Assessment of Corrective Measures

River Rouge Power Plant Bottom Ash Basin
Coal Combustion Residual Unit
1 Belanger Park Drive
River Rouge, Michigan

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Executive Summary

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule), as amended July 30, 2018. The CCR Rule, which became effective on October 19, 2015 (amendment effective August 29, 2018), applies to the River Rouge Power Plant (RRPP) Bottom Ash Basin (BAB). In accordance with the schedule defined in 40 CFR 257.90(b)(1), a groundwater monitoring system was installed around the RRPP BAB as required by 40 CFR 257.91, and background groundwater monitoring well sampling was completed as required by 40 CFR 257.93.

As documented in the January 31, 2018 Annual Groundwater Monitoring Report for the River Rouge Power Plant, covering calendar year 2017 activities, DTE Electric Company (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.

DTE Electric proactively constructed and has been operating a groundwater collection system since March 2, 2018 to mitigate any potential risk of migration of water from the BAB. The installed collection system controls groundwater flow within the vicinity of the RRPP BAB CCR unit, and groundwater is now directed inward toward the extraction wells. As such, all monitoring wells that were located hydraulically upgradient or downgradient of the RRPP BAB prior to the collection system installation are within the capture zone of the operating groundwater collection system.

As detailed in the 2018 Annual Groundwater Monitoring Report, DTE Electric Company, River Rouge Power Plant, Bottom Ash Basin Coal Combustion Residual Unit dated January 2019 (2018 Annual Report), statistically significant groundwater concentrations were reported above the groundwater protection standards (GWPSs) for arsenic and/or lithium Appendix IV constituents during the 2018 assessment monitoring events. 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 (ACM) to prevent further releases, to remediate any releases, and to restore the affected area to original conditions. The ACM must be completed within 90 days, unless the owner or operator demonstrates the need for additional time to complete the assessment of corrective measures due to site-specific conditions or circumstances. DTE Electric proceeded with initiating an ACM per §257.96 by January 14, 2019, completed an original ACM Report on April 15, 2019, and completed the first Semi-Annual Progress Report on the remedy selection and design on October 15, 2019 with subsequent Semi-Annual Progress Reports completed in accordance with §257.97(a).

As documented in the October 17, 2016 Initial Written Closure Plan for a CCR Impoundment - DTE Energy River Rouge Power Plant Ash Basin, submitted in accordance with §257.102(b),

DTE Electric proposed to close the RRPP BAB by CCR removal and offsite disposal including decontamination of the unit and backfilling/surface grading to restore the former BAB area to pre-operation conditions. The RRPP BAB CCR unit Closure Plan was updated in July 2020 (TRC, July 2020) concurrent with the development of a RRPP BAB CCR unit Closure Design Manual to include removal and off-site disposal of CCR, decontamination of the unit, and then restoration of the basin for continued use for stormwater and non-CCR wastewater management. CCR removal and off-site disposal was considered a conservative and viable source material management option for the site, offering a high level of long term performance and reliability, and therefore was selected and designed for the BAB CCR source materials.

In accordance with §257.102(e)(i), closure of the River Rouge BAB CCR unit was initiated 30-days after the last known receipt of waste. The RRPP ceased coal-fired operations in May 2020 and the CCR closure by removal of the BAB was completed with mobilization beginning in June 2020 and CCR removal occurring from July through September 2020 as documented in the Bottom Ash Basin Closure Certification Report DTE Electric Company River Rouge Power Plant Bottom Ash Basin Coal Combustion Residual Unit, 1 Belanger Park Drive, River Rouge, Michigan dated November 2020 and revised in February 2021 (TRC, November 2020, Revised February 2021). After CCR removal was completed, the former BAB was repurposed into a non-CCR process water pond.

In 2020, prior to and concurrent with source CCR removal activities, and in 2021, subsequent to the source CCR removal activities from the BAB CCR unit, semi-annual groundwater monitoring and annual nature and extent groundwater monitoring have been performed. The statistical evaluation of the 2020/2021 semi-annual Appendix IV groundwater data continue to show statistically significant groundwater concentrations above the GWPSs for arsenic and lithium at MW-16-01. There were no other results reported at statistically significant concentrations above the GWPSs for the remaining Appendix IV parameters for any of the 2020/2021 semiannual assessment monitoring events. Concentrations of the Appendix IV parameters were below the GWPSs in all nature and extent wells located around the perimeter of the RRPP BAB, 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 groundwater conditions are monitored post-CCR removal, the potential CCR constituents within groundwater are located entirely within the capture zone of the groundwater extraction system; as long as the groundwater extraction system is in operation, there is no potential for affected groundwater to migrate off site. In addition, all of the land that overlies the potentially affected groundwater is owned by DTE Electric.

As mentioned above, DTE Electric is proactively managing the potential groundwater migration pathway at RRPP BAB CCR unit using the installed groundwater extraction system around the RRPP BAB as an interim measure. DTE Electric will continue to operate this system while engineering evaluations for a final groundwater remedy are completed, until such time that risk of migration of CCR constituents from the RRPP BAB CCR unit to receptors is effectively mitigated, and source control and monitoring can be demonstrated to effectively prevent migration of CCR constituents to the Rouge River above actionable cleanup levels. Although CCR source materials have already been removed from the BAB, the remedy for RRPP BAB source materials and the final remedy for addressing affected groundwater will be formally selected per §257.97 at least 30 days after the public meeting required under §257.96(e) is held.

On behalf of DTE Electric, TRC has prepared this revised ACM to evaluate the effectiveness of additional potential corrective measures in meeting the requirements and objectives of the remedy specified in §257.96, including protectiveness of human health and the environment, achievement of the GWPS, and source control.

1.0 Introduction

1.1 Site Overview and Description of CCR Unit

The DTE Electric Company (DTE Electric) River Rouge Power Plant (RRPP) is located at 1 Belanger Park Drive, within the City of River Rouge in Wayne County, Michigan. The RRPP, including the Bottom Ash Basin (BAB) Coal Combustion Residual (CCR) unit, was originally constructed in the early 1950s on the southern shore of the Rouge River Short Cut Canal and along the west bank of the Detroit River in River Rouge, Michigan. The former BAB, located immediately north of the RRPP and south of the Rouge River Short Cut Canal, formerly received sluiced bottom ash and other process effluent from the RRPP throughout its operational life through May 2020 when CCR generation at the RRPP ceased.

The RRPP former BAB was a sedimentation basin that was an incised CCR surface impoundment. In 1998, sheet piling was placed around the perimeter of the open excavation impoundment and the sheets were pushed to a depth of approximately 30 feet below ground surface (ft bgs) into native clay soil. Sluiced ash from the power plant was first pumped to two decanting hydrobin structures; the decanted sluiced ash water gravity-drained to the eastern end of the BAB where it combined with other process flow effluent pumped from the power plant. Discharge water from the BAB over-topped an overflow weir and flowed into a weir box structure before draining to a below-grade pump station on the west side of the former BAB.

The pump station contained two sets of centrifugal pumps; one set of pumps (no longer active) recirculated the sluice water back into the plant and the other set of pumps discharge to a surface water outfall in the overflow canal with other site storm and process water effluent authorized via a National Pollution Discharge Elimination System (NPDES) permit and/or to the combined sewer to the Wayne County Downriver Wastewater Treatment Plant (WWTP). Settled CCR materials that escaped the hydrobin ash separation process were periodically dredged from the basin and disposed offsite.

After CCR removal was completed in September 2020 (in accordance with the BAB closure design plans and specifications), the former BAB[1] was repurposed into a non-CCR process water pond. There is a sheet pile weir near the middle of the former 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 former BAB is maintained at an elevation of no higher than 577 feet before being discharged into the Detroit River (via the overflow canal) in accordance with the NPDES permit.

DTE Electric is proactively managing the potential groundwater migration pathway at the RRPP BAB CCR unit using a groundwater extraction system consisting of 11 groundwater extraction wells installed around the former RRPP BAB as an interim measure. The groundwater extraction system was constructed during January and February 2018, began operation in early March 2018, and is currently operational and effectively capturing the affected groundwater in the vicinity of the former RRPP BAB.

[1] For consistency throughout this ACM document, the BAB is referred to as “former” following CCR removal and BAB closure activities completed in September 2020.

1.2 Regulatory Background

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of 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 RRPP BAB. In accordance with the schedule defined in 40 CFR 257.90(b)(1), a groundwater monitoring system has been installed around the RRPP BAB as required by 40 CFR 257.91, and background groundwater monitoring well sampling has been completed as required by 40 CFR 257.93.

As documented 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 assessment monitoring's initial 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*. After the initial assessment monitoring sampling event, the monitoring system was 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 was collected and evaluated in 2018 are presented in the *2018 Annual Groundwater Monitoring Report* (TRC, January 2019).

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 by §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 groundwater capture zone of the proactively constructed groundwater collection system that has been operated as an interim remedy since March 2, 2018 to mitigate any potential risk of migration of groundwater from the area of the (now former) RRPP BAB.

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 to prevent further releases, to remediate any releases, and to restore affected area to original conditions. The Assessment of Corrective Measures (ACM) must be completed within 90 days, unless the owner or operator demonstrates the need for additional time to complete the assessment of corrective measures due to site-specific conditions or circumstances.

Although DTE Electric proceeded with initiating an assessment of corrective measures per the CCR Rule by January 14, 2019, as noted above, DTE Electric has been proactively managing the potential migration pathway. As stated above, DTE Electric's initially-selected management strategy is to operate a groundwater extraction system to mitigate any risk of migration of CCR constituents 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 CCR-affected groundwater in the vicinity of the RRPP BAB.

As stated above, DTE Electric initiated an ACM per §257.96 by January 14, 2019, completed the initial ACM Report on April 15, 2019 and completed Semi-Annual Progress Reports on the remedy selection and design in accordance with §257.97a. The preferred alternative in the ACM was to close the RRPP BAB by CCR removal with offsite CCR disposal and to address the CCR-affected groundwater by continuing to operate the already in-place interim groundwater collection system. However, with the completion of source removal activities in 2020 (see next paragraph), and ongoing performance monitoring, the final remedy is still being evaluated.

The RRPP BAB CCR unit Closure Plan was updated in July 2020 (TRC, July 2020). In accordance with §257.101(a)(1), closure for the River Rouge BAB CCR unit was initiated 30-days after the last known receipt of waste. The RRPP ceased coal fired operations in May 2020 and the BAB closure by CCR removal was completed with construction equipment mobilization occurring in June 2020, and CCR removal occurring from July through September 2020 as documented in the *Bottom Ash Basin Closure Certification Report DTE Electric Company River Rouge Power Plant Bottom Ash Basin Coal Combustion Residual Unit, 1 Belanger Park Drive, River Rouge, Michigan* (TRC, November 2020, Revised February 2021). After CCR removal was completed, the former BAB was repurposed into a non-CCR process water pond. Once engineering evaluations for the final groundwater remedy are completed, the final remedy for the RRPP BAB CCR unit and affected groundwater will be formally selected per §257.97 at least 30-days after the public meeting required under §257.96(e) is held.

The *2021 Annual Groundwater Monitoring and Corrective Action Report* (TRC, January 2022) presented the monitoring results and the statistical evaluation of the assessment monitoring parameters (Appendix IV to Part 257 of the CCR Rule) for the February and October 2021 assessment groundwater monitoring events for the RRPP BAB CCR unit. During assessment monitoring, data are evaluated to identify Appendix IV constituents present at statistically significant levels exceeding a GWPS. In addition, nature and extent groundwater sampling data from existing monitoring wells around the former BAB that was performed in October 2021 are presented in the report.

1.3 Assessment of Corrective Measures Objectives

On behalf of DTE Electric, TRC has prepared this revised Assessment of Corrective Measures Report (ACM) (TRC, April 15, 2019, revised August 4, 2022) to evaluate the effectiveness of potential corrective measures in meeting the requirements and objectives of the remedy specified in §257.96, including protectiveness of human health and the environment, achievement of the GWPS, and source control. A remedy shall be formally selected upon completion of this assessment. This revised ACM builds upon the results and conclusions of the original ACM (April 15, 2019), accounts for source removal activities that have occurred since the original drafting of the ACM, and adds an additional remedial option (e.g. remedial injections). Similar to the original ACM, this revised ACM is an analysis of the effectiveness of potential corrective measures and addresses the following factors:

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

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

2.0 Hydrogeology/Current Conditions

2.1 Geologic/Hydrogeologic Setting

The RRPP BAB CCR unit is located immediately adjacent to the Rouge River near the intersection of the Rouge River and Detroit River (Figure 1). The BAB is constructed with steel sheet pile walls that extend to a depth of approximately 30 ft (approximately 5 ft into an underlying silty-clay confining unit). Soils surrounding the RRPP BAB CCR unit consist of 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 feet to about 8 feet in thickness near the former 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 more than a 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 lower potential aquifer. Therefore, there is no hydraulic connection between the uppermost aquifer and the underlying Dundee limestone, and groundwater within the limestone is artesian.

2.2 Environmental Setting and Monitoring Network

A groundwater monitoring system was 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 were installed south-southwest of the RRPP BAB to 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 were installed to the north-northeast, downgradient of the RRPP BAB CCR unit under non-pumping conditions (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).

Eleven groundwater recovery wells were installed as part of the interim measures groundwater extraction system (Figure 2) to prevent the migration of CCR constituents in groundwater toward the Rouge River. Additional monitoring wells were added to evaluate the groundwater extraction system zone of influence in the uppermost aquifer. Although operation of the groundwater extraction system has changed groundwater flow significantly near 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 monitoring wells MW-16-01 through MW-16-03 are no longer 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. Potentiometric groundwater surface depictions for the uppermost aquifer for pre and post extraction system operation are shown on Figure 3 (September 2017), Figure 4 (April 2018), Figure 5 (October 2018), and Figure 6 (October 2021).

2.3 On-Site Groundwater Flow Conditions

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 was 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. A representative historic potentiometric groundwater surface (from September 2017) for the uppermost aquifer is displayed on Figure 3.

Due to the installation and continuous operation of the interim measures groundwater extraction system since March 2, 2018, the current groundwater flow regime is significantly different from pre-groundwater extraction system installation/operation monitoring events. The extraction wells surrounding the BAB maintain an inward hydraulic gradient that extends to the edge of the river thus maintaining hydraulic capture of the potentially CCR-affected groundwater. The groundwater capture zone within the uppermost aquifer extends beyond all CCR groundwater monitoring system wells, except for background monitoring well MW-17-07 (Figure 5 and 6). 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).

2.4 Nature and Extent of Environmental Impacts

2.4.1 Potential Extent of CCR Source Materials

The RRPP BAB was originally installed as an open excavation concurrent with power plant construction in the 1950s and has received sluiced bottom ash generated from coal combustion processes during plant operations for nearly 70 years. The excavation was maintained with 2H:1V side slopes with periodic dredging operations performed to remove the settled CCR materials. In 1998, sheet pile walls were installed around the perimeter of the BAB to a depth of 30 ft below ground surface (bgs) and were supported with sheet pile tie-backs installed approximately 15 ft laterally from the wall. After sheet pile wall installation, the design specification for construction called for the basin bottom to be excavated/dredged to an elevation of 560 ft (approximately 19 ft bgs).

Periodically throughout the operation of the BAB, settled bottom ash was dredged from the basin and hauled to Sibley Quarry for final disposition. Some CCR resided outside the confines of the current BAB as a result of the original sheet pile construction efforts and potentially due to the original layout of the BAB prior to the sheet piling in 1998. This material was removed during BAB closure activities.

2.4.2 Characterization of Groundwater

Establishing Groundwater Protection Standards

In accordance with §257.95(h) and the Stats Plan for the site, 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 calculations of the GWPSs are documented in the *Assessment Monitoring Data Summary and Statistical Evaluation* (Initial Assessment Monitoring Statistical Evaluation Memo) (TRC, October 2018a). GWPSs are 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 are 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.

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 (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 *Assessment Monitoring Statistical Evaluation* (TRC, October 2018b). The calculated upper and lower confidence limits and comparison of the lower confidence limits to the GWPSs are provided in the *2018 Annual Groundwater Monitoring Report* (TRC, January 2019).

The statistical evaluation of the May 2018 Appendix IV indicator parameters showed 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.

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 the *2018 Annual Groundwater Monitoring Report* (TRC, January 2019).

Data Comparison to Background Limits – Second Semiannual Event (October 2018) through Second Semiannual Event (October 2021)

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* (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 the *2018 Annual Groundwater Monitoring Report* (TRC, January 2019).

The statistical evaluation of the October 2018 Appendix IV indicator parameters showed results above the GWPS for:

- Arsenic at MW-16-01

Beginning with the First Semiannual Event of 2019 (March 2019) through the First Semiannual Event of 2021 (February 2021), the statistical evaluation of Appendix IV parameters showed continued results above GWPSs for:

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

The statistical evaluation of the October 2021 Appendix IV parameters shows continued results above the GWPS for:

- Arsenic at MW-16-01.

No other constituents were observed at statistically significant levels exceeding the Appendix IV GWPSs during the October 2018 through October 2021 assessment monitoring events.

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 annually since October 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.

Groundwater elevation data were collected concurrent with each sampling event to evaluate and characterize the nature and extent of the release 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. The nature and extent groundwater sampling defined the extent of CCR affected groundwater as presented in the 2018 and 2019 Annual Groundwater Monitoring Reports (TRC; January 31, 2019 and January 30, 2020) and the 2020 and 2021 Annual Groundwater Monitoring and Corrective Action Reports (TRC; January 2021 and January 2022).

Lithium at MW-17-15 was the only Appendix IV parameter detected at concentrations above the GWPS throughout the nature and extent monitoring well network since 2018, and since 2019 has been below the GWPS (Figure 7). This monitoring well is located within the radius of influence of the groundwater extraction system. Concentrations of all other Appendix IV parameters were below the GWPSs in all other wells within the nature and extent monitoring well network, delineating the extent of the potential CCR groundwater release above GWPS to be only at MW-16-01 for arsenic (Figure 7), but to also be within the capture zone of the groundwater extraction system that has been operational since March 2, 2018. Therefore, as groundwater conditions are monitored post-CCR removal, the potential CCR constituents within groundwater are located entirely within the capture zone of the groundwater extraction system; as long as the groundwater extraction system is in operation and/or another method is used to treat and/or control the movement of arsenic within groundwater, there is no potential for affected groundwater to migrate off site. In addition, all of the land that overlies the potentially affected groundwater is owned by DTE Electric.

2.5 Potential Receptors and Exposure Pathways

Surface water bodies present in the area of the RRPP include the Rouge River (dredged bottom depth of 20.5 feet below river surface; 557 feet mean sea level [MSL]), and the Detroit River (bottom depth of approximately 43 feet below river surface; 534.5 feet MSL). Given the depth to the uppermost aquifer sand and gravel unit, there is a potential hydraulic connection between the uppermost aquifer and the adjacent surface water.

Concentrations of arsenic and/or lithium above their respective GWPSs were observed in monitoring wells MW-16-01, MW-16-02, MW-17-14, and MW-17-15 in the past. Lithium concentrations are below the GWPS at each of these wells since the first semi-annual sampling event in 2021. However, arsenic currently remains at a concentration above the arsenic GWPS at MW-16-01 only. These monitoring wells are all located well within the hydraulic capture zone 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 well 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 and/or another method is used to treat and/or control the movement of arsenic within groundwater, 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 and there are no water supply wells located at the RRPP property.

3.0 Identification and Assessment of Remedial Options to Develop Corrective Measure Alternatives

3.1 CCR Source Material Management Technologies

In order to remediate potential impacts of CCR source materials, the following list of viable CCR source material management technologies were assembled and assessed in 2019, and compared to a No Action alternative:

1. *In Situ* Management (e.g., capping);
2. Source Removal (with on-site or off-site landfilling, or reuse)

The source removal option was selected and implemented in 2020 as described below.

3.1.1 No Action

A source management strategy of no action involves making no efforts to contain or remove the CCR if it were to remain in place at the end of the useful life of the BAB. CCR would be left in the basin without a cover or additional containment. A strategy of no action was not considered due to its ineffectiveness of reducing potential exposures to the CCR material or potential migration of CCR material beyond the confines of the BAB.

3.1.2 In Situ Management (Capping)

In situ management is completed by achieving the CCR rule cleanup requirements while leaving the CCR materials in place. A protective cap is a potential option to achieve closure in place. The CCR source materials would be left in the BAB and confined by the sheet pile walls and clay bottom. Any CCR material identified outside the confines of the sheet pile walls would be excavated and deposited within the basin limits to confine the CCR material for long-term on-site management. Certified clean fill material would be placed atop any left-in-place CCR material, and a protective cover or cap would be installed at ground surface to contain the CCR, minimize or eliminate infiltration into the former basin, and to prevent the contained materials from migrating or affecting groundwater. The protective cover is often composed of a high-density polyethylene (HDPE) geomembrane liner and a layer of seeded topsoil. This protective cover would serve to isolate the CCR and to minimize the potential for migration of constituents. Groundwater monitoring and cap maintenance would take place regularly for at least 30 years after closure. These required monitoring and maintenance activities represent a significant long-term liability for the site as well as an ongoing potential risk for release of contaminants from the closed unit to the environment. Additionally, because of the in-place closure, the future land use in the area of the closed unit would be restricted.

3.1.3 Removal (With Off-Site Landfilling or Beneficial Reuse)

Source removal would be completed by excavating the CCR source material from its current location and transporting to a contained location offsite for disposal (or reuse). The limits of excavation would include the visible CCR within the confines of the sheet pile walls and clay base, and removal of any CCR materials identified outside the confines of the sheet piling to ensure that all CCR is removed. Following removal, the excavation cavity would be backfilled to grade with certified clean fill material and covered with a layer of seeded topsoil. Because all CCR material would be removed, no ongoing cap maintenance would be required.

As documented in the October 17, 2016 Initial Written Closure Plan (AECOM, October 2016) developed in accordance with §257.102(b) and updated in July 2020 (TRC, July 2020), DTE Electric closed the RRPP BAB by CCR removal and offsite disposal including decontamination of the unit and restoration of the basin for continued use for stormwater and non-CCR wastewater management. This source removal approach is further described in Section 4.

3.2 CCR – Impacted Groundwater Management Technologies

In order to remediate CCR-impacted groundwater, the following list of viable management technologies has been assembled and will be further assessed and reviewed herein:

1. Source Control with Monitoring and Institutional Site Controls (based on applicable regulatory framework);
2. Groundwater Capture/Extraction;
3. Impermeable Barrier (sheet pile or slurry wall) with Strategically-located Groundwater Capture/Extraction; and
4. Geochemical Sequestration via amendment injection or installation of a Permeable Reactive Barrier (PRB) Wall to retard contaminant movement.

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

3.2.1 Source Control with Monitoring and Institutional Site Controls

Source control with monitoring relies on physical, chemical, and/or biological *in situ* processes to act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of constituents in the subsurface environment. A source control and monitoring approach will work best at sites where contaminant source areas have been effectively removed or remediated, and any residual constituents are separated from any nearby receptors by a sufficient time of groundwater travel (affected by distance, permeability, and/or hydraulic gradient) such that any naturally-occurring *in situ* remediation process may effectively eliminate the potential for the contaminant to reach the receptor at concentrations above applicable criteria.

3.2.2 Groundwater Capture/Extraction

Groundwater capture approaches are utilized to reduce the mobility of constituents of concern (COCs) by preventing groundwater from migrating offsite and/or to surface water receptors. Capture of groundwater is accomplished via installation of a groundwater extraction well network screened within water bearing zones or with recovery trenches used to intercept groundwater flow. System components for an extraction management strategy typically include extraction points, pumps, electrical feed, well vaults, flow meters, and other miscellaneous appurtenances, and a discharge option for extracted groundwater.

3.2.3 Impermeable Barrier with Strategically-Located Groundwater Capture/Extraction

To reduce the number of wells required to maintain COC capture, an impermeable barrier consisting of a sheet pile or slurry containment wall could be placed to minimize COC migration from the BAB. A slurry wall is a mixture of soil, water and bentonite clay that is poured into trenches to create an impermeable vertical wall. A sheet pile wall consists of driven rigid materials (pilings) into the ground to form an impermeable barrier. Groundwater recover wells, installed at strategic locations in coordination with the barrier, would extract groundwater to prevent the migration of groundwater around the installed barrier. As stated in Subsection 3.2.2, the groundwater extraction system would include extraction points, pumps, electrical feed, well vaults, flow meters, and other miscellaneous appurtenances, and a discharge option for extracted groundwater.

3.2.4 Geochemical Sequestration via Amendment Injection or Permeable Reactive Barrier

Geochemical sequestration can be an effective *in situ* groundwater treatment technology to bind, destroy, or transform COCs. Geochemical amendments are introduced through discrete direct injections or trenching. Discrete injections would consist of utilizing a drill rig to inject a designed reactive material within targeted areas of the aquifer to destroy or enhance the degradation of the constituents of concern, or to immobilize (trap/bind) the constituents through adsorption or precipitation. Similar to direct injections, a PRB is a wall of a designed reactive material constructed *in situ* in the path of groundwater flow. A PRB uses materials that destroy or enhance the degradation of the constituents or trap the constituents through adsorption or precipitation. The PRB is permeable and therefore allows the treated groundwater to flow through. PRBs are typically installed between the contaminant source and the point(s) of compliance. PRBs are generally installed in a line perpendicular to the ground water flow direction using conventional trenching techniques. The reactive amendment is blended into the trench to form a continuous, flow-through barrier across the plume. The permeability of the installed PRB is targeted to be higher than the native aquifer materials so that the flow through the wall is not impeded at the time of installation or throughout the wall's operational life.

4.0 Analysis and Comparison of Corrective Measure Alternatives

4.1 CCR Source Material Management

As originally documented in the October 17, 2016 *Initial Written Closure Plan for a CCR Impoundment - DTE Energy River Rouge Power Plant Ash Basin* and updated in July 2020 (TRC, July 2020), and as detailed in the RRPP BAB CCR unit Closure Design Manual, DTE Electric closed the RRPP BAB by CCR removal and offsite disposal including decontamination of the unit and restoring the basin for stormwater/non-CCR wastewater management. The CCR removal and disposal activities conducted in 2020 were documented in the *Bottom Ash Basin Closure Certification Report, DTE Electric Company, River Rouge Power Plant Bottom Ash Basin Coal Combustion Residual Unit, 1 Belanger Park Drive, River Rouge, Michigan* (TRC, November 2020, Revised February 2021). CCR removal and off-site disposal is considered a conservative and viable source material management option for the site, offering a high level of long-term performance and reliability, and therefore, was chosen and initiated 30-days after the last known receipt of waste.

4.2 Groundwater Management Technologies

4.2.1 Balancing Criteria for Groundwater Corrective Measures

The evaluation process of each technology identified in Section 3, contained in Subsections 4.2.2 through 4.2.5, generally consists of a weighted comparison of each alternative based on the benefits and drawbacks of each option, considering factors such as the following:

- Risk reduction, including:
  - Magnitude of reduction of existing risks;
  - Magnitude of residual risks; and
  - Short term risks;
- Long term management required;
- Time to full protection;
- Potential receptor exposure to remaining wastes;
- Long-term reliability; and
- Potential need for replacement.

The selected corrective measures will be based on the balance between these various criteria for each alternative, rather than basing the corrective measure selection on only one of the criteria (e.g., reliability).

Groundwater management technologies identified in Section 3 are evaluated in the following subsections.

4.2.2 Source Control with Monitoring and Institutional Controls

Source control and monitoring relies on physical, chemical, and/or biological *in situ* processes to act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of constituents in the subsurface environment. This approach works best at sites where contaminant source areas have been effectively removed or remediated, and any residual constituents are separated from any nearby receptors by a sufficient groundwater time of travel (affected by distance, permeability, and/or hydraulic gradient) such that any naturally-occurring *in situ* remediation process may effectively eliminate the potential for the contaminant to reach the receptor at concentrations above the applicable criteria. Source control and monitoring generally offers an advantage over other options considered in that no active remediation system requires installation or maintenance.

Performance: In the case of the RRPP's BAB, the CCR (the presumed source of COCs in groundwater) was removed when CCR closure by removal was performed in 2020. Additionally, during the closure by removal operations, some soils and fill material were removed from around the perimeter of the BAB. In spite of this source removal effort, groundwater containing elevated COC concentrations are expected to continue to vent to the nearby Rouge River (within 75 feet of the former BAB) for some time unless operation of the existing interim measures groundwater extraction system continues. The impact of source removal on groundwater conditions downgradient of the former BAB will continue to be assessed through on-going semi-annual Assessment Monitoring and annual Nature and Extent monitoring while the interim groundwater extraction system continues to operate.

Reliability: Without operation of the groundwater extraction system and without taking any additional remedial actions, COC concentrations in groundwater have potential to migrate to and vent to surface water adjacent to the site suggesting that continued groundwater monitoring only may not be a reliable alternative for groundwater management. However, now that source removal from the BAB has occurred, monitoring, as a groundwater management strategy, will continue to be assessed to determine whether COC concentrations in groundwater will be effectively attenuated before venting to nearby surface water.

Ease of Implementation: The existing CCR monitoring well network was effectively designed and installed and is adequate to assess the groundwater conditions at the site currently and in the future. Therefore, ongoing monitoring would require limited effort for its implementation.

From an annual effort perspective, the current monitoring program would be performed as required on a semi-annual (assessment monitoring), and/or annual basis (nature and extent monitoring) each calendar year until it can be demonstrated that any CCR contaminant concentrations in groundwater are not reaching any downgradient receptors above applicable criteria.

Safety Impacts: Groundwater monitoring would have limited safety concerns when compared to other groundwater management technologies considered.

Cross-Media Impacts: Groundwater monitoring activities would have no greater impact to air, surrounding surface water, or surrounding soils when compared to other groundwater management technologies considered.

Control of Exposure to Residual Contamination: As indicated above, now that source materials have been removed, groundwater monitoring as a groundwater management strategy for this site will be reassessed to determine if COC concentrations in groundwater will naturally drop below actionable levels. Exposure to CCR-impacted groundwater by site workers during sampling would be effectively controlled through safe work practices and the use of personal protective equipment (PPE).

Time Required to Begin and Complete: When technically viable, groundwater monitoring generally offers a low-cost alternative for site remediation, as minimal capital costs are required for its implementation, and no carbon footprint occurs except for energy usages during site monitoring activities. Groundwater monitoring could be quickly initiated utilizing the existing well network and ongoing monitoring costs would be incurred on an annual basis. For the RRPP BAB CCR unit, groundwater monitoring could be implemented concurrent with shutdown of the interim measures groundwater extraction system. If at any time during the subsequent groundwater monitoring demonstration period, an unacceptable exposure of a COC by a sensitive receptor becomes apparent, the idled groundwater extraction system could be restarted to effectively reestablish hydraulic control in the RRPP BAB CCR unit.

Institutional Requirements: Monitoring groundwater on site adjacent to the former BAB will require the impacted area to be demarcated and defined within the property deed as a restricted use area. All the land that overlies the potentially affected groundwater is owned by DTE Electric. As noted above, monitoring of groundwater conditions in the vicinity of the closed unit will be potentially required until it can be demonstrated that groundwater concentrations are not reaching sensitive receptors above actionable levels.

4.2.3 Groundwater Capture

A groundwater extraction system, if designed, installed, operated, and maintained appropriately in conjunction with source removal will offer an effective remediation solution for the site (as currently demonstrated by on-going operations of the interim measures groundwater extraction system). Using installed piezometers and monitoring wells in proximity to the extraction system, hydraulic capture (before venting to the Rouge River) will be demonstrated. Extracted groundwater will be managed and discharged with the RRPP facility’s stormwater and non-CCR process water under the RRPP NPDES permit.

Groundwater extraction can be accomplished using wells screened within water bearing zones (as with the existing interim measures groundwater extraction system) or with recovery trenches. Necessary system components for an extraction management strategy include extraction points, pumps, electrical feed, well vaults, flow meters, and other miscellaneous appurtenances.

Due to the expected complexity of trench construction near the Rouge River and former BAB, capital costs associated with a trench construction would likely surpass costs expected of an equally effective groundwater extraction well system. An extraction well system was chosen for the installed interim measure at the site.

Design and operation of a system shall consider COC migration control, potential changes in oxidation state within water bearing zones that could cause unwanted scale formation in well screens and/or extraction equipment, or the introduction of facultative bacteria within the water bearing zone causing unwanted biogrowth that could affect rates of extraction, or in the case of arsenic, increased solubility and mobilization due to the creation of a more reduced aquifer condition. A routine system inspection and maintenance program would be required to maximize groundwater recovery rates while minimizing system downtime resulting from chemical and/or biological activity.

Prior to implementation of the interim measures groundwater extraction system, groundwater pump tests were performed on wells installed both north and south of the BAB to determine the connectivity of the uppermost aquifer with the Rouge River and extraction rate requirements. The results of these pump tests were used in full-scale system design.

Performance: Groundwater extraction wells or a groundwater recovery trench with strategically-located wells would both achieve adequate groundwater capture at a reasonable extraction rate and therefore will be capable of effectively preventing COC migration before the COCs may vent to the Rouge River. The potential for unintended biological or chemical changes that may occur in extraction well screens, extraction trench collection drains, and associated piping systems due to increased aeration, introduction of soil bacteria to deeper well screen or trench drain areas, and/or changes in certain water quality parameters (pH, temperature, redox, etc.) may negatively affect long-term performance.

Reliability: If properly installed, operated, and maintained, groundwater capture will offer an effective and reliable remediation solution for the site when compared to other alternatives; however, a groundwater extraction system will rely on power consumption in order to continuously capture and contain groundwater to prevent groundwater from discharging at the Rouge River. Interruption of power for any extended period would render the system ineffective.

Ease of Implementation: Installation of vertical extraction wells proximal to the BAB would not be hampered due to spatial limitations and therefore were chosen for the interim measures groundwater extraction system. A groundwater recovery trench would offer more construction challenges than a system consisting only of vertical wells due to the position of the BAB, position of sheet pile hold-back ties, and the position of the Rouge River relative to the layout of a trench. Also, because of limited ground surface space between the BAB and the Rouge River, storage of large volumes of trench backfill in the vicinity of the trench may also affect the practicality of trench construction. Because only low recovery well extraction rates have been needed for capture of COCs by way of the interim measures groundwater extraction system, discharge into the BAB is not causing BAB capacity concerns. Due to the large groundwater extraction rate necessary from a recovery trench to maintain COC capture (due to the potential large influx of water from the Rouge River), the water balance within the BAB would need to be more closely scrutinized so that an overflow condition within the BAB does not occur.

Safety Impacts: Installation and operation of a groundwater capture system would have comparable safety concerns to the implementation of other groundwater management technologies considered. Construction efforts, including drilling, excavation, and electrical installation would expose site workers to general site construction safety concerns. Safety impacts to site workers during operation and maintenance activities would be effectively controlled through safe work practices and the use of personal protective equipment (PPE).

Cross-Media Impacts: Groundwater capture activities would have no greater impact to air, surrounding surface water, or surrounding soils when compared to other groundwater management technologies considered.

Control of Exposure to Residual Contamination: Migration of constituents toward the Rouge and Detroit Rivers is currently being prevented by implementing the interim measures groundwater capture system. Exposure to CCR-impacted groundwater by site workers during operation of the system would be effectively controlled through safe work practices and the use of personal protective equipment (PPE).

Time Required to Begin and Complete: DTE Electric's existing interim corrective measure management strategy for addressing groundwater is to operate a groundwater extraction system to mitigate any risk of migration from the RRPP former BAB to receptors. 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 former BAB that had CCR removed in 2020. It is expected that this interim measure groundwater extraction system will continue to be operated until such time that the system may be idled, and a monitoring only approach can be implemented.

Institutional Requirements: Groundwater capture on site adjacent to the former BAB will require the impacted area to be demarcated and defined within the property deed as a restricted use area. All the land that overlies the potentially affected groundwater is owned by DTE Electric.

Interim Measures Selection: As stated in Section 2.2 and detailed in the above-detailed option screening criteria, an interim measures groundwater extraction system consisting of 11 groundwater extraction wells was installed in early 2018. Prior to design and installation, a groundwater pumping test was performed to estimate the groundwater withdrawal rates for the groundwater extraction system to maintain hydraulic capture around the BAB and to prevent migration of CCR constituents to off-site surface water bodies (e.g., Rouge and Detroit Rivers). Since startup, groundwater has been extracted consistently and continuously from the groundwater extraction system at a combined rate of approximately 20 to 30 gallons per minute (gpm) and groundwater hydraulic capture has been maintained in the RRPP BAB CCR unit. Performance of this interim measures groundwater extraction system will continue to be assessed as a long-term groundwater management strategy through its ongoing operations at the site.

4.2.4 Impermeable Barrier Wall with Strategic Groundwater Extraction

An impermeable barrier wall, constructed of either sheet pile or slurry, could be installed to restrict the groundwater flow paths directly from the former BAB to the Rouge River. The impermeable wall would need to be installed into the clay confining unit underlying the uppermost groundwater aquifer at the site. However, because these flow paths are simply diverted, extraction wells located at each edge of the wall would be required to capture/contain this diverted groundwater. The wall would serve the purpose of reducing the total number of extraction points deemed necessary at the expense of installing the barrier wall without complete elimination of ongoing operational costs.

Performance: An impermeable barrier will effectively minimize the movement of COCs directly toward the Rouge River from the former BAB. Although unexpected, there is potential for some leakage through the wall at construction joints in the case of a sheet pile wall. Also, groundwater will move around the ends of the impermeable wall and will discharge to the Rouge River; wells would be installed to control this groundwater movement.

Reliability: If properly installed, operated, and maintained, an impermeable wall with strategic groundwater extraction would offer an effective and reliable remediation solution for the site when compared to other alternatives. Interruption of power or if long-term well/pump maintenance affects well capture performance, migration of COCs around the wall and toward the Rouge River may be exacerbated due to the increased gradient around the wall. Ongoing maintenance and pump/well rehabilitation is expected but the relative magnitude of these efforts should be less than the groundwater capture approach described in Section 4.2.3 as there would be fewer extraction points to be maintained.

Ease of Implementation: Similar to the construction of a groundwater recovery trench, installation of a sheet pile or slurry wall would take up considerable space between the former BAB and the Rouge River, and the limited space in this area, particularly due to the presence of extraction wells installed as part of the interim measures groundwater extraction system, may make the installation more challenging. Depending on installer preferences, there may be a need to remove trees and other vegetation along the riverbank to enlarge the work area. Both wall types, but more notably for the slurry wall, may prevent vehicular traffic atop the wall following its installation.

Safety Impacts: Installation of an impermeable barrier system would have additional safety concerns compared to other groundwater management technologies considered. Construction efforts, including drilling, excavation, sheet pile or slurry wall installation, and electrical installation would expose site workers to general site construction safety concerns. Safety impacts to site workers during operation and maintenance activities would be effectively controlled through safe work practices and the use of personal protective equipment (PPE).

Cross-Media Impacts: Ambient air could be impacted during the installation of a slurry wall, if installed via excavation. Long-term impacts to site soils, groundwater, and nearby surface water would be minimal using this technology.

Control of Exposure to Residual Contamination: Migration of constituents toward the Rouge and Detroit Rivers would be prevented by implementing an impermeable barrier with strategic groundwater capture approach. Exposure to CCR source materials and CCR-impacted groundwater by site workers during installation and operation of the system would be effectively controlled through safe work practices and the use of personal protective equipment (PPE).

Time Required to Begin and Complete: Installation of the sheet pile or slurry walls combined with groundwater extraction would have considerably longer construction duration when compared to other options considered.

Long-term maintenance and monitoring of the extraction system would still be required, consistent with other technologies; however, it is anticipated that pursuing groundwater extraction would require a shorter duration to achieve full protection when compared to source control and monitoring, if implemented in coordination with CCR source material removal.

Institutional Requirements: An impermeable barrier with strategic groundwater capture system installed on site adjacent to the former BAB will require all impacted areas to be demarcated and defined within the property deed as a restricted use area. All the land that overlies the potentially affected groundwater and location of an impermeable barrier is owned by DTE Electric.

4.2.5 Geochemical Sequestration via Amendment Injection or a Permeable Reactive Barrier (PRB) Wall

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

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

Ferric (oxidized) iron and zero-valent (reduced) iron (ZVI) have been demonstrated to be effective in the removal of arsenic in groundwater by way of adsorption onto the iron surfaces. Once adsorbed, the [As5+] and [As3+] ions will form complexes with iron corrosion products including ferrous hydroxide and ferric oxyhydroxides, and then become occluded by successive layers of corrosion products. Lithium is an additional site COC that may be attributable to the historical BAB operations. Lithium treatment by ZVI is undocumented in literature, and therefore *in situ* treatment with ZVI is not expected. However, lithium concentrations are trending down since the removal of CCR was completed in 2020 and have not exceeded the GWPS since 2020.

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

Arsenic removal by reactive in situ chemistry has been implemented in pilot and full- scale field installations; however, to be sure of its success and exact construction specifications, the proposed PRB would require an extensive bench treatability study for this site, if a PRB wall was to be implemented. Localized injections may be implemented faster and easier than a full-plume width PRB; increased number of localized injection points may also specifically target known areas where high groundwater COC concentrations exist to more effectively and efficiently reduce residual groundwater concentrations. Furthermore, the efficacy of using geochemical sequestration requires evaluation to determine if the act of sequestration has the potential to result in unwanted conditions resulting in the mobilization of other metals that are currently not identified as constituents of concern.

In order to further evaluate groundwater cleanup remedies following CCR removal, DTE Electric retained TRC to complete bench-scale testing with the objective of evaluating alternative in situ groundwater treatment technologies to reduce arsenic concentrations in on-site groundwater. A bench-scale treatability study was conducted in early 2022 to evaluate two in situ treatment options for removing arsenic from groundwater at the former RRPP BAB and to potentially provide a final groundwater remedy for this site. Injection of reagents that can immobilize arsenic in place were considered as an alternative to continuing the groundwater extraction system. Since the source has been removed, reagents would act as a one-time treatment for arsenic-affected groundwater rather than as a permeable reactive barrier (PRB) more suitable for treating the leading edge of a migrating plume.

Arsenic is the key parameter of concern, however since the groundwater has been impacted by CCR, the parameters in Appendix III and Appendix IV were monitored during the bench-scale testing to assure that the concentrations of any of these water quality parameters do not increase above actionable levels.

Two injectable treatment reagents were considered[2]: (1) zero-valent iron (ZVI), and (2) a solution of guar gum and ferrous sulfate. A treatability study was conducted to evaluate whether the two reagents could successfully reduce arsenic concentrations to below 5 micrograms per liter (µg/L). The study used site groundwater and site soils (from the targeted groundwater zone) for testing purposes.

During the bench testing, it was determined that the site soil used was capable of sorbing considerable amounts of arsenic. As such, the ferrous sulfate/guar gum tests were redesigned by providing a more robust arsenic concentration to overcome the soil sorption properties and

[2] A third treatment approach may include a combination of these two reagents.

so the reduction of arsenic could be more easily quantified.

The bench testing results demonstrated the following:

- ZVI can effectively remove both [As5+] (arsenate) and [As3+] (arsenite) from the site groundwater. A ZVI dose of 1 g ZVI/L of solution was sufficient to remove 100 µg/L of arsenic from the water.
- ZVI treatment did not increase any of the other Appendix III or IV parameters, thereby satisfying the requirement that no detrimental effects to water quality will occur.
- Microbial reduction of the guar gum/ferrous sulfate treatment of the arsenic to the target 5 µg/L was not achieved within the test period (38 days). While the approach may work if given a longer reaction time, the success of the approach cannot be confirmed from this bench testing. In a full-scale in situ application, guar gum could be used as a dispersing agent to keep ZVI suspended during injection, and the combination of ZVI and guar gum/ferrous sulfate should provide a viable approach for treating arsenic at the site, as the guar gum-ferrous sulfate addition will provide added insurance that the treated water will remain anaerobic/reduced for an extended time period. It should be noted that arsenic stabilization using either ZVI or guar gum/ferrous sulfate will become reversible if the system becomes oxic over time. However, geochemical conditions at the site are not expected to change the redox state of the uppermost aquifer in the future.

Performance: Geochemical sequestration has potential to control the migration of arsenic in groundwater to the Rouge River. Bench-scale treatment tests confirmed the overall treatment capability of an injection program. The key to achieving good arsenic removal would likely be the ability to distribute the media uniformly throughout the target groundwater treatment zone rather than the application dose. Further field pilot testing would be justified to confirm the overall treatment capability of an injection program or wall based on the specific site groundwater conditions, media dispersion, and the necessary wall thickness to achieve the targeted treatment capacity (efficiency). Also, because of particle surface occlusion caused by the adsorption of arsenic-iron complexes, there is potential for treatment to become less effective over time; in a worst-case situation, follow-up injections or PRB removal and reconstruction could be required prior to project completion.

Geochemical sequestration will offer less to no certainty toward the control of lithium migration. However, in combination with source control, lithium is being effectively controlled and has declined to below the GWPS in 2021 after the CCR removal was completed in 2020.

Reliability: Since no active pumping would be required in a geochemical sequestration application, targeted injections or a permeable reactive barrier wall would be more reliable to operate than other proposed options. However, *in situ* reactive material has potential to either plug (due to chemical precipitation) or become deactivated (due to chemical reaction and/or binding onto particle surfaces), and therefore, follow-up injections or wall replacement in the future could be required.

Lithium, due to the chemical nature of this element, is not expected to be treated with the ZVI injections or wall based on the treatability testing performed, and therefore this technology may not be a viable solution for lithium. However, in combination with source control, lithium is being effectively controlled and has declined to below the GWPS in 2021 after the CCR removal was completed in 2020.

Ease of Implementation: PRB wall construction would be performed similarly to slurry wall construction but with different materials of construction. Similar to the slurry wall, the PRB wall construction may be challenging because of the limited space available for installation equipment, trench spoils, and temporary trench materials storage. To be fully passive, a portion of the reactive barrier wall would need to be constructed on the west side of the BAB, further complicating the installation efforts.

Discrete injections would consist of utilizing a drill rig to inject a designed reactive material within targeted areas of the aquifer at a designed spacing interval to create near uniform vertical and lateral coverage. Discrete injections may be less challenging when compared to the PRB wall construction with less surface area required for installation equipment, spoils, and material storage. In a full-scale in situ application, guar gum could be used as a dispersing agent to keep ZVI suspended during injection, and the combination of ZVI and guar gum/ferrous sulfate should provide a viable approach for treating arsenic at the site, as the guar gum-ferrous sulfate addition will provide added insurance that the treated water will remain anaerobic/reduced for an extended time period.

Safety Impacts: Installation of a PRB or direct injections of reactive media would have similar safety concerns compared to installation of an impermeable slurry wall. Construction efforts, including excavation, PRB installation trenching, or drill rig operation would expose site workers to general site construction safety concerns. Safety impacts to site workers during operation and maintenance activities would be effectively controlled through safe work practices and the use of personal protective equipment (PPE).

Cross-Media Impacts: Ambient air could be impacted during the installation of a PRB, if installed via excavation. Impacts to the ambient air during the direct injection approach would be limited. Long-term impacts to site soils, groundwater, and nearby surface water would be minimal using this technology.

Control of Exposure to Residual Contamination: Long term performance of an injection program or PRB for preventing migration of constituents toward the Rouge and Detroit Rivers cannot be easily predicted. Remediation of lithium has not been shown to be as equally effective as arsenic treatment, and therefore lithium may pass through the injection areas or PRB without treatment prior to discharge at the Rouge River. However, lithium has been below the GWPS since 2021.

Exposure to CCR source materials and CCR-impacted groundwater by site workers during installation and operation of an injection area or PRB would be effectively controlled through safe work practices and the use of personal protective equipment (PPE).

Time Required to Begin and Complete: PRB wall construction would be comparable to slurry wall construction in duration, but with different materials of construction. Localized injections may be implemented sooner than a PRB approach requiring fewer materials and less mobilization of installation/construction equipment.

Performance monitoring would be required to verify performance, and whether unintended breakthrough of COC occurs. Reactive media replacement in the future could be required if rebound within the injection area or breakthrough of an installed PRB is observed. Compared to other technologies, it is anticipated that a PRB would require a longer duration to achieve full protection as it lacks active pumping, while a direct injection approach is anticipated to take a shorter period to achieve full protection as it would directly cover the entire groundwater impact area.

Institutional Requirements: A geochemical sequestration approach on site adjacent to the former BAB will require all impacted areas to be demarcated and defined within the property deed as a restricted use area. All the land that overlies the potentially affected groundwater and location of injection areas or a PRB is owned by DTE Electric. State-level injection permitting would also be anticipated for the geochemical sequestration approach.

5.0 Corrective Measure Alternatives Evaluation Summary

5.1 CCR Source Material Management

As documented in the October 17, 2016 *Initial Written Closure Plan (AECOM, October 2016)* developed in accordance with §257.102(b), DTE Electric proposed to close the RRPP BAB by CCR removal and offsite disposal including decontamination of the unit. The RRPP BAB CCR unit Closure Plan was updated in July 2020 (TRC, July 2020), and CCR removal was completed in accordance with the updated plan and in accordance with a closure design manual prepared for the BAB. CCR was removed from within and around the BAB, off-site disposal, and restoration of the former basin for use as a stormwater/non-CCR process water management structure. The closure was initiated 30-days after the last known receipt of waste, as it was considered the most conservative and viable source material management option for the site, offering a high level of long-term performance and reliability. Removal of CCR was completed with mobilization in June 2020 and CCR removal occurring from July through September 2020 as documented in the *Bottom Ash Basin Closure Certification Report DTE Electric Company River Rouge Power Plant Bottom Ash Basin Coal Combustion Residual Unit, 1 Belanger Park Drive, River Rouge, Michigan* dated November 2020 and revised in February 2021 (TRC, November 2020, Revised February 2021).

5.2 Groundwater Management

DTE Electric is proactively managing the potential groundwater migration pathway at RRPP BAB CCR unit using an installed interim groundwater extraction system around the RRPP former BAB. This system was constructed during January and February 2018, began operation in early March 2018, and effectively captures groundwater in the vicinity of the RRPP BAB CCR unit eliminating the potential for Appendix III and Appendix IV parameters to migrate off-site from the RRPP BAB CCR unit. DTE Electric will continue to operate this interim system until such time that the potential for migration of CCR constituents from the RRPP BAB CCR unit are mitigated and/or other active remediation is implemented, and monitoring can demonstrate that migration of CCR constituents to the Rouge River above applicable cleanup levels has been abated. The remedy for RRPP BAB addressing affected groundwater will be formally selected per §257.97 after the public meeting required under §257.96(e) is held.

6.0 Report Certification

I, the undersigned Michigan Professional Engineer, hereby certify that I am familiar with the technical requirements of Title 40 Code of Federal Regulations Part 257 Subpart D (§257). I also certify that it is my professional opinion that, to the best of my knowledge, information, and belief, that the information in this demonstration is in accordance with current good and accepted engineering practice(s) and standard(s) and meets the requirements of §257.96.

For the purpose of this document, "certify" and "certification" shall be interpreted and construed to be a "statement of professional opinion." The certification is understood and intended to be an expression of my professional opinion as a Michigan Licensed Professional Engineer, based upon knowledge, information, and belief. The statement(s) of professional opinion are not and shall not be interpreted or construed to be a guarantee or a warranty of the analysis herein.

Name David B. McKenzie, P.E.	License Expiration Date December 17, 2023	STATE OF MICHIGAN ★ DAVID B MCKENZIE ENGINEER No. 6201042332 ★ LICENSED PROFESSIONAL ENGINEER Stamp
Company TRC Engineers Michigan, Inc.	Date 10/3/22	

7.0 References

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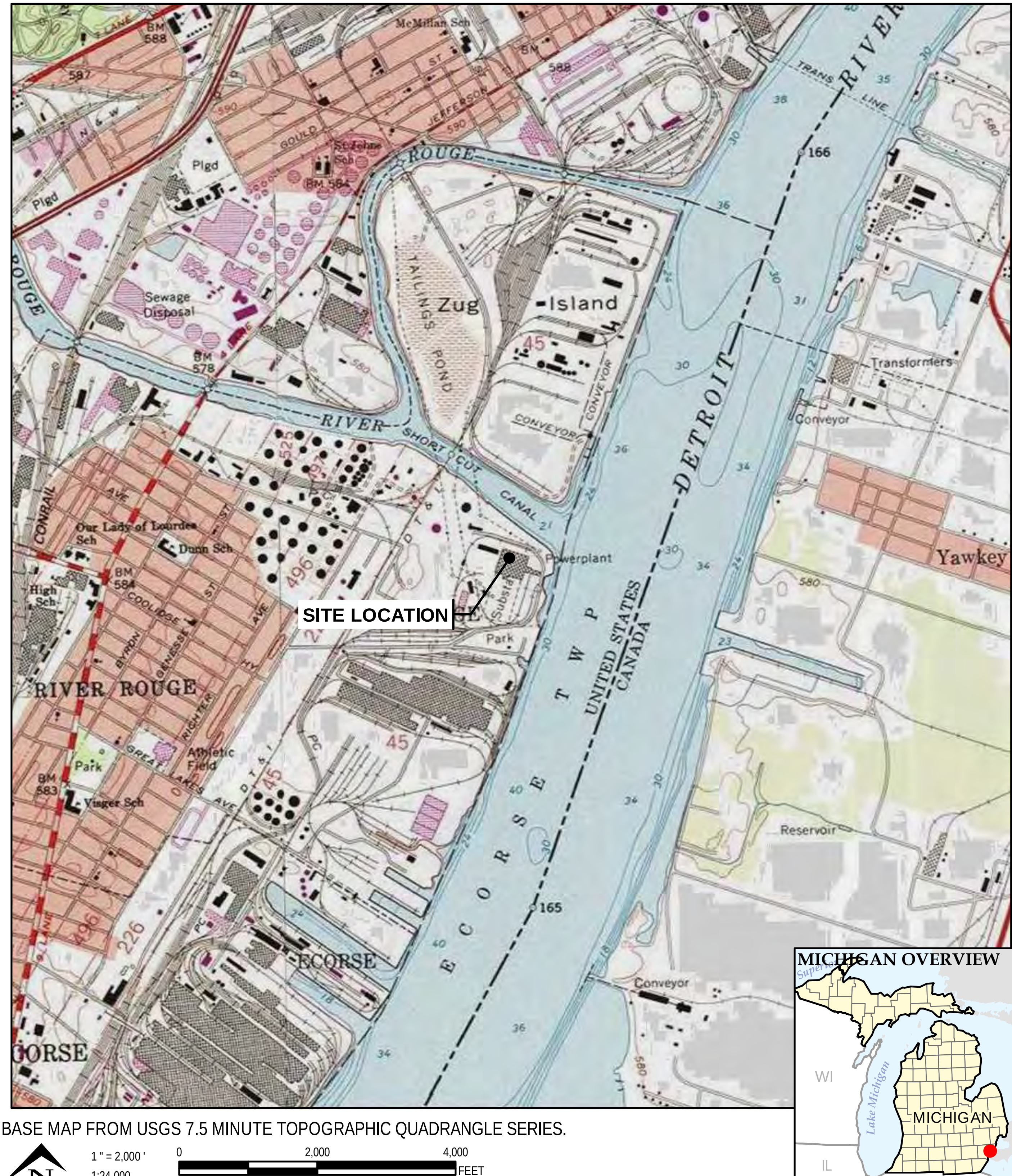
Figures



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

1 " = 2,000 '
1:24,000

0 2,000 4,000 FEET

TRC

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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

E:\DTE\CCR_Sites\2017_265996\265996-SLMMB.mxd -- Saved By: BDEEGAN on 10/9/2017, 14:51:49 PM

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.

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	**FIGURE 2**	
APPROVED BY:	V. BUENING		
DATE:	JANUARY 2019		

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FILE NO.: 265996-0005-030.mxd

TRC - GIS

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

Plot Date: 1/2/2019, 16:16:10 PM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: E:\DTE\CCR_Sites\2017_265996\265996-0005-030.mxd

LEGEND

- MONITORING POINT
- UPPERMOST AQUIFER MONITORING WELLS
- BEDROCK MONITORING WELL
- GROUNDWATER CONTOUR (.25' INTERVAL, DASHED WHERE INFERRED)
- (575.25) ELEVATION FT (NAVD 88)
- INFERRED GROUNDWATER FLOW DIRECTION

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
SEPTEMBER 2017

DRAWN BY:	S. MAJOR	PROJ NO.:	265996.0005.0000
CHECKED BY:	C. SCIESZKA		**FIGURE 3**
APPROVED BY:	V. BUENING		
DATE:	JANUARY 2018		

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Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
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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 4**
APPROVED BY:	V. BUENING		
DATE:	JANUARY 2019		

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

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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		
APPROVED BY:	V. BUENING	**FIGURE 5**	
DATE:	JANUARY 2019		

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

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LEGEND

- COMPLIANCE WELLS
- MONITORING POINT
- NATURE AND EXTENT WELLS
- EXTRACTION WELL
- GROUNDWATER CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- INFERRED GROUNDWATER FLOW DIRECTION
- (575.86) ELEVATION FT (NAVD 88)

NOTES

1. BASE MAP IMAGERY FROM GOOGLE, 03/2021.
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.

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 2021

DRAWN BY:	A. FOJTIK	PROJ NO.:	413591.0005
CHECKED BY:	B. YELEN		
APPROVED BY:	V. BUENING	**FIGURE 6**	
DATE:	JANUARY 2022		

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TRC - GIS

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

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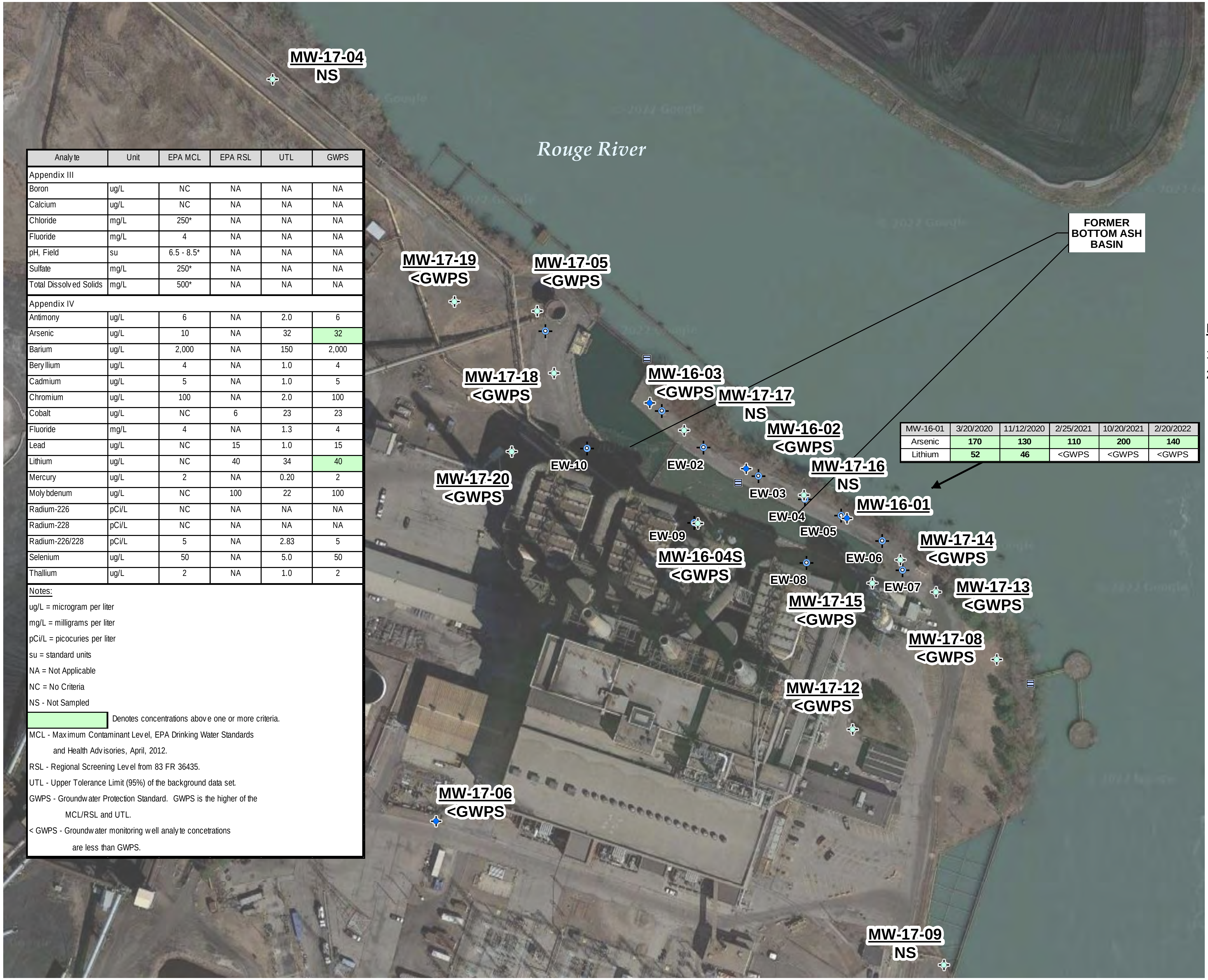
LEGEND

- COMPLIANCE WELLS
- MONITORING POINT
- NATURE AND EXTENT WELLS
- EXTRACTION WELL



Analyte	Unit	EPA MCL	EPA RSL	UTL	GWPS
Appendix III					
Boron	ug/L	NC	NA	NA	NA
Calcium	ug/L	NC	NA	NA	NA
Chloride	mg/L	250*	NA	NA	NA
Fluoride	mg/L	4	NA	NA	NA
pH, Field	su	6.5 - 8.5*	NA	NA	NA
Sulfate	mg/L	250*	NA	NA	NA
Total Dissolved Solids	mg/L	500*	NA	NA	NA
Appendix IV					
Antimony	ug/L	6	NA	2.0	6
Arsenic	ug/L	10	NA	32	32
Barium	ug/L	2,000	NA	150	2,000
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
Fluoride	mg/L	4	NA	1.3	4
Lead	ug/L	NC	15	1.0	15
Lithium	ug/L	NC	40	34	40
Mercury	ug/L	2	NA	0.20	2
Molybdenum	ug/L	NC	100	22	100
Radium-226	pCi/L	NC	NA	NA	NA
Radium-228	pCi/L	NC	NA	NA	NA
Radium-226/228	pCi/L	5	NA	2.83	5
Selenium	ug/L	50	NA	5.0	50
Thallium	ug/L	2	NA	1.0	2

Notes:

ug/L = microgram per liter

mg/L = milligrams per liter

pCi/L = picocuries per liter

su = standard units

NA = Not Applicable

NC = No Criteria

NS - Not Sampled

[green box] Denotes concentrations above one or more criteria.

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.

< GWPS - Groundwater monitoring well analyte concetrations are less than GWPS.

MW-16-01	3/20/2020	11/12/2020	2/25/2021	10/20/2021	2/20/2022
Arsenic	**170**	**130**	**110**	**200**	**140**
Lithium	**52**	**46**	<GWPS	<GWPS	<GWPS

NOTES

1. BASE MAP IMAGERY FROM GOOGLE, 03/2021.
2. WELL LOCATIONS SURVEYED BY BMJ ENGINEERS AND SURVEYORS INC. IN JUNE 2016 & JUNE 2017.

N

0 100 200 Feet

1 " = 150 '

1:1,800

PROJECT:

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

TITLE:

NATURE AND EXTENT OF GWPS EXCEEDANCES 2020 TO 2022

DRAWN BY:	A. FOJTIK	PROJ NO.:	461816.0005
CHECKED BY:	B. YELEN		
APPROVED BY:	V. BUENING	FIGURE 7	
DATE:	SEPTEMBER 2022		

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