg/L	4	NA	NA	NA	1.4	1.3	1.2	0.80	0.55	0.34
pH, Field	SU	6.5 - 8.5*	NA	NA	NA	7.41	7.4	7.45	7.39	7.32	7.54
Sulfate	mg/L	250*	NA	NA	NA	--	19	2.0	--	8.0	6.8
Total Dissolved Solids	mg/L	500*	NA	NA	NA	--	440	250	--	390	230
Appendix IV											
Antimony	ug/L	6	NA	2.0	6	< 2.0	--	--	< 2.0	--	--
Arsenic	ug/L	10	NA	32	**32**	15	< 5.0	7.9	< 5.0	< 5.0	< 5.0
Barium	ug/L	2,000	NA	150	2,000	74	39	24	22	26	15
Beryllium	ug/L	4	NA	1.0	4	< 1.0	--	--	< 1.0	--	--
Cadmium	ug/L	5	NA	1.0	5	< 1.0	--	--	< 1.0	--	--
Chromium	ug/L	100	NA	2.0	100	< 2.0	--	--	< 2.0	--	--
Cobalt	ug/L	NC	6	23	23	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Fluoride	mg/L	4	NA	1.3	4	1.4	1.3	1.2	0.80	0.55	0.34
Lead	ug/L	NC	15	1.0	15	< 1.0	--	--	< 1.0	--	--
Lithium	ug/L	NC	40	34	**40**	**45**	28	27	15	11	< 8.0
Mercury	ug/L	2	NA	0.20	2	< 0.20	--	--	< 0.20	--	--
Molybdenum	ug/L	NC	100	22	100	6.1	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	0.398	0.257	0.326	0.145	0.32	0.234
Radium-226/228	pCi/L	5	NA	2.83	5	0.638	< 0.592	0.884	0.413	< 0.465	0.978
Radium-228	pCi/L	NC	NA	NA	NA	< 0.343	< 0.592	< 0.600	< 0.399	< 0.465	0.744
Selenium	ug/L	50	NA	5.0	50	< 5.0	--	--	< 5.0	--	--
Thallium	ug/L	2	NA	1.0	2	< 1.0	--	--	< 1.0	--	--

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

NC - no criteria.

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Table 4
Summary of Groundwater Protection Standard Exceedances – May 2018
River Rouge Power Plant Bottom Ash Basin – RCRA CCR Monitoring Program
River Rouge, Michigan

Appendix IV	Units	GWPS	**MW-16-01**		**MW-16-02**		**MW-16-03**	
			LCL	UCL	LCL	UCL	LCL	UCL
Arsenic	ug/L	32	35	170	NA	NA	4.0	17
Lithium	ug/L	40	47	52	41	70	11	51

Notes:

ug/L - micrograms per liter.

NA - not applicable.

GWPS - Groundwater Protection Standard.

UCL - Upper Confidence Limit (99%) of the downgradient data set.

LCL - Lower Confidence Limit (99%) of the downgradient data set.

🟩 Indicates a statistically significant exceedance of the GWPS. An exceedance occurs when the LCL exceeds the GWPS.

Table 5
Summary of Groundwater Protection Standard Exceedances – October 2018
River Rouge Power Plant Bottom Ash Basin – RCRA CCR Monitoring Program
River Rouge, Michigan

Appendix IV	Units	GWPS	MW-16-01		MW-16-02		MW-16-03	
			LCL	UCL	LCL	UCL	LCL	UCL
Arsenic	ug/L	32	36	170	NA	NA	NA	NA
Lithium	ug/L	40	37	65	9.7	66	-19	54

Notes:

ug/L - micrograms per liter.

NA - not applicable.

GWPS - Groundwater Protection Standard.

UCL - Upper Confidence Limit (99%) of the downgradient data set.

LCL - Lower Confidence Limit (99%) of the downgradient data set.

🟩 Indicates a statistically significant exceedance of the GWPS. An exceedance occurs when the LCL exceeds the GWPS.

Table 6
Summary of Nature and Extent Analytical Data – October 2018
River Rouge Power Plant Bottom Ash Basin – RCRA CCR Monitoring Program
River Rouge, Michigan

					Sample Location:	**MW-16-04S**	**MW-17-05**	**MW-17-13**	**MW-17-14**	**MW-17-15**	**MW-17-18**	**MW-17-20**
					Sample Date:	10/16/2018	10/15/2018	10/16/2018	10/16/2018	10/16/2018	10/15/2018	10/16/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	N&E Wells						
Appendix III												
Boron	ug/L	NC	NA	NA	NA	530	290	--	1,900	1,900	410	550
Calcium	ug/L	NC	NA	NA	NA	180,000	70,000	--	100,000	140,000	240,000	330,000
Chloride	mg/L	250*	NA	NA	NA	870	71	--	80	190	580	660
Fluoride	mg/L	4	NA	NA	NA	0.62	0.64	--	0.48	1.2	0.40	0.51
pH, Field	SU	6.5 - 8.5*	NA	NA	NA	6.92	7.24	6.85	6.94	6.91	6.80	6.73
Sulfate	mg/L	250*	NA	NA	NA	57	12	--	11	14	170	650
Total Dissolved Solids	mg/L	500*	NA	NA	NA	1,800	420	--	690	840	1,500	2,300
Appendix IV												
Antimony	ug/L	6	NA	2.0	6	--	--	--	--	--	--	--
Arsenic	ug/L	10	NA	32	**32**	< 5.0	< 5.0	< 5.0	< 5.0	**34**	< 5.0	< 5.0
Barium	ug/L	2,000	NA	150	2,000	130	20	--	120	350	190	100
Beryllium	ug/L	4	NA	1.0	4	--	--	--	--	--	--	--
Cadmium	ug/L	5	NA	1.0	5	--	--	--	--	--	--	--
Chromium	ug/L	100	NA	2.0	100	--	--	--	--	--	--	--
Cobalt	ug/L	NC	6	23	23	< 1.0	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0
Fluoride	mg/L	4	NA	1.3	4	0.62	0.64	--	0.48	1.2	0.40	0.51
Lead	ug/L	NC	15	1.0	15	--	--	--	--	--	--	--
Lithium	ug/L	NC	40	34	**40**	24	13	< 8.0	**45**	**77**	22	32
Mercury	ug/L	2	NA	0.20	2	--	--	--	--	--	--	--
Molybdenum	ug/L	NC	100	22	100	< 5.0	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA	0.954	0.346	--	0.454	0.890	1.06	1.10
Radium-226/228	pCi/L	5	NA	2.83	5	1.42	< 0.450	--	0.906	1.98	2.31	2.27
Radium-228	pCi/L	NC	NA	NA	NA	< 0.475	< 0.450	--	0.452	1.09	1.25	1.17
Selenium	ug/L	50	NA	5.0	50	--	--	--	--	--	--	--
Thallium	ug/L	2	NA	1.0	2	--	--	--	--	--	--	--

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

NA - not applicable.

NC - no criteria.

-- - not analyzed.

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

RSL - Regional Screening Level from 83 FR 36435.

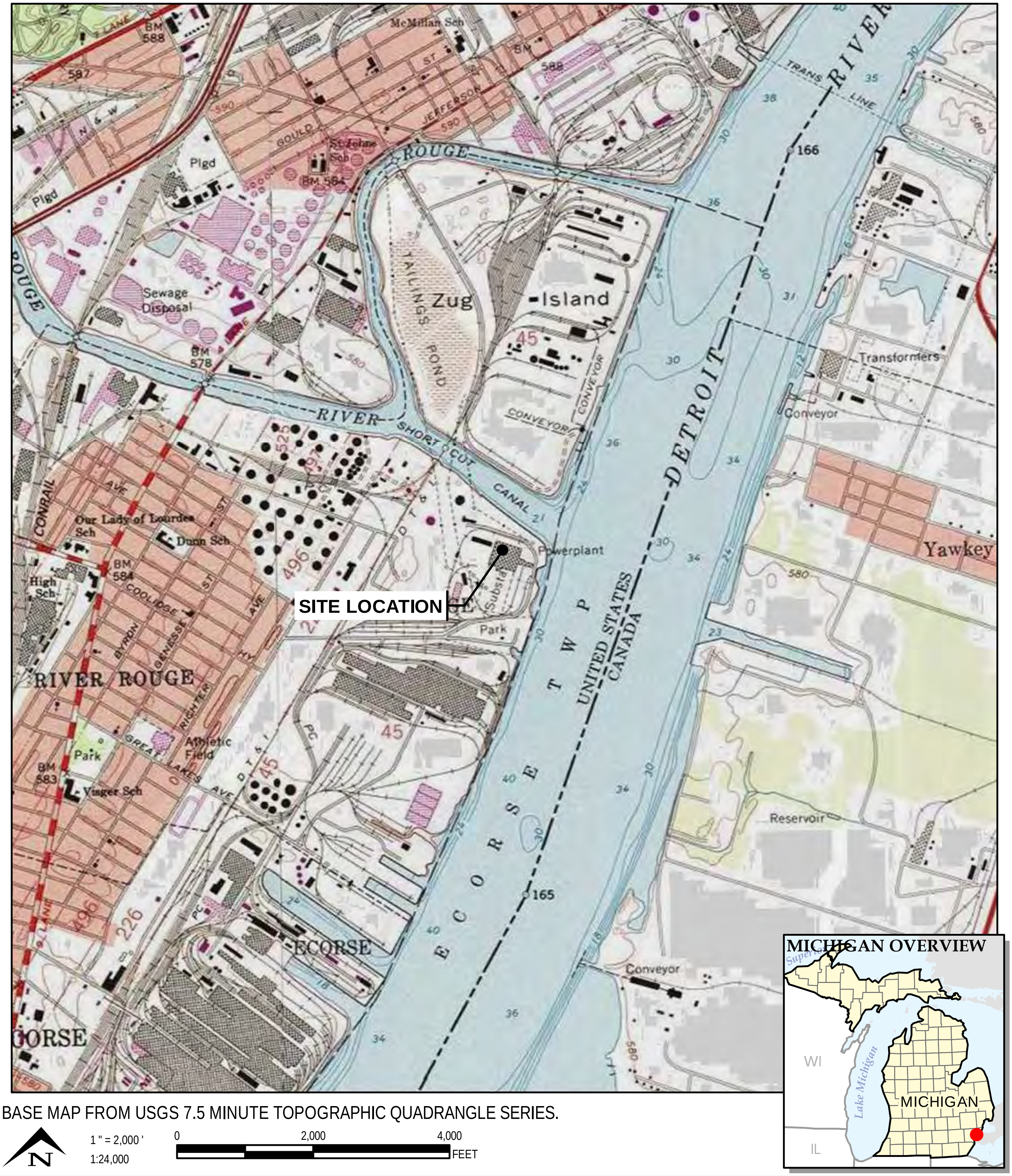
UTL - Upper Tolerance Limit (95%) of the background data set.

GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL.

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

Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.

Figures


SITE LOCATION
Zug
Island
TAILINGS POND
ROUGE
RIVER
SHORT CUT CANAL
DETROIT
RIVER
UNITED STATES
CANADA
ECORSE TWP
Powerplant
Substa
Park
RIVER ROUGE
ECORSE
Sewage Disposal
Plgd
St Johns Sch
McMillan Sch
Our Lady of Lourdes Sch
Dunn Sch
High Sch
Visger Sch
Athletic Field
Park
CONRAIL
JEFFERSON
GOULD
COOLIDGE
BYRON
GENESSEE
RICHTER
GREAT LAKES AVE
CONVEYOR
Conveyor
Transformers
Yawkey
Reservoir
TRANS LINE
166
165
MICHIGAN OVERVIEW
Superior
WI
IL
Lake Michigan
MICHIGAN
N
1 " = 2,000 '
1:24,000
0
2,000
4,000
FEET

BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

TRC

1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080

TRC - GIS

PROJECT:	**DTE ELECTRIC COMPANY RIVER ROUGE POWER PLANT 1 BELANGER PARK DRIVE RIVER ROUGE, MICHIGAN**
TITLE:	**SITE LOCATION MAP**

DRAWN BY:	J. PAPEZ
CHECKED BY:	S HOLMSTROM
APPROVED BY:	V. BUENING
DATE:	OCTOBER 2017
PROJ. NO.:	265996.0005
FILE:	265996-SLMMB.mxd

FIGURE 1

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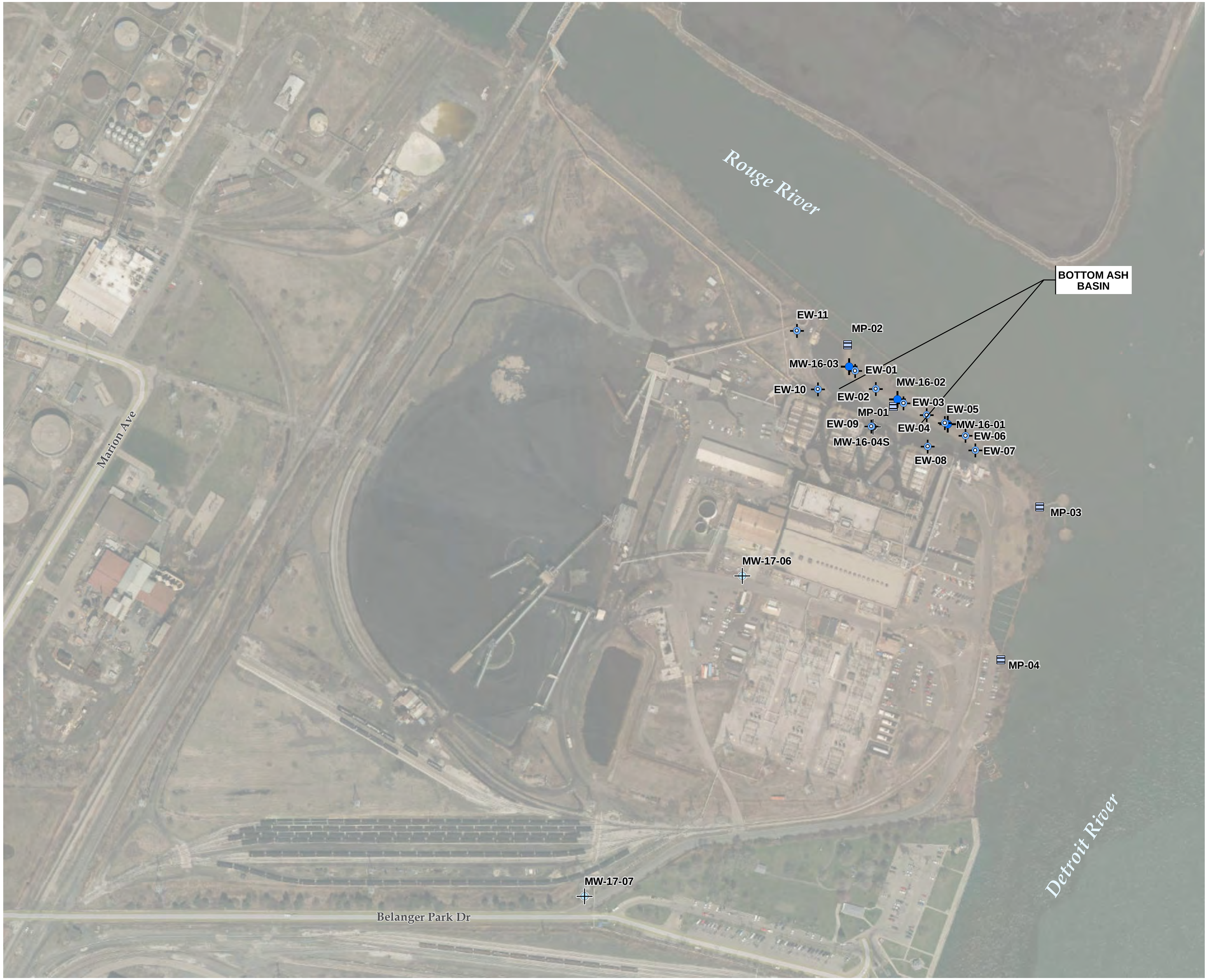
Rouge River
BOTTOM ASH BASIN
EW-11
MP-02
MW-16-03
EW-01
EW-10
EW-02
MW-16-02
EW-03
MP-01
EW-05
EW-09
EW-04
MW-16-01
MW-16-04S
EW-06
EW-08
EW-07
MP-03
MW-17-06
MP-04
Marion Ave
MW-17-07
Belanger Park Dr
Detroit River

LEGEND

- ✦ DOWNGRADIENT MONITORING WELLS
- ✦ MONITORING WELLS (STATIC WATER LEVEL ONLY)
- ✛ BACKGROUND MONITORING WELL
- ▤ MONITORING POINT
- ⊕ EXTRACTION WELL

NOTES

1. BASE MAP IMAGERY FROM ESRI/MICROSOFT, “WORLD IMAGERY”, WEB BASEMAP SERVICE LAYER.
2. WELL LOCATIONS SURVEYED BY BMJ ENGINEERS AND SURVEYORS INC. IN JUNE 2016 & JUNE 2017.

N

0 300 600 Feet

1 " = 300 '

1:3,600

PROJECT:

DTE ELECTRIC COMPANY
RIVER ROUGE POWER PLANT BOTTOM ASH BASIN
1 BELANGER PARK DRIVE
RIVER ROUGE, MICHIGAN

TITLE:

MONITORING NETWORK AND SITE PLAN

DRAWN BY:	B. DEEGAN	PROJ NO.:	265996.0005.0000
CHECKED BY:	C. SCIESZKA		
APPROVED BY:	V. BUENING	**FIGURE 2**	
DATE:	JANUARY 2019		

TRC

1540 Eisenhower Place
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www.trcsolutions.com

FILE NO.: 265996-0005-030.mxd

TRC - GIS

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

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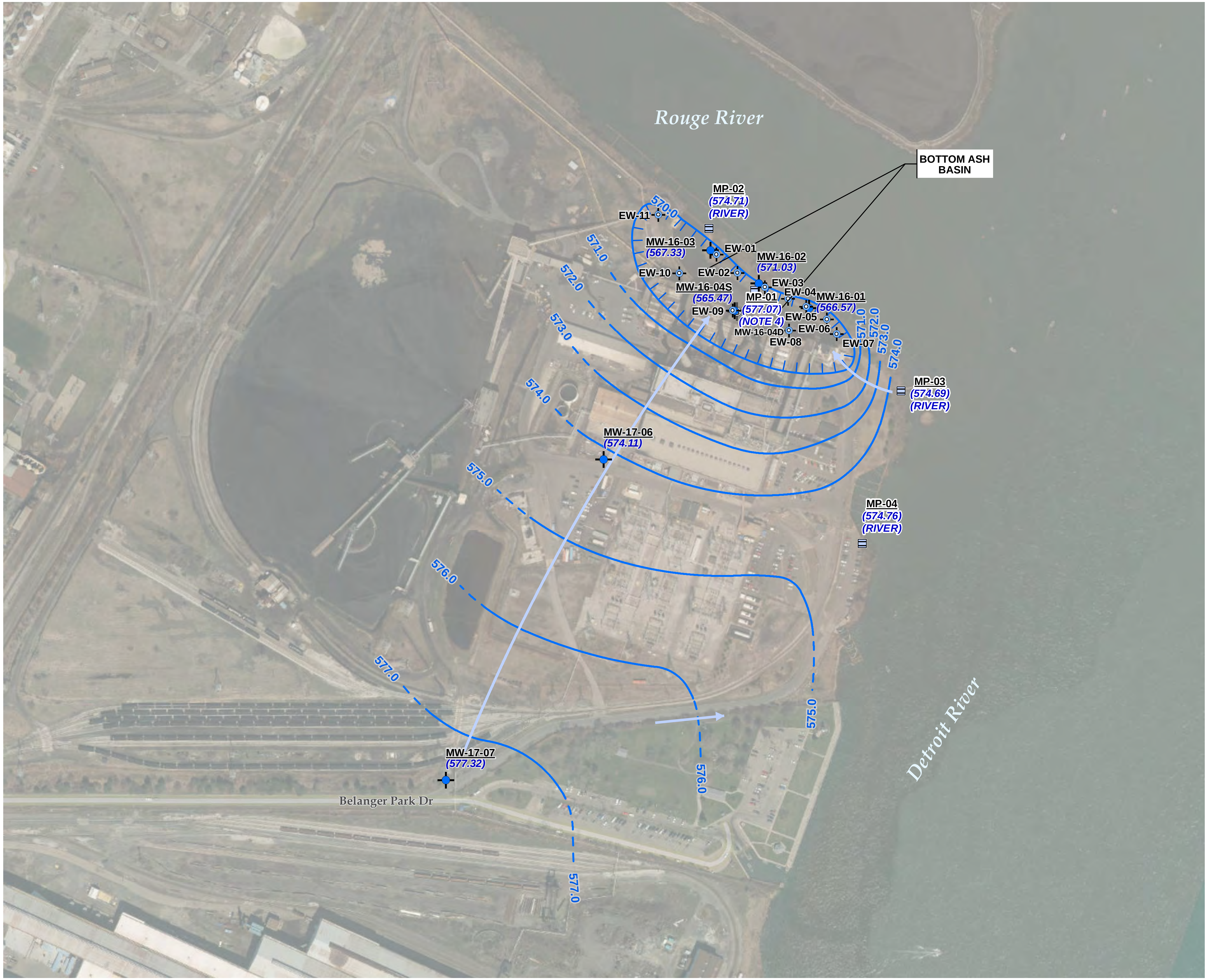
Rouge River
BOTTOM ASH BASIN
MP-02
(574.71)
(RIVER)
EW-11
570.0
571.0
572.0
573.0
574.0
575.0
576.0
577.0
MW-16-03
(567.33)
EW-01
MW-16-02
(571.03)
EW-10
EW-02
MW-16-04S
(565.47)
EW-03
EW-04
MW-16-01
(566.57)
MP-01
(577.07)
(NOTE 4)
EW-09
EW-05
EW-06
MW-16-04D
EW-08
EW-07
571.0
572.0
573.0
574.0
MP-03
(574.69)
(RIVER)
MW-17-06
(574.11)
MP-04
(574.76)
(RIVER)
575.0
576.0
MW-17-07
(577.32)
577.0
Belanger Park Dr
Detroit River

LEGEND

▤	MONITORING POINT
✦	UPPERMOST AQUIFER MONITORING WELLS
⊕	BEDROCK MONITORING WELL
⊙	EXTRACTION WELL
∼	GROUNDWATER CONTOUR (1' INTERVAL, DASHED WHERE INFERRED)
→	INFERRED GROUNDWATER FLOW DIRECTION
(575.25)	ELEVATION FT (NAVD 88)

NOTES

1. BASE MAP IMAGERY FROM ESRI/MICROSOFT, "WORLD IMAGERY", WEB BASEMAP SERVICE LAYER.
2. WELL LOCATIONS SURVEYED BY BMJ ENGINEERS AND SURVEYORS INC. IN JUNE 2016 & JUNE 2017.
3. GROUNDWATER ELEVATIONS DISPLAYED IN FEET RELATIVE TO NORTH AMERICAN VERTICAL DATUM OF 1988.
4. ELEVATION REPRESENTATIVE OF BOTTOM ASH BASIN SURFACE WATER ELEVATION NOT GROUNDWATER ELEVATION.

N

0 300 600
Feet

1 " = 300 '
1:3,600

PROJECT:
DTE ELECTRIC COMPANY
RIVER ROUGE POWER PLANT BOTTOM ASH BASIN
1 BELANGER PARK DRIVE
RIVER ROUGE, MICHIGAN

TITLE:
GROUNDWATER POTENTIOMETRIC
SURFACE MAP
APRIL 2018

DRAWN BY:	S. MAJOR	PROJ NO.:	265996.0005.0000
CHECKED BY:	C. SCIESZKA		FIGURE 3
APPROVED BY:	V. BUENING		
DATE:	JANUARY 2019		

TRC

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FILE NO.: 265996-0005-028.mxd

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

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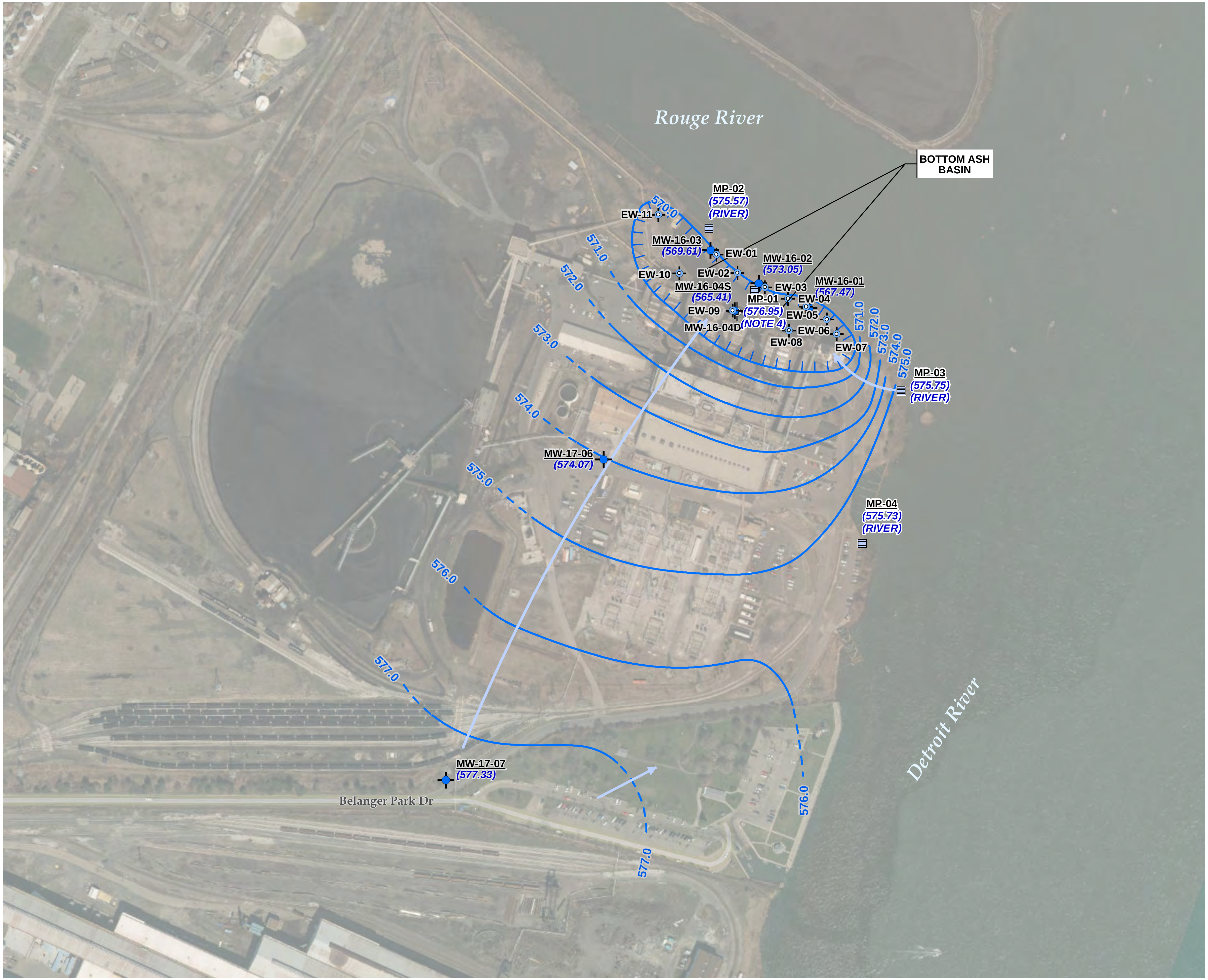
Rouge River
Detroit River
Belanger Park Dr
BOTTOM ASH BASIN
MP-02
(575.57)
(RIVER)
EW-11
MW-16-03
(569.61)
EW-01
MW-16-02
(573.05)
EW-10
EW-02
MW-16-04S
(565.41)
EW-03
MW-16-01
(567.47)
MP-01
(576.95)
(NOTE 4)
EW-04
EW-09
EW-05
MW-16-04D
EW-06
EW-08
EW-07
MP-03
(575.75)
(RIVER)
MW-17-06
(574.07)
MP-04
(575.73)
(RIVER)
MW-17-07
(577.33)
570.0
571.0
572.0
573.0
574.0
575.0
576.0
577.0

LEGEND

▤	MONITORING POINT
✦	UPPERMOST AQUIFER MONITORING WELLS
Ⓑ	BEDROCK MONITORING WELL
⊙	EXTRACTION WELL
∼	GROUNDWATER CONTOUR (1' INTERVAL, DASHED WHERE INFERRED)
→	INFERRED GROUNDWATER FLOW DIRECTION
(575.25)	ELEVATION FT (NAVD 88)

NOTES

1. BASE MAP IMAGERY FROM ESRI/MICROSOFT, "WORLD IMAGERY", WEB BASEMAP SERVICE LAYER.
2. WELL LOCATIONS SURVEYED BY BMJ ENGINEERS AND SURVEYORS INC. IN JUNE 2016 & JUNE 2017.
3. GROUNDWATER ELEVATIONS DISPLAYED IN FEET RELATIVE TO NORTH AMERICAN VERTICAL DATUM OF 1988.
4. ELEVATION REPRESENTATIVE OF BOTTOM ASH BASIN SURFACE WATER ELEVATION NOT GROUNDWATER ELEVATION.

N

0 300 600
Feet

1 " = 300 '
1:3,600

PROJECT:
DTE ELECTRIC COMPANY
RIVER ROUGE POWER PLANT BOTTOM ASH BASIN
1 BELANGER PARK DRIVE
RIVER ROUGE, MICHIGAN

TITLE:

GROUNDWATER POTENTIOMETRIC SURFACE MAP
MAY 2018

DRAWN BY:	S. MAJOR	PROJ NO.:	265996.0005.0000
CHECKED BY:	C. SCIESZKA		FIGURE 4
APPROVED BY:	V. BUENING		
DATE:	JANUARY 2019		

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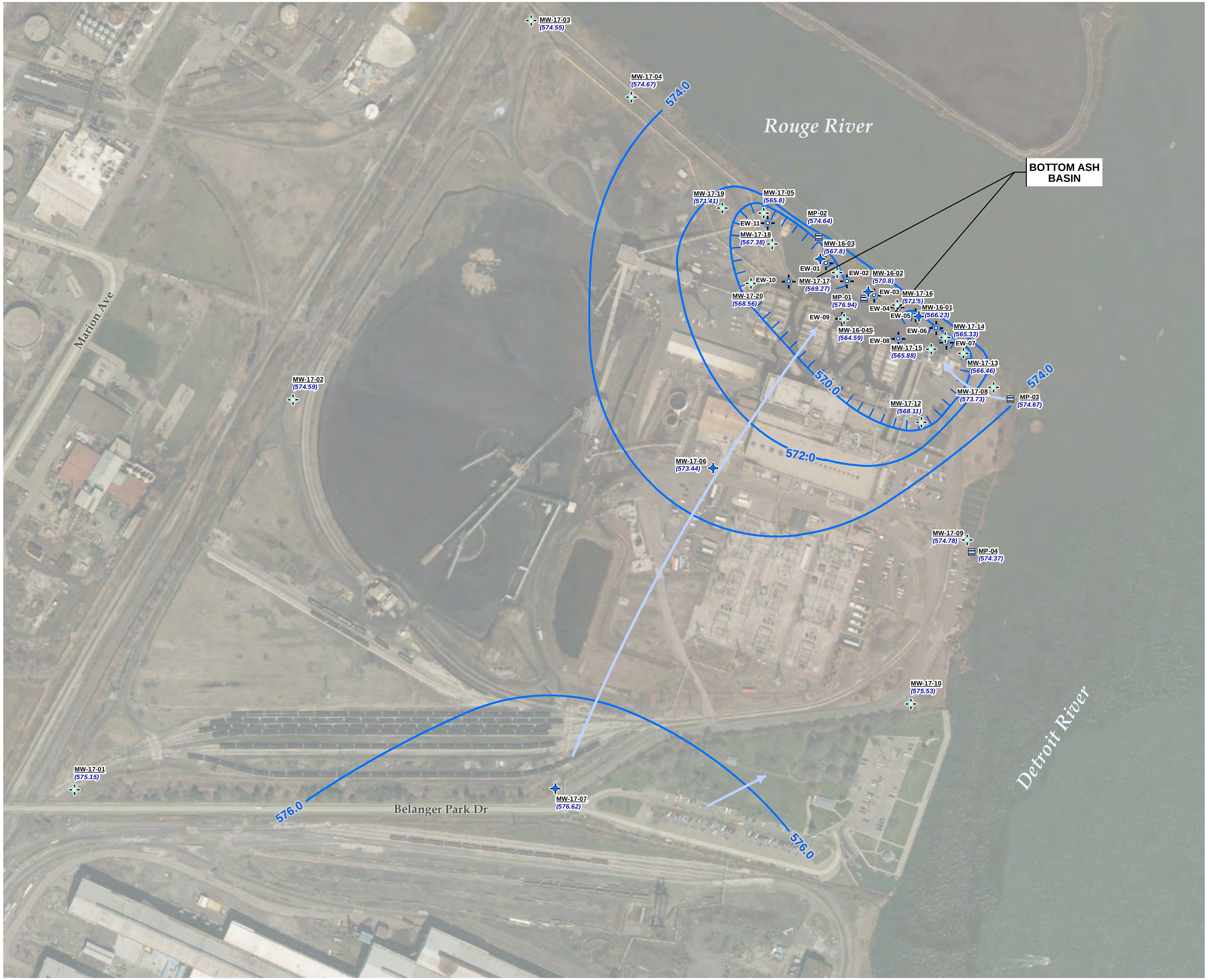

Rouge River
Detroit River
Marion Ave
Belanger Park Dr
BOTTOM ASH BASIN
MW-17-03 (574.55)
MW-17-04 (574.67)
574.0
MW-17-19 (571.41)
MW-17-05 (565.8)
EW-11
MP-02 (574.64)
MW-17-18 (567.38)
MW-16-03 (567.8)
EW-01
EW-02
MW-16-02 (570.8)
EW-10
MW-17-17 (569.27)
MW-17-20 (568.56)
MP-01 (576.94)
EW-03
MW-17-16 (571.5)
EW-04
MW-16-01 (566.23)
EW-05
EW-09
MW-16-04S (564.59)
EW-06
MW-17-14 (565.33)
EW-08
EW-07
MW-17-15 (565.88)
MW-17-13 (566.46)
570.0
574.0
MW-17-08 (573.73)
MP-03 (574.67)
MW-17-12 (568.11)
MW-17-02 (574.59)
572.0
MW-17-06 (573.44)
MW-17-09 (574.78)
MP-04 (574.37)
MW-17-10 (575.53)
MW-17-01 (575.15)
576.0
MW-17-07 (576.62)
576.0

LEGEND

- ✦ COMPLIANCE WELLS
- ▤ MONITORING POINT
- ✦ NATURE AND EXTENT WELLS
- ⊕ EXTRACTION WELL
- ∼ GROUNDWATER CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- → INFERRED GROUNDWATER FLOW DIRECTION
- *(575.25)* ELEVATION FT (NAVD 88)

NOTES

1. BASE MAP IMAGERY FROM ESRI/MICROSOFT, "WORLD IMAGERY", WEB BASEMAP SERVICE LAYER.
2. WELL LOCATIONS SURVEYED BY BMJ ENGINEERS AND SURVEYORS INC. IN JUNE 2016 & JUNE 2017.
3. GROUNDWATER ELEVATIONS DISPLAYED IN FEET RELATIVE TO NORTH AMERICAN VERTICAL DATUM OF 1988.
4. ELEVATION REPRESENTATIVE OF BOTTOM ASH BASIN SURFACE WATER ELEVATION NOT GROUNDWATER ELEVATION.

N

0 300 600
Feet
1 " = 300 '
1:3,600

PROJECT:
DTE ELECTRIC COMPANY
RIVER ROUGE POWER PLANT BOTTOM ASH BASIN
1 BELANGER PARK DRIVE
RIVER ROUGE, MICHIGAN

TITLE:
GROUNDWATER POTENTIOMETRIC
SURFACE MAP
OCTOBER 2018

DRAWN BY:	S. MAJOR	PROJ NO.:	265996.0005.0000
CHECKED BY:	C. SCIESZKA		**FIGURE 5**
APPROVED BY:	V. BUENING		
DATE:	JANUARY 2019		

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FILE NO.: 265996-0005-032.mxd

Plot Date: 1/28/2019, 15:23:42 PM by SMAJOR -- LAYOUT: ANSI B(11"x17")
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Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

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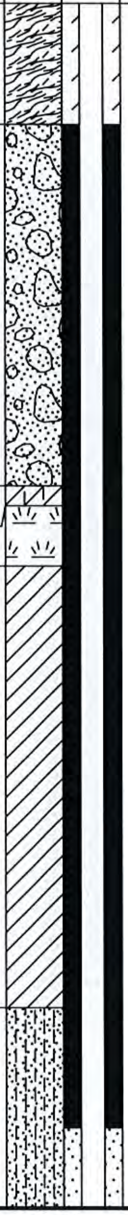
Appendix A
Groundwater Extraction Well and Nature & Extent Monitoring Well Soil Boring and Well Logs

WELL CONSTRUCTION LOG

WELL NO. MW-17-01

Page 1 of 2

Facility/Project Name: DTE Electric Company River Rouge Power Plant		Date Drilling Started: 6/7/17	Date Drilling Completed: 6/7/17	Project Number: 277472.0000.0000
Drilling Firm: Stearns Drilling	Drilling Method: Direct Push/Hollow Stem Auger	Surface Elev. (ft) 578.8	TOC Elevation (ft) 578.47	Total Depth (ft bgs) 25.0 Borehole Dia. (in) 8/3.75/2
Boring Location: SW corner of property, in grassy area adjacent to DTE power plant sign. N: 283333.66 E: 13460427.96		Personnel Logged By - C. Scieszka Driller - G. Geerligs		Drilling Equipment: Geoprobe 7822DT
Civil Town/City/or Village: River Rouge	County: Wayne	State: Michigan	Water Level Observations: While Drilling: Date/Time 6/7/17 00:00 ▽ Depth (ft bgs) 2.5 After Drilling: Date/Time 6/15/17 16:50 ▼ Depth (ft bgs) 3.85	



SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	PID (PPM)	COMMENTS
1 GP	100			**TOPSOIL** mostly fine to medium sand, little silt, dark brown (10YR 3/3), no odor, dry, medium dense.		<1	Soil sample collected (0-2') at 1030.
			2 ▽ 4 ▼	**GRAVEL WITH SAND** mostly fine to coarse gravel, little fine to coarse sand, very dark gray (10YR 3/1), no odor, dry, dense, little fine to coarse slag and coal fragments present. Change to saturated at 2.5 feet.	GW		
			6	Change to crushed rock-like material, white (10YR 8/1) with moderate reddish brown staining, no odor, saturated, dense at 5.8 to 6.0 feet, wood chips present at 6.0 feet.	CL-ML		
2 GP	80			**SILTY CLAY** mostly clay, little to some silt, low plasticity, dark gray (10YR 4/1), no odor, medium stiff, moist.			
			8	**PEAT** high organic content, black (10YR 2/1), slight natural odor, moist, stiff.			
			10 12	**CLAY** mostly clay, trace silt, medium plasticity, greenish gray (GLEY1 5/1), no odor, moist, soft. Change to greenish gray (GLEY1 5/1) with olive (5Y 5/4) mottles at 9.5 feet. Change to very soft at 11.0 feet.	CL		Hollow stem augers set at 10.0 feet below ground surface prior to drilling through confining clay unit.
3 GP	70		14	**SILTY SAND** mostly fine to medium sand, little to some silt, gray (10YR 5/1), no odor, saturated, medium dense.	SM		

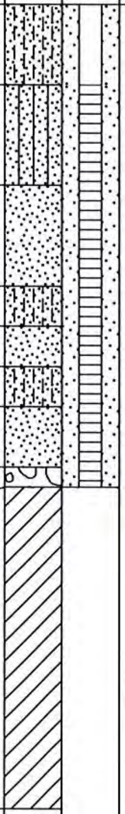
Signature:	Firm: TRC Environmental Corporation 1540 Eisenhower Place Ann Arbor, MI 48108 734.971.7080 Fax 734.971.9022

Checked By: T. Hess

WELL CONSTRUCTION LOG

WELL NO. MW-17-01

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	PID (PPM)	COMMENTS
					SM		
			16	**SANDY SILT** mostly silt, few to little fine to medium sand, trace clay, no to low plasticity, gray (10YR 5/1), no odor, saturated, stiff.	ML		
4 GP	100			2-inch thick interval of wood, dark brown, moist to saturated, no odor, dense at 17.0 feet.			
			18	**SAND** mostly fine to medium sand, gray (10YR 5/1), no odor, saturated, medium dense.	SP		
				SILTY SAND mostly fine to medium sand, little to some silt, trace clay, gray (10YR 5/1), no odor, saturated, loose, trace organic woody material.	SM		
				SAND mostly fine to medium sand, gray (10YR 5/1), no odor, saturated, medium dense.	SP		
			20	**SILTY SAND** mostly fine to medium sand, little to some silt, trace clay, gray (10YR 5/1), no odor, saturated, loose, trace organic woody material.	SM		
				SAND mostly medium to coarse sand, trace fine gravel, dark gray (10YR 4/1), no odor, saturated, loose, wood fragments present 20 to 20.25, shell present at 20.5 feet.	SP		
5 GP	90		22	Grades to **GRAVEL** mostly subrounded fine gravel, trace medium to coarse sand, color varies with grain, generally (10YR 4/1), no odor, saturated, loose.	GW		
			24	**CLAY** mostly clay, medium plasticity, gray (10YR 5/1), no odor, moist, soft to medium stiff.	CL		
				End of boring at 25.0 feet below ground surface.			
			26				
			28				
			30				
			32				
			34				



WELL CONSTRUCTION LOG

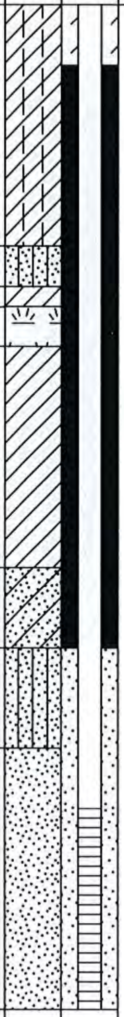
WELL NO. MW-17-02

Page 1 of 1

Facility/Project Name: DTE Electric Company River Rouge Power Plant	Date Drilling Started: 6/7/17	Date Drilling Completed: 6/7/17	Project Number: 277472.0000.0000
Drilling Firm: Stearns Drilling	Drilling Method: Direct Push/Hollow Stem Auger	Surface Elev. (ft): 578.4	TOC Elevation (ft): 581.24
Total Depth (ft bgs): 25.0	Borehole Dia. (in): 8/3.75		
Boring Location: E side of perimeter road, adjacent to W property boundary, approximately 35 feet E of property fence. N: 284560.52 E: 13461114.44	Personnel Logged By - C. Scieszka Driller - G. Geerligs	Drilling Equipment: Geoprobe 7822DT	
Civil Town/City/or Village: River Rouge	County: Wayne	State: Michigan	

Water Level Observations:
While Drilling: Date/Time 6/7/17 00:00 ▽ Depth (ft bgs) 6.0
After Drilling: Date/Time 6/8/17 11:10 ▼ Depth (ft bgs) 3.25

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET
1 GP	100		0–5
2 GP	80		5–10
3 GP	85		10–15
4 GP	90		15–20
5 GP	90		20–25



LITHOLOGIC DESCRIPTION	USCS	PID (PPM)	COMMENTS
SILTY CLAY mostly clay, some silt, trace coarse sand to fine gravel, low plasticity, brown (10YR 4/3), no odor, dry, very stiff.	CL-ML	<1 <1 <1	Soil sample collected (3-5') at 1430.
SANDY SILT mostly silt, some fine sand, non plastic, gray (10YR 5/1) with black mottles (10YR 2/1), no odor, saturated, very stiff.	ML		
Grades to **CLAY** mostly clay, trace silt, trace fine sand, gray (10YR 5/1), no odor, moist, soft.	CL		
PEAT high organic content, woody, dark brown (10YR 3/3), no odor, dry to moist, medium dense.			
CLAY mostly clay, trace silt, medium plasticity, greenish gray (GLEY1 5/1) with olive (5Y 5/4) mottles, no odor, moist, soft to medium stiff.	CL		Hollow stem augers set at 10.0 feet below ground surface prior to drilling through confining clay unit.
Grades to **SANDY CLAY** mostly clay, little to some fine to medium sand, low to medium plasticity, gray (10YR 5/1), no odor, saturated, soft.	CL		
Grades to **SANDY SILT** mostly silt, little to some fine to medium sand, trace clay, no to low plasticity, gray (10YR 5/1), no odor, saturated, soft to stiff.	ML		
SAND mostly fine to medium sand, trace to few silt, gray (10YR 5/1), with yellowish brown (10YR 5/6) mottles, no odor, saturated, medium dense to dense. Change to no silt, dark gray (10YR 4/1) at 20.0 feet.	SP		
End of boring at 25.0 feet below ground surface.			

Signature: Chris Scieszka	Firm: TRC Environmental Corporation 1540 Eisenhower Place Ann Arbor, MI 48108	734.971.7080 Fax 734.971.9022

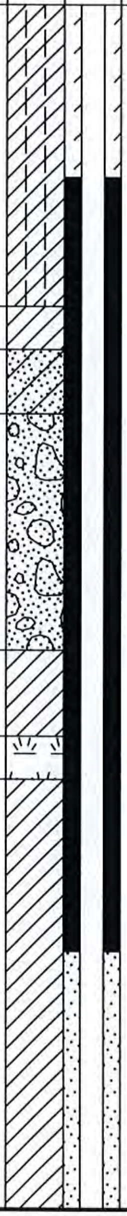
Checked By: T. Hess

WELL CONSTRUCTION LOG

WELL NO. MW-17-03

Page 1 of 2

Facility/Project Name: DTE Electric Company River Rouge Power Plant		Date Drilling Started: 6/8/17	Date Drilling Completed: 6/8/17	Project Number: 277472.0000.0000
Drilling Firm: Stearns Drilling	Drilling Method: Direct Push/Hollow Stem Auger	Surface Elev. (ft) 577.2	TOC Elevation (ft) 580.20	Total Depth (ft bgs) 25.0 Borehole Dia. (in) 8/3.75
Boring Location: NW corner of property, in grassy area adjacent to above ground coke gas pipeline. N: 285753.35 E: 13461863.58		Personnel Logged By - C. Scieszka Driller - G. Geerligs		Drilling Equipment: Geoprobe 7822DT
Civil Town/City/or Village: River Rouge	County: Wayne State: Michigan	Water Level Observations: While Drilling: Date/Time 6/8/17 00:00 ▽ Depth (ft bgs) 2.5 After Drilling: Date/Time 6/8/17 11:05 ▼ Depth (ft bgs) 2.11		



SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	PID (PPM)	COMMENTS
1 GP	90		2	**SILTY CLAY** mostly clay, little to some silt, trace fine to coarse gravel, trace fine to coarse sand, no to low plasticity, dark brown (10YR 3/3) to black (10YR 2/1), no odor, dry, medium stiff. ▼ ▽ Change to saturated at 2.5 feet.	CL-ML	<1	Soil sample collected (0-2') at 0833.
			4	**CLAY** mostly clay, trace silt, low to medium plasticity, gray (10YR 5/1), no odor, moist, medium stiff.	CL		
				SANDY CLAY mostly clay, little to some fine to medium sand, low plasticity, black (10YR 2/1), slight petroleum-like odor, saturated, stiff, slight metallic-like greasy sheen coating grains.	CL		
2 GP	100		6	**GRAVEL WITH SAND** mostly rounded fine gravel, little medium to coarse sand, trace silt, dark grayish brown (10YR 4/2), slight petroleum-like odor, saturated, medium dense to dense, slight metallic-like greasy sheen coating grains 4.75 to 5.0 feet. Change to no odor, no sheen at 5.0 feet.	GP		
			8	**CLAY** mostly clay, little to some sand, low to medium plasticity, dark gray (10YR 4/1), no odor, moist, soft to medium stiff.	CL		
				PEAT high organic content, woody, dark brown (10YR 3/3), no odor, dry to moist, medium dense.			
3 GP	60		10 12	**CLAY** mostly clay, trace silt, medium plasticity, greenish gray (GLEY1 5/1) with olive (5Y 5/4) mottles, no odor, moist, soft to medium stiff. Change to brown (10YR 5/3) with gray (10YR 5/1) mottles, stiff at 10.0 feet.	CL		Hollow stem augers set at 10.0 feet below ground surface prior to drilling through confining clay unit.

Signature:

Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, MI 48108
734.971.7080
Fax 734.971.9022

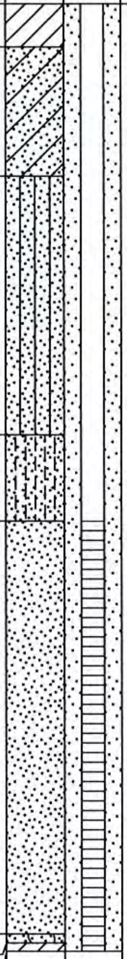
Checked By: T. Hess

WELL CONSTRUCTION LOG

WELL NO. MW-17-03

Page 2 of 2

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	PID (PPM)	COMMENTS
					CL				
4 GP	100			Grades to **SANDY CLAY** mostly clay, little to some fine to medium sand, low to medium plasticity, gray (10YR 5/1), no odor, moist, soft.	CL				
			16	Grades to **SANDY SILT** mostly silt, little to some fine to medium sand, trace clay, no to low plasticity, grayish brown (10YR 5/2), no odor, saturated, soft to stiff.	ML				
			18						
				SILTY SAND mostly fine to medium sand, little to some silt, dark gray (10YR 4/1), no odor, saturated, medium dense to dense, wood fragments present at 20.0 feet.	SM				
5 GP	90		20	**SAND** mostly medium to coarse sand, generally dark gray (10YR 4/1), no odor, saturated, medium dense.	SP				
			22						
			24						
				GRAVEL WITH SAND mostly subrounded to rounded fine gravel, few to little medium to coarse sand, generally dark gray (10YR 4/1), no odor, saturated, medium dense, wood fragments present.	GP				
			26	**CLAY** mostly clay, medium plasticity, gray (10YR 5/1), no odor, moist, soft to medium stiff.	CL				
				End of boring at 25.0 feet below ground surface.					
			28						
			30						
			32						



WELL CONSTRUCTION LOG

WELL NO. MW-17-04

Page 1 of 1

Facility/Project Name: DTE Electric Company River Rouge Power Plant		Date Drilling Started: 6/8/17		Date Drilling Completed: 6/8/17	Project Number: 277472.0000.0000
Drilling Firm: Stearns Drilling	Drilling Method: Direct Push/Hollow Stem Auger	Surface Elev. (ft) 578.3	TOC Elevation (ft) 578.01	Total Depth (ft bgs) 25.0	Borehole Dia. (in) 8/3.75

Boring Location: N side of perimeter road, immediately adjacent to concrete barrier at N property boundary, W of ash basins.

N: 285513.07 E: 13462179.29

Personnel
Logged By - C. Scieszka
Driller - G. Geerligs

Drilling Equipment: Geoprobe 7822DT

Civil Town/City/or Village: River Rouge

County: Wayne

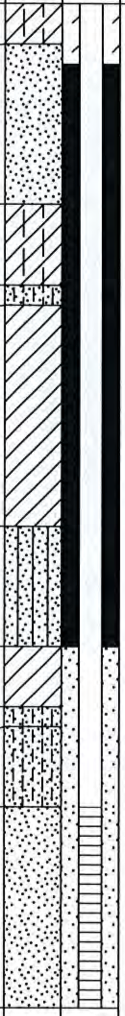
State: Michigan

Water Level Observations:
While Drilling: Date/Time 6/8/17 00:00 ∇ Depth (ft bgs) 3.0
After Drilling: Date/Time 6/15/17 17:00 ▼ Depth (ft bgs) 3.15

SAMPLE Number and Type	Recovery (%)	Blow Counts	Depth in Feet
1 GP	70		0–5
2 GP	50		5–10
3 GP	90		10–15
4 GP	90		15–20
5 GP	10		20–25

Lithologic Description	USCS	PID (PPM)	Comments
SILTY CLAY mostly clay, little to some silt, trace fine to coarse gravel, trace fine to coarse sand, low plasticity, yellowish brown (10YR 5/6), no odor, dry, very stiff.	CL-ML	<1	Soil sample collected (0-2') at 1232.
SAND mostly fine to coarse sand, trace to few fine to coarse gravel, yellowish brown (10YR 5/6), no odor, dry, medium dense to dense. Change to saturated at 3.0 feet.	SW		
SILTY CLAY mostly clay, little to some silt, low plasticity, black (10YR 2/1), no odor, moist, medium stiff.	CL-ML		
SILTY SAND mostly fine to medium sand, little silt, few fine gravel, very dark gray (10YR 3/1), no odor, saturated, medium dense.	SM		
CLAY mostly clay, trace silt, medium plasticity, greenish gray (GLEY1 5/1) with olive (5Y 5/4) mottles, no odor, moist, soft to medium stiff. 1-inch thick interval of peat, high organic content, woody, dark brown (10YR 3/3), no odor, dry to moist, medium dense at 9.0 feet.	CL		Hollow stem augers set at 10.0 feet below ground surface prior to drilling through confining clay unit.
1-inch thick interval of peat, high organic content, woody, dark brown (10YR 3/3), no odor, dry to moist, medium dense at 10.0 feet. Grades to **SANDY SILT** mostly silt, little to some fine to medium sand, trace clay, no to low plasticity, gray (10YR 5/1) with yellowish brown (10YR 5/6) mottles, no odor, saturated, soft to medium stiff.	ML		
CLAY mostly clay, trace to few silt, trace to few fine to medium sand, medium plasticity, gray (10YR 5/1) with yellowish brown (10YR 5/6) mottles, no odor, moist, medium stiff.	CL		
SANDY SILT mostly silt, little to some fine to medium sand, trace clay, no to low plasticity, gray (10YR 5/1) with yellowish brown (10YR 5/6) mottles, no odor, saturated, soft to medium stiff.	SM		
SAND WITH SILT mostly fine to medium sand, few to little silt, dark gray (10YR 5/1), no odor, saturated, medium dense. 1-inch thick interval of wood fragments at 19.0 feet.	SM		
SAND mostly medium to coarse sand, generally dark gray (10YR 4/1), no odor, saturated, medium dense.	SP		

End of boring at 25.0 feet below ground surface.



Signature:

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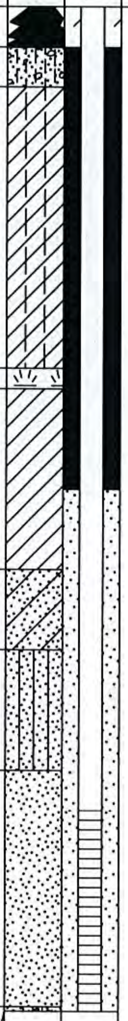
WELL CONSTRUCTION LOG

WELL NO. MW-17-05

Page 1 of 1

Facility/Project Name: DTE Electric Company River Rouge Power Plant		Date Drilling Started: 6/9/17	Date Drilling Completed: 6/9/17	Project Number: 277472.0000.0000	
Drilling Firm: Stearns Drilling	Drilling Method: Direct Push/Hollow Stem Auger	Surface Elev. (ft) 578.7	TOC Elevation (ft) 581.61	Total Depth (ft bgs) 25.0	Borehole Dia. (in) 3.75/2
Boring Location: N of coal hopper conveyor, W of ash basins. N: 285148.09 E: 13462595.42		Personnel Logged By - C. Scieszka Driller - G. Geerligs		Drilling Equipment: Geoprobe 7822DT	
Civil Town/City/or Village: River Rouge	County: Wayne	State: Michigan	Water Level Observations: While Drilling: Date/Time 6/9/17 00:00 ▽ Depth (ft bgs) 14.0 After Drilling: Date/Time 6/15/17 17:05 ▼ Depth (ft bgs) 2.84		



SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	PID (PPM)	COMMENTS
1 GP	100			**COAL AND SAND** mostly crushed coal, few to little fine to medium sand, black (10YR 2/1), no odor, dry, dense.			
				SILTY SAND WITH GRAVEL mostly fine to medium sand, little to some silt, few to little fine to coarse gravel, dark brown (10YR 3/3), no odor, dry, dense, trace slag and coal fragments present.	SM	<1 <1	Soil sample collected (1-3') at 0900.
2 GP	100		5	**SILTY CLAY** mostly clay, some silt, low plasticity, gray (10YR 5/1), no odor, dry, very stiff to hard. Change to medium plasticity, moist at 5.0 feet. 1-inch diameter slag fragment present at 8.0 feet.	CL-ML	<1 <1	
				PEAT high organic content, woody, dark brown (10YR 3/3), no odor, moist, medium dense.			
3 GP	50		10	**CLAY** mostly clay, trace silt, medium plasticity, greenish gray (GLEY1 5/1) with olive (5Y 5/4) mottles, no odor, moist, soft to medium stiff.	CL	<1	
4 GP	100		15	**SANDY CLAY** mostly clay, little fine to medium sand, medium plasticity, gray (10YR 5/1), no odor, saturated, soft to medium stiff.	CL		
				Grades to **SANDY SILT** mostly silt, little to some fine to medium sand, trace clay, no to low plasticity, gray (10YR 5/1), no odor, saturated, soft to stiff.	ML		
5 GP	80		20	**SAND** mostly fine to medium sand, few coarse sand, dark gray (10YR 4/1), no odor, saturated, medium dense.	SP		
			25	**SILTY SAND WITH GRAVEL** mostly fine to medium sand, little to some silt, few subrounded to rounded fine gravel, gray (10YR 5/1), no odor, saturated, dense. End of boring at 25.0 feet below ground surface.	SM		

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WELL CONSTRUCTION LOG

WELL NO. MW-17-08

Page 1 of 1

Facility/Project Name: DTE Electric Company River Rouge Power Plant	Date Drilling Started: 6/12/17	Date Drilling Completed: 6/12/17	Project Number: 277472.0000.0000

Drilling Firm: Stearns Drilling	Drilling Method: Direct Push/Hollow Stem Auger	Surface Elev. (ft) 577.5	TOC Elevation (ft) 580.52	Total Depth (ft bgs) 25.0	Borehole Dia. (in) 8/3.75/2

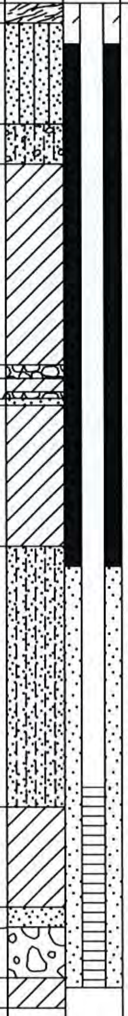
Boring Location: NE corner of property, in grassy area E of ash basins. N: 284600.04 E: 13463317.93	Personnel Logged By - C. Scieszka Driller - G. Geerligs	Drilling Equipment: Geoprobe 7822DT

Civil Town/City/or Village: River Rouge	County: Wayne	State: Michigan	Water Level Observations: While Drilling: Date/Time 6/12/17 00:00 ▽ Depth (ft bgs) 9.0 After Drilling: Date/Time 6/15/17 15:10 ▼ Depth (ft bgs) 2.30

SAMPLE Number and Type	Recovery (%)	Blow Counts
1 GP	90	
2 GP	50	
3 GP	100	
4 GP	100	
5 GP	80	

Depth in feet: 5, 10, 15, 20, 25

LITHOLOGIC DESCRIPTION	USCS	PID (PPM)	COMMENTS
TOPSOIL mostly sand, some silt, very dark gray (10YR 3/1), no odor, dry, loose.			
▼ **SANDY SILT WITH CLAY** mostly silt, little to some fine to medium sand, few to little clay, trace fine to coarse gravel, non plastic, brown (10YR5/3), no odor, dry, stiff.	ML	<1	Soil sample collected (1-3') at 1335.
SILTY SAND WITH GRAVEL mostly fine to coarse sand, little silt, few to little fine to coarse gravel, black (10YR 2/1), no odor, dry, dense, trace slag and coal fragments present.	SM	<1	
CLAY mostly clay, few silt, few fine to medium sand, trace fine gravel, low plasticity, dark grayish brown (10YR 4/2), no odor, dry, stiff.	CL	<1	
▽ 4-inch thick interval of slag fill, mostly medium sand to fine gravel sized slag, black (10YR 2/1), no odor, saturated, dense, wood fragments present at 9.0 feet.	CL		
2-inch thick interval of slag fill, mostly medium sand to fine gravel sized slag, black (10YR 2/1), no odor, saturated, dense, brick and wood fragments present at 9.7 feet. 2-inch thick interval of sand, mostly fine to medium sand, trace fine gravel, gray (10YR 5/1), no odor, saturated, medium dense at 9.8 feet. Change to no silt, no fine to medium sand, no fine gravel, medium plasticity, gray (10YR 5/1), moist, soft at 10.0 feet.	CL		Hollow stem augers set at 10.5 feet below ground surface prior to drilling through confining clay unit.
SILTY SAND mostly fine sand, little to some silt, gray (10YR 5/1), no odor, saturated, dense.	SM		
CLAY mostly clay, trace silt, medium plasticity, gray (10YR 5/1), no odor, moist, soft.	CL		
SAND mostly fine to coarse sand, trace fine gravel, gray (10YR 5/1), no odor, saturated, loose to medium dense, coarsens downward.	SW		
GRAVEL mostly coarse gravel, few fine gravel, few fine to coarse sand, gray (10YR 5/1), no odor, saturated, dense.	GP		
CLAY mostly clay, trace silt, medium plasticity, gray (10YR 5/1), no odor, moist, soft.	CL		
End of boring at 25.0 feet below ground surface.			



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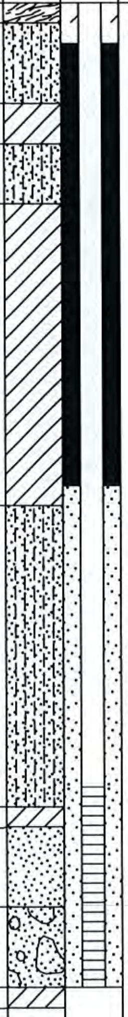
WELL CONSTRUCTION LOG

WELL NO. MW-17-09

Page 1 of 1

Facility/Project Name: DTE Electric Company River Rouge Power Plant		Date Drilling Started: 6/13/17	Date Drilling Completed: 6/13/17	Project Number: 277472.0000.0000
Drilling Firm: Stearns Drilling	Drilling Method: Direct Push/Hollow Stem Auger	Surface Elev. (ft) 577.8	TOC Elevation (ft) 581.05	Total Depth (ft bgs) 25.0	Borehole Dia. (in) 8/3.75/2
Boring Location: E of security gate, immediately adjacent to Detroit River. N: 284119.51 E: 13463234.58		Personnel Logged By - C. Scieszka Driller - G. Geerligs		Drilling Equipment: Geoprobe 7822DT
Civil Town/City/or Village: River Rouge	County: Wayne	State: Michigan	Water Level Observations: While Drilling: Date/Time 6/13/17 00:00 ▽ Depth (ft bgs) 1.0 After Drilling: Date/Time 6/15/17 16:36 ▼ Depth (ft bgs) 2.35	



SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	PID (PPM)	COMMENTS
1 GP	70			**TOPSOIL**		1.2	Soil sample collected (0-1') at 0930.
			▽ ▼	**SILTY SAND WITH CLAY** mostly fine to medium sand, little to some silt, few to little clay, dark grayish brown (10YR 4/2), no odor, dry, medium dense. Change to saturated at 1.0 feet.	SM		
				CLAY mostly clay, trace silt, medium plasticity, gray (10YR 5/1), no odor, moist, medium stiff.	CL		
				SILTY SAND mostly fine to medium sand, little to some silt, trace clay, dark gray (10YR 4/1), no odor, saturated, medium dense.	SM		
2 GP	50		5	**CLAY** mostly clay, trace silt, medium plasticity, gray (10YR 5/1), no odor, moist, medium stiff.	CL		
			10	0.5-inch thick fine sand seam at 9.5 feet.			Hollow stem augers set at 10.0 feet below ground surface prior to drilling through confining clay unit.
3 GP	80			1-inch thick interval of wood at 12.5 feet.			
				SILTY SAND mostly fine to medium sand, few to some silt, gray (10YR 5/1), no odor, saturated, dense.	SM		
4 GP	100		15				
5 GP	60		20	**CLAY** mostly clay, medium plasticity, gray (10YR 5/1), no odor, moist, soft to medium stiff.	CL		
				SAND mostly fine to coarse sand, generally dark gray (10YR 4/1), no odor, saturated, loose, coarsens downward.	SW		
				GRAVEL WITH SAND mostly subrounded to rounded fine to coarse gravel, little fine to coarse sand, generally dark gray (10YR 4/1), no odor, saturated, loose to medium dense.	GW		
			25	**CLAY** mostly clay, trace silt, medium plasticity, gray (10YR 5/1), no odor, moist, soft to medium stiff.	CL		
				End of boring at 25.0 feet below ground surface.			

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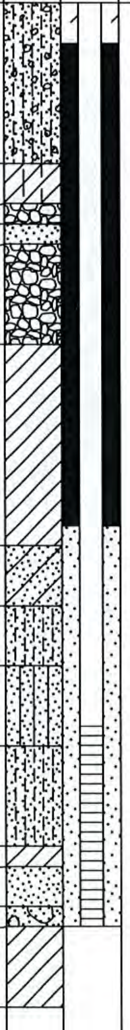
WELL CONSTRUCTION LOG

WELL NO. MW-17-10

Page 1 of 1

Facility/Project Name: DTE Electric Company River Rouge Power Plant		Date Drilling Started: 6/13/17	Date Drilling Completed: 6/13/17	Project Number: 277472.0000.0000
Drilling Firm: Stearns Drilling	Drilling Method: Direct Push/Hollow Stem Auger	Surface Elev. (ft) 578.7 TOC Elevation (ft) 581.41	Total Depth (ft bgs) 25.0	Borehole Dia. (in) 8/3.75/2
Boring Location: SE corner of property, in grassy area E of main entrance drive. N: 283603.83 E: 13463057.61		Personnel Logged By - C. Scieszka Driller - G. Geerligs	Drilling Equipment: Geoprobe 7822DT	
Civil Town/City/or Village: River Rouge	County: Wayne State: Michigan	Water Level Observations: While Drilling: Date/Time 6/13/17 00:00 ▽ Depth (ft bgs) 5.0 After Drilling: Date/Time 6/15/17 16:40 ▼ Depth (ft bgs) 2.81		



SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	PID (PPM)	COMMENTS
1 GP	70			**SILTY SAND WITH GRAVEL** mostly fine to medium sand, little to some silt, few to little fine to coarse gravel, brown (10YR 5/3), no odor, dry, loose. ▼ Change to black (10YR 2/1), trace to few slag and brick fragments at 1.0 feet. Change to brown (10YR 5/3), trace to few slag and cinder fragments at 2.0 feet.	SM	<1 <1	Soil sample collected (2-4') at 1345.
			5	▽ **SILTY CLAY** mostly clay, little to some silt, trace coarse sand, low plasticity, brown (10YR 5/3), no odor, dry, hard.	CL-ML		
2 GP	100			**FILL** mostly peat, few to little wood fragments, trace slag fragments, black (10YR 2/1), no odor, saturated, soft.			
				SAND mostly fine to medium sand, trace silt, dark gray (10YR 4/1), no odor, saturated, medium dense.	SP		
				FILL mostly slag and debris, few to little peat, few to little wood fragments, black (10YR 2/1), no odor, saturated, medium dense to dense.			
3 GP	90		10	**CLAY** mostly clay, trace silt, medium plasticity, gray (10YR 5/1), no odor, moist, medium stiff.	CL		Hollow stem augers set at 10.0 feet below ground surface prior to drilling through confining clay unit.
				SANDY CLAY mostly clay, little to some fine to medium sand, low plasticity, greenish gray (GLEY1 5/1), no odor, moist, stiff.	CL		
4 GP	95		15	**SILTY SAND** mostly fine to medium sand, little to some silt, gray (10YR 5/1), no odor, saturated, dense.	SM		
				SANDY SILT mostly silt, little to some fine to medium sand, no plasticity, gray (10YR 5/1) with olive yellow (2.5Y 6/6) mottles, no odor, saturated, stiff to very stiff.	ML		
			20	**SILTY SAND** mostly fine to medium sand, little to some silt, gray (10YR 5/1), no odor, saturated, dense.	SM		
5 GP	100			**CLAY** mostly clay, medium plasticity, gray (10YR 5/1), no odor, moist, soft to medium stiff.	CL		
				SAND mostly fine to coarse sand, generally dark gray (10YR 4/1), no odor, saturated, loose, coarsens downward.	SW		
				GRAVEL WITH SAND mostly subrounded to rounded fine to coarse gravel, little fine to coarse sand, generally dark gray (10YR 4/1), no odor, saturated, loose to medium dense.	GW		
			25	**CLAY** mostly clay, trace silt, medium plasticity, gray (10YR 5/1), no odor, moist, soft to medium stiff. End of boring at 25.0 feet below ground surface.	CL		

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WELL CONSTRUCTION LOG

WELL NO. MW-17-12

Facility/Project Name: DTE Electric Company River Rouge Power Plant	Date Drilling Started: 12/12/17	Date Drilling Completed: 12/12/17	Project Number: 290217.0000.0000

Drilling Firm: Stock Drilling Inc.	Drilling Method: Sonic	Surface Elev. (ft) 580.5	TOC Elevation (ft) 580.51	Total Depth (ft bgs) 30.0	Borehole Dia. (in) 6

Boring Location: Adjacent to existing monitoring well MW-17-12P.
N: 284489.95 E: 13463091.32

Personnel
Logged By - Jake Krenz
Driller - Ryan Brown

Drilling Equipment: TSi 150 CC

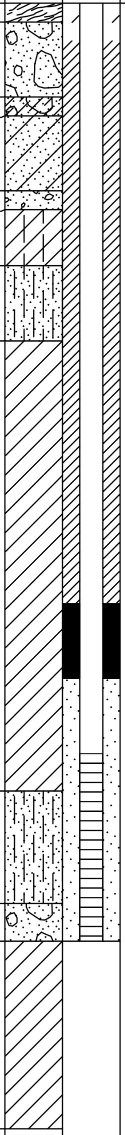
Civil Town/City/or Village: River Rouge	County: Wayne County	State: Michigan

Water Level Observations:
While Drilling: Date/Time 12/12/17 00:00 ▽ Depth (ft bgs) 5.0
After Drilling: Date/Time 2/26/18 12:29 ▼ Depth (ft bgs) 4.48

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET
1 CS	100		0–10
2 CS	0		10–20
3 CS	100		20–30

LITHOLOGIC DESCRIPTION	USCS
TOPSOIL	
GRAVEL WITH SAND mostly fine to coarse gravel, little fine to coarse sand, gray (10YR 5/1), no odor, dry, loose.	GW
CLAYEY GRAVEL mostly fine to coarse gravel, little to some clay, few fine to medium sand, gray (10YR 5/1), no odor, moist, loose.	GC
SANDY CLAY mostly clay, little fine to medium sand, trace fine to medium gravel, trace silt, medium plasticity, brown (10YR 5/4), no odor, moist, stiff. Change to dark gray (10YR 4/1) at 4.0 feet.	CL
SAND mostly, medium to coarse sand, trace fine to medium gravel, gray (10YR 5/1), no odor, saturated, loose.	SP
SILTY CLAY mostly clay, little to some silt, trace fine to coarse gravel, low to medium plasticity, gray (10YR 5/1), no odor, dry to moist, stiff.	CL-ML
SANDY SILT mostly silt, little to some fine sand, non plastic, gray (10YR 5/1), no odor, dry, medium stiff.	SM
CLAY mostly clay, trace to few silt, trace fine sand, medium to high plasticity, gray (10YR 5/1), no odor, moist, medium stiff. Change to trace silt, no fine sand, medium plasticity at 20.0 feet.	CL
SILTY SAND mostly fine sand, little to some silt, gray (10YR 5/1), no odor, saturated, medium dense to loose.	SM
GRAVEL WITH SAND mostly medium to coarse gravel, little medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose.	GW
CLAY mostly clay, trace silt, trace fine gravel, medium to high plasticity, gray (10YR 5/1), no odor, saturated, soft.	CL
End of boring at 30.0 feet below ground surface.	

GRAPHIC LOG · WELL DIAGRAM



COMMENTS

Signature:

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WELL CONSTRUCTION LOG

WELL NO. MW-17-13

Facility/Project Name: DTE Electric Company River Rouge Power Plant	Date Drilling Started: 12/6/17	Date Drilling Completed: 12/6/17	Project Number: 290217.0000.0000

Drilling Firm: Stock Drilling Inc.	Drilling Method: Sonic	Surface Elev. (ft) 579.4	TOC Elevation (ft) 578.90	Total Depth (ft bgs) 30.0	Borehole Dia. (in) 6

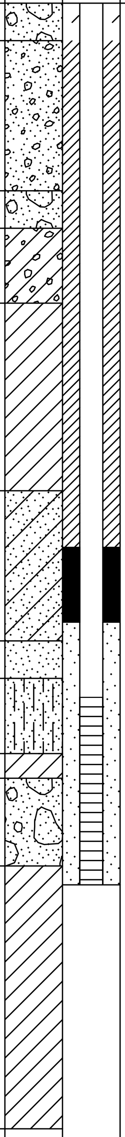
Boring Location: Aproximatley 80 feet east of the ash basin and 20 feet south of the fence.
N: 284706.40 E: 13463222.55

Personnel
Logged By - Jake Krenz
Driller - Ryan Brown

Drilling Equipment: TSi 150 CC

Civil Town/City/or Village: River Rouge	County: Wayne County	State: Michigan	Water Level Observations: While Drilling: Date/Time 12/6/17 00:00 ▽ Depth (ft bgs) 17.0 After Drilling: Date/Time 2/26/18 12:41 ▼ Depth (ft bgs) 3.82

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
1 CS	100		0–10	**GRAVEL WITH SAND** mostly medium to coarse gravel, little to some medium to coarse sand, black (10YR 2/1), no odor, dry, loose.	GP	
				SAND WITH GRAVEL mostly medium to coarse sand, few to little medium to coarse gravel, trace clay, very dark gray (10YR 3/1), no odor, dry, medium dense. Change to few clay at 4.0 feet.	SP	
			5	**GRAVEL WITH SAND** mostly fine to coarse gravel, little to some medium to coarse sand, grayish brown (10YR 4/2), no odor, dry, loose.	GW	
				GRAVELY CLAY mostly clay, few to little medium to coarse gravel, few fine to medium sand, trace silt, medium plasticity, dark gray (10YR 3/1), no odor, dry, loose.	CL	
				CLAY mostly clay, trace to few medium to coarse gravel, high plasticity, dark gray (10YR 4/1), no odor, moist to saturated, soft.	CL	
2 CS	100		10–20	**SANDY CLAY** mostly clay, some fine sand, medium to low plasticity, dark gray (10YR 4/1), no odor, saturated, soft.	CL	
			15	**SAND** mostly fine sand, trace silt, gray (10YR 5/1), no odor, saturated, loose.	SP	
				SILTY SAND mostly fine sand, few to little silt, gray (10YR 5/1), no odor, saturated, loose.	SM	
3 CS	100		20–30	**CLAY** mostly clay, trace to few silt, medium plasticity, gray (10YR 6/1), no odor, saturated, medium stiff.	CL	
				GRAVEL WITH SAND mostly medium to coarse gravel, little to some medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose.	GW	
			25	**CLAY** mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, saturated, loose.	CL	
			30	End of boring at 30.0 feet below ground surface.		



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WELL CONSTRUCTION LOG

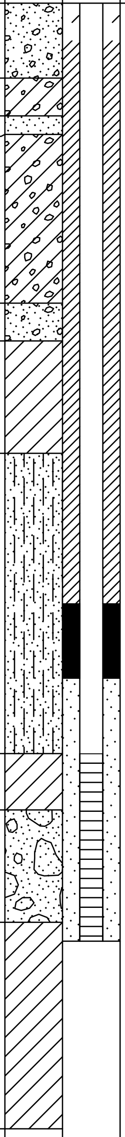
WELL NO. MW-17-14

Page 1 of 1

Facility/Project Name: DTE Electric Company River Rouge Power Plant		Date Drilling Started: 12/7/17	Date Drilling Completed: 12/7/17	Project Number: 290217.0000.0000
Drilling Firm: Stock Drilling Inc.	Drilling Method: Sonic	Surface Elev. (ft) 579.9	TOC Elevation (ft) 579.35	Total Depth (ft bgs) 30.0
				Borehole Dia. (in) 6
Boring Location: Approximately 20 feet northwest of extraction vault EW-07. N: 284756.77 E: 13463166.29		Personnel Logged By - Jake Krenz Driller - Ryan Brown		Drilling Equipment: TSi 150 CC
Civil Town/City/or Village: River Rouge	County: Wayne County	State: Michigan	Water Level Observations: While Drilling: Date/Time 12/7/17 00:00 ▽ Depth (ft bgs) 8.0 After Drilling: Date/Time 2/26/18 13:39 ▼ Depth (ft bgs) 4.34	

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
1 CS	100		0	**SAND WITH GRAVEL** mostly medium to coarse sand, few to little medium to coarse gravel, dark brown (10YR 3/3), no odor, dry, loose, trace brick fragments.	SP	
				GRAVELY CLAY mostly clay, little to some medium to coarse gravel, medium plasticity, very dark gray (10YR 3/1), no odor, moist, loose.	CL	
			▼	**SAND** mostly fine to medium sand, trace fine to medium gravel, dark yellowish brown (10YR 3/4), no odor, moist, loose.	SP	
			5	**CLAY WITH GRAVEL** mostly clay, few to little medium to coarse gravel, medium to high plasticity, black (10YR 2/1), no odor, moist, soft.	CL	
			▽	**SAND WITH GRAVEL** mostly medium to coarse sand, few to little medium to coarse gravel, black (10YR 2/1), no odor, saturated, loose.	SP	
2 CS	100		10	**CLAY** mostly clay, trace silt, high plasticity, dark gray (10YR 4/1), no odor, moist, soft to medium stiff.	CL	
			15	**SILTY SAND** mostly fine sand, few to little silt, gray (10YR 5/1), no odor, saturated, loose.	SP	
3 CS	100		20	**CLAY** mostly clay, trace fine to medium gravel, trace silt, medium to low plasticity, dark grayish brown (10YR 4/2), no odor, moist, soft.	CL	
				GRAVEL WITH SAND mostly medium to coarse gravel, little to some medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose.	GP	
			25	**CLAY** mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, moist to saturated, very soft.	CL	
			30	End of boring at 30.0 feet below ground surface.		

GRAPHIC LOG / WELL DIAGRAM



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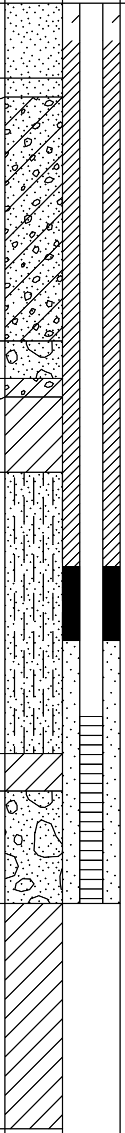
WELL CONSTRUCTION LOG

WELL NO. MW-17-15

Page 1 of 1

Facility/Project Name: DTE Electric Company River Rouge Power Plant		Date Drilling Started: 12/8/17	Date Drilling Completed: 12/8/17	Project Number: 290217.0000.0000
Drilling Firm: Stock Drilling Inc.	Drilling Method: Sonic	Surface Elev. (ft) 580.0	TOC Elevation (ft) 579.75	Total Depth (ft bgs) 30.0 Borehole Dia. (in) 6
Boring Location: Northwest corner of building directly south of EW-07. N: 284720.04 E: 13463122.43		Personnel Logged By - Jake Krenz Driller - Ryan Brown		Drilling Equipment: TSi 150 CC
Civil Town/City/or Village: River Rouge	County: Wayne County State: Michigan	Water Level Observations: While Drilling: Date/Time 12/8/17 00:00 ▽ Depth (ft bgs) 10.0 After Drilling: Date/Time 2/26/18 14:22 ▼ Depth (ft bgs) 4.35		

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
1 CS	100			**SAND** mostly medium sand, trace to few fine to coarse gravel, trace to few coal ash, black (10YR 2/1), no odor, dry, loose.	SP	
				Change to no coal ash, mostly fine to medium sand, trace fine to medium gravel, light brownish gray (2.5Y 6/2) at 1.0 feet.	SP	
			▼	**SAND WITH COAL ASH** mostly medium to coarse sand, some coal ash, trace fine to medium gravel, black (10YR 2/1), no odor, dry, loose.		
			5	**SANDY CLAY WITH GRAVEL** mostly clay, little to some fine to medium sand, few to little medium to coarse gravel, trace silt, dark gray (10YR 4/1), no odor, medium to low plasticity, moist, medium stiff to stiff. Trace brick and concrete fragments present at 8.0 feet.	CL	
2 CS	100		10 ▽	**FILL** mostly concrete fragments, some medium to coarse gravel, little to some medium to coarse sand, gray (10YR 5/1), no odor, dry, loose.	CL	
				GRAVELY CLAY mostly clay, some medium to coarse gravel, trace fine to medium sand, high plasticity, dark gray (10YR 4/1), no odor, saturated, very soft.	CL	
				CLAY mostly clay, trace to few silt, high plasticity, gray (10YR 5/1), no odor moist, soft.		
			15	**SILTY SAND** mostly fine sand, few to little silt, gray (10YR 5/1), no odor, saturated, loose.	SM	
3 CS	100		20	**CLAY** mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, moist, soft.	CL	
				GRAVEL WITH SAND mostly medium to coarse gravel, little medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose.	GP	
			25	**CLAY** mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, saturated, soft.	CL	
			30	End of boring at 30.0 feet below ground surface.		



Signature:

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WELL CONSTRUCTION LOG

WELL NO. MW-17-16

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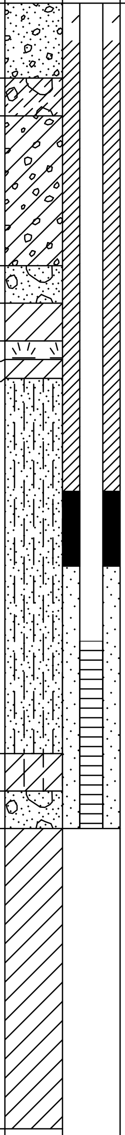
Facility/Project Name: DTE Electric Company River Rouge Power Plant			Date Drilling Started: 12/7/17	Date Drilling Completed: 12/7/17		Project Number: 290217.0000.0000
Drilling Firm: Stock Drilling Inc.	Drilling Method: Sonic		Surface Elev. (ft) 580.2	TOC Elevation (ft) 579.73	Total Depth (ft bgs) 30.0	Borehole Dia. (in) 6
Boring Location: Adjacent to EW-04 N: 284858.50 E: 13463014.92			Personnel Logged By - Jake Krenz Driller - Ryan Brown		Drilling Equipment: TSi 150 CC	
Civil Town/City/or Village: River Rouge	County: Wayne County	State: Michigan	Water Level Observations: While Drilling: Date/Time 12/7/17 00:00 ▽ Depth (ft bgs) 7.0 After Drilling: Date/Time 2/26/18 13:51 ▼ Depth (ft bgs) 5.59			

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 CS	100			**SAND WITH GRAVEL** mostly fine to coarse sand, few to little medium to coarse gravel, trace silt, very dark grayish brown (10YR 3/2), no odor, dry, loose. Change to little to some medium to coarse gravel just above 2.0 feet.	SW			
				GRAVEL WITH CLAY mostly medium to coarse gravel, few to little clay, few fine to medium sand, very dark gray (10YR 3/1), no odor, moist, loose.	GC			
			5 ▼ ▽	**GRAVELLY CLAY** mostly clay, little to some medium to coarse gravel, trace to few fine to medium sand, medium plasticity, very dark gray (10YR 3/1), no odor, moist, soft.	CL			
				GRAVEL WITH SAND mostly medium to coarse gravel, few to little medium to coarse sand, trace clay, very dark gray (10YR 3/1), no odor, saturated, loose.	GP			
				CLAY mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, moist, medium stiff.	CL			
				PEAT mostly peat, few to little clay, black (10YR 2/1), no odor, dry, loose.	PT			
			10	**CLAY** mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, moist, medium stiff.	CL			
2 CS	80		15	**SAND WITH SILT** mostly fine to medium sand, few to little silt, gray (10YR 5/1), no odor, saturated, loose.	SM			
3 CS	100		20	**CLAY WITH SILT** mostly clay, few to little silt, medium plasticity, dark gray (10YR 4/1), no odor, moist, soft.	CL			
				GRAVEL WITH SAND mostly medium to coarse gravel, little to some medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose.	GP			
			25	**CLAY** mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, saturated, very soft.	CL			
			30	End of boring at 30.0 feet below ground surface.				



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WELL CONSTRUCTION LOG

WELL NO. MW-17-17

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Facility/Project Name: DTE Electric Company River Rouge Power Plant	Date Drilling Started: 12/11/17	Date Drilling Completed: 12/11/17	Project Number: 290217.0000.0000

Drilling Firm: Stock Drilling Inc.	Drilling Method: Sonic	Surface Elev. (ft) 579.8	TOC Elevation (ft) 579.35	Total Depth (ft bgs) 30.0	Borehole Dia. (in) 6

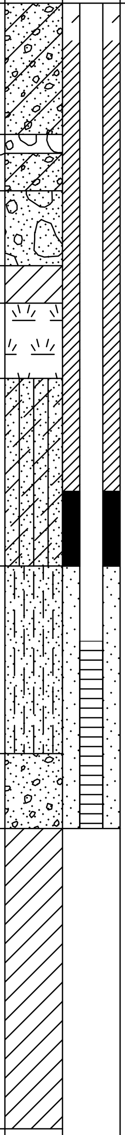
Boring Location: North side of bottom ash basin between bottom ash basin and the Rouge River, halfway between EW-01 and EW-02.
N: 284960.61 E: 13462826.40

Personnel
Logged By - Jake Krenz
Driller - Ryan Brown

Drilling Equipment: TSi 150 CC

Civil Town/City/or Village: River Rouge	County: Wayne County	State: Michigan	Water Level Observations: While Drilling: Date/Time 12/11/17 00:00 ▽ Depth (ft bgs) 5.0 After Drilling: Date/Time 2/26/18 14:04 ▼ Depth (ft bgs) 4.65

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
1 CS	100		0	**SANDY CLAY WITH GRAVEL** mostly clay, little to some fine to medium sand, few to little fine to coarse gravel, low plasticity, dark grayish brown, (10YR 4/2), no odor, moist, stiff.	CL	
				GRAVEL mostly medium to coarse gravel, few fine to coarse sand, brown (10YR 4/3), no odor, dry, loose.	GP	
			5	**SANDY CLAY WITH GRAVEL** mostly clay, little to some fine to medium sand, few to little fine to coarse gravel, low plasticity, dark grayish brown, (10YR 4/2), no odor, moist, stiff.	CL	
				GRAVEL WITH SAND mostly fine to medium gravel, trace coarse gravel, little to some medium to coarse sand, black (10YR 2/1), no odor, saturated, loose.	GW	
				CLAY mostly clay, trace silt, medium to high plasticity, dark gray (10YR 4/1), no odor, moist, medium stiff.	CL	
				PEAT mostly fibrous woody material, trace to few clay, dark grayish brown (10YR 4/2), no odor, moist, loose.	PT	
2 CS	100		10	**SILTY SAND WITH CLAY** mostly fine sand, little to some silt, few clay, dark gray (10YR 4/1), no odor, saturated, loose to medium dense.	SM	
			15	**SILTY SAND** mostly fine to medium sand, little silt, dark gray (10YR 4/1), no odor, saturated, loose.	SM	
3 CS	100		20	**SAND WITH GRAVEL** mostly medium to coarse sand, little medium to coarse gravel, dark gray (10YR 4/1), no odor, saturated, loose.	SP	
			25	**CLAY** mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, moist to saturated, very soft.	CL	
			30	End of boring at 30.0 feet below ground surface.		



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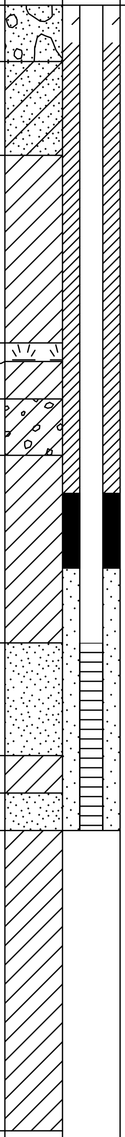
WELL CONSTRUCTION LOG

WELL NO. MW-17-18

Page 1 of 1

Facility/Project Name: DTE Electric Company River Rouge Power Plant		Date Drilling Started: 12/8/17	Date Drilling Completed: 12/8/17	Project Number: 290217.0000.0000
Drilling Firm: Stock Drilling Inc.	Drilling Method: Sonic	Surface Elev. (ft) 579.7	TOC Elevation (ft) 579.00	Total Depth (ft bgs) 30.0 / Borehole Dia. (in) 6
Boring Location: In the road halfway between EW-10 and EW-11. N: 285050.70 E: 13462621.63		Personnel Logged By - Jake Krenz Driller - Ryan Brown		Drilling Equipment: TSi 150 CC
Civil Town/City/or Village: River Rouge	County: Wayne County / State: Michigan	Water Level Observations: While Drilling: Date/Time 12/8/17 00:00 ▽ Depth (ft bgs) 10.5 After Drilling: Date/Time 2/26/18 14:43 ▼ Depth (ft bgs) 3.68		

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
				GRAVEL WITH SAND mostly medium to coarse gravel, little fine to medium sand, grayish brown (10YR 5/2), no odor, dry, loose.	GP	
			▼	**SANDY CLAY** mostly clay, little to some fine to medium sand, trace to few medium to coarse gravel, medium to low plasticity, dark gray (10YR 4/1), no odor, moist, medium stiff. Wood fragment present at 3.0 feet.	CL	
1 CS	100		5	**CLAY** mostly clay, trace to few fine to coarse sand, trace fine to coarse gravel, trace silt, low plasticity, brown (10YR 4/3), no odor, moist, stiff.	CL	
			10 ▽	**PEAT** mostly peat, few to little clay, very dark grayish brown (10YR 3/2), no odor, moist, loose.	PT	
				CLAY mostly clay, trace silt, high plasticity, very dark gray (10YR 3/1), no odor, moist, soft.	CL	
				CLAY WITH GRAVEL mostly clay, few to little fine to medium gravel , few fine to medium sand, low plasticity dark gray (10YR 4/1), no odor, saturated, very soft.	CL	
2 CS	100		15	**CLAY** mostly clay, trace silt, high plasticity, very dark gray (10YR 3/1), no odor, moist, soft. Change to gray (10YR 5/1), very soft at 15.0 feet.	CL	
				SAND mostly medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose.	SP	
			20	**CLAY** moslty clay, trace silt, high plasticity, gray (10YR 5/1), no odor, moist, soft.	CL	
				SAND mostly medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose.	SP	
3 CS	100		25	**CLAY** mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, saturated, soft.	CL	
			30	End of boring at 30.0 feet below ground surface.		



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WELL CONSTRUCTION LOG

WELL NO. MW-17-19

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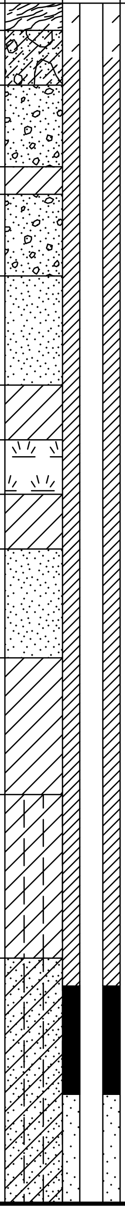
Facility/Project Name: DTE Electric Company River Rouge Power Plant	Date Drilling Started: 12/11/17	Date Drilling Completed: 12/11/17	Project Number: 290217.0000.0000

Drilling Firm: Stock Drilling Inc.	Drilling Method: Sonic	Surface Elev. (ft) 578.4	TOC Elevation (ft) 577.99	Total Depth (ft bgs) 40.0	Borehole Dia. (in) 6

Boring Location: Approximately 80 feet northwest of abandoned dock hopper on west side of bottom ash basin along the west side of road. N: 285163.45 E: 13462465.18	Personnel Logged By - Jake Krenz Driller - Ryan Brown	Drilling Equipment: TSi 150 CC

Civil Town/City/or Village: River Rouge	County: Wayne County	State: Michigan	Water Level Observations: While Drilling: Date/Time 12/11/17 00:00 ▽ Depth (ft bgs) 3.5 After Drilling: Date/Time 2/26/18 15:06 ▼ Depth (ft bgs) 2.70

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 CS	100			**TOPSOIL** grass roots, black (10YR 2/1), no odor, dry, loose.				
				GRAVEL WITH CLAY AND SAND mostly medium to coarse gravel, little to some medium to coarse sand, few to little clay, very pale brown (10YR 8/2), no odor, moist, loose, trace brick fragments.	GP			
			2	**SAND WITH GRAVEL** mostly medium to coarse sand, little medium to coarse gravel, trace to few clay, dark gray (10YR 4/1), no odor, moist, loose. Change to brown (10YR 5/2) at 2.5 feet.	SP			
			4	**CLAY** mostly clay, trace fine sand, trace silt, trace fine gravel, low plasticity, very dark gray (10YR 3/1), no odor, moist, medium stiff.	CL			
			6	**SAND WITH GRAVEL** mostly medium to coarse sand, few to little medium to coarse gravel, trace to few coal ash, trace clay, black (10YR 2/1), no odor, saturated, loose.	SP			
				SAND mostly medium to coarse sand, few fine gravel, trace clay, dark brown (10YR 3/3), no odor, saturated, loose.	SP			
			8	**CLAY** mostly clay, trace silt, trace medium to coarse gravel, medium plasticity, dark gray (10YR 4/1), no odor, moist, stiff.	CL			
2 CS	100		10	**PEAT** mostly organic plant material, dark brown (10YR 3/3), no odor, moist, loose.	PT			
				CLAY mostly clay, trace silt, trace medium to coarse gravel, medium plasticity, dark gray (10YR 4/1), no odor, moist, medium stiff.	CL			
			12	**SAND** mostly medium to coarse sand, trace to few fine gravel, dark gray (10YR 4/1), no odor, saturated, loose.	SP			
			14	**CLAY** mostly clay, trace to few silt, trace fine sand, gray (10YR 5/1), no odor, low plasticity, saturated, soft.	CL			
			16	**SILTY CLAY** mostly clay, little to some silt, low plasticity, gray (10YR 5/1), no odor, saturated, soft.	CL-ML			
			18 20	**SANDY CLAY WITH SILT** mostly clay, little to some fine sand, few to little silt, low plasticity, gray (10YR 5/1), no odor, saturated, very soft.	CL			



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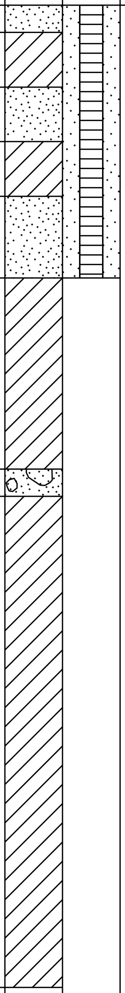
SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
3 CS	100			**SAND** mostly medium to coarse sand, trace fine to medium gravel, trace clay, gray (10YR 5/1), no odor, saturated, loose.	SP	
				CLAY mostly clay, trace to few silt, trace fine sand, low plasticity, gray (10YR 5/1), no odor, saturated, very soft.	CL	
			24	**SAND** mostly medium to coarse sand, trace fine to medium gravel, trace clay, gray (10YR 5/1), no odor, saturated, loose.	SP	
				CLAY mostly clay, trace silt, medium to high plasticity, gray (10YR 5/1), no odor, saturated, soft.	CL	
			26	**SAND** mostly medium to coarse sand, trace fine to medium gravel, trace clay, gray (10YR 5/1), no odor, saturated, loose.	SP	
			28 30	**CLAY** mostly clay, trace silt, medium to high plasticity, gray (10YR 5/1), no odor, saturated, soft.	CL	
4 CS	100			**GRAVEL WITH SAND** mostly medium to coarse gravel, little medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose.	GP	
			32 34 36 38	**CLAY** mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, saturated, soft.	CL	
			40 42 44 46 48 50	End of boring at 40.0 feet below ground surface.		

GRAPHIC LOG / WELL DIAGRAM



WELL CONSTRUCTION LOG

WELL NO. MW-17-20

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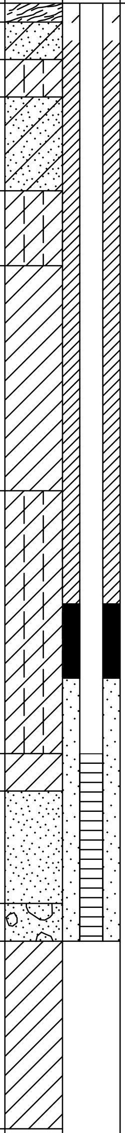
Facility/Project Name: DTE Electric Company River Rouge Power Plant	Date Drilling Started: 12/12/17	Date Drilling Completed: 12/12/17	Project Number: 290217.0000.0000

Drilling Firm: Stock Drilling Inc.	Drilling Method: Sonic	Surface Elev. (ft) 580.1	TOC Elevation (ft) 579.40	Total Depth (ft bgs) 30.0	Borehole Dia. (in) 6

Boring Location: Approximately 120 feet east of MW-17-11P and approximately 35 feet north of coal conveyor. N: 284927.20 E: 13462555.00	Personnel Logged By - Jake Krenz Driller - Ryan Brown	Drilling Equipment: TSi 150 CC

Civil Town/City/or Village: River Rouge	County: Wayne County	State: Michigan	Water Level Observations: While Drilling: Date/Time 12/12/18 00:00 ▽ Depth (ft bgs) 13.0 After Drilling: Date/Time 2/26/18 15:15 ▼ Depth (ft bgs) 4.02

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 CS	100			**TOPSOIL** grass roots, black (10YR 2/1), dry, loose.				
				SANDY CLAY mostly clay, little to some sand, trace fine gravel, low plasticity, dark gray (10YR 4/1), no odor, dry, medium stiff to stiff.	CL ML			
			▼	**SILTY CLAY** mostly clay, little to some silt, no to low plasticity, yellowish brown (10YR 5/4) mottled with dark gray (10YR 4/1), no odor, dry to moist, medium stiff to stiff.	CL			
			5	**SANDY CLAY** mostly clay, little fine sand, trace to few fine to medium gravel, low plasticity, dark grayish brown (10YR 4/2), no odor, dry to moist, stiff.	CL-ML			
				CLAY WITH SILT mostly clay, little silt, trace fine gravel, low to medium plasticity, very dark gray (10YR 3/1), no odor, moist, medium stiff to stiff.	CL			
2 CS	100		10	**CLAY** mostly clay, trace to few fine to medium sand, trace fine gravel, medium to high plasticity, dark grayish brown (10YR 4/2), no odor, moist, stiff. Change to few to little fine to coarse gravel, soft, at 10.0 feet. ▽ Change to trace fine gravel, stiff at 11.0 feet.	CL			
			15	**SILTY CLAY** mostly clay, little to some silt, trace to few fine sand, no to low plasticity, dark grayish brown (10YR 4/2), no odor, saturated, very soft.	CL-ML			
3 CS	100		20	**CLAY** mostly clay, trace silt, medium plasticity, gray (10YR 5/1), no odor, saturated, soft.	CL			
				SAND mostly medium to coarse sand, trace fine gravel, gray (10YR 5/1), no odor, saturated, loose.	SP			
			25	**GRAVEL WITH SAND** mostly medium to coarse gravel, little to some medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose.	GP			
				CLAY mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, saturated, soft.	CL			
			30	End of boring at 30.0 feet below ground surface.				



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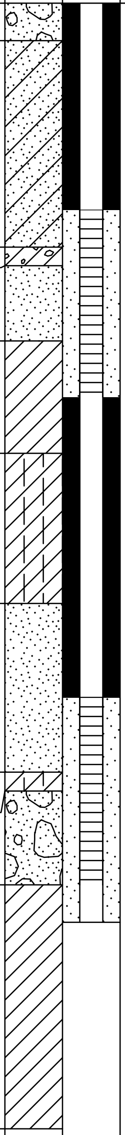
WELL CONSTRUCTION LOG

WELL NO. EW-01

Page 1 of 1

Facility/Project Name: DTE Electric Company River Rouge Power Plant		Date Drilling Started: 12/18/17	Date Drilling Completed: 12/18/17	Project Number: 290217.0000.0000
Drilling Firm: Stock Drilling Inc.	Drilling Method: Sonic	Surface Elev. (ft) 579.8	TOC Elevation (ft) 577.69	Total Depth (ft bgs) 30.0
				Borehole Dia. (in) 10
Boring Location: West end of bottom ash basin between the bottom ash basin and the Rouge River. N: 284991.02 E: 13462791.17		Personnel Logged By - Jake Krenz Driller - Ryan Brown		Drilling Equipment: TSi 150 CC
Civil Town/City/or Village: River Rouge	County: Wayne County	State: Michigan	Water Level Observations: While Drilling: Date/Time 12/18/17 00:00 ▽ Depth (ft bgs) 7.0 After Drilling: Date/Time 2/26/18 16:24 ▼ Depth (ft bgs) 4.78	

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
				SANDY GRAVEL mostly medium to coarse gravel, little fine to medium sand, grayish brown (10YR 5/2), no odor, dry, loose.	GP	
1 CS	100		▼ 5	**SANDY CLAY WITH GRAVEL** mostly clay, little to some fine to medium sand, few to little fine to medium gravel, trace brick fragments, no to low plasticity, dark grayish brown (10YR 4/2), no odor, dry, medium stiff to stiff.	CL	
			▽	**CLAY WITH GRAVEL** mostly clay, few fine to medium sand, few to little fine to medium gravel, trace brick fragments, non to low plasticity, dark grayish brown (10YR 4/2), no odor, dry, medium stiff to stiff.	CL	
			10	**SAND** mostly medium to coarse sand, trace to few fine to medium gravel, black (10YR 2/1), petroleum odor, saturated, loose.	SP	
				CLAY mostly clay, trace to few silt, medium plasticity, black (10YR 2/1), no odor, slight petroleum odor, soft to medium stiff. Change to trace silt, gray (10YR 5/1) at 11.0 feet.	CL	
2 CS	100		15	**CLAY WITH SILT** mostly clay, few to little silt, low to medium plasticity, gray (10YR 5/1), no odor, saturated, very soft. Wood fragment present at 15.5 feet.	CL	
			20	**SAND** mostly medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose. Wood fragment present at 18.5 feet.	SP	
				SILTY CLAY mostly clay, little to some silt, no to low plasticity, gray (10YR 5/1), no odor, saturated, medium stiff.	CL-ML	
				GRAVEL WITH SAND mostly medium to coarse gravel, little to some medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose.	GP	
3 CS	100		25	**CLAY** mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, saturated, soft.	CL	
			30	End of boring at 30.0 feet below ground surface.		



Signature: Jacob Krenz

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WELL CONSTRUCTION LOG

WELL NO. EW-02

Page 1 of 1

Facility/Project Name: DTE Electric Company River Rouge Power Plant	Date Drilling Started: 12/18/17	Date Drilling Completed: 12/18/17	Project Number: 290217.0000.0000

Drilling Firm: Stock Drilling Inc.	Drilling Method: Sonic	Surface Elev. (ft) 579.8	TOC Elevation (ft) 578.26	Total Depth (ft bgs) 30.0	Borehole Dia. (in) 10

Boring Location: North side of bottom ash basin between bottom ash basin and the Rouge River, approximately 40 feet east of MW-17-17. N: 284933.54 E: 13462856.69	Personnel Logged By - Jake Krenz Driller - Ryan Brown	Drilling Equipment: TSi 150 CC

Civil Town/City/or Village: River Rouge	County: Wayne County	State: Michigan	Water Level Observations: While Drilling: Date/Time 12/18/17 00:00 ▽ Depth (ft bgs) 5.0 After Drilling: Date/Time 2/26/18 16:22 ▼ Depth (ft bgs) 3.88

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET
1 CS	80		0–10
2 CS	100		10–20
3 CS	100		20–30

LITHOLOGIC DESCRIPTION

SAND WITH GRAVEL mostly fine to medium sand, few to little fine to coarse gravel, few clay, very dark gray (10YR 3/1), no odor, moist, loose.

SAND mostly fine to medium sand, trace gravel, few clay, very dark gray (10YR 3/1), no odor, moist, loose.

SLAG mostly slag, trace fine to medium gravel, trace medium to coarse sand, dark grayish brown (10YR 4/2), no odor, saturated, loose.

SAND mostly fine to medium sand, little to some coal ash, trace fine to medium gravel, black (10YR 2/1), petroleum odor, saturated, loose.

PEAT mostly organic, fibrous material, trace clay, very dark grayish brown (10YR 3/2), no odor, moist, medium dense to loose.

SILTY CLAY mostly clay, some silt, few fine sand, no to low plasticity, gray (10YR 5/1), no odor, saturated, soft.

SILTY SAND mostly fine sand, little to some silt, trace clay, gray (10YR 5/1), no odor, saturated, loose.

SAND mostly fine to medium sand, trace silt, gray (10YR 5/1), no odor saturated, loose.

SAND WITH GRAVEL mostly fine to medium sand, little to some gravel, trace silt, gray (10YR 5/1), no odor saturated, loose.

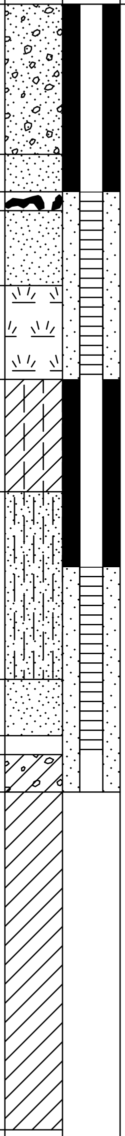
CLAY WITH GRAVEL mostly clay, little medium to coarse gravel, medium plasticity, gray (10YR 5/1), no odor, moist, medium stiff to stiff.

CLAY mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, saturated, very soft.

End of boring at 30.0 feet below ground surface.

USCS: SP, SP, SP, PT, CL-ML, SM, SP, CL, CL

GRAPHIC LOG / WELL DIAGRAM



COMMENTS

Signature: Jal Krenz

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Checked By: Chris Scieszka

WELL CONSTRUCTION LOG

WELL NO. EW-03

Page 1 of 1

Facility/Project Name: DTE Electric Company River Rouge Power Plant	Date Drilling Started: 12/19/17	Date Drilling Completed: 12/19/17	Project Number: 290217.0000.0000

Drilling Firm: Stock Drilling Inc.	Drilling Method: Sonic	Surface Elev. (ft) 579.6	TOC Elevation (ft) 577.81	Total Depth (ft bgs) 30.0	Borehole Dia. (in) 10

Boring Location: North side of bottom ash basin between bottom ash basin and the Rouge River, adjacent to MW-16-02.
N: 284888.69 E: 13462943.43

Personnel
Logged By - Jake Krenz
Driller - Ryan Brown

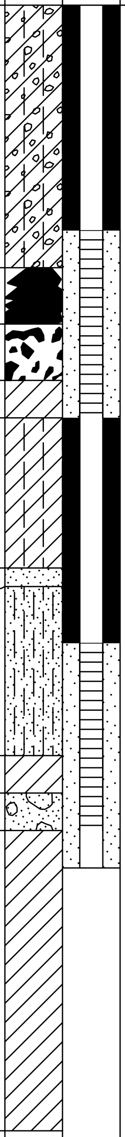
Drilling Equipment: TSi 150 CC

Civil Town/City/or Village: River Rouge	County: Wayne County	State: Michigan

Water Level Observations:
While Drilling: Date/Time 12/19/17 00:00 ▽ Depth (ft bgs) 8.5
After Drilling: Date/Time 2/26/18 16:21 ▼ Depth (ft bgs) 3.84

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
1 CS	70		0–5 ▼	**SILTY CLAY WITH GRAVEL** mostly clay, little silt, few to little fine to coarse gravel, low plasticity, gark grayish brown, (10YR 4/2), no odor, dry, stiff.	CL	
			▽	**COAL ASH** mostly coal ash, few fine to coarse slag fragments, dark gray (10YR 4/1), no odor, dry, loose.		
				SLAG mostly slag, little coal ash, black (10YR 2/1), no odor, moist to saturated, loose.		
2 CS	100		10	**CLAY** mostly clay, few silt, low to medium plasticity, gray (10YR 5/1), no odor, moist, medium stiff.	CL	
				SILTY CLAY mostly clay, little to some silt, no to low plasticity, gray (10YR 5/1), no odor, moist to saturated, soft.	CL-ML	
			15	**SAND** mostly fine to medium sand, gray (10YR 5/1), no odor, saturated, loose.	SP	
				SILTY SAND mostly fine sand, little to some silt, gray (10YR 5/1), no odor, moist to saturated, medium dense.	SM	
3 CS	100		20	**CLAY** mostly clay, trace silt, medium plasticity, gray (10YR 5/1), no odor, moist, stiff.	CL	
				GRAVEL WITH SAND mostly fine to coarse gravel, little medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose.	GW	
			25	**CLAY** mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, saturated, soft.	CL	
			30	End of boring at 30.0 feet below ground surface.		

GRAPHIC LOG / WELL DIAGRAM



Signature:

Checked By: Chris Scieszka

Firm: TRC Environmental Corporation
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WELL CONSTRUCTION LOG

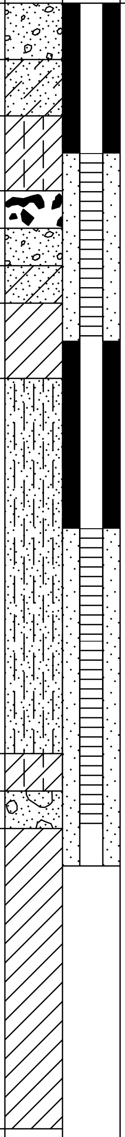
WELL NO. EW-04

Facility/Project Name: DTE Electric Company River Rouge Power Plant	Date Drilling Started: 12/19/17	Date Drilling Completed: 12/19/17	Project Number: 290217.0000.0000

Drilling Firm: Stock Drilling Inc.	Drilling Method: Sonic	Surface Elev. (ft) 580.1	TOC Elevation (ft) 578.39	Total Depth (ft bgs) 30.0	Borehole Dia. (in) 10

Boring Location: North side of bottom ash basin between bottom ash basin and the Rouge River, adjacent to MW-17-16. N: 284852.00 E: 13463016.10	Personnel Logged By - Jake Krenz Driller - Ryan Brown	Drilling Equipment: TSi 150 CC

Civil Town/City/or Village: River Rouge	County: Wayne County	State: Michigan	Water Level Observations: While Drilling: Date/Time 12/19/17 00:00 ▽ Depth (ft bgs) 6.0 After Drilling: Date/Time 2/26/18 16:19 ▼ Depth (ft bgs) 4.63



SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
1 CS	100			**SAND WITH GRAVEL** mostly fine to medium sand, few to little fine to medium gravel, very dark gray (10YR 3/1), no odor, dry, loose.	SP	
				SAND WITH CLAY mostly fine to medium sand, few to little clay, trace to few fine to medium gravel, dark grayish brown (10YR 4/2), no odor, dry, medium dense.	SC	
			5	**SILTY CLAY** mostly clay, little to some silt, trace to few fine sand, no to low plasticity, dark gray (10YR 4/1) mottled with brown (10YR 4/3), no odor, dry, stiff.	CL-ML	
				SLAG mostly fine to medium gravel-sized slag fragments, trace medium to coarse gravel, very dark grayish brown (10YR 3/2), no odor, moist, loose.		
2 CS	0		10	**GRAVELY SAND** mostly fine to coarse sand, little fine to coarse gravel, black (10YR 2/1), no odor, moist to saturated, loose.	SW	no recovery from 10.0 to 30.0 feet, lithology and well placement based on adjacent boring for MW-17-16.
				SANDY CLAY mostly clay, little fine to medium sand, trace to few fine to medium gravel, non-plastic to low plasticity, dark gray (10YR 4/1), no odor, moist, stiff.	CL	
				CLAY mostly clay, trace silt, medium to high plasticity, gray (10YR 5/1), no odor, moist, soft.	CL	
			15	**SAND WITH SILT** mostly fine to medium sand, few to little silt, gray (10YR 5/1), no odor, saturated, loose.	SP	
3 CS	0		20	**CLAY WITH SILT** mostly clay, few to little silt, medium plasticity, dark gray (10YR 4/1), no odor, moist, soft.	CL	
				SANDY GRAVEL mostly medium to coarse gravel, little to some medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose.	GP	
			25	**CLAY** mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, saturated, very soft.	CL	
			30	End of boring at 30.0 feet below ground surface.		

Signature: Jacob Krenz

Checked By: Chris Scieszka

Firm: TRC Environmental Corporation
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WELL CONSTRUCTION LOG

WELL NO. EW-05

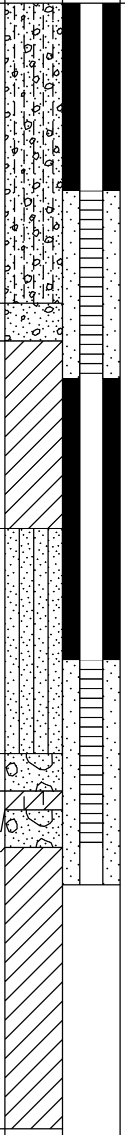
Page 1 of 1

Facility/Project Name: DTE Electric Company River Rouge Power Plant	Date Drilling Started: 12/20/17	Date Drilling Completed: 12/20/17	Project Number: 290217.0000.0000

Drilling Firm: Stock Drilling Inc.	Drilling Method: Sonic	Surface Elev. (ft) 580.4	TOC Elevation (ft) 578.40	Total Depth (ft bgs) 30.0	Borehole Dia. (in) 10

Boring Location: North side of bottom ash basin between bottom ash basin and the Rouge River, adjacent to MW-16-01. N: 284826.83 E: 13463073.34	Personnel Logged By - Jake Krenz Driller - Ryan Brown	Drilling Equipment: TSi 150 CC

Civil Town/City/or Village: River Rouge	County: Wayne County	State: Michigan	Water Level Observations: While Drilling: Date/Time 12/20/17 00:00 ▽ Depth (ft bgs) 8.0 After Drilling: Date/Time 2/26/18 16:17 ▼ Depth (ft bgs) 4.96



SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
1 CS	100		5 ▼ ▽	**SAND WITH SILT AND GRAVEL** mostly fine to medium sand, little fine to coarse gravel, few to little silt, dark gray (10YR 4/1), no odor, dry, loose.	SM	
				SAND WITH GRAVEL mostly medium to coarse sand, little fine to medium gravel, black (10YR 2/1), slight petroleum odor, saturated, loose.	SP	
			10	**CLAY** mostly clay, trace fine sand, trace silt, dark gray (10YR 4/1), no odor, medium plasticity, moist, medium stiff. Change to no sand at 11.0 feet.	CL	
2 CS	100		15	**SANDY SILT** mostly silt, some fine sand, trace clay, no plasticity, gray (10YR 5/1), no odor, moist to saturated, medium dense.	ML	
3 CS	100		20	**GRAVEL WITH SAND** mostly medium to coarse gravel, some medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose.	GP	
				SILTY CLAY mostly clay, some silt, low plasticity, gray (10YR 5/1), no odor, moist, medium stiff.	CL-ML	
			25	**GRAVEL WITH SAND** mostly medium to coarse gravel, some medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose.	GP	
				CLAY mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, moist, soft.	CL	
			30	End of boring at 30.0 feet below ground surface.		

Signature:

Checked By: Chris Scieszka

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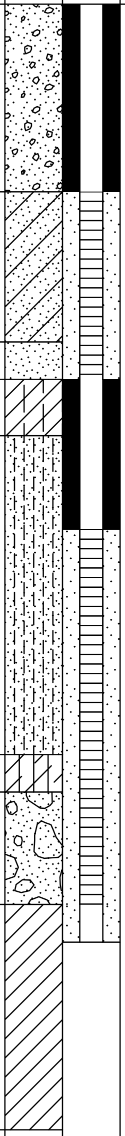
WELL CONSTRUCTION LOG

WELL NO. EW-06

Page 1 of 1

Facility/Project Name: DTE Electric Company River Rouge Power Plant		Date Drilling Started: 12/17/17	Date Drilling Completed: 12/17/17	Project Number: 290217.0000.0000
Drilling Firm: Stock Drilling Inc.	Drilling Method: Sonic	Surface Elev. (ft) 580.3 / TOC Elevation (ft) 578.59	Total Depth (ft bgs) 30.0	Borehole Dia. (in) 10
Boring Location: North side of bottom ash basin, approximately 35 feet north of east end of bottom ash basin. N: 284786.76 E: 13463137.86		Personnel Logged By - Jake Krenz Driller - Ryan Brown	Drilling Equipment: TSi 150 CC	
Civil Town/City/or Village: River Rouge	County: Wayne County / State: Michigan	Water Level Observations: While Drilling: Date/Time 12/17/17 00:00 ▽ Depth (ft bgs) 9.0 After Drilling: Date/Time 2/26/18 16:15 ▼ Depth (ft bgs) 4.86		



SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
1 CS	80		0	**SAND WITH GRAVEL** mostly medium to coarse sand, little to some fine to coarse gravel, very dark gray (10YR 4/1), no odor, dry, loose, brick fragments present. Change to brown (10YR 5/3) at 3.0 feet.	SP	
			5 ▼	**SANDY CLAY** mostly clay, little to some fine to medium sand, trace to few fine to medium gravel, no to low plasticity, dark grayish brown (10YR 4/2), no odor, dry, medium stiff to stiff. Change to moist at 8.0 feet. ▽ Large brick fragment present at 8.5 feet.	CL	
				SAND mostly medium sand, trace to few fine to medium gravel, black (10YR 2/1), no odor, saturated, loose.	SP	
2 CS	100		10	**CLAY WITH SILT** mostly clay, few to little silt, medium plasticity, gray (10YR 5/1), no odor, moist to saturated, soft.	CL	
				SILTY SAND mostly fine sand, little to some silt, gray (10YR 5/1), no odor, saturated, loose to medium dense.	SM	
			15			
3 CS	100		20	**SILT WITH CLAY** mostly silt, little clay, gray (10YR 5/1), no odor, no plasticity, moist, medium dense.	ML	
				GRAVEL WITH SAND mostly medium to coarse gravel, little to some medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose.	GP	
			25	**CLAY** mostly clay, trace silt, high plasitcity, gray (10YR 5/1), no odor, saturated, soft.	CL	
			30	End of boring at 30.0 feet below ground surface.		

Signature: Jake Krenz

Firm: TRC Environmental Corporation
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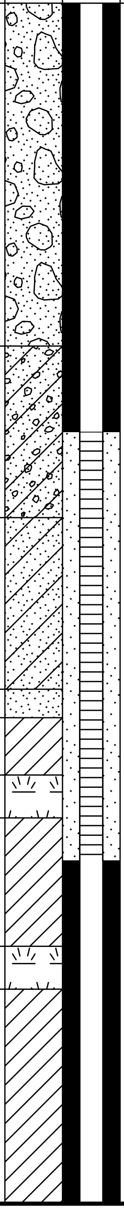
Checked By: Chris Scieszka

WELL CONSTRUCTION LOG

WELL NO. EW-07

Page 1 of 2

Facility/Project Name: DTE Electric Company River Rouge Power Plant		Date Drilling Started: 12/17/17	Date Drilling Completed: 12/17/17	Project Number: 290217.0000.0000
Drilling Firm: Stock Drilling Inc.	Drilling Method: Sonic	Surface Elev. (ft) 579.8 TOC Elevation (ft) 578.27	Total Depth (ft bgs) 30.0	Borehole Dia. (in) 10
Boring Location: East end of bottom ash basin approximately 40 feet east of bottom ash basin. N: 284740.74 E: 13463169.62		Personnel Logged By - Jake Krenz Driller - Ryan Brown	Drilling Equipment: TSi 150 CC	
Civil Town/City/or Village: River Rouge	County: Wayne County State: Michigan	Water Level Observations: While Drilling: Date/Time 12/17/17 00:00 ▽ Depth (ft bgs) 8.0 After Drilling: Date/Time 2/26/18 16:13 ▼ Depth (ft bgs) 4.19		



SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
1 CS	100			**SANDY GRAVEL** mostly medium to coarse gravel, some fine to coarse sand, light grayish brown (10YR 6/2), no odor, dry, loose. Change to very dark gray (10YR 3/1) at 0.5 feet. Change to brown (10YR 4/3) at 2.0 feet. Change to dark grayish brown (10YR 4/2), brick fragments present at 3.0 feet.	GP	
			2			
			4	▼ **SANDY CLAY WITH GRAVEL** mostly clay, little to some fine to coarse sand, little fine to coarse gravel, no to low plasticity, dark grayish brown (10YR 4/2), no odor, dry to moist, stiff, brick fragments present.	CL	
			6	**CLAY WITH SAND** mostly clay, few to little fine to medium sand, trace to few silt, low plasticity, dark grayish brown (10YR 4/2), no odor, dry to moist, stiff.	CL	
			8	▽ **SAND** mostly medium to coarse sand, trace medium gravel, gray (10YR 5/1), no odor, saturated, loose.	SP	
				CLAY mostly clay, trace to few silt, trace fine sand, medium plasticity, grayish brown, (10YR 5/2), no odor, moist, stiff.	CL	
				PEAT mostly organic material, trace clay, very dark grayish brown (10YR 3/2), no odor, moist, medium dense to loose.	PT	
			10	**CLAY** mostly clay, trace silt, medium plasticity, dark gray (10YR 4/1), no odor, moist, soft to medium stiff.	CL	
				PEAT mostly organic material, trace clay, very dark grayish brown (10YR 3/2), no odor, moist, medium dense to loose.	PT	
			12	**CLAY** mostly clay, trace silt, medium plasticity, dark gray (10YR 4/1), no odor, moist, soft to medium stiff.	CL	

Signature:

Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, MI 48108
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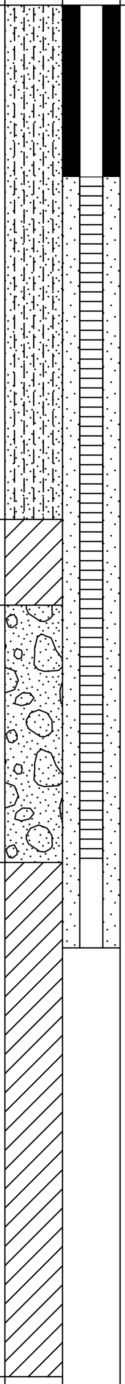
Checked By: Chris Scieszka

TRC

WELL CONSTRUCTION LOG

WELL NO. EW-07



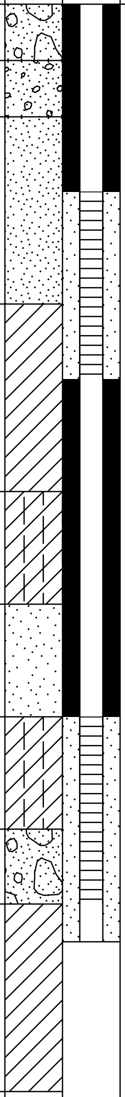
SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
2 CS	100		16 18	**SILTY SAND** mostly fine sand, little to some silt, gray (10YR 5/1), no odor, saturated, medium dense to loose.	SM	
3 CS	100		20	**CLAY** mostly clay, high plasticity, gray (10YR 5/1), no odor, moist to saturated, soft.	CL	
			22	**GRAVEL WITH SAND** mostly medium to coarse gravel, little to some medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose.	GP	
			24 26 28	**CLAY** mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, saturated, soft.	CL	
			30 32	End of boring at 30.0 feet below ground surface.		

WELL CONSTRUCTION LOG

WELL NO. EW-08

Page 1 of 1

Facility/Project Name: DTE Electric Company River Rouge Power Plant		Date Drilling Started: 12/22/17		Date Drilling Completed: 12/22/17	Project Number: 290217.0000.0000	
Drilling Firm: Stock Drilling Inc.	Drilling Method: Sonic	Surface Elev. (ft) 580.4	TOC Elevation (ft) 578.43	Total Depth (ft bgs) 30.0	Borehole Dia. (in) 10	
Boring Location: Approximately 25 feet south of bottom ash basin, approximately 100 feet from the east end of the bottom ash basin. N: 284752.45 E: 13463018.95		Personnel Logged By - Jake Krenz Driller - Ryan Brown		Drilling Equipment: TSi 150 CC		
Civil Town/City/or Village: River Rouge	County: Wayne County	State: Michigan	Water Level Observations: While Drilling: Date/Time 12/22/17 00:00 ▽ Depth (ft bgs) 13.0 After Drilling: Date/Time 2/26/18 16:28 ▼ Depth (ft bgs) 3.66			



SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
1 CS	70			**GRAVEL WITH SAND** mostly medium to coarse gravel, little fine to medium sand, dark gray (10YR 4/1), no odor, dry, medium dense.	GP	
				SAND WITH GRAVEL mostly fine to medium sand, little fine to medium gravel, pale brown (10YR 6/3), no odor, dry, loose.	SP	
			▼ 5	**SAND** mostly fine to medium sand, yellowish brown, (10YR 5/4), no odor, dry, loose.	SP	
2 CS	100		10	**CLAY** mostly clay, few silt, trace fine sand, trace fine to medium gravel, low to medium plasticity, dark gray (10YR 4/1), no odor, dry, medium stiff. Change to no silt, no sand, medium to high plasticity, gray (10YR 5/1) to dark gray (10YR 4/1), moist at 10.0 feet.	CL	
			▽ 15	**SILTY CLAY** mostly clay, few to little silt, low to medium plasticity, gray (10YR 5/1), no odor, moist to saturated, soft.	CL-ML	
				SILTY SAND WITH CLAY mostly fine sand, little silt, few clay, gray (10YR 5/1), no odor, moist, medium dense.	ML	
3 CS	100		20	**SILTY CLAY** mostly clay, little to some silt, low plasticity, grayish brown (10YR 5/2), no odor, moist, medium stiff.	CL-ML	
				GRAVEL WITH SAND mostly medium to coarse gravel, little medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose.	GP	
			25	**CLAY** mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, moist to saturated, soft.	CL	
			30	End of boring at 29.0 feet below ground surface.		

Signature:

Checked By: Chris Scieszka

Firm: TRC Environmental Corporation
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WELL CONSTRUCTION LOG

WELL NO. EW-09

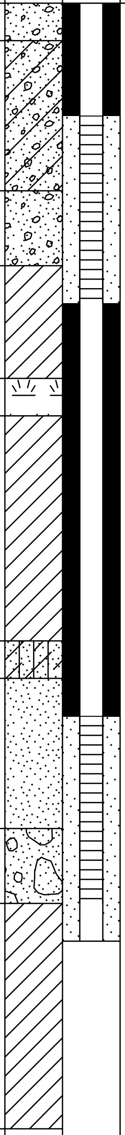
Page 1 of 1

Facility/Project Name: DTE Electric Company River Rouge Power Plant	Date Drilling Started: 12/21/17	Date Drilling Completed: 12/21/17	Project Number: 290217.0000.0000

Drilling Firm: Stock Drilling Inc.	Drilling Method: Sonic	Surface Elev. (ft) 580.0	TOC Elevation (ft) 578.18	Total Depth (ft bgs) 30.0	Borehole Dia. (in) 10

Boring Location: Adjacent to MW-16-04S N: 284815.46 E: 13462842.17	Personnel Logged By - Jake Krenz Driller - Ryan Brown	Drilling Equipment: TSi 150 CC

Civil Town/City/or Village: River Rouge	County: Wayne County	State: Michigan	Water Level Observations: While Drilling: Date/Time 12/21/17 00:00 ▽ Depth (ft bgs) 5.0 After Drilling: Date/Time 2/26/18 16:39 ▼ Depth (ft bgs) 3.56

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 CS	100			**SAND WITH GRAVEL** mostly medium to coarse sand, few to little fine to coarse gravel, dark gray (10YR 4/1), no odor, dry, loose.	SP			
			▼ 5 ▽	**SANDY CLAY WITH GRAVEL** mostly clay, little fine to medium sand, few to little medium to coarse gravel, non plastic to low plasticity, dark gray (10YR 4/1), no odor, moist, medium stiff. Change to dark yellowish brown (10YR 4/4) at 2.5 feet. Change to dark gray (10YR 4/1) at 3.0 feet.	CL			
				SAND WITH GRAVEL mostly fine to medium sand, little fine to medium gravel, trace to few clay, black (10YR 2/1), no odor, saturated, medium dense.	SP			
				CLAY mostly clay, few silt, low plasticity, brown (10YR 5/3), no odor, moist, very stiff.	CL			
2 CS	100		10	**PEAT** mostly organic material, trace clay, very dark grayish brown (10YR 3/2), no odor, moist, loose.	PT			
			15	**CLAY** mostly clay, medium to high plasticity, dark gray (10YR 4/1), no odor, moist, soft.	CL			
				SILTY SAND WITH CLAY mostly fine sand, little silt, few to little clay, gray (10YR 5/1), no odor, moist to saturated, medium dense to loose.	SM			
3 CS	100		20	**SAND** mostly fine sand, few silt, gray (10YR 5/1), no odor, moist to saturated, loose to medium dense. Change to medium to coarse sand, shells present at 21.0 feet	SP			
				GRAVEL WITH SAND mostly fine to coarse gravel, little to some medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose.	GW			
			25	**CLAY** mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, saturated, soft.	CL			
			30	End of boring at 30.0 feet below ground surface.				

Signature:

Checked By: Chris Scieszka

Firm: TRC Environmental Corporation
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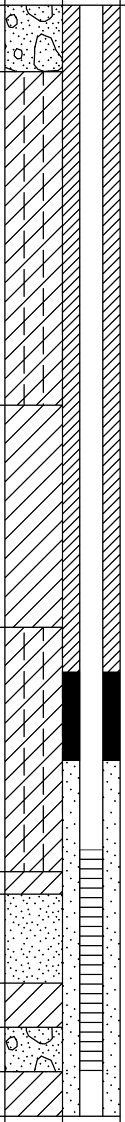
WELL CONSTRUCTION LOG

WELL NO. EW-10

Page 1 of 1

Facility/Project Name: DTE Electric Company River Rouge Power Plant		Date Drilling Started: 12/21/17	Date Drilling Completed: 12/21/17		Project Number: 290217.0000.0000
Drilling Firm: Stock Drilling Inc.	Drilling Method: Sonic	Surface Elev. (ft) 579.3	TOC Elevation (ft) 577.51	Total Depth (ft bgs) 25.0	Borehole Dia. (in) 10
Boring Location: Approximately 100 feet west of abandoned bridge, approximately 30 feet south of bottom ash basin. N: 284932.34 E: 13462673.99		Personnel Logged By - Jake Krenz Driller - Ryan Brown		Drilling Equipment: TSi 150 CC	
Civil Town/City/or Village: River Rouge	County: Wayne County	State: Michigan	Water Level Observations: While Drilling: Date/Time 12/21/17 00:00 ∇ Depth (ft bgs) 19.5 After Drilling: Date/Time 2/26/18 16:32 ▼ Depth (ft bgs) 3.17		

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
1 CS	100			**GRAVEL WITH SAND** mostly medium to coarse gravel, little fine to coarse sand, dark gray (10YR 4/1), no odor, dry, medium dense.	GP	
			▼ 5	**CLAY WITH SILT** mostly clay, few to little silt, trace fine gravel, low plasticity, dark gray (10YR 4/1), no odor, dry, very stiff. Change to trace coarse gravel, trace silt, medium stiff at 3.5 feet. Change to no coarse gravel, brown (10YR 5/3), stiff at 5.0 feet. Change to soft at 8.0 feet.	CL	
2 CS	100		10	**CLAY** mostly clay, medium to high plasticity, gray (10YR 5/1), no odor, moist, medium stiff.	CL	
			15	**SILTY CLAY** mostly clay, little silt, low plasticity, gray (10YR 5/1), no odor, moist, soft to medium stiff.	CL-ML	
3 CS	100		∇ 20	**CLAY** mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, saturated, soft.	CL	
				SAND mostly medium to coarse sand, gray (10YR 5/1), no odor, saturated, no odor, loose.	SP	
				CLAY mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, saturated, soft.	CL	
				GRAVEL WITH SAND mostly medium to coarse gravel, little to some medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose.	GP	
			25	**CLAY** mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, saturated, soft.	CL	
				End of boring at 25.0 feet below ground surface.		



Signature:

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Checked By: Chris Scieszka

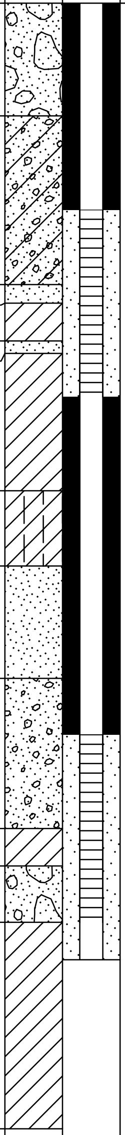
WELL CONSTRUCTION LOG

WELL NO. EW-11

Page 1 of 1

Facility/Project Name: DTE Electric Company River Rouge Power Plant		Date Drilling Started: 12/20/17	Date Drilling Completed: 12/20/17	Project Number: 290217.0000.0000	
Drilling Firm: Stock Drilling Inc.	Drilling Method: Sonic	Surface Elev. (ft) 578.8	TOC Elevation (ft) 577.11	Total Depth (ft bgs) 30.0	Borehole Dia. (in) 10
Boring Location: Approximately 45 feet west of pump house slab and approximately 20 feet south of abandoned dock hopper. N: 285116.63 E: 13462608.03		Personnel Logged By - Jake Krenz Driller - Ryan Brown		Drilling Equipment: TSi 150 CC	
Civil Town/City/or Village: River Rouge	County: Wayne County	State: Michigan	Water Level Observations: While Drilling: Date/Time 12/20/17 00:00 ∇ Depth (ft bgs) 3.0 After Drilling: Date/Time 2/26/18 16:35 ▼ Depth (ft bgs) 2.78		

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
1 CS	100			**GRAVEL WITH SAND** mostly medium to coarse gravel, little medium to coarse sand, black (10YR 2/1), no odor, dry, medium dense. Change to brown (10YR 5/3) at 1.0 feet.	GP	
			5	**SANDY CLAY WITH GRAVEL** mostly clay, some medium to coarse sand, little medium to coarse gravel, low plasticity, very dark gray (10YR 3/1), no odor, moist to saturated, medium stiff.	CL	
				SAND mostly medium to coarse sand, trace fine gravel, black (10YR 2/1), no odor, saturated, medium dense.	SP	
				CLAY mostly clay, trace silt, trace fine gravel, medium to high plasticity, very dark gray (10YR 3/1), no odor, moist, medium stiff.	CL	
2 CS	100		10	**SAND** mostly medium to coarse sand, trace fine gravel, black (10YR 2/1), no odor, saturated, medium dense.	SP	
				CLAY mostly clay, trace silt, trace fine gravel, medium to high plasticity, very dark gray (10YR 3/1), no odor, moist, medium stiff. Change to dark gray (10YR 4/1), soft at 11.0 feet.	CL	
			15	**SILTY CLAY** mostly clay, little to some silt, low plasticity, gray (10YR 5/1), no odor, moist, medium stiff.	CL-ML	
				SAND mostly fine sand, few silt, trace clay, gray (10YR 5/1), no odor, saturated, medium dense.	SP	
3 CS	100		20	**SAND WITH GRAVEL** mostly medium to coarse sand, few to little fine gravel, gray (10YR 5/1), no odor, saturated, loose.	SP	
				CLAY mostly clay, medium to high plasticity, gray (10YR 5/1), no odor, saturated, soft.	CL	
			25	**GRAVEL WITH SAND** mostly medium to coarse gravel, little medium to coarse sand, gray (10YR 5/1), no odor, saturated, loose.	GP	
				CLAY mostly clay, trace silt, high plasticity, gray (10YR5/1), no odor, saturated, soft.	CL	
			30	End of boring at 30.0 feet below ground surface.		



Signature: Jacob Krenz

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Appendix B
Data Quality Reviews

Laboratory Data Quality Review
Groundwater Monitoring Event April 2018
DTE Electric Company River Rouge Power Plant (DTE RRPP)

Groundwater samples were collected by TRC for the April 2018 sampling event for the Bottom Ash Basin at the DTE RRPP. Samples were analyzed for anions and total metals by Test America Laboratories, Inc. (Test America) located in Canton, Ohio and radium by Test America located in St. Louis, Missouri. The laboratory analytical results are reported in laboratory report J93851-1.

During the April 2018 sampling event, a groundwater sample was collected from each of the following wells:

- MW-16-01
- MW-16-02
- MW-16-03
- MW-17-06
- MW-17-07

In addition, a groundwater sample was collected in non-compliance monitoring well MW-16-04S which was submitted for analysis along with the compliance well samples and are included for quality review purposes.

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride)	EPA 9056A
Total Metals	EPA 6020, EPA 7470A
Radium (Radium-226, Radium-228, Total Radium)	SW846 9315, SW846 9320

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Quality Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Data Review (USEPA, 2017) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt, as noted in the cover page or case narrative;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures;

- Data for laboratory control samples (LCSs) and laboratory control sample duplicates (LCSDs). The LCS/LCSDs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD). Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes;
- Percent recoveries for the carriers for radium-226 and radium-228 analyses; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation are noted below.

- Appendix IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- No target analytes were detected in the method blank.
- The percent recoveries for the carriers for radium-226 and radium-228 analyses were within QC limits.
- LCS/LCSD recoveries and RPDs were within laboratory control limits.
- MS/MSD analyses were performed on sample MW-16-01 for metals and on sample MW-16-03 for fluoride. The recovery of calcium in the MS was above QC limit for batch 322404. The calcium concentration in the parent sample (MW-16-01) was >4x the spike concentration; therefore, the laboratory control limits are not applicable and data usability was not affected.
- The field duplicate pair samples were Dup-01 and MW-16-04S. The relative percent differences (RPDs) between the parent and duplicate sample were within QC limits.

Laboratory Data Quality Review
Groundwater Monitoring Event May 2018
DTE Electric Company River Rouge Power Plant (DTE RRPP)

Groundwater samples were collected by TRC for the May 2018 sampling event for the Bottom Ash Basin at the DTE RRPP. Samples were analyzed for anions, total dissolved solids, and total metals by Test America Laboratories, Inc. (Test America) located in Canton, Ohio and radium by Test America located in St. Louis, Missouri. The laboratory analytical results are reported in laboratory report J96445-1.

During the May 2018 sampling event, a groundwater sample was collected from each of the following wells:

- MW-16-01
- MW-16-02
- MW-16-03
- MW-17-06
- MW-17-07

In addition, a groundwater sample was collected in non-compliance monitoring well MW-16-04S which was submitted for analysis along with the compliance well samples and are included for quality review purposes.

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 9056A
Total Dissolved Solids	SM 2540C
Total Metals	EPA 6010B, EPA 6020, EPA 7470A
Radium (Radium-226, Radium-228, Total Radium)	SW846 9315, SW846 9320

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Quality Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Data Review (USEPA, 2017) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt, as noted in the cover page or case narrative;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures;

- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes;
- Percent recoveries for the carriers for radium-226 and radium-228 analyses; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation are noted below.

- Appendix IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- The boron concentration in the method blank associated with prep batch 329849 was 34.9 J μg/L. Boron results that are ≤10x the method blank concentration may be false positives. The boron results in samples MW-16-03 and MW-17-06 were less than 10x the method blank concentration; therefore, these results may be false positives. However, the concentration of boron in the sample from MW-17-06 was within the historical range of boron concentrations measured at that well. The boron concentration at MW-16-03 was significantly lower than the historical boron concentrations detected at that well, this is likely due to the operation of the groundwater extraction system installed around the bottom ash basin.
- The percent recoveries for the carriers for radium-226 and radium-228 analyses were within QC limits.
- LCS recoveries and RPDs were within laboratory control limits.
- The field duplicate pair samples were Dup-01 and MW-16-04S. The relative percent differences (RPDs) between the parent and duplicate sample were within QC limits.

Laboratory Data Quality Review
Groundwater Monitoring Event October 2018
DTE Electric Company River Rouge Power Plant (DTE RRPP)

Groundwater samples were collected by TRC for the October 2018 sampling event for the Bottom Ash Basin at the DTE RRPP. Samples were analyzed for anions, total dissolved solids, and select total metals by Test America Laboratories, Inc. (Test America) located in North Canton, Ohio and radium by Test America located in St. Louis, Missouri. The laboratory analytical results are reported in laboratory reports 240-102982-1 and 240-102982-3.

During the October 2018 sampling event, a groundwater sample was collected from each of the following compliance wells:

- MW-16-01
- MW-16-02
- MW-16-03
- MW-17-06
- MW-17-07

During the October 2018 sampling event, a groundwater sample was also collected from each of the following nature and extent wells:

- MW-17-05
- MW-17-13
- MW-17-14
- MW-17-15
- MW-17-18
- MW-17-20

In addition, a groundwater sample was collected from non-compliance monitoring well MW-16-04S which was submitted for analysis along with the compliance well samples and are included for quality review purposes.

Each sample was analyzed for one or more of the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	SW846 9056A
Total Dissolved Solids (TDS)	SM 2540C
Total Metals	SW846 6010B, SW846 6020
Radium (Radium-226, Radium-228, Total Radium)	SW846 9315, SW846 9320

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Quality Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Data Review (USEPA, 2017) and the Department of Energy Evaluation of

Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt, as noted in the cover page or case narrative;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures;
- Data for laboratory control samples (LCSs) and laboratory control sample duplicates (LCSDs). The LCS/LCSDs are used to assess the accuracy and precision of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD). Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes;
- Percent recoveries for the carriers for radium-226 and radium-228 analyses; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation are noted below.

- The reviewed Appendix III and IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- A method blank was analyzed with each analytical batch. No target analytes were detected in the method blanks.

- The percent recoveries for the carriers for radium-226 and radium-228 analyses were within acceptance limits.
- LCS and/or LCSD recoveries and relative percent differences (RPDs), where applicable, were within laboratory acceptance limits.
- MS/MSD analyses were performed on sample MW-16-02 for anions. All recoveries and RPDs were within the acceptance limits.
- The field duplicate pair samples were Dup-01/MW-16-03 and Dup-02/MW-17-14. The RPDs and/or duplicate error ratios (DERs) between the parent and duplicate samples were within acceptance limits.
- A constant weight was not achieved after three drying cycles for the TDS analysis of sample MW-17-18. The positive result for TDS in this sample was potentially impacted, as summarized in Attachment A.

Attachment B

Summary of Data Non-Conformances for Groundwater Analytical Data
DTE RRPP – RCRA CCR Monitoring Program
River Rouge, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
MW-17-18_20181015	10/15/2018	Total Dissolved Solids	A constant weight was not achieved after 3 drying cycles. Potential uncertainty exists for total dissolved solids result due to the variability.

Appendix C
Appendix IV Assessment Monitoring Statistical Evaluation – May 2018 Data

Technical Memorandum

Date: October 15, 2018

To: DTE Electric Company

From: Darby Litz, TRC
Sarah Holmstrom, TRC
Kristin Lowery, TRC

Project No.: 265996.0005.0000 Phase 002, Task 001

Subject: Appendix IV Assessment Monitoring Statistical Evaluation – DTE Electric Company, River Rouge Power Plant, Bottom Ash Basin Coal Combustion Residual Unit

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Introduction

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule). The CCR Rule, which became effective on October 19, 2015, applies to DTE Electric Company (DTE Electric) River Rouge Power Plant (RRPP) Coal Combustion Residual Bottom Ash Basin (BAB) CCR unit located in River Rouge, Michigan (the Site).

During the first detection monitoring event for DTE Electric RRPP BAB CCR unit, several Appendix III constituents were observed in downgradient monitoring wells at concentrations constituting statistically significant increases (SSIs) over the background concentrations established for the site. TRC reported the SSIs for the Bottom Ash Basin in the 2017 *Annual Groundwater Monitoring Report* on behalf of DTE Electric in accordance with the requirements of §257.90(e). In response to the SSIs over background limits noted during the detection monitoring event, DTE Electric initiated assessment monitoring. During the 90-day period after triggering assessment monitoring, groundwater samples were collected from the groundwater monitoring system wells (April 6, 2018) and analyzed for Appendix IV constituents pursuant to §257.95(b). The results from the initial assessment monitoring sampling event were used to establish groundwater protection standards (GWPSs) for the Appendix IV constituents in accordance with §257.95(h). The monitoring system was subsequently sampled for the Appendix III and Appendix IV constituents within 90 days from the initial Appendix IV sampling event (May 30, 2018). In accordance with §257.95, the assessment monitoring data must be compared to Groundwater Protection Standards (GWPSs) to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs. This memorandum presents the limits derived for the Appendix IV parameters for the RRPP BAB CCR unit that will be used to compare to the GWPSs.

Assessment Monitoring Statistical Evaluation

The three compliance wells utilized for the BABs CCR Unit includes MW-16-01, MW-16-02 and MW-16-03. Following the initial and resample assessment monitoring sampling event, compliance well data for the RRPP BAB were evaluated in accordance with the *Groundwater Statistical Evaluation Plan* (Stats Plan) (TRC, October 2017; Revised December 2017). For each detected constituent, the concentrations for each well were first compared directly to the GWPS. Parameter-well combinations that included a direct exceedance of the GWPS were retained for further analysis. As a result, arsenic was retained for evaluation at MW-16-01 and MW-16-03, beryllium at MW-16-02, and lithium at MW-16-01, MW-16-02, and MW-16-03.

Groundwater data were then evaluated utilizing ChemStat™ statistical software. ChemStat™ is a software tool that is commercially available for performing statistical evaluation consistent with procedures outlined in U.S. EPA's Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (Unified Guidance; UG). Within the ChemStat™ statistical program (and the UG), confidence limits were selected to perform the statistical comparison of compliance data to a fixed standard. Parametric and non-parametric confidence intervals were calculated for each of the CCR Appendix IV parameters using a 99 percent confidence level, i.e., a significance level (α) of 0.01. The following narrative describes the methods employed, the results obtained and the ChemStat™ output files are included as an attachment.

The statistical data evaluation included the following steps:

- Review of data quality checklists for the baseline/background data sets for CCR Appendix IV constituents;
- Evaluation of percentage of non-detects for each baseline/background well-constituent (w/c) pair;
- Graphical representation of the baseline data as time versus concentration (T v. C) by well/constituent pair;
- Outlier testing of individual data points that appear from the graphical representations as potential outliers;
- Evaluation of visual trends apparent in the graphical representations for statistical significance;
- Distribution of the data; and
- Calculation of the confidence intervals for each cumulative dataset.

The results of these evaluations are presented and discussed below.

Data Quality

Data from each sampling round were evaluated for completeness, overall quality and usability, method-specified sample holding times, precision and accuracy, and potential sample contamination. The review was completed using the following quality control (QC) information which at a minimum included chain-of-custody forms, investigative sample results including blind field duplicates, and, as provided by the laboratory, method blanks, laboratory control spikes, laboratory duplicates. The data were found to be complete and usable for the purposes of the CCR monitoring program.

Percentage of Non-detects

The percentage of non-detect observations for constituents with one or more detection above a GWPS is included in Table 1. Non-detect data was handled in accordance with the Stats Plan for the purposes of calculating confidence intervals.

Time versus Concentration Graphs

The T v. C graphs show potential outliers for arsenic (high values for MW-16-01 in April and May 2018, and high value for MW-16-03 in September 2016) and beryllium (single detection in MW-16-02 in June 2017). This data set was tested using the ChemStat™ software to assess whether the potential outliers are statistically significant, as discussed further below.

The T v. C graphs showed potential trending for some Appendix IV well/constituent pairs. These were tested by the ChemStat™ software to assess whether the trends are statistically significant.

Outlier Testing

The Dixon's Outlier Test in ChemStat™ was used to test the potential outliers in the arsenic data set for MW-16-01 and MW-16-03 that were identified in the T v. C graphs. The suspect data points for MW-16-01 were found to not be outliers at the 0.05 significance level; therefore, the potential outliers were not confirmed and not removed from the data set. The suspect data point for MW-16-03 was found to be an outlier at the 0.05 significance level and was removed from the data set.

The Dixon's Outlier Test could not be used on the suspected beryllium outlier due to the high percentage of non-detects. Therefore, the single detection was classified as an outlier and removed from the data set.

Trend Analysis

Visual trends apparent in the T v. C graphs were evaluated in ChemStat™ using the Sens Slope estimator to determine if a subset of data should be used in calculating the confidence interval. Trends were evaluated using a 95-percent (two-tailed) confidence level, i.e., a significance level (α) of 0.05. No trends were found to be significant.

Distribution of the Data Sets

ChemStat™ was utilized to evaluate each data set for normality. If the skewness coefficient was calculated to be between negative one and one, then the data were assumed to be approximately normally distributed. If the skewness coefficient was calculated as greater than one (or less than negative one) then the calculation was performed on the natural log (Ln) of the data. If the Ln of the data still determined that the data appeared to be skewed, then the Shapiro-Wilk test of normality (Shapiro-Wilk) was performed. The Shapiro-Wilk statistic was calculated on both non-transformed data, and the Ln-transformed data. If the Shapiro-Wilk statistic indicated that normal distributional assumptions were not valid, then the parameter was considered a candidate for non-parametric statistical evaluation. The data distributions are summarized in Table 1.

Confidence Intervals

Table 1 presents the calculated confidence intervals for each well-constituent pair. For normal and lognormal distributions, confidence intervals are calculated for 99 percent confidence using parametric methods. For non-normal background datasets, a nonparametric confidence interval is utilized, resulting in the highest and lowest values from the contributing dataset as the confidence limits. Confidence intervals were calculated using only the eight most recent sampling events to ensure that data was recent enough to be representative of current site conditions.

The confidence intervals calculated through the above-described process will be compared to the GWPS to determine if an exceedance has occurred. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS. If the statistical tests conclude that an exceedance of the GWPS, verification resampling may be conducted by the facility. Once the resampling data are available, the comparison to the GWPS will be evaluated.

Attachments

Table 1 – Summary of Descriptive Statistics and Confidence Interval Calculations
Attachment A – ChemStat™ Outputs

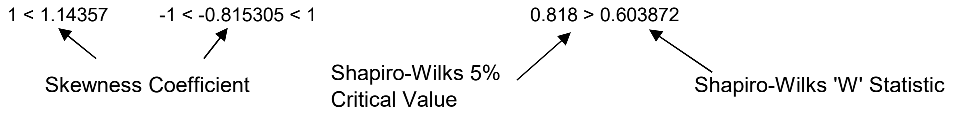
Table 1

Summary of Descriptive Statistics and Confidence Interval Calculations

Table 1
Summary of Descriptive Statistics and Confidence Interval Calculations
Assessment Monitoring Statistical Evaluation
DTE Electric Company – River Rouge Power Plant

Parameter[1]	Percent Non-Detect	Outliers?	Trend?	Skewness		Shapiro-Wilks Test (5% Critical Value)		Parametric / Non-Parametric	Confidence Interval[2]
				Un-Transformed	Natural Log	Un-Transformed	Natural Log		
MW-16-01									
Arsenic	0%	No	No	1 < 1.1593	1 < 1.14357	0.818 > 0.603872	0.818 > 0.629581	Non-parametric	[35 ,170]
Lithium	0%	No	No	-1 < -0.815305 < 1	--	--	--	Parametric	[47, 52]
MW-16-02									
Beryllium	88%	Yes[3]	--	--	--	--	--	--	--
Lithium	0%	No	No	-1 < -0.997215 < 1	--	--	--	Parametric	[41, 70]
MW-16-03									
Arsenic	22%	Yes	No	-1 < 0.480136 < 1	--	--	--	Parametric	[4.0, 17]
Lithium	0%	No	No	-1.03428 < -1	-1.17372 < -1	0.818 > 0.752255	0.818 > 0.698096	Non-parametric	[11, 51]

Notes:



(1) Well-parameter combinations that have one or more direct exceedances of the Groundwater Protection Standard.

(2) The most recent eight data points are used to calculate the confidence interval to be representative of current conditions.

(3) The beryllium outlier is a single detection. With the outlier removed, the dataset is 100% non-detects; therefore, further analysis is unnecessary.

Attachment A

ChemStat™ Confidence Interval Outputs

Concentrations (ug/L)

Parameter: Arsenic

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 18
Total Non-Detect: 2
Percent Non-Detects: 11.1111%
Total Background Measurements: 0
There are 0 background locations

Loc.	Meas.	ND	Date	Conc.	Original

There are 2 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-16-01	9	0 (0%)	9/30/2016	37	37
			11/18/2016	39	39
			1/20/2017	40	40
			3/10/2017	38	38
			4/28/2017	37	37
			6/16/2017	35	35
			7/21/2017	36	36
			4/6/2018	160	160
			5/30/2018	170	170
MW-16-03	9	2 (22.2222%)	9/30/2016	40	40
			11/18/2016	21	21
			1/20/2017	13	13
			3/10/2017	12	12
			4/28/2017	12	12
			6/16/2017	12	12
			7/21/2017	12	12
			4/6/2018	ND<5 U	ND<5 U
			5/30/2018	ND<5 U	ND<5 U

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

The detected beryllium was removed as an outlier

Concentrations (ug/L)

Parameter: Beryllium

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 8
Total Non-Detect: 7
Percent Non-Detects: 87.5%
Total Background Measurements: 0
There are 0 background locations

Loc.	Meas.	ND	Date	Conc.	Original

There is 1 compliance location

Loc.	Meas.	ND	Date	Conc.	Original
MW-16-02	8	7 (87.5%)	9/30/2016	ND<1 U	ND<1 U
			11/18/2016	ND<1 U	ND<1 U
			1/20/2017	ND<1 U	ND<1 U
			3/10/2017	ND<1 U	ND<1 U
			4/28/2017	ND<1 U	ND<1 U
			6/16/2017	4.5	4.5
			7/21/2017	ND<1 U	ND<1 U
			4/6/2018	ND<1 U	ND<1 U

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Concentrations (ug/L)

Parameter: Lithium

Original Data (Not Transformed)

Non-Detects Replaced with Detection Limit

Total Measurements: 27
Total Non-Detect: 0
Percent Non-Detects: 0%
Total Background Measurements: 0
There are 0 background locations

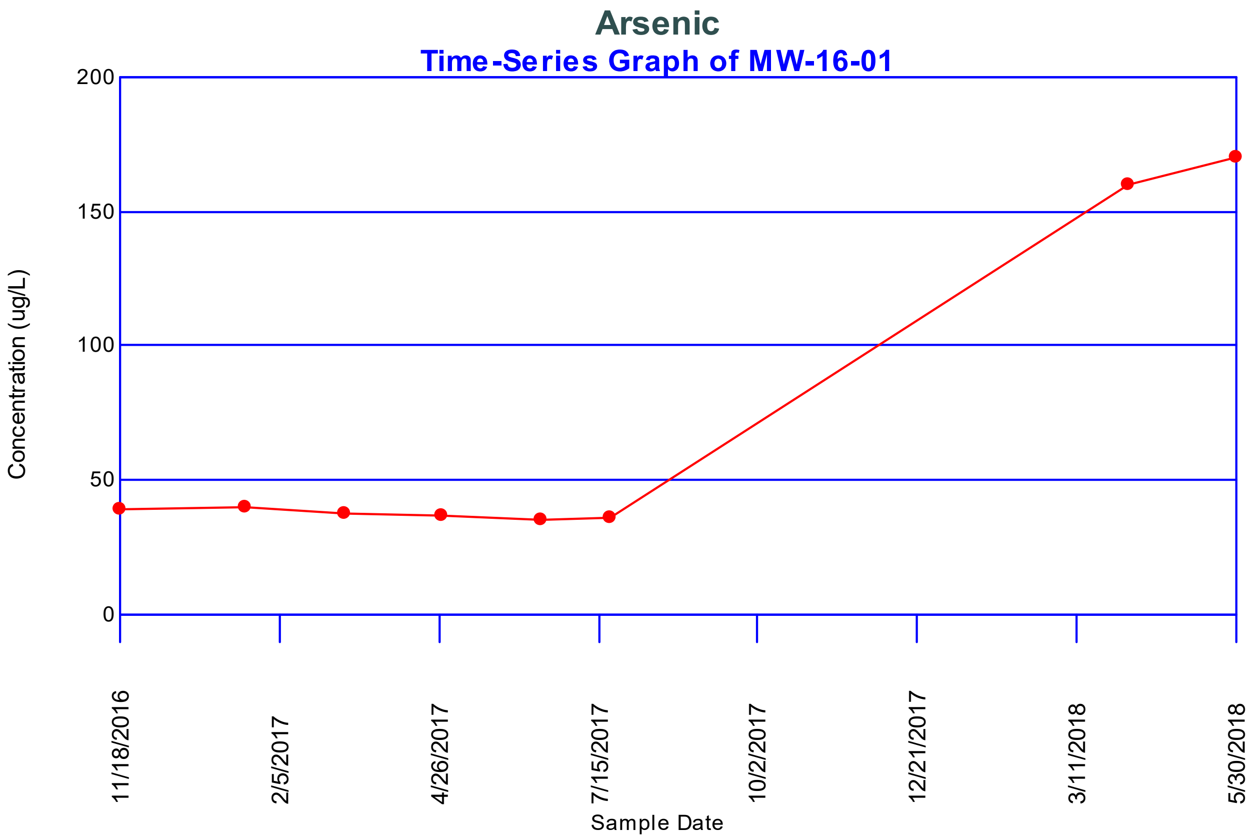
Loc.	Meas.	ND	Date	Conc.	Original

There are 3 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-16-01	9	0 (0%)	9/30/2016	53	53
			11/18/2016	50	50
			1/20/2017	48	48
			3/10/2017	49	49
			4/28/2017	53	53
			6/16/2017	51	51
			7/21/2017	44	44
			4/6/2018	49	49
			5/30/2018	51	51
MW-16-02	9	0 (0%)	9/30/2016	64	64
			11/18/2016	62	62
			1/20/2017	64	64
			3/10/2017	58	58
			4/28/2017	71	71
			6/16/2017	64	64
			7/21/2017	52	52
			4/6/2018	45	45
			5/30/2018	28	28
MW-16-03	9	0 (0%)	9/30/2016	44	44
			11/18/2016	44	44
			1/20/2017	49	49
			3/10/2017	45	45
			4/28/2017	51	51
			6/16/2017	49	49
			7/21/2017	41	41
			4/6/2018	15	15
			5/30/2018	11	11

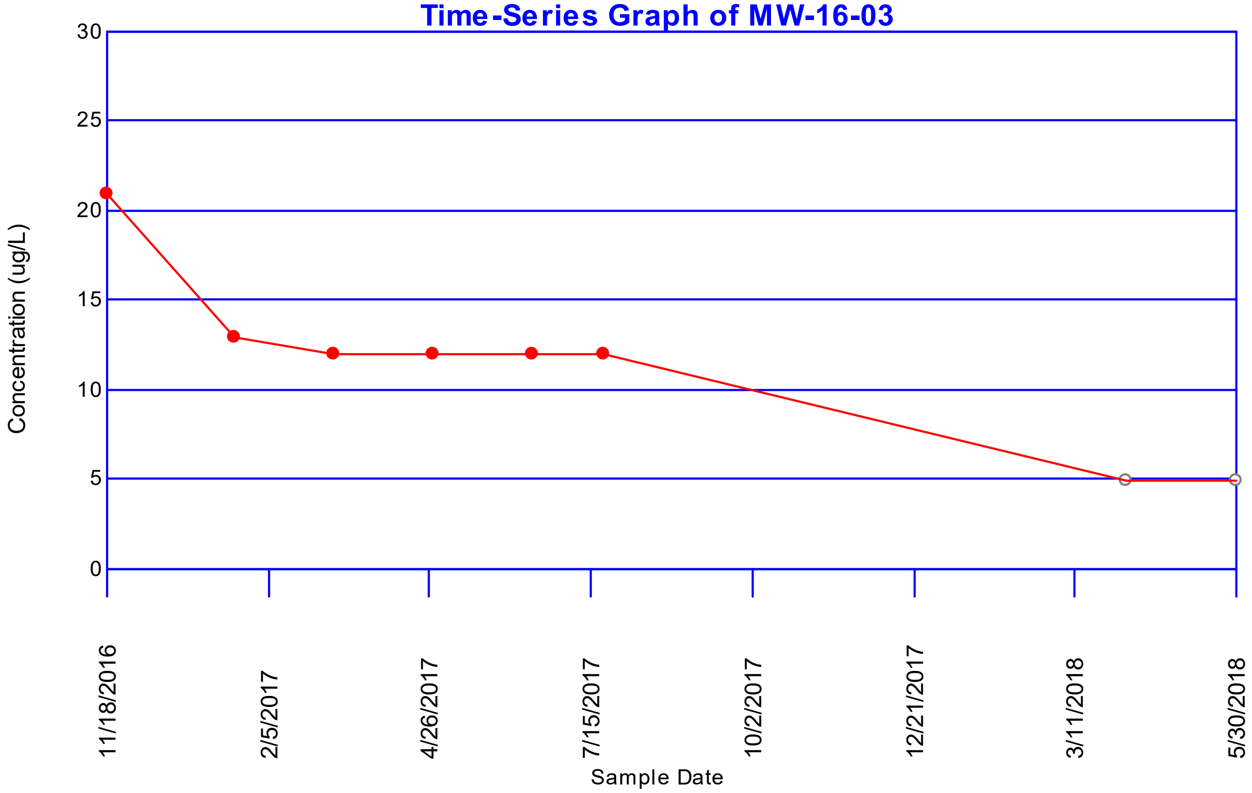
There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original



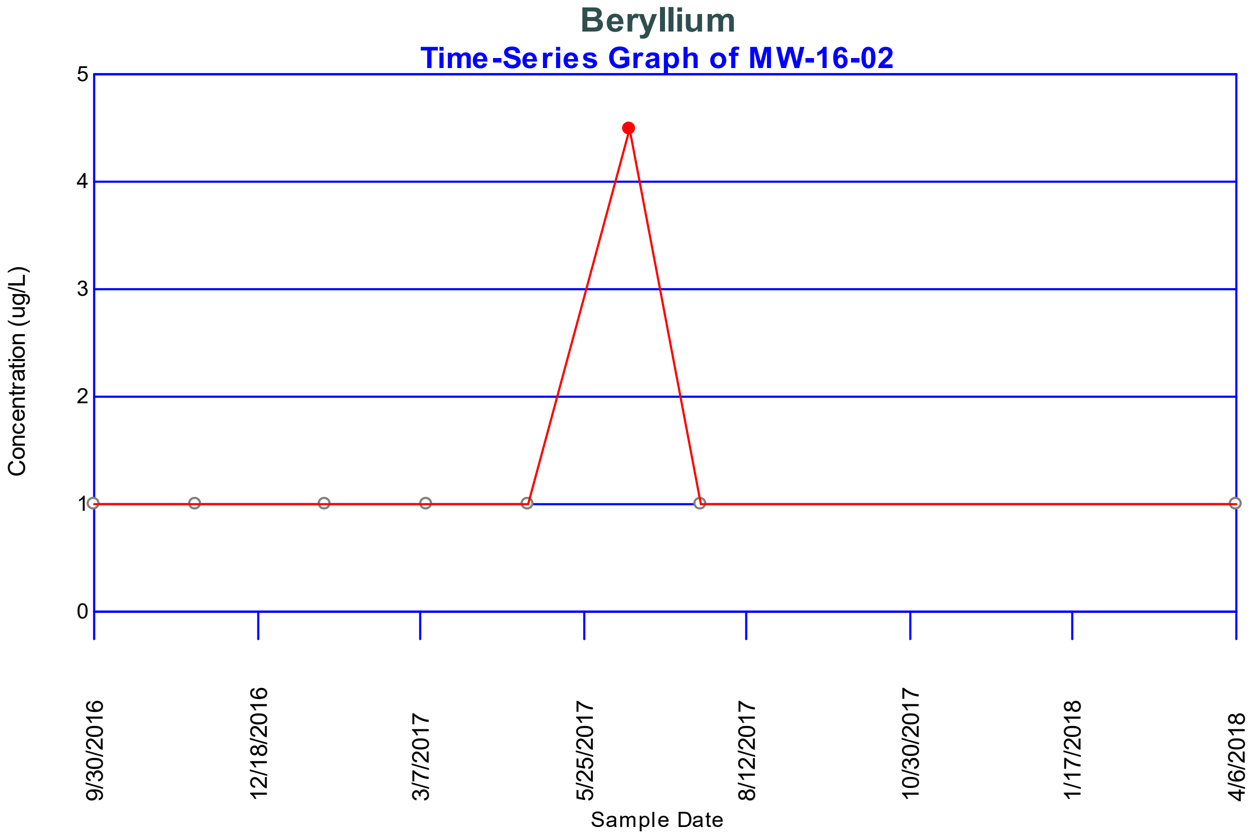
Arsenic

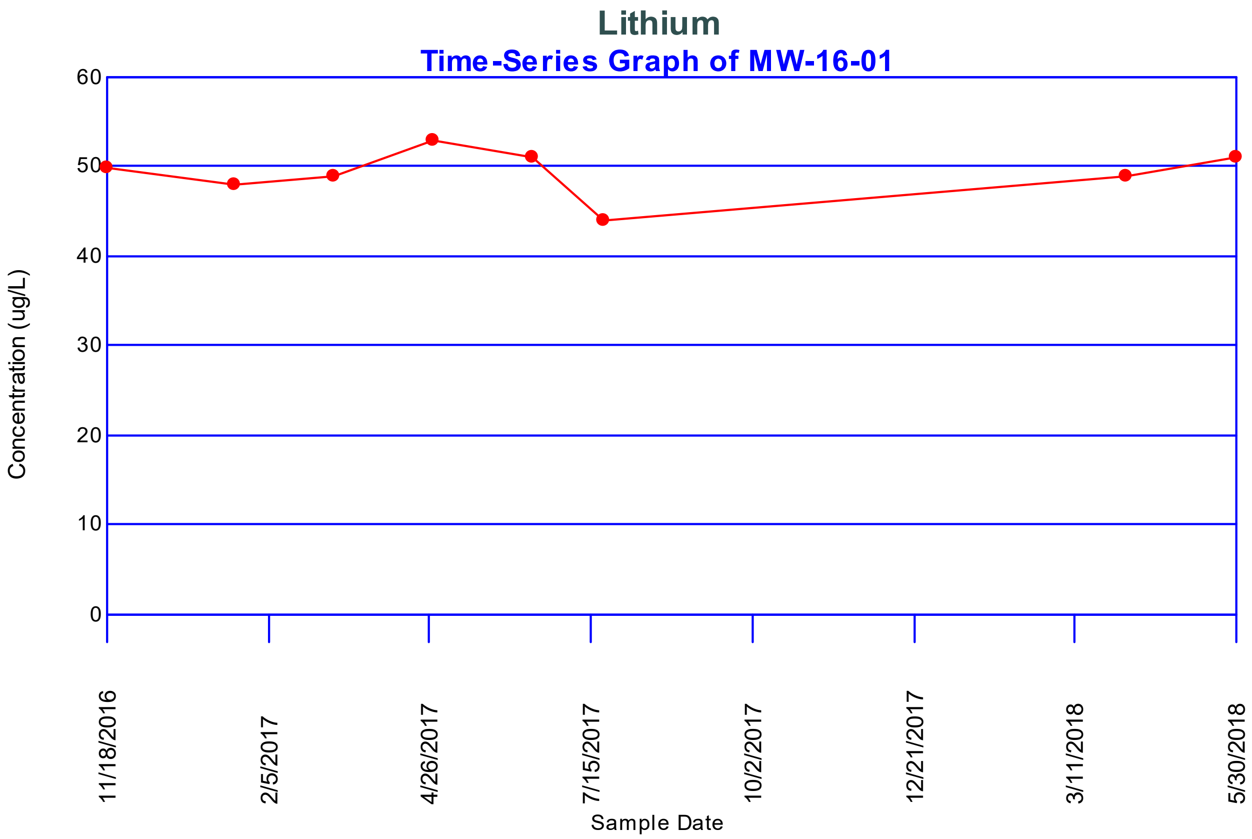
Time-Series Graph of MW-16-01

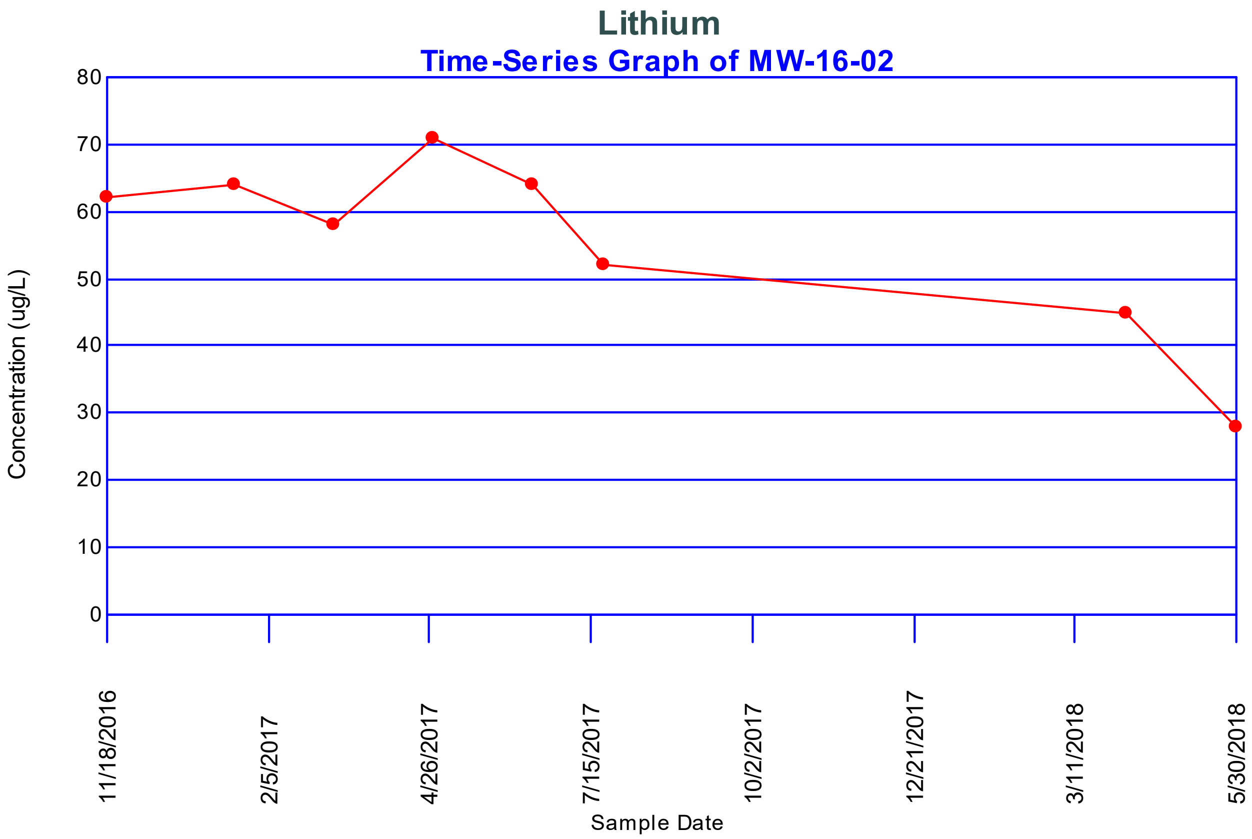


Arsenic

Time-Series Graph of MW-16-03

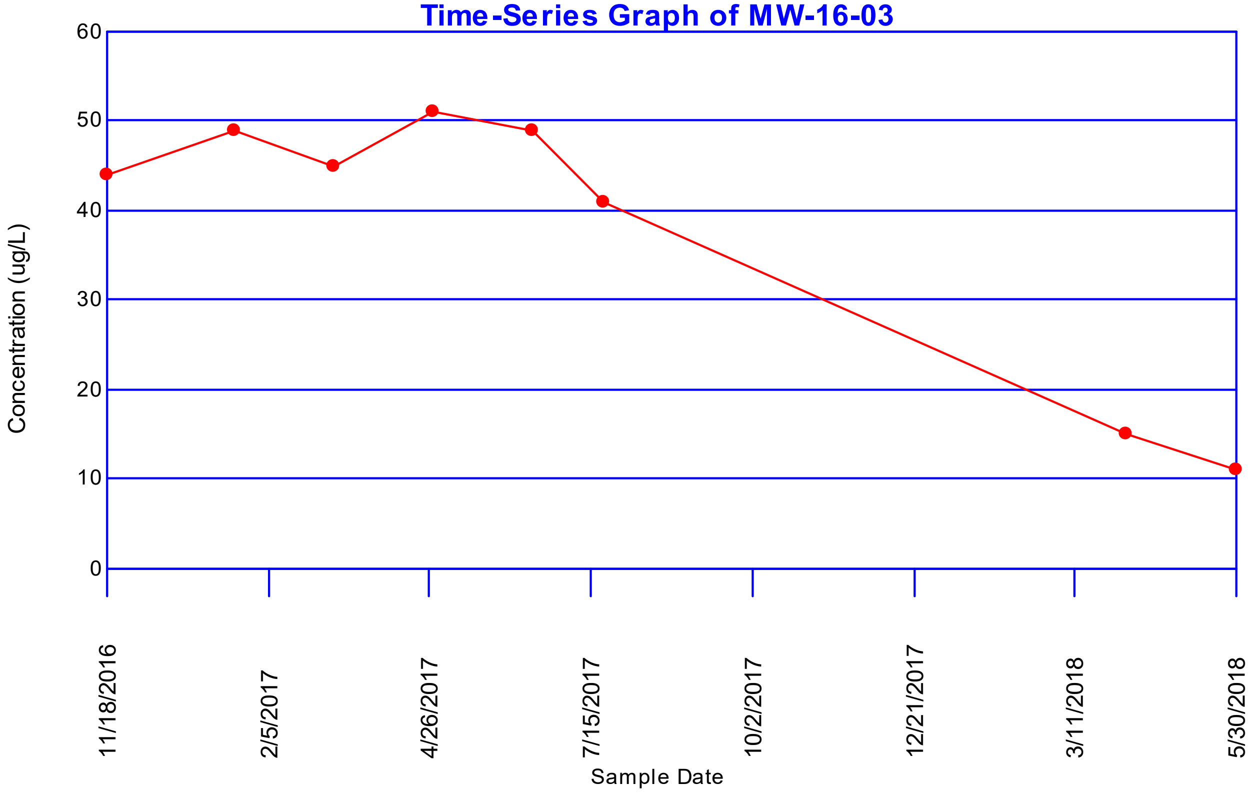

Beryllium
Time-Series Graph of MW-16-02
Concentration (ug/L)
0
1
2
3
4
5
9/30/2016
12/18/2016
3/7/2017
5/25/2017
8/12/2017
10/30/2017
1/17/2018
4/6/2018
Sample Date


Lithium
Time-Series Graph of MW-16-01
Concentration (ug/L)
60
50
40
30
20
10
0
11/18/2016
2/5/2017
4/26/2017
7/15/2017
10/2/2017
12/21/2017
3/11/2018
5/30/2018
Sample Date


Lithium
Time-Series Graph of MW-16-02
Concentration (ug/L)
80
70
60
50
40
30
20
10
0
11/18/2016
2/5/2017
4/26/2017
7/15/2017
10/2/2017
12/21/2017
3/11/2018
5/30/2018
Sample Date

Lithium

Time-Series Graph of MW-16-03



Dixon's Test for Outliers

Parameter: Arsenic

Location: MW-16-01

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

For 8 Measurements...
5% Level of Significance

Iteration	Highest	Lowest	Critical	Outlier
1	0.0746269	0.008	0.554	None

Loc.	Date	Conc.	Outlier
MW-16-01	11/18/2016	39	FALSE
	1/20/2017	40	FALSE
	3/10/2017	38	FALSE
	4/28/2017	37	FALSE
	6/16/2017	35	FALSE
	7/21/2017	36	FALSE
	4/6/2018	160	FALSE
	5/30/2018	170	FALSE

Dixon's Test for Outliers

Parameter: Arsenic

Location: MW-16-03

Original Data (Not Transformed)

Cohen's Adjustment

For 8 Measurements...
5% Level of Significance

Iteration	Highest	Lowest	Critical	Outlier
1	0.5	0	0.554	None

Loc.	Date	Conc.	Outlier
MW-16-03	11/18/2016	21	FALSE
	1/20/2017	13	FALSE
	3/10/2017	12	FALSE
	4/28/2017	12	FALSE
	6/16/2017	12	FALSE
	7/21/2017	12	FALSE
	4/6/2018	ND<5 U	FALSE
	5/30/2018	ND<5 U	FALSE

Sen's Slope Analysis

Parameter: Arsenic

Location: MW-16-01

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

95% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
40 (1/20/2017)	39 (11/18/2016)	(40 - 39)/(2 - 1)	1
38 (3/10/2017)	39 (11/18/2016)	(38 - 39)/(3 - 1)	-0.5
37 (4/28/2017)	39 (11/18/2016)	(37 - 39)/(4 - 1)	-0.666667
35 (6/16/2017)	39 (11/18/2016)	(35 - 39)/(5 - 1)	-1
36 (7/21/2017)	39 (11/18/2016)	(36 - 39)/(6 - 1)	-0.6
160 (4/6/2018)	39 (11/18/2016)	(160 - 39)/(7 - 1)	20.1667
170 (5/30/2018)	39 (11/18/2016)	(170 - 39)/(8 - 1)	18.7143
38 (3/10/2017)	40 (1/20/2017)	(38 - 40)/(3 - 2)	-2
37 (4/28/2017)	40 (1/20/2017)	(37 - 40)/(4 - 2)	-1.5
35 (6/16/2017)	40 (1/20/2017)	(35 - 40)/(5 - 2)	-1.66667
36 (7/21/2017)	40 (1/20/2017)	(36 - 40)/(6 - 2)	-1
160 (4/6/2018)	40 (1/20/2017)	(160 - 40)/(7 - 2)	24
170 (5/30/2018)	40 (1/20/2017)	(170 - 40)/(8 - 2)	21.6667
37 (4/28/2017)	38 (3/10/2017)	(37 - 38)/(4 - 3)	-1
35 (6/16/2017)	38 (3/10/2017)	(35 - 38)/(5 - 3)	-1.5
36 (7/21/2017)	38 (3/10/2017)	(36 - 38)/(6 - 3)	-0.666667
160 (4/6/2018)	38 (3/10/2017)	(160 - 38)/(7 - 3)	30.5
170 (5/30/2018)	38 (3/10/2017)	(170 - 38)/(8 - 3)	26.4
35 (6/16/2017)	37 (4/28/2017)	(35 - 37)/(5 - 4)	-2
36 (7/21/2017)	37 (4/28/2017)	(36 - 37)/(6 - 4)	-0.5
160 (4/6/2018)	37 (4/28/2017)	(160 - 37)/(7 - 4)	41
170 (5/30/2018)	37 (4/28/2017)	(170 - 37)/(8 - 4)	33.25
36 (7/21/2017)	35 (6/16/2017)	(36 - 35)/(6 - 5)	1
160 (4/6/2018)	35 (6/16/2017)	(160 - 35)/(7 - 5)	62.5
170 (5/30/2018)	35 (6/16/2017)	(170 - 35)/(8 - 5)	45
160 (4/6/2018)	36 (7/21/2017)	(160 - 36)/(7 - 6)	124
170 (5/30/2018)	36 (7/21/2017)	(170 - 36)/(8 - 6)	67
170 (5/30/2018)	160 (4/6/2018)	(170 - 160)/(8 - 7)	10

Number of Q values = 28

Ordered Q Values

n	Q
1	-2
2	-2
3	-1.66667
4	-1.5
5	-1.5
6	-1
7	-1

8	-1
9	-0.666667
10	-0.666667
11	-0.6
12	-0.5
13	-0.5
14	1
15	1
16	10
17	18.7143
18	20.1667
19	21.6667
20	24
21	26.4
22	30.5
23	33.25
24	41
25	45
26	62.5
27	67
28	124

Sen's Estimator (Median Q) is 1

Time Period	**Observations**
11/18/2016	1
1/20/2017	1
3/10/2017	1
4/28/2017	1
6/16/2017	1
7/21/2017	1
4/6/2018	1
5/30/2018	1

There are 0 time periods with multiple data

A = 0
B = 0
C = 0
D = 0
E = 0
F = 0
a = 1176
b = 3024
c = 112
Group Variance = 65.3333
For 95% confidence interval (two-tailed), Z at (1-0.95)/2 = 1.97737
C = 15.9829
M1 = (28 - 15.9829)/2.0 = 6.00856
M2 = (28 + 15.9829)/2.0 + 1 = 22.9914
Lower limit is -1 = Q(6)
Upper limit is 33.25 = Q(23)
-1 < 0 < 33.25 indicating no trend in data.

Sen's Slope Analysis

Parameter: Arsenic
Location: MW-16-03
Original Data (Not Transformed)
Cohen's Adjustment

95% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
13 (1/20/2017)	21 (11/18/2016)	(13 - 21)/(2 - 1)	-8
12 (3/10/2017)	21 (11/18/2016)	(12 - 21)/(3 - 1)	-4.5
12 (4/28/2017)	21 (11/18/2016)	(12 - 21)/(4 - 1)	-3
12 (6/16/2017)	21 (11/18/2016)	(12 - 21)/(5 - 1)	-2.25
12 (7/21/2017)	21 (11/18/2016)	(12 - 21)/(6 - 1)	-1.8
ND<5 U (4/6/2018)	21 (11/18/2016)	(5 - 21)/(7 - 1)	-2.66667
ND<5 U (5/30/2018)	21 (11/18/2016)	(5 - 21)/(8 - 1)	-2.28571
12 (3/10/2017)	13 (1/20/2017)	(12 - 13)/(3 - 2)	-1
12 (4/28/2017)	13 (1/20/2017)	(12 - 13)/(4 - 2)	-0.5
12 (6/16/2017)	13 (1/20/2017)	(12 - 13)/(5 - 2)	-0.333333
12 (7/21/2017)	13 (1/20/2017)	(12 - 13)/(6 - 2)	-0.25
ND<5 U (4/6/2018)	13 (1/20/2017)	(5 - 13)/(7 - 2)	-1.6
ND<5 U (5/30/2018)	13 (1/20/2017)	(5 - 13)/(8 - 2)	-1.33333
12 (4/28/2017)	12 (3/10/2017)	(12 - 12)/(4 - 3)	0
12 (6/16/2017)	12 (3/10/2017)	(12 - 12)/(5 - 3)	0
12 (7/21/2017)	12 (3/10/2017)	(12 - 12)/(6 - 3)	0
ND<5 U (4/6/2018)	12 (3/10/2017)	(5 - 12)/(7 - 3)	-1.75
ND<5 U (5/30/2018)	12 (3/10/2017)	(5 - 12)/(8 - 3)	-1.4
12 (6/16/2017)	12 (4/28/2017)	(12 - 12)/(5 - 4)	0
12 (7/21/2017)	12 (4/28/2017)	(12 - 12)/(6 - 4)	0
ND<5 U (4/6/2018)	12 (4/28/2017)	(5 - 12)/(7 - 4)	-2.33333
ND<5 U (5/30/2018)	12 (4/28/2017)	(5 - 12)/(8 - 4)	-1.75
12 (7/21/2017)	12 (6/16/2017)	(12 - 12)/(6 - 5)	0
ND<5 U (4/6/2018)	12 (6/16/2017)	(5 - 12)/(7 - 5)	-3.5
ND<5 U (5/30/2018)	12 (6/16/2017)	(5 - 12)/(8 - 5)	-2.33333
ND<5 U (4/6/2018)	12 (7/21/2017)	(5 - 12)/(7 - 6)	-7
ND<5 U (5/30/2018)	12 (7/21/2017)	(5 - 12)/(8 - 6)	-3.5
ND<5 U (5/30/2018)	ND<5 U (4/6/2018)	(5 - 5)/(8 - 7)	0

Number of Q values = 28

Ordered Q Values

n	Q
1	-8
2	-7
3	-4.5
4	-3.5
5	-3.5
6	-3
7	-2.66667

```
8              -2.33333
9              -2.33333
10             -2.28571
11             -2.25
12             -1.8
13             -1.75
14             -1.75
15             -1.6
16             -1.4
17             -1.33333
18             -1
19             -0.5
20             -0.333333
21             -0.25
22             0
23             0
24             0
25             0
26             0
27             0
28             0
Sen's Estimator (Median Q) is -1.675
```

```
Tied Group     Value          Members
1              12             4
2              5              2
```

```
Time Period                   Observations
11/18/2016                    1
1/20/2017                     1
3/10/2017                     1
4/28/2017                     1
6/16/2017                     1
7/21/2017                     1
4/6/2018                      1
5/30/2018                     1
There are 0 time periods with multiple data
```

```
A = 174
B = 0
C = 24
D = 0
E = 14
F = 0
a = 1176
b = 3024
c = 112
Group Variance = 55.6667
For 95% confidence interval (two-tailed), Z at (1-0.95)/2 = 1.97737
C = 14.7532
M1 = (28 - 14.7532)/2.0 = 6.62342
M2 = (28 + 14.7532)/2.0 + 1 = 22.3766
Lower limit is -2.66667 = Q(7)
Upper limit is 0 = Q(22)
-2.66667 < 0 < 0 indicating no trend in data.
```

Sen's Slope Analysis

Parameter: Lithium

Location: MW-16-01

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

95% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
48 (1/20/2017)	50 (11/18/2016)	(48 - 50)/(2 - 1)	-2
49 (3/10/2017)	50 (11/18/2016)	(49 - 50)/(3 - 1)	-0.5
53 (4/28/2017)	50 (11/18/2016)	(53 - 50)/(4 - 1)	1
51 (6/16/2017)	50 (11/18/2016)	(51 - 50)/(5 - 1)	0.25
44 (7/21/2017)	50 (11/18/2016)	(44 - 50)/(6 - 1)	-1.2
49 (4/6/2018)	50 (11/18/2016)	(49 - 50)/(7 - 1)	-0.166667
51 (5/30/2018)	50 (11/18/2016)	(51 - 50)/(8 - 1)	0.142857
49 (3/10/2017)	48 (1/20/2017)	(49 - 48)/(3 - 2)	1
53 (4/28/2017)	48 (1/20/2017)	(53 - 48)/(4 - 2)	2.5
51 (6/16/2017)	48 (1/20/2017)	(51 - 48)/(5 - 2)	1
44 (7/21/2017)	48 (1/20/2017)	(44 - 48)/(6 - 2)	-1
49 (4/6/2018)	48 (1/20/2017)	(49 - 48)/(7 - 2)	0.2
51 (5/30/2018)	48 (1/20/2017)	(51 - 48)/(8 - 2)	0.5
53 (4/28/2017)	49 (3/10/2017)	(53 - 49)/(4 - 3)	4
51 (6/16/2017)	49 (3/10/2017)	(51 - 49)/(5 - 3)	1
44 (7/21/2017)	49 (3/10/2017)	(44 - 49)/(6 - 3)	-1.66667
49 (4/6/2018)	49 (3/10/2017)	(49 - 49)/(7 - 3)	0
51 (5/30/2018)	49 (3/10/2017)	(51 - 49)/(8 - 3)	0.4
51 (6/16/2017)	53 (4/28/2017)	(51 - 53)/(5 - 4)	-2
44 (7/21/2017)	53 (4/28/2017)	(44 - 53)/(6 - 4)	-4.5
49 (4/6/2018)	53 (4/28/2017)	(49 - 53)/(7 - 4)	-1.33333
51 (5/30/2018)	53 (4/28/2017)	(51 - 53)/(8 - 4)	-0.5
44 (7/21/2017)	51 (6/16/2017)	(44 - 51)/(6 - 5)	-7
49 (4/6/2018)	51 (6/16/2017)	(49 - 51)/(7 - 5)	-1
51 (5/30/2018)	51 (6/16/2017)	(51 - 51)/(8 - 5)	0
49 (4/6/2018)	44 (7/21/2017)	(49 - 44)/(7 - 6)	5
51 (5/30/2018)	44 (7/21/2017)	(51 - 44)/(8 - 6)	3.5
51 (5/30/2018)	49 (4/6/2018)	(51 - 49)/(8 - 7)	2

Number of Q values = 28

Ordered Q Values

n	Q
1	-7
2	-4.5
3	-2
4	-2
5	-1.66667
6	-1.33333
7	-1.2

```
8               -1
9               -1
10              -0.5
11              -0.5
12              -0.166667
13              0
14              0
15              0.142857
16              0.2
17              0.25
18              0.4
19              0.5
20              1
21              1
22              1
23              1
24              2
25              2.5
26              3.5
27              4
28              5
Sen's Estimator (Median Q) is 0.0714286

Tied Group      Value           Members
1               49              2
2               51              2

Time Period                     Observations
11/18/2016                      1
1/20/2017                       1
3/10/2017                       1
4/28/2017                       1
6/16/2017                       1
7/21/2017                       1
4/6/2018                        1
5/30/2018                       1
There are 0 time periods with multiple data

A = 36
B = 0
C = 0
D = 0
E = 4
F = 0
a = 1176
b = 3024
c = 112
Group Variance = 63.3333
For 95% confidence interval (two-tailed), Z at (1-0.95)/2 = 1.97737
C = 15.7363
M1 = (28 - 15.7363)/2.0 = 6.13183
M2 = (28 + 15.7363)/2.0 + 1 = 22.8682
Lower limit is -1.33333 = Q(6)
Upper limit is 1 = Q(23)
-1.33333 < 0 < 1 indicating no trend in data.
```

Sen's Slope Analysis

Parameter: Lithium

Location: MW-16-02

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

95% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
64 (1/20/2017)	62 (11/18/2016)	(64 - 62)/(2 - 1)	2
58 (3/10/2017)	62 (11/18/2016)	(58 - 62)/(3 - 1)	-2
71 (4/28/2017)	62 (11/18/2016)	(71 - 62)/(4 - 1)	3
64 (6/16/2017)	62 (11/18/2016)	(64 - 62)/(5 - 1)	0.5
52 (7/21/2017)	62 (11/18/2016)	(52 - 62)/(6 - 1)	-2
45 (4/6/2018)	62 (11/18/2016)	(45 - 62)/(7 - 1)	-2.83333
28 (5/30/2018)	62 (11/18/2016)	(28 - 62)/(8 - 1)	-4.85714
58 (3/10/2017)	64 (1/20/2017)	(58 - 64)/(3 - 2)	-6
71 (4/28/2017)	64 (1/20/2017)	(71 - 64)/(4 - 2)	3.5
64 (6/16/2017)	64 (1/20/2017)	(64 - 64)/(5 - 2)	0
52 (7/21/2017)	64 (1/20/2017)	(52 - 64)/(6 - 2)	-3
45 (4/6/2018)	64 (1/20/2017)	(45 - 64)/(7 - 2)	-3.8
28 (5/30/2018)	64 (1/20/2017)	(28 - 64)/(8 - 2)	-6
71 (4/28/2017)	58 (3/10/2017)	(71 - 58)/(4 - 3)	13
64 (6/16/2017)	58 (3/10/2017)	(64 - 58)/(5 - 3)	3
52 (7/21/2017)	58 (3/10/2017)	(52 - 58)/(6 - 3)	-2
45 (4/6/2018)	58 (3/10/2017)	(45 - 58)/(7 - 3)	-3.25
28 (5/30/2018)	58 (3/10/2017)	(28 - 58)/(8 - 3)	-6
64 (6/16/2017)	71 (4/28/2017)	(64 - 71)/(5 - 4)	-7
52 (7/21/2017)	71 (4/28/2017)	(52 - 71)/(6 - 4)	-9.5
45 (4/6/2018)	71 (4/28/2017)	(45 - 71)/(7 - 4)	-8.66667
28 (5/30/2018)	71 (4/28/2017)	(28 - 71)/(8 - 4)	-10.75
52 (7/21/2017)	64 (6/16/2017)	(52 - 64)/(6 - 5)	-12
45 (4/6/2018)	64 (6/16/2017)	(45 - 64)/(7 - 5)	-9.5
28 (5/30/2018)	64 (6/16/2017)	(28 - 64)/(8 - 5)	-12
45 (4/6/2018)	52 (7/21/2017)	(45 - 52)/(7 - 6)	-7
28 (5/30/2018)	52 (7/21/2017)	(28 - 52)/(8 - 6)	-12
28 (5/30/2018)	45 (4/6/2018)	(28 - 45)/(8 - 7)	-17

Number of Q values = 28

Ordered Q Values

n	Q
1	-17
2	-12
3	-12
4	-12
5	-10.75
6	-9.5
7	-9.5

8	-8.66667
9	-7
10	-7
11	-6
12	-6
13	-6
14	-4.85714
15	-3.8
16	-3.25
17	-3
18	-2.83333
19	-2
20	-2
21	-2
22	0
23	0.5
24	2
25	3
26	3
27	3.5
28	13

Sen's Estimator (Median Q) is -4.32857

Tied Group	**Value**	**Members**
1	64	2

Time Period	**Observations**
11/18/2016	1
1/20/2017	1
3/10/2017	1
4/28/2017	1
6/16/2017	1
7/21/2017	1
4/6/2018	1
5/30/2018	1

There are 0 time periods with multiple data

A = 18
B = 0
C = 0
D = 0
E = 2
F = 0
a = 1176
b = 3024
c = 112
Group Variance = 64.3333
For 95% confidence interval (two-tailed), Z at (1-0.95)/2 = 1.97737
C = 15.8601
M1 = (28 - 15.8601)/2.0 = 6.06995
M2 = (28 + 15.8601)/2.0 + 1 = 22.93
Lower limit is -9.5 = Q(6)
Upper limit is 0.5 = Q(23)
-9.5 < 0 < 0.5 indicating no trend in data.

Sen's Slope Analysis

Parameter: Lithium

Location: MW-16-03

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

95% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
49 (1/20/2017)	44 (11/18/2016)	(49 - 44)/(2 - 1)	5
45 (3/10/2017)	44 (11/18/2016)	(45 - 44)/(3 - 1)	0.5
51 (4/28/2017)	44 (11/18/2016)	(51 - 44)/(4 - 1)	2.33333
49 (6/16/2017)	44 (11/18/2016)	(49 - 44)/(5 - 1)	1.25
41 (7/21/2017)	44 (11/18/2016)	(41 - 44)/(6 - 1)	-0.6
15 (4/6/2018)	44 (11/18/2016)	(15 - 44)/(7 - 1)	-4.83333
11 (5/30/2018)	44 (11/18/2016)	(11 - 44)/(8 - 1)	-4.71429
45 (3/10/2017)	49 (1/20/2017)	(45 - 49)/(3 - 2)	-4
51 (4/28/2017)	49 (1/20/2017)	(51 - 49)/(4 - 2)	1
49 (6/16/2017)	49 (1/20/2017)	(49 - 49)/(5 - 2)	0
41 (7/21/2017)	49 (1/20/2017)	(41 - 49)/(6 - 2)	-2
15 (4/6/2018)	49 (1/20/2017)	(15 - 49)/(7 - 2)	-6.8
11 (5/30/2018)	49 (1/20/2017)	(11 - 49)/(8 - 2)	-6.33333
51 (4/28/2017)	45 (3/10/2017)	(51 - 45)/(4 - 3)	6
49 (6/16/2017)	45 (3/10/2017)	(49 - 45)/(5 - 3)	2
41 (7/21/2017)	45 (3/10/2017)	(41 - 45)/(6 - 3)	-1.33333
15 (4/6/2018)	45 (3/10/2017)	(15 - 45)/(7 - 3)	-7.5
11 (5/30/2018)	45 (3/10/2017)	(11 - 45)/(8 - 3)	-6.8
49 (6/16/2017)	51 (4/28/2017)	(49 - 51)/(5 - 4)	-2
41 (7/21/2017)	51 (4/28/2017)	(41 - 51)/(6 - 4)	-5
15 (4/6/2018)	51 (4/28/2017)	(15 - 51)/(7 - 4)	-12
11 (5/30/2018)	51 (4/28/2017)	(11 - 51)/(8 - 4)	-10
41 (7/21/2017)	49 (6/16/2017)	(41 - 49)/(6 - 5)	-8
15 (4/6/2018)	49 (6/16/2017)	(15 - 49)/(7 - 5)	-17
11 (5/30/2018)	49 (6/16/2017)	(11 - 49)/(8 - 5)	-12.6667
15 (4/6/2018)	41 (7/21/2017)	(15 - 41)/(7 - 6)	-26
11 (5/30/2018)	41 (7/21/2017)	(11 - 41)/(8 - 6)	-15
11 (5/30/2018)	15 (4/6/2018)	(11 - 15)/(8 - 7)	-4

Number of Q values = 28

Ordered Q Values

n	Q
1	-26
2	-17
3	-15
4	-12.6667
5	-12
6	-10
7	-8

8	-7.5
9	-6.8
10	-6.8
11	-6.33333
12	-5
13	-4.83333
14	-4.71429
15	-4
16	-4
17	-2
18	-2
19	-1.33333
20	-0.6
21	0
22	0.5
23	1
24	1.25
25	2
26	2.33333
27	5
28	6

Sen's Estimator (Median Q) is -4.35714

Tied Group	**Value**	**Members**
1	49	2

Time Period	**Observations**
11/18/2016	1
1/20/2017	1
3/10/2017	1
4/28/2017	1
6/16/2017	1
7/21/2017	1
4/6/2018	1
5/30/2018	1

There are 0 time periods with multiple data

A = 18
B = 0
C = 0
D = 0
E = 2
F = 0
a = 1176
b = 3024
c = 112
Group Variance = 64.3333
For 95% confidence interval (two-tailed), Z at (1-0.95)/2 = 1.97737
C = 15.8601
M1 = (28 - 15.8601)/2.0 = 6.06995
M2 = (28 + 15.8601)/2.0 + 1 = 22.93
Lower limit is -10 = Q(6)
Upper limit is 1 = Q(23)
-10 < 0 < 1 indicating no trend in data.

Skewness Coefficient

Parameter: Arsenic

Original Data (Not Transformed)
Non-Detects Replaced with 1/2 DL

Skewness > 1 indicates positively skewed data
Skewness < -1 indicates negatively skewed data

Compliance Locations

Location	Obs.	Mean	Std. Dev.	Skewness
MW-16-01	8	69.375	59.1027	**1.1593**

All Locations

Obs.	Mean	Std. Dev.	Skewness
8	69.375	59.1027	**1.1593**

Skewness Coefficient

Parameter: Arsenic

Natural Logarithm Transformation
Non-Detects Replaced with 1/2 DL

Skewness > 1 indicates positively skewed data
Skewness < -1 indicates negatively skewed data

Compliance Locations

Location	Obs.	Mean	Std. Dev.	Skewness
MW-16-01	8	3.99385	0.687607	**1.14357**

All Locations

Obs.	Mean	Std. Dev.	Skewness
8	3.99385	0.687607	**1.14357**

Skewness Coefficient

Parameter: Arsenic

Original Data (Not Transformed)

Cohen's Adjustment

Skewness > 1 indicates positively skewed data
Skewness < -1 indicates negatively skewed data

Compliance Locations

Location	Obs.	Mean	Std. Dev.	Skewness
MW-16-03	8	10.6462	6.2645	0.480136

All Locations

Obs.	Mean	Std. Dev.	Skewness
8	10.6462	6.2645	0.480136

Skewness Coefficient

Parameter: Lithium

Original Data (Not Transformed)
Non-Detects Replaced with 1/2 DL

Skewness > 1 indicates positively skewed data
Skewness < -1 indicates negatively skewed data

Compliance Locations

Location	Obs.	Mean	Std. Dev.	Skewness
MW-16-03	8	38.125	15.8694	**-1.03428**
MW-16-02	8	55.5	13.6905	-0.997215
MW-16-01	8	49.375	2.66927	-0.815305

All Locations

Obs.	Mean	Std. Dev.	Skewness
24	47.6667	13.7798	**-1.12642**

Skewness Coefficient

Parameter: Lithium

Natural Logarithm Transformation
Non-Detects Replaced with 1/2 DL

Skewness > 1 indicates positively skewed data
Skewness < -1 indicates negatively skewed data

Compliance Locations

Location	Obs.	Mean	Std. Dev.	Skewness
MW-16-03	8	3.51573	0.604008	**-1.17372**
MW-16-02	8	3.98227	0.298208	**-1.40266**
MW-16-01	8	3.89812	0.0553668	-0.939346

All Locations

Obs.	Mean	Std. Dev.	Skewness
24	3.79871	0.426664	**-2.21914**

Shapiro-Wilks Test of Normality

Parameter: Arsenic

Location: MW-16-01

Normality Test of Parameter Concentrations

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

K = 4 for 8 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	35	170	135	0.6052	81.702
2	36	160	124	0.3164	39.2336
3	37	40	3	0.1743	0.5229
4	38	39	1	0.0561	0.0561
5	39	38	-1		
6	40	37	-3		
7	160	36	-124		
8	170	35	-135		

Sum of b values = 121.515
Sample Standard Deviation = 59.1027
W Statistic = 0.603872

5% Critical value of 0.818 exceeds 0.603872
Evidence of non-normality at 95% level of significance

1% Critical value of 0.749 exceeds 0.603872
Evidence of non-normality at 99% level of significance

Shapiro-Wilks Test of Normality

Parameter: Arsenic

Location: MW-16-01

Normality Test of Parameter Concentrations

Natural Logarithm Transformation

Non-Detects Replaced with 1/2 DL

K = 4 for 8 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	3.55535	5.1358	1.58045	0.6052	0.956489
2	3.58352	5.07517	1.49165	0.3164	0.47196
3	3.61092	3.68888	0.0779615	0.1743	0.0135887
4	3.63759	3.66356	0.0259755	0.0561	0.00145722
5	3.66356	3.63759	-0.0259755		
6	3.68888	3.61092	-0.0779615		
7	5.07517	3.58352	-1.49165		
8	5.1358	3.55535	-1.58045		

Sum of b values = 1.44349
Sample Standard Deviation = 0.687607
W Statistic = 0.629581

5% Critical value of 0.818 exceeds 0.629581
Evidence of non-normality at 95% level of significance

1% Critical value of 0.749 exceeds 0.629581
Evidence of non-normality at 99% level of significance

Shapiro-Wilks Test of Normality

Parameter: Lithium

Location: MW-16-03

Normality Test of Parameter Concentrations

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

K = 4 for 8 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	11	51	40	0.6052	24.208
2	15	49	34	0.3164	10.7576
3	41	49	8	0.1743	1.3944
4	44	45	1	0.0561	0.0561
5	45	44	-1		
6	49	41	-8		
7	49	15	-34		
8	51	11	-40		

Sum of b values = 36.4161
Sample Standard Deviation = 15.8694
W Statistic = 0.752255

5% Critical value of 0.818 exceeds 0.752255
Evidence of non-normality at 95% level of significance

1% Critical value of 0.749 is less than 0.752255
Data is normally distributed at 99% level of significance

Shapiro-Wilks Test of Normality

Parameter: Lithium

Location: MW-16-03

Normality Test of Parameter Concentrations

Natural Logarithm Transformation

Non-Detects Replaced with 1/2 DL

K = 4 for 8 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	2.3979	3.93183	1.53393	0.6052	0.928335
2	2.70805	3.89182	1.18377	0.3164	0.374545
3	3.71357	3.89182	0.178248	0.1743	0.0310687
4	3.78419	3.80666	0.0224729	0.0561	0.00126073
5	3.80666	3.78419	-0.0224729		
6	3.89182	3.71357	-0.178248		
7	3.89182	2.70805	-1.18377		
8	3.93183	2.3979	-1.53393		

Sum of b values = 1.33521
Sample Standard Deviation = 0.604008
W Statistic = 0.698096

5% Critical value of 0.818 exceeds 0.698096
Evidence of non-normality at 95% level of significance

1% Critical value of 0.749 exceeds 0.698096
Evidence of non-normality at 99% level of significance

Confidence Interval

Parameter: Arsenic

Original Data (Not Transformed)

Cohen's Adjustment

Compliance Locations

Location	**MW-16-03**
Mean	10.6462
Std Dev	6.2645
Degrees of Freedom	7
Comparison Level	**32**
Untransformed Comp. Level	32

Confidence	t-Stat	Interval	Mid-Point	Significant
99%	2.99795	[4.00624, 17.2862]	10.6462	FALSE
95%	1.89458	[6.45003, 14.8424]	10.6462	FALSE

Non-Parametric Confidence Interval

Parameter: Arsenic
Well: MW-16-01
Original Data (Not Transformed)
Non-Detects Replaced with 1/2 DL
99% Comparion Level
Total measurements = 8

Ranks

Point	Date	Value	Rank	Bkgrnd
MW-16-01	6/16/2017	35	1	TRUE
MW-16-01	7/21/2017	36	2	TRUE
MW-16-01	4/28/2017	37	3	TRUE
MW-16-01	3/10/2017	38	4	TRUE
MW-16-01	11/18/2016	39	5	TRUE
MW-16-01	1/20/2017	40	6	TRUE
MW-16-01	4/6/2018	160	7	TRUE
MW-16-01	5/30/2018	170	8	TRUE

M = 8
n + 1 - M = 1
Two Sided Confidence Level = 99.2%

Upper Confidence Interval X(8) = 170
Lower Confidence Inverval X(1) = 35
35 > 32 Indicating Statistical Significance

Confidence Interval

Parameter: Lithium

Original Data (Not Transformed)
Non-Detects Replaced with 1/2 DL

Compliance Locations

Location	**MW-16-01**
Mean	49.375
Std Dev	2.66927
Degrees of Freedom	7
Comparison Level	**40**
Untransformed Comp. Level	40

Confidence	**t-Stat**	**Interval**	**Mid-Point**	**Significant**
99%	2.99795	[46.5457, 52.2043]	49.375	**TRUE**
95%	1.89458	[47.587, 51.163]	49.375	**TRUE**

Location	**MW-16-02**
Mean	55.5
Std Dev	13.6905
Degrees of Freedom	7
Comparison Level	**40**
Untransformed Comp. Level	40

Confidence	**t-Stat**	**Interval**	**Mid-Point**	**Significant**
99%	2.99795	[40.989, 70.011]	55.5	**TRUE**
95%	1.89458	[46.3297, 64.6703]	55.5	**TRUE**

Non-Parametric Confidence Interval

Parameter: Lithium

Well: MW-16-03

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

99% Comparion Level

Total measurements = 8

Ranks

Point	Date	Value	Rank	Bkgrnd
MW-16-03	5/30/2018	11	1	TRUE
MW-16-03	4/6/2018	15	2	TRUE
MW-16-03	7/21/2017	41	3	TRUE
MW-16-03	11/18/2016	44	4	TRUE
MW-16-03	3/10/2017	45	5	TRUE
MW-16-03	6/16/2017	49	6.5	TRUE
MW-16-03	1/20/2017	49	6.5	TRUE
MW-16-03	4/28/2017	51	8	TRUE

M = 8

n + 1 - M = 1

Two Sided Confidence Level = 99.2%

Upper Confidence Interval X(8) = 51

Lower Confidence Inverval X(1) = 11

11 <= 40 Indicating No Statistical Significance

Appendix D

Appendix IV Assessment Monitoring Statistical Evaluation – October 2018 Data

Technical Memorandum

Date: January 31, 2019

To: DTE Electric Company

From: Darby Litz, TRC
Sarah Holmstrom, TRC
Kristin Lowery, TRC

Project No.: 265996.0005.0000 Phase 002, Task 001

Subject: Appendix IV Assessment Monitoring Statistical Evaluation for October 2018 Groundwater Monitoring Event – DTE Electric Company, River Rouge Power Plant, Bottom Ash Basin Coal Combustion Residual Unit

Introduction

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule), as amended July 30, 2018. The CCR Rule, which became effective on October 19, 2015 (amendment effective August 29, 2018), applies to DTE Electric Company (DTE Electric) River Rouge Power Plant (RRPP) Coal Combustion Residual Bottom Ash Basin (BAB) CCR unit located in River Rouge, Michigan (the Site).

In response to the statistically significant increases (SSIs) above background for boron, fluoride and pH, DTE Electric established an Assessment Monitoring Program for the RRPP BAB CCR unit pursuant to §257.94(e) of the CCR Rule as presented in the April 13, 2018 *Establishment of an Assessment Monitoring Program River Rouge Power Plant Bottom Ash Basin Coal Combustion Residual Unit* letter. In accordance with §257.95, TRC conducted two assessment monitoring events, a preliminary and subsequent initial semiannual assessment monitoring event, at the RRPP BAB CCR unit. The preliminary Appendix IV only assessment monitoring event (per §257.95(b)) was performed on April 6, 2018, and the subsequent initial semiannual assessment monitoring event (per §257.95(d), Appendix III and IV parameters) was performed on May 30 and 31, 2018. The results from the initial assessment monitoring sampling event were used to establish groundwater protection standards (GWPSs) for the Appendix IV constituents in accordance with §257.95(h). The results from the assessment monitoring sampling events were subsequently used to perform the statistical comparison to the established GWPSs.

On October 15, 2018, it was determined that pursuant to §257.93 (h) that arsenic and lithium are present at statistically significant levels above their respective GWPSs at one or more down gradient well locations at the RRPP BAB CCR unit[1].

Although DTE Electric will proceed with assessment of corrective measures per §257.95(g)(3), DTE Electric is currently operating a groundwater extraction system as a presumptive remedy to maintain hydraulic control around the RRPP BAB to address the uncertainty around the potential migration of CCR constituents from the RRPP BAB to groundwater. This system has effectively captured groundwater in the vicinity of the RRPP BAB CCR unit since it began operation on March 2, 2018, and eliminates the potential for Appendix III and Appendix IV parameters to migrate from the RRPP BAB CCR unit.

In accordance with §257.96(b), DTE Electric is continuing assessment monitoring for the RRPP BAB CCR unit. The second semiannual assessment monitoring event for the Appendix III and detected Appendix IV constituents was conducted on October 16, 2018. In accordance with §257.95, the assessment monitoring data must be compared to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs. This memorandum presents the limits derived for the Appendix IV parameters for the RRPP BAB CCR unit that will be used to compare to the GWPSs.

Assessment Monitoring Statistical Evaluation

The three compliance wells utilized for the BAB CCR Unit are MW-16-01, MW-16-02 and MW-16-03. Following the second semiannual assessment monitoring sampling event, compliance well data for the RRPP BAB were evaluated in accordance with the *Groundwater Statistical Evaluation Plan* (Stats Plan) (TRC, October 2017; Revised December 2017). For each detected constituent, the concentrations for each well were first compared directly to the GWPS within a rolling window of eight sampling events. Parameter-well combinations that included a direct exceedance of the GWPS were retained for further analysis. As a result, arsenic was retained for evaluation at MW-16-01, beryllium at MW-16-02, and lithium at MW-16-01, MW-16-02, and MW-16-03.

Groundwater data were then evaluated utilizing ChemStat™ statistical software. ChemStat™ is a software tool that is commercially available for performing statistical evaluation consistent with procedures outlined in U.S. EPA’s Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (Unified Guidance; UG). Within the ChemStat™ statistical program (and the UG), confidence limits were selected to perform the statistical comparison of compliance data to a fixed standard. Parametric and non-parametric confidence intervals were calculated for each of the CCR Appendix IV parameters using a 99 percent confidence level, i.e., a significance level (α) of 0.01. The following narrative describes the methods employed, the results obtained and the ChemStat™ output files are included as an attachment.

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[1] TRC. 2018. *Notification of Appendix IV Constituents at Statistically Significant Levels Above the Groundwater Protection Standards; River Rouge Power Plant Bottom Ash Basin Coal Combustion Residual Unit,* October.

Due to the initiation of operation of the groundwater extraction system to establish groundwater capture in the area of the BAB in March of 2018 and subsequent changes in groundwater flow rate and direction, the data set used for statistical evaluation was limited to the four most recent events. Use of the four most recent data points provides the minimum density of data as recommended per the UG and is representative of current conditions at the BAB under the hydraulic influence of the groundwater extraction system.

The statistical data evaluation included the following steps:

- Review of data quality checklists for the baseline/background data sets for CCR Appendix IV constituents;
- Evaluation of percentage of non-detects for each baseline/background well-constituent pair;
- Graphical representation of the baseline data as time versus concentration (T v. C) by well/constituent pair;
- Outlier testing of individual data points that appear from the graphical representations as potential outliers;
- Evaluation of visual trends apparent in the graphical representations for statistical significance;
- Distribution of the data; and
- Calculation of the confidence intervals for each cumulative dataset.

The results of these evaluations are presented and discussed below.

Data Quality

Data from each sampling round were evaluated for completeness, overall quality and usability, method-specified sample holding times, precision and accuracy, and potential sample contamination. The review was completed using the following quality control (QC) information which at a minimum included chain-of-custody forms, investigative sample results including blind field duplicates, and, as provided by the laboratory, method blanks, laboratory control spikes, laboratory duplicates. The data were found to be complete and usable for the purposes of the CCR monitoring program.

Percentage of Non-detects

The percentage of non-detect observations for constituents with one or more detection above a GWPS is included in Table 1. Non-detect data was handled in accordance with the Stats Plan for the purposes of calculating confidence intervals.

Time versus Concentration Graphs

The T v. C graphs show a potential outlier for beryllium (single detection in MW-16-02 in June 2017). This data set was tested using the ChemStat™ software to assess whether the potential outliers are statistically significant, as discussed further below.

The T v. C graphs showed potential trending for some Appendix IV well/constituent pairs. These were tested by the ChemStat™ software to assess whether the trends are statistically significant.

Outlier Testing

The Dixon's Outlier Test in ChemStat™ could not be used on the suspected beryllium outlier due to the high percentage of non-detects. Therefore, the single detection was classified as an outlier and removed from the data set, per the double quantification rule as outlined in the UG.

Trend Analysis

Visual trends apparent in the T v. C graphs were evaluated in ChemStat™ using the Sens Slope estimator to determine if a subset of data should be used in calculating the confidence interval. Trends were evaluated using a 95-percent (two-tailed) confidence level, i.e., a significance level (α) of 0.05. Statistically significant decreasing trends were found in lithium at MW-16-02 and MW-16-03. These lithium decreasing trends will continue to be monitored and are likely resulting from changes in groundwater quality due to operation of the groundwater extraction system.

Distribution of the Data Sets

ChemStat™ was utilized to evaluate each data set for normality. If the skewness coefficient was calculated to be between negative one and one, then the data were assumed to be approximately normally distributed. If the skewness coefficient was calculated as greater than one (or less than negative one) then the calculation was performed on the natural log (Ln) of the data. If the Ln of the data still determined that the data appeared to be skewed, then the Shapiro-Wilk test of normality (Shapiro-Wilk) was performed. The Shapiro-Wilk statistic was calculated on both non-transformed data, and the Ln-transformed data. If the Shapiro-Wilk statistic indicated that normal distributional assumptions were not valid, then the parameter was considered a candidate for non-parametric statistical evaluation. The data distributions are summarized in Table 1.

Confidence Intervals

Variability is recognized in the data set due to changing groundwater quality in response to the operation of the groundwater extraction system. Calculating a confidence interval around a trending data set incorporates not only variability present naturally in the underlying dataset, but can exaggerate variability. The downward trend in lithium concentrations at MW-16-02 and MW-16-03 are likely causing the confidence interval to be much wider than expected given the confidence level (e.g., 99%) and sample size (n=4). However, lithium concentrations have already triggered assessment monitoring (e.g., not a newly identified GWPS exceedance) and remedial efforts are ongoing; therefore, traditional confidence interval calculations are presented in this statistical evaluation until more data are available. Once groundwater conditions stabilize under the current system operation with a more consistent trend, and additional post-treatment data are collected, confidence bands may be a more appropriate option to determine compliance with the CCR Rule. Confidence bands are selected by the UG as the appropriate method for calculating confidence intervals on trending data. A confidence band calculates upper and lower confidence limits at each point along the trend to reduce variability and create a narrower confidence interval. At least 8 to 10 measurements should be available when computing a confidence band around a linear regression.

Table 1 presents the calculated confidence intervals for each well-constituent pair. For normal and lognormal distributions, confidence intervals are calculated for 99 percent confidence using parametric methods. For non-normal background datasets, a nonparametric confidence interval is utilized, resulting in the highest and lowest values from the contributing dataset as the confidence limits. Confidence intervals were calculated using only the four most recent sampling events to ensure that data was recent enough to be representative of current site conditions.

The confidence intervals calculated through the above-described process will be compared to the GWPS to determine if an exceedance has occurred. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS. If the statistical tests conclude that an exceedance of the GWPS, verification resampling may be conducted by the facility. Once the resampling data are available, the comparison to the GWPS will be evaluated.

Attachments

Table 1 – Summary of Descriptive Statistics and Confidence Interval Calculations
Attachment A – ChemStat™ Outputs

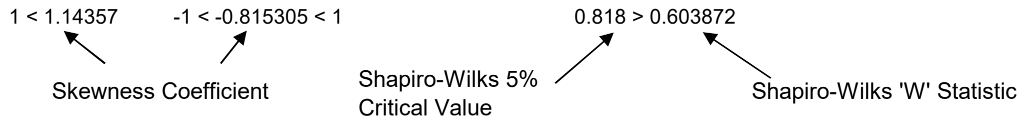
Table 1

Summary of Descriptive Statistics and Confidence Interval Calculations

Table 1
Summary of Descriptive Statistics and Confidence Interval Calculations
Assessment Monitoring Statistical Evaluation
DTE Electric Company – River Rouge Power Plant

Parameter(1)	Percent Non-Detect	Outliers?	Trend?	Skewness		Shapiro-Wilks Test (5% Critical Value)		Parametric / Non-Parametric	Confidence Interval(2)
				Un-Transformed	Natural Log	Un-Transformed	Natural Log		
MW-16-01									
Arsenic	0%	No	No	-1.13552 < 1	-1.14972 < -1	0.748 > 0.693515	0.748 > 0.662826	Non-Parametric	[36, 170]
Lithium	0%	No	No	-1 < 0.394175 < 1	--	--	--	Parametric	[37, 65]
MW-16-02									
Beryllium	89%	Yes(3)	--	--	--	--	--	--	--
Lithium	0%	No	Yes	-1 < 0.150305< 1	--	--	--	Parametric	[10, 66]
MW-16-03									
Lithium	9%	No	Yes	-1 < 0.880396 < 1	--	--	--	Parametric	[-19, 54]

Notes:



(1) Well-parameter combinations that have one or more direct exceedances of the Groundwater Protection Standard within a rolling window of eight sampling events.
(2) The most recent four data points are used to calculate the confidence interval to be representative of current conditions.
(3) The beryllium outlier is a single detection. With the outlier removed, the dataset is 100% non-detects; therefore, further analysis is unnecessary.

Attachment A

ChemStat™ Confidence Interval Outputs

Concentrations (ug/L)

Parameter: Arsenic

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

Total Measurements: 11
Total Non-Detect: 0
Percent Non-Detects: 0%
Total Background Measurements: 0
There are 0 background locations

Loc.	Meas.	ND	Date	Conc.	Original

There is 1 compliance location

Loc.	Meas.	ND	Date	Conc.	Original
MW-16-01	11	0 (0%)	8/5/2016	37	37
			9/30/2016	37	37
			11/18/2016	39	39
			1/20/2017	40	40
			3/10/2017	38	38
			4/28/2017	37	37
			6/16/2017	35	35
			7/21/2017	36	36
			4/6/2018	160	160
			5/30/2018	170	170
			10/16/2018	160	160

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Concentrations (ug/L)

Parameter: Beryllium

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

Total Measurements: 9
Total Non-Detect: 8
Percent Non-Detects: 88.8889%
Total Background Measurements: 0
There are 0 background locations

Loc.	Meas.	ND	Date	Conc.	Original

There is 1 compliance location

Loc.	Meas.	ND	Date	Conc.	Original
MW-16-02	9	8 (88.8889%)	8/5/2016	ND<0.5 U	ND<1 U
			9/30/2016	ND<0.5 U	ND<1 U
			11/18/2016	ND<0.5 U	ND<1 U
			1/20/2017	ND<0.5 U	ND<1 U
			3/10/2017	ND<0.5 U	ND<1 U
			4/28/2017	ND<0.5 U	ND<1 U
			6/16/2017	4.5	4.5
			7/21/2017	ND<0.5 U	ND<1 U
			4/6/2018	ND<0.5 U	ND<1 U

There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original

Concentrations (ug/L)

Parameter: Lithium

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

Total Measurements: 33
Total Non-Detect: 1
Percent Non-Detects: 3.0303%
Total Background Measurements: 0
There are 0 background locations

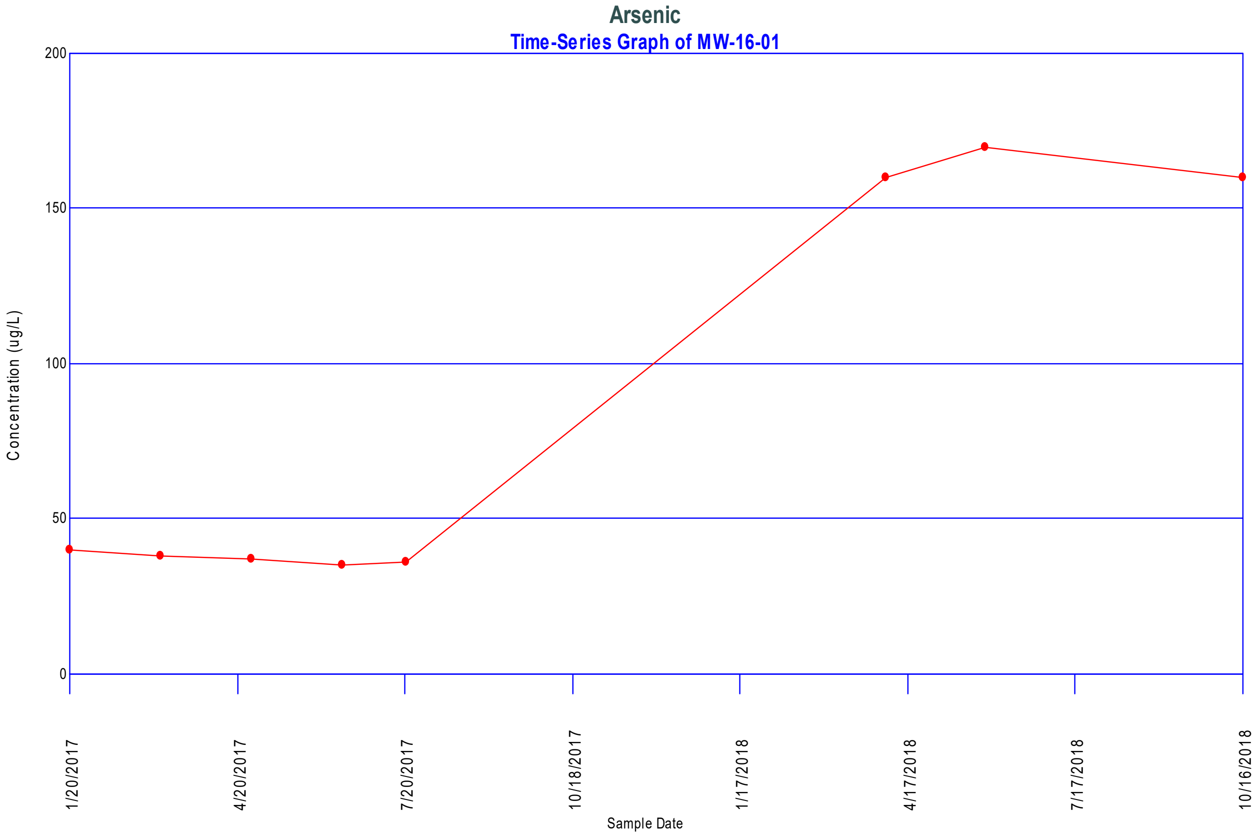
Loc.	Meas.	ND	Date	Conc.	Original

There are 3 compliance locations

Loc.	Meas.	ND	Date	Conc.	Original
MW-16-01	11	0 (0%)	8/5/2016	44	44
			9/30/2016	53	53
			11/18/2016	50	50
			1/20/2017	48	48
			3/10/2017	49	49
			4/28/2017	53	53
			6/16/2017	51	51
			7/21/2017	44	44
			4/6/2018	49	49
			5/30/2018	51	51
			10/16/2018	59	59
MW-16-02	11	0 (0%)	8/5/2016	57	57
			9/30/2016	64	64
			11/18/2016	62	62
			1/20/2017	64	64
			3/10/2017	58	58
			4/28/2017	71	71
			6/16/2017	64	64
			7/21/2017	52	52
			4/6/2018	45	45
			5/30/2018	28	28
			10/16/2018	27	27
MW-16-03	11	1 (9.09091%)	8/5/2016	29	29
			9/30/2016	44	44
			11/18/2016	44	44
			1/20/2017	49	49
			3/10/2017	45	45
			4/28/2017	51	51
			6/16/2017	49	49
			7/21/2017	41	41
			4/6/2018	15	15
			5/30/2018	11	11
			10/16/2018	ND<4 U	ND<8 U

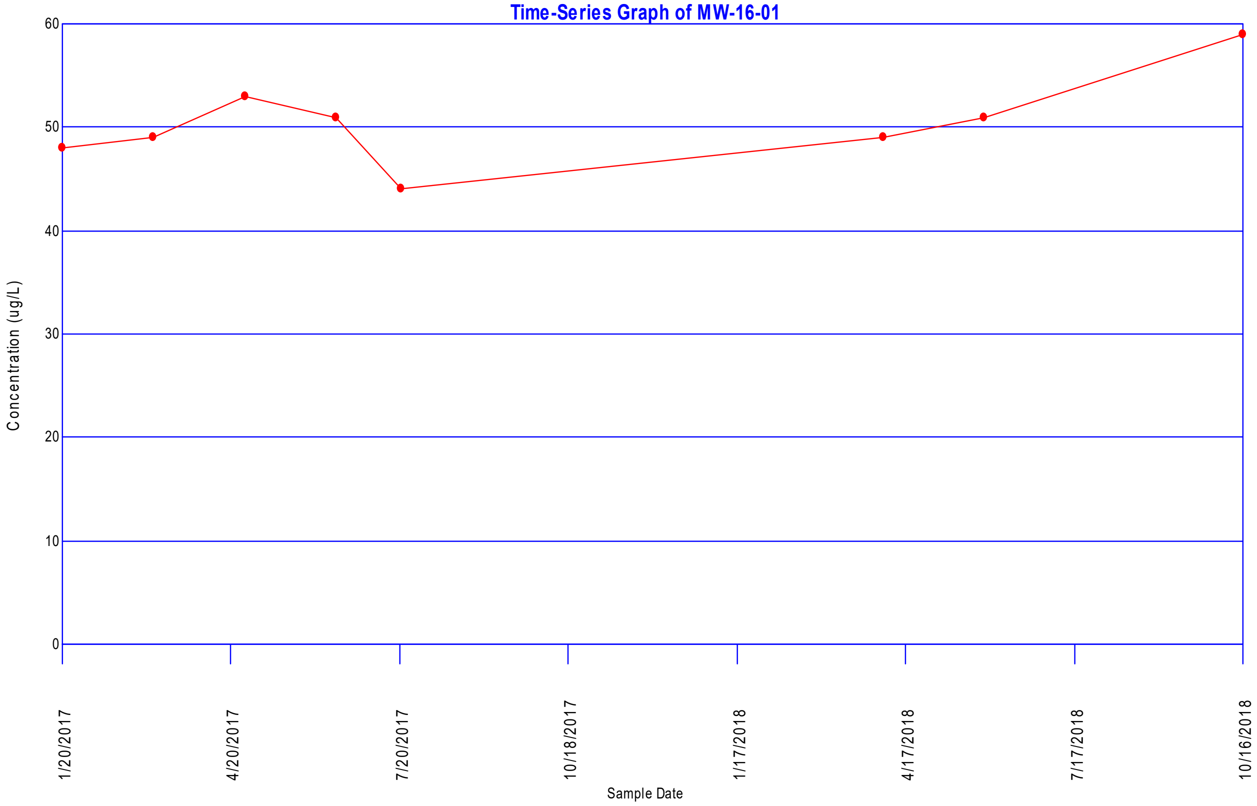
There are 0 unused locations

Loc.	Meas.	ND	Date	Conc.	Original


Arsenic
Time-Series Graph of MW-16-01
Concentration (ug/L)
200
150
100
50
0
1/20/2017
4/20/2017
7/20/2017
10/18/2017
1/17/2018
4/17/2018
7/17/2018
10/16/2018
Sample Date

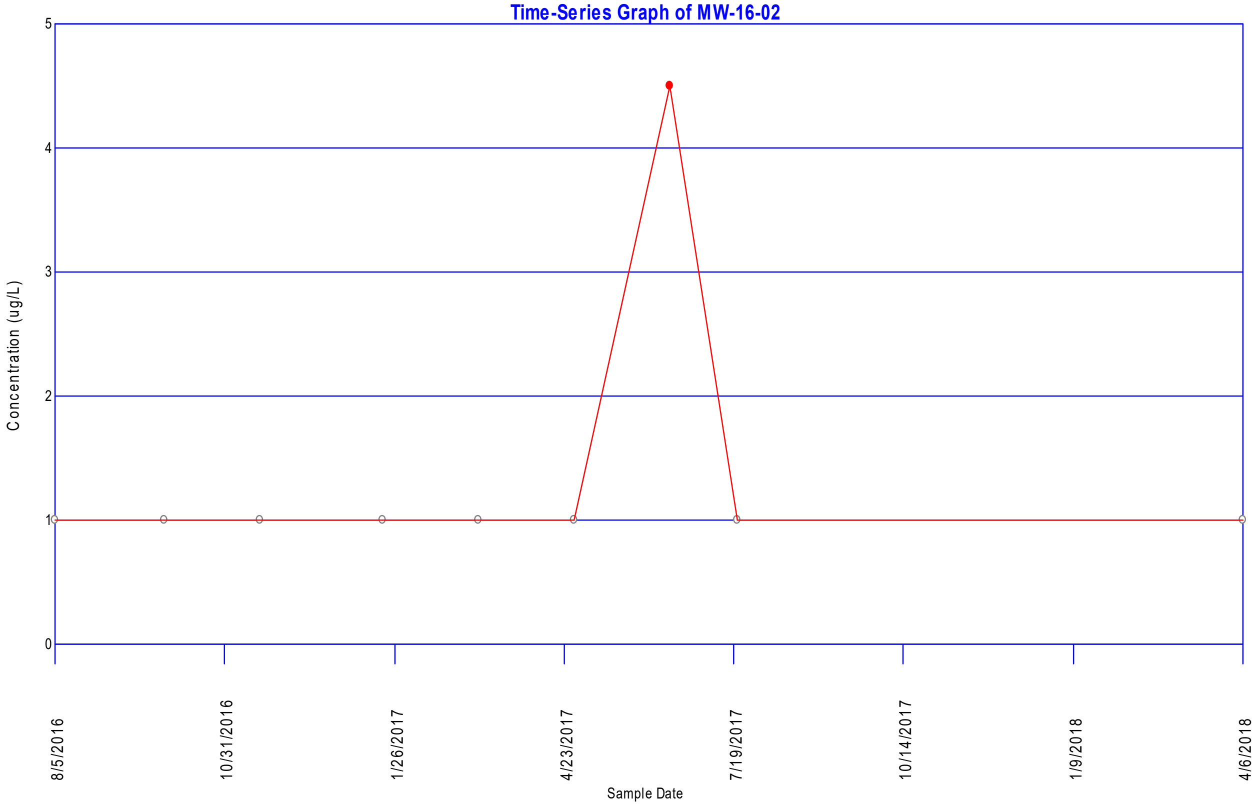
Lithium

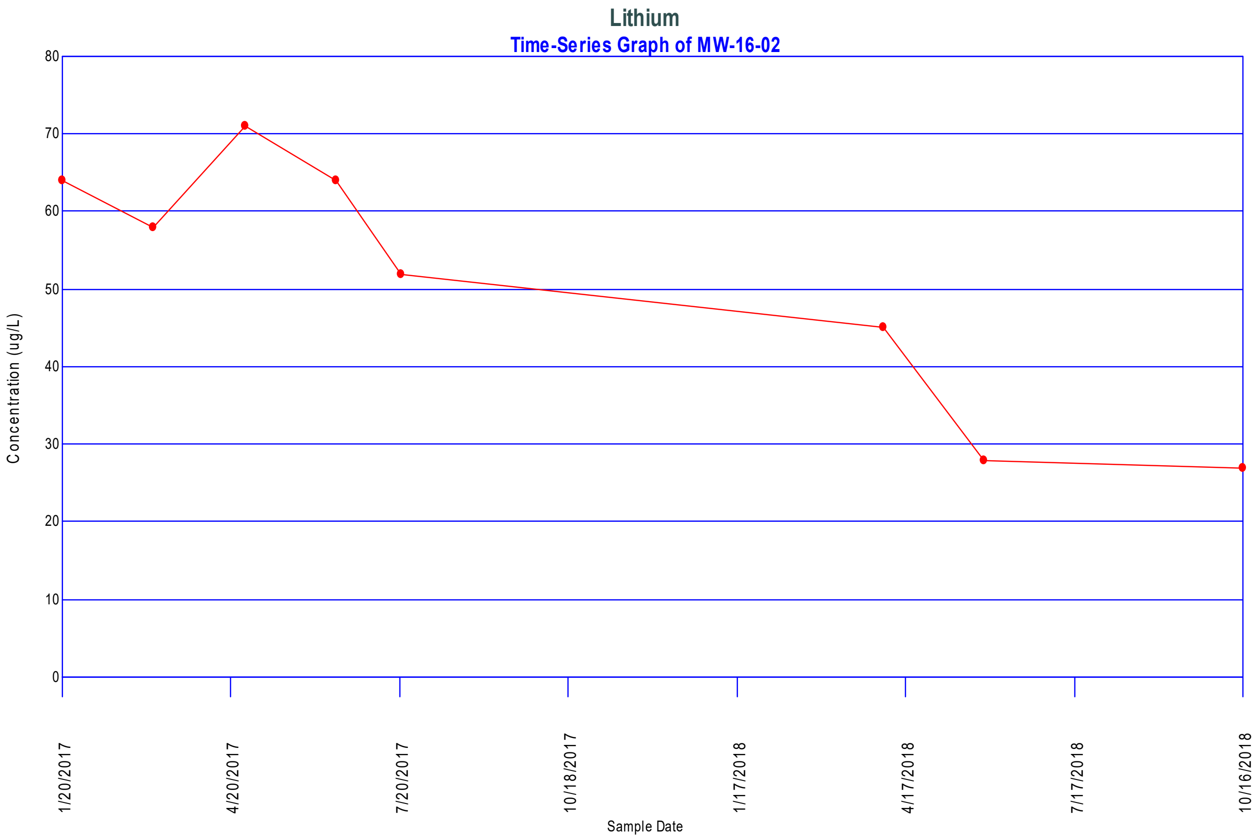
Time-Series Graph of MW-16-01



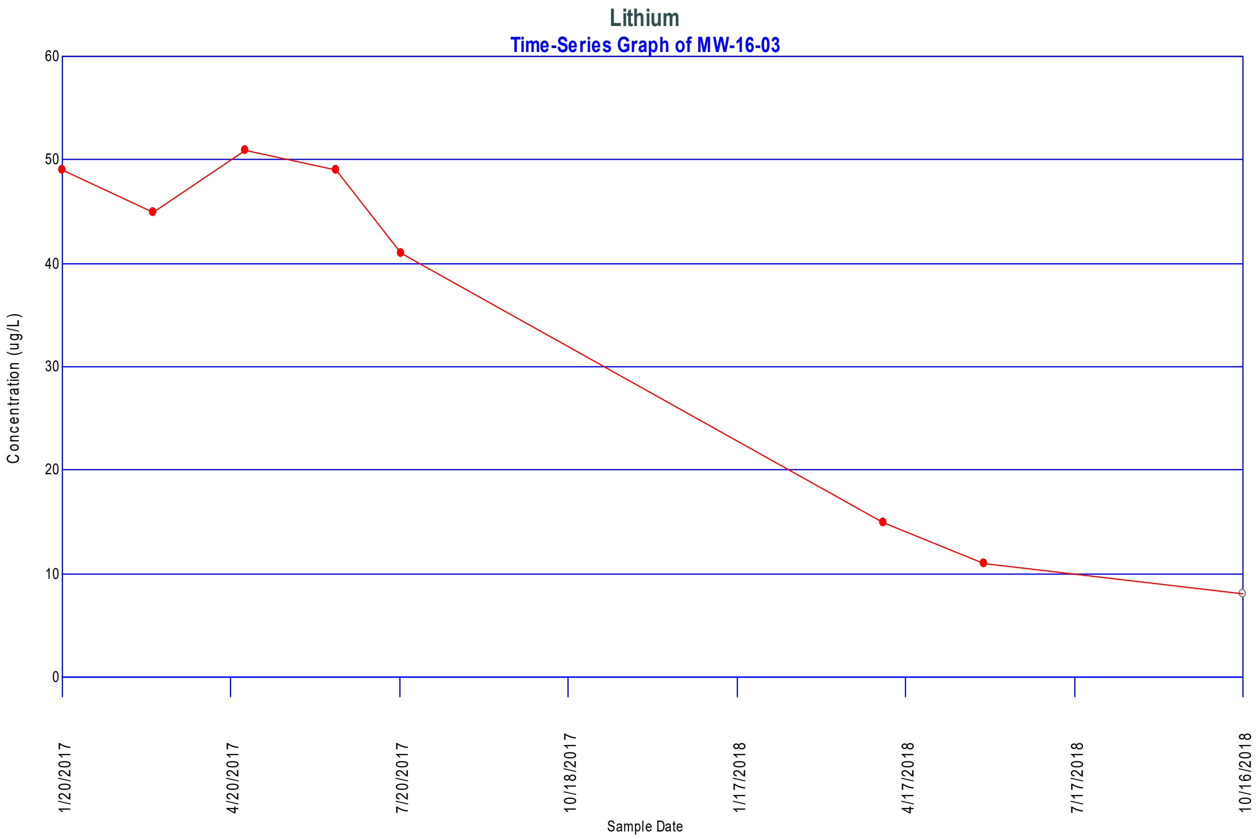
Beryllium

Time-Series Graph of MW-16-02




Lithium

Time-Series Graph of MW-16-02


Lithium
Time-Series Graph of MW-16-03
60
50
40
30
20
10
0
Concentration (ug/L)
1/20/2017
4/20/2017
7/20/2017
10/18/2017
1/17/2018
4/17/2018
7/17/2018
10/16/2018
Sample Date

Sen's Slope Analysis

Parameter: Arsenic

Location: MW-16-01

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

95% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
38 (3/10/2017)	40 (1/20/2017)	(38 - 40)/(2 - 1)	-2
37 (4/28/2017)	40 (1/20/2017)	(37 - 40)/(3 - 1)	-1.5
35 (6/16/2017)	40 (1/20/2017)	(35 - 40)/(4 - 1)	-1.66667
36 (7/21/2017)	40 (1/20/2017)	(36 - 40)/(5 - 1)	-1
160 (4/6/2018)	40 (1/20/2017)	(160 - 40)/(6 - 1)	24
170 (5/30/2018)	40 (1/20/2017)	(170 - 40)/(7 - 1)	21.6667
160 (10/16/2018)	40 (1/20/2017)	(160 - 40)/(8 - 1)	17.1429
37 (4/28/2017)	38 (3/10/2017)	(37 - 38)/(3 - 2)	-1
35 (6/16/2017)	38 (3/10/2017)	(35 - 38)/(4 - 2)	-1.5
36 (7/21/2017)	38 (3/10/2017)	(36 - 38)/(5 - 2)	-0.666667
160 (4/6/2018)	38 (3/10/2017)	(160 - 38)/(6 - 2)	30.5
170 (5/30/2018)	38 (3/10/2017)	(170 - 38)/(7 - 2)	26.4
160 (10/16/2018)	38 (3/10/2017)	(160 - 38)/(8 - 2)	20.3333
35 (6/16/2017)	37 (4/28/2017)	(35 - 37)/(4 - 3)	-2
36 (7/21/2017)	37 (4/28/2017)	(36 - 37)/(5 - 3)	-0.5
160 (4/6/2018)	37 (4/28/2017)	(160 - 37)/(6 - 3)	41
170 (5/30/2018)	37 (4/28/2017)	(170 - 37)/(7 - 3)	33.25
160 (10/16/2018)	37 (4/28/2017)	(160 - 37)/(8 - 3)	24.6
36 (7/21/2017)	35 (6/16/2017)	(36 - 35)/(5 - 4)	1
160 (4/6/2018)	35 (6/16/2017)	(160 - 35)/(6 - 4)	62.5
170 (5/30/2018)	35 (6/16/2017)	(170 - 35)/(7 - 4)	45
160 (10/16/2018)	35 (6/16/2017)	(160 - 35)/(8 - 4)	31.25
160 (4/6/2018)	36 (7/21/2017)	(160 - 36)/(6 - 5)	124
170 (5/30/2018)	36 (7/21/2017)	(170 - 36)/(7 - 5)	67
160 (10/16/2018)	36 (7/21/2017)	(160 - 36)/(8 - 5)	41.3333
170 (5/30/2018)	160 (4/6/2018)	(170 - 160)/(7 - 6)	10
160 (10/16/2018)	160 (4/6/2018)	(160 - 160)/(8 - 6)	0
160 (10/16/2018)	170 (5/30/2018)	(160 - 170)/(8 - 7)	-10

Number of Q values = 28

Ordered Q Values

n	Q
1	-10
2	-2
3	-2
4	-1.66667
5	-1.5
6	-1.5
7	-1

8	-1
9	-0.666667
10	-0.5
11	0
12	1
13	10
14	17.1429
15	20.3333
16	21.6667
17	24
18	24.6
19	26.4
20	30.5
21	31.25
22	33.25
23	41
24	41.3333
25	45
26	62.5
27	67
28	124

Sen's Estimator (Median Q) is 18.7381

Tied Group	**Value**	**Members**
1	160	2

Time Period	**Observations**
1/20/2017	1
3/10/2017	1
4/28/2017	1
6/16/2017	1
7/21/2017	1
4/6/2018	1
5/30/2018	1
10/16/2018	1

There are 0 time periods with multiple data

A = 18
B = 0
C = 0
D = 0
E = 2
F = 0
a = 1176
b = 3024
c = 112
Group Variance = 64.3333
For 95% confidence interval (two-tailed), Z at (1-0.95)/2 = 1.97737
C = 15.8601
M1 = (28 - 15.8601)/2.0 = 6.06995
M2 = (28 + 15.8601)/2.0 + 1 = 22.93
Lower limit is -1.5 = Q(6)
Upper limit is 41 = Q(23)
-1.5 < 0 < 41 indicating no trend in data.

Sen's Slope Analysis

Parameter: Lithium

Location: MW-16-02

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

95% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
58 (3/10/2017)	64 (1/20/2017)	(58 - 64)/(2 - 1)	-6
71 (4/28/2017)	64 (1/20/2017)	(71 - 64)/(3 - 1)	3.5
64 (6/16/2017)	64 (1/20/2017)	(64 - 64)/(4 - 1)	0
52 (7/21/2017)	64 (1/20/2017)	(52 - 64)/(5 - 1)	-3
45 (4/6/2018)	64 (1/20/2017)	(45 - 64)/(6 - 1)	-3.8
28 (5/30/2018)	64 (1/20/2017)	(28 - 64)/(7 - 1)	-6
27 (10/16/2018)	64 (1/20/2017)	(27 - 64)/(8 - 1)	-5.28571
71 (4/28/2017)	58 (3/10/2017)	(71 - 58)/(3 - 2)	13
64 (6/16/2017)	58 (3/10/2017)	(64 - 58)/(4 - 2)	3
52 (7/21/2017)	58 (3/10/2017)	(52 - 58)/(5 - 2)	-2
45 (4/6/2018)	58 (3/10/2017)	(45 - 58)/(6 - 2)	-3.25
28 (5/30/2018)	58 (3/10/2017)	(28 - 58)/(7 - 2)	-6
27 (10/16/2018)	58 (3/10/2017)	(27 - 58)/(8 - 2)	-5.16667
64 (6/16/2017)	71 (4/28/2017)	(64 - 71)/(4 - 3)	-7
52 (7/21/2017)	71 (4/28/2017)	(52 - 71)/(5 - 3)	-9.5
45 (4/6/2018)	71 (4/28/2017)	(45 - 71)/(6 - 3)	-8.66667
28 (5/30/2018)	71 (4/28/2017)	(28 - 71)/(7 - 3)	-10.75
27 (10/16/2018)	71 (4/28/2017)	(27 - 71)/(8 - 3)	-8.8
52 (7/21/2017)	64 (6/16/2017)	(52 - 64)/(5 - 4)	-12
45 (4/6/2018)	64 (6/16/2017)	(45 - 64)/(6 - 4)	-9.5
28 (5/30/2018)	64 (6/16/2017)	(28 - 64)/(7 - 4)	-12
27 (10/16/2018)	64 (6/16/2017)	(27 - 64)/(8 - 4)	-9.25
45 (4/6/2018)	52 (7/21/2017)	(45 - 52)/(6 - 5)	-7
28 (5/30/2018)	52 (7/21/2017)	(28 - 52)/(7 - 5)	-12
27 (10/16/2018)	52 (7/21/2017)	(27 - 52)/(8 - 5)	-8.33333
28 (5/30/2018)	45 (4/6/2018)	(28 - 45)/(7 - 6)	-17
27 (10/16/2018)	45 (4/6/2018)	(27 - 45)/(8 - 6)	-9
27 (10/16/2018)	28 (5/30/2018)	(27 - 28)/(8 - 7)	-1

Number of Q values = 28

Ordered Q Values

n	Q
1	-17
2	-12
3	-12
4	-12
5	-10.75
6	-9.5
7	-9.5

8	-9.25
9	-9
10	-8.8
11	-8.66667
12	-8.33333
13	-7
14	-7
15	-6
16	-6
17	-6
18	-5.28571
19	-5.16667
20	-3.8
21	-3.25
22	-3
23	-2
24	-1
25	0
26	3
27	3.5
28	13

Sen's Estimator (Median Q) is -6.5

Tied Group	**Value**	**Members**
1	64	2

Time Period	**Observations**
1/20/2017	1
3/10/2017	1
4/28/2017	1
6/16/2017	1
7/21/2017	1
4/6/2018	1
5/30/2018	1
10/16/2018	1

There are 0 time periods with multiple data

A = 18
B = 0
C = 0
D = 0
E = 2
F = 0
a = 1176
b = 3024
c = 112
Group Variance = 64.3333
For 95% confidence interval (two-tailed), Z at (1-0.95)/2 = 1.97737
C = 15.8601
M1 = (28 - 15.8601)/2.0 = 6.06995
M2 = (28 + 15.8601)/2.0 + 1 = 22.93
Lower limit is -9.5 = Q(6)
Upper limit is -2 = Q(23)

-2 < 0 indicating a downward trend in data.

Sen's Slope Analysis

Parameter: Lithium
Location: MW-16-03
Original Data (Not Transformed)
Non-Detects Replaced with 1/2 DL

95% Confidence Level

Xj	Xk	(Xj - Xk)/(j-k)	Q
45 (3/10/2017)	49 (1/20/2017)	(45 - 49)/(2 - 1)	-4
51 (4/28/2017)	49 (1/20/2017)	(51 - 49)/(3 - 1)	1
49 (6/16/2017)	49 (1/20/2017)	(49 - 49)/(4 - 1)	0
41 (7/21/2017)	49 (1/20/2017)	(41 - 49)/(5 - 1)	-2
15 (4/6/2018)	49 (1/20/2017)	(15 - 49)/(6 - 1)	-6.8
11 (5/30/2018)	49 (1/20/2017)	(11 - 49)/(7 - 1)	-6.33333
ND<4 U (10/16/2018)	49 (1/20/2017)	(4 - 49)/(8 - 1)	-6.42857
51 (4/28/2017)	45 (3/10/2017)	(51 - 45)/(3 - 2)	6
49 (6/16/2017)	45 (3/10/2017)	(49 - 45)/(4 - 2)	2
41 (7/21/2017)	45 (3/10/2017)	(41 - 45)/(5 - 2)	-1.33333
15 (4/6/2018)	45 (3/10/2017)	(15 - 45)/(6 - 2)	-7.5
11 (5/30/2018)	45 (3/10/2017)	(11 - 45)/(7 - 2)	-6.8
ND<4 U (10/16/2018)	45 (3/10/2017)	(4 - 45)/(8 - 2)	-6.83333
49 (6/16/2017)	51 (4/28/2017)	(49 - 51)/(4 - 3)	-2
41 (7/21/2017)	51 (4/28/2017)	(41 - 51)/(5 - 3)	-5
15 (4/6/2018)	51 (4/28/2017)	(15 - 51)/(6 - 3)	-12
11 (5/30/2018)	51 (4/28/2017)	(11 - 51)/(7 - 3)	-10
ND<4 U (10/16/2018)	51 (4/28/2017)	(4 - 51)/(8 - 3)	-9.4
41 (7/21/2017)	49 (6/16/2017)	(41 - 49)/(5 - 4)	-8
15 (4/6/2018)	49 (6/16/2017)	(15 - 49)/(6 - 4)	-17
11 (5/30/2018)	49 (6/16/2017)	(11 - 49)/(7 - 4)	-12.6667
ND<4 U (10/16/2018)	49 (6/16/2017)	(4 - 49)/(8 - 4)	-11.25
15 (4/6/2018)	41 (7/21/2017)	(15 - 41)/(6 - 5)	-26
11 (5/30/2018)	41 (7/21/2017)	(11 - 41)/(7 - 5)	-15
ND<4 U (10/16/2018)	41 (7/21/2017)	(4 - 41)/(8 - 5)	-12.3333
11 (5/30/2018)	15 (4/6/2018)	(11 - 15)/(7 - 6)	-4
ND<4 U (10/16/2018)	15 (4/6/2018)	(4 - 15)/(8 - 6)	-5.5
ND<4 U (10/16/2018)	11 (5/30/2018)	(4 - 11)/(8 - 7)	-7

Number of Q values = 28

Ordered Q Values

n	Q
1	-26
2	-17
3	-15
4	-12.6667
5	-12.3333
6	-12
7	-11.25

8	-10
9	-9.4
10	-8
11	-7.5
12	-7
13	-6.83333
14	-6.8
15	-6.8
16	-6.42857
17	-6.33333
18	-5.5
19	-5
20	-4
21	-4
22	-2
23	-2
24	-1.33333
25	0
26	1
27	2
28	6

Sen's Estimator (Median Q) is -6.8

Tied Group	**Value**	**Members**
1	49	2

Time Period	**Observations**
1/20/2017	1
3/10/2017	1
4/28/2017	1
6/16/2017	1
7/21/2017	1
4/6/2018	1
5/30/2018	1
10/16/2018	1

There are 0 time periods with multiple data

A = 18
B = 0
C = 0
D = 0
E = 2
F = 0
a = 1176
b = 3024
c = 112
Group Variance = 64.3333
For 95% confidence interval (two-tailed), Z at (1-0.95)/2 = 1.97737
C = 15.8601
M1 = (28 - 15.8601)/2.0 = 6.06995
M2 = (28 + 15.8601)/2.0 + 1 = 22.93
Lower limit is -12 = Q(6)
Upper limit is -2 = Q(23)

-2 < 0 indicating a downward trend in data.

Skewness Coefficient

Parameter: Arsenic

Original Data (Not Transformed)
Non-Detects Replaced with 1/2 DL

Skewness > 1 indicates positively skewed data
Skewness < -1 indicates negatively skewed data

Compliance Locations

Location	Obs.	Mean	Std. Dev.	Skewness
MW-16-01	4	131.5	63.8409	**-1.13552**

All Locations

Obs.	Mean	Std. Dev.	Skewness
4	131.5	63.8409	**-1.13552**

Skewness Coefficient

Parameter: Arsenic

Natural Logarithm Transformation
Non-Detects Replaced with 1/2 DL

Skewness > 1 indicates positively skewed data
Skewness < -1 indicates negatively skewed data

Compliance Locations

Location	Obs.	Mean	Std. Dev.	Skewness
MW-16-01	4	4.71742	0.756472	**-1.14972**

All Locations

Obs.	Mean	Std. Dev.	Skewness
4	4.71742	0.756472	**-1.14972**

Shapiro-Wilks Test of Normality

Parameter: Arsenic

Location: MW-16-01

Normality Test of Parameter Concentrations

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

K = 2 for 4 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	36	170	134	0.6872	92.0848
2	160	160	0	0.1677	0
3	160	160	0		
4	170	36	-134		

Sum of b values = 92.0848
Sample Standard Deviation = 63.8409
W Statistic = 0.693515

5% Critical value of 0.748 exceeds 0.693515
Evidence of non-normality at 95% level of significance

1% Critical value of 0.687 is less than 0.693515
Data is normally distributed at 99% level of significance

Shapiro-Wilks Test of Normality

Parameter: Arsenic

Location: MW-16-01

Normality Test of Parameter Concentrations

Natural Logarithm Transformation

Non-Detects Replaced with 1/2 DL

K = 2 for 4 measurements

i	x(i)	x(n-i+1)	x(n-1+1)-x(i)	a(n-i+1)	b(i)
1	3.58352	5.1358	1.55228	0.6872	1.06673
2	5.07517	5.07517	0	0.1677	0
3	5.07517	5.07517	0		
4	5.1358	3.58352	-1.55228		

Sum of b values = 1.06673
Sample Standard Deviation = 0.756472
W Statistic = 0.662826

5% Critical value of 0.748 exceeds 0.662826
Evidence of non-normality at 95% level of significance

1% Critical value of 0.687 exceeds 0.662826
Evidence of non-normality at 99% level of significance

Skewness Coefficient

Parameter: Lithium

Original Data (Not Transformed)
Non-Detects Replaced with 1/2 DL

Skewness > 1 indicates positively skewed data
Skewness < -1 indicates negatively skewed data

Compliance Locations

Location	Obs.	Mean	Std. Dev.	Skewness
MW-16-01	4	50.75	6.23832	0.394175
MW-16-02	4	38	12.4633	0.150305
MW-16-03	4	17.75	16.1529	0.880396

All Locations

Obs.	Mean	Std. Dev.	Skewness
12	35.5	18.0429	-0.490148

Non-Parametric Confidence Interval

Parameter: Arsenic

Well: MW-16-01

Original Data (Not Transformed)

Non-Detects Replaced with 1/2 DL

99% Comparion Level

Total measurements = 4

Ranks

Point	Date	Value	Rank	Bkgrnd
MW-16-01	7/21/2017	36	1	TRUE
MW-16-01	4/6/2018	160	2.5	TRUE
MW-16-01	10/16/2018	160	2.5	TRUE
MW-16-01	5/30/2018	170	4	TRUE

M = 4

n + 1 - M = 1

Two Sided Confidence Level = 87.5%

Upper Confidence Interval X(4) = 170

Lower Confidence Inverval X(1) = 36

36 > 32 Indicating Statistical Significance

Confidence Interval

Parameter: Lithium

Original Data (Not Transformed)
Non-Detects Replaced with 1/2 DL

Compliance Locations

Location	**MW-16-01**
Mean	50.75
Std Dev	6.23832
Degrees of Freedom	3
Comparison Level	**40**
Untransformed Comp. Level	40

Confidence	**t-Stat**	**Interval**	**Mid-Point**	**Significant**
99%	4.54071	[36.5868, 64.9132]	50.75	FALSE
95%	2.35336	[43.4095, 58.0905]	50.75	**TRUE**

Location	**MW-16-02**
Mean	38
Std Dev	12.4633
Degrees of Freedom	3
Comparison Level	**40**
Untransformed Comp. Level	40

Confidence	**t-Stat**	**Interval**	**Mid-Point**	**Significant**
99%	4.54071	[9.70395, 66.296]	38	FALSE
95%	2.35336	[23.3347, 52.6653]	38	FALSE

Location	**MW-16-03**
Mean	17.75
Std Dev	16.1529
Degrees of Freedom	3
Comparison Level	**40**
Untransformed Comp. Level	40

Confidence	**t-Stat**	**Interval**	**Mid-Point**	**Significant**
99%	4.54071	[-18.9228, 54.4228]	17.75	FALSE
95%	2.35336	[-1.25684, 36.7568]	17.75	FALSE