MONITORING WELL INSTALLATION REPORT
COAL COMBUSTION RESIDUALS (CCR) RULE

INACTIVE SCRUBBER BASINS
DTE ST. CLAIR PLANT
EAST CHINA, MICHIGAN

Prepared for:

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Detroit, MI 48226

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1.0 INTRODUCTION

At the request of DTE Electric Company (DTE), AECOM Technical Services, Inc. (AECOM) has prepared this Well Installation Report to document the installation of monitoring wells at the DTE St. Clair Power Plant (SCPP), located in East China, Michigan (**Figure 1**). The field activities were conducted in the vicinity of the inactive Scrubber Basins in order to establish a groundwater monitoring network as required by the United States Environmental Protection Agency (USEPA) Final Rule 40 Code of Federal Regulations (CFR), Part 257, Section 257.91 Sub-Part (a) (Rule). The Rule was established to regulate the disposal of Coal Combustion Residuals (CCR) produced by electric generating facilities (USEPA, 2015).

1.1 Site Location

The SCPP is located in St. Clair County Michigan approximately 1 mile north of the city of East China, Michigan. The SCPP is a coal-fired and oil-fired generating plant built in the 1950s. The SCPP is bounded to the east by the St. Clair River. Topography in the vicinity of the inactive Scrubber Basin area is relatively flat with elevations varying from 585 feet mean sea level (ft msl) west of the basins and up to 590 ft msl in the eastern basin area towards the St. Clair River.

1.2 Description of the CCR Unit

The SCPP inactive Scrubber Basins are located approximately 2,600 feet west of the main plant and encompass an area approximately 15 acres in size (**Figure 1**). The two (2) Scrubber Basins were built in 1973 to handle flue gas desulfurization (FGD) scrubber material generated as the scrubber cleaned the gases passing through the smokestacks. Filling of the basins ceased in the mid-1970s. The basins are located adjacent to each other with their long axis oriented northeast to southwest. The eastern basin is approximately 1,300 feet in length with a maximum width of approximately 280 feet. The western is also approximately 1,300 feet in length and is approximately 190-feet wide. An earthen berm approximately 50-feet wide separates the two (2) basins. For purposes of the CCR groundwater study, the two (2) basins were considered a combined CCR multi-unit.

2.0 HYDROGEOLOGY

The following section presents information regarding the site-specific geologic and hydrogeologic conditions based on the findings from the well installation activities.

2.1 Regional Setting

The DTE SCPP site is located in St. Clair County, west of the St. Clair River, and is situated above a thick sequence of Pleistocene-age glacial materials comprised of primarily lacustrine deposits and glacial tills. The thickness of the unconsolidated deposits ranges between 100 and 400 feet. Sand and gravel lenses, where present, in these unconsolidated deposits are potential water-supply sources.

These unconsolidated materials overly bedrock comprised of sandstones and shales of Devonian to Mississippian age on a regional scale. Bedrock in the vicinity of the SCPP site is primarily the Devonian shales of the Bedford or Antrim formations. Bedrock is also a water-supply source in the region where coarser grained sands and gravels are not present.

2.2 Local Setting

The inactive Scrubber Basins are situated above a glacial till comprised primarily of clays and silty clays with traces of sand and gravel ranging in thickness from 135 to 142 feet. The lower 5 to 15 feet of this till unit has increased silt and some sand content. This zone was observed to yield groundwater during the

well installation activities. The till unit overlies shale bedrock that was observed to be moderately to highly weathered in at least the upper 3 to 5 feet at all locations.

Groundwater at the site is encountered in the lower portion of the glacial till that rests on top of weathered bedrock and is stored under confined conditions in the vicinity of the Scrubber Basins. The groundwater bearing zone is located at depths ranging from 125 to 137 feet below ground surface (bgs) across the Scrubber Basin area. Groundwater depth measurements in the monitoring wells range between 3.5 and 11 feet bgs. Groundwater elevations range from 580 to 581 feet above mean sea level (ft amsl) at wells BKG-1 and BKG-2 located west of the Scrubber Basins. Groundwater elevations along the line of wells MW-1 to MW-5 located west of the basins range from approximately 583 to 586 ft msl.

The hydrogeologic conditions observed at the Scrubber Basins is generally consistent with conditions observed at the SCPP Bottom Ash Basin located approximately 3,000 feet to the east. Groundwater elevations at the Scrubber Basins are generally higher than those observed at the Bottom Ash Basin area (where groundwater is also under confined conditions).

Lithologic information for each inactive Scrubber Basin area monitoring well is provided on the monitoring well construction logs included in **Appendix A**. Geologic Cross-sections are presented in **Appendix B**.

2.2.1 Uppermost Aquifer System

The following section presents the expectations under the CCR Rule for identifying the uppermost aquifer subject to groundwater monitoring and describes the lithologic unit identified as the uppermost aquifer in the vicinity of the combined footprint of the inactive Scrubber Basins at the SCPP.

As described in the CCR Rule:

> *"The owner or operator of a CCR unit must install a groundwater monitoring system that consists of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer…"*

Applicable definitions from the CCR rule (40 CFR 257.93) regarding the definition of an aquifer and the uppermost aquifer include the following:

> *"**Aquifer** means a geologic formation, group of formations, or portion of a formation capable of yielding usable quantities of groundwater to wells or springs."*
>
> *"**Uppermost aquifer** means the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary. Upper limit is measured at a point nearest to the natural ground surface to which the aquifer rises during the wet season."*

Based on the well installation activities findings the uppermost aquifer occurs at the base of the glacial till which contains a higher silt and sand content and overlies shale bedrock. This zone occurs at depths ranging from 125 to 137 feet bgs and ranges between approximately 5- to 15-feet thick. Till composition above this saturated interval is predominately clay with variable amounts of silt. The upper portion of the underlying shale bedrock is moderately to highly weathered but was not observed to be highly saturated. Geologic cross-sections for the inactive Scrubber Basin area wells are presented in **Appendix B**.

2.2.2 Groundwater Flow and Hydraulic Conductivity

Groundwater flow in the vicinity of the CCR unit is expected to be to the east-southeast based on the observation that regional recharge areas are generally located in the upland areas to the west and regional discharge areas being dominated by the St. Clair River to the east. Based on this regional

observation, the inactive Scrubber Basins groundwater monitoring system was installed with the anticipation wells to the west of the basins would be upgradient and wells to the east would be downgradient.

In contrast, groundwater elevations measured at the Bottom Ash Basin wells and the inactive Scrubber Basins wells do not suggest a consistent direction of flow. Inactive Scrubber Basins monitoring wells MW-1 through MW-5 (located east of the basins) exhibit groundwater elevations that are on the order of 3.5 to 4 feet higher than wells BKG-01 and BKG-02 to the west. Elevations in wells MW-1 through MW-5 are also on the order of 3 to 3.5 feet higher than the monitoring wells located at the SCPP Bottom Ash Basin area located further to the east. Potentiometric surface maps from the March 2018 and September 2018 sampling events are presented in **Appendix C**. The maps suggest that there is a groundwater high point between the inactive Scrubber Basins and the Bottom Ash Basin area. This is unusual in that there is no evidenced or expected source of recharge in that area (i.e. no source of direct or rapid surface infiltration or source of bedrock recharge) and in that it is contrary to the known regional flow direction. There are several non-CCR ponds in the vicinity of the Inactive Scrubber Basin Area but none are known to lose water, so they are not considered a significant potential source for groundwater recharge via infiltration.

Further, the geologic boring logs on site indicate that the uppermost aquifer is confined by over 100 feet of relatively uniform, low-permeability clay till that acts as an aquiclude, significantly preventing any potential infiltration of surface water. Accordingly, the groundwater flow direction at the inactive Scrubber Basins is identified as indeterminate.

In this scenario, the groundwater monitoring system wells cannot be expected to serve as simple upgradient or downgradient monitoring points. This is because of two (2) main factors:

- The expected lack of vertical hydraulic connection between surface features like the inactive Scrubber Basins and the uppermost aquifer suggests an infiltration time that is far greater than the age of the basins and their expected closure time frame, and suggests a potential for lateral diffusion of infiltration that is wider than the limits of the waste unit (where monitoring wells MW-1 through MW-5 are installed).
- The infiltration rate is further countered or reversed by the upward hydraulic gradient of the aquifer. The clay rich till is relatively dry but water levels in the monitoring wells installed to the till/bedrock boundary rise to within 3.5 to 11 feet bgs.

The factors supporting this position are discussed in the following sections.

Hydraulic Conductivity

Hydraulic conductivity testing was not performed on the monitoring wells installed in the inactive Scrubber Basin area. However, the lithologic conditions in the area are similar to those observed at the Bottom Ash Basin area located to the east within the SCPP main operational area. Hydraulic conductivity values for these Bottom Ash Basin wells range from 0.009 to 0.017 feet per day (TRC 2017). The mean hydraulic conductivity the Bottom Ash Basin was reported as 0.013 feet per day. Similar lithologic conditions were also observed at the Belle River Power Plant Diversion Basin (located approximately 0.7 miles northwest of the St. Clair Scrubber Basins) during CCR investigation activities at the site. Hydraulic conductivity values for the Diversion Basin wells range from 0.2 to 0.5 feet per day (TRC 2017).

Based on the similar hydrogeologic conditions observed at both areas, the Bottom Ash Basin conductivity values can be considered reasonable and appropriate for the uppermost aquifer monitored at the inactive Scrubber Basin area.

Horizontal Time of Travel

The horizontal time of travel for the inactive Scrubber Basin Area was calculated using Darcy Flux calculations and the following input values:

- Hydraulic Gradient (foot/foot) – based on average of dry and wet season potentiometric contours
- Hydraulic Conductivity (feet/day) – based on estimates from the Bottom Ash Basin aquifer system
- Effective Porosity (unit less) – based on published values for silty clays

Assuming an effective porosity of 40 percent for a silty clay, a gradient value of 0.0022 foot/foot with a median conductivity value of 0.013 feet/day, the horizontal time of travel is estimated to be 0.000072 feet/day (or 0.026 feet/year).

3.0 GROUNDWATER MONITORING SYSTEM INSTALLATION

The CCR groundwater monitoring system was installed between May 23 and June 12, 2018. This included the installation of five (5) monitoring wells located east of the inactive Scrubber Basins, and two (2) monitoring wells located west of the inactive Scrubber Basins. Monitoring well locations are shown on **Figure 2**. **Table 1** contains information regarding well locations and construction details. Well lithologic and construction logs are included as **Appendix A**.

3.1 Borehole Advancement and Well Installation

Each monitoring well was installed by a State of Michigan licensed well driller as directly observed by an AECOM geologist. Borings were advanced using a rotosonic drill rig and soil cores were collected in continuous sections for examination and lithologic description by the on-site geologist to the terminating depth of each borehole. Photographs of each soil core were also collected. Each borehole was advanced into the upper portion of the uppermost usable aquifer. Upon reaching the target depth, a monitoring well was installed in the borehole.

3.2 Well Construction

Each monitoring well was constructed of 2-inch diameter polyvinyl chloride (PVC) casing with a 10-foot section 0.010-inch slotted PVC screen. The annular space (between the borehole wall and well casing) was backfilled with a clean silica sand pack extending at least 2 feet above the top of the screen. A minimum 2-foot thick bentonite seal was placed on top of the sand pack and each seal was allowed to hydrate for at least 1 hour per manufacturer's specifications. The remaining annular space was filled with a cement/bentonite grout emplaced via tremie method to within approximately 12 inches of the ground surface.

3.3 Well Development

Each monitoring well was developed no sooner than 24-hours after grout emplacement to enhance hydraulic connection between the well and the aquifer and to remove potable water introduced to the subsurface during drilling activities. A submersible pump was used to remove at least five (5) well volumes or until the water was visibly clear of sediments, turbidity was less than 10 nephalometric turbidity units (NTUs), and water quality measurements [temperature, pH, conductivity, and oxidation-reduction potential (ORP)] were stable over at least three well volumes.

3.4 Well Survey

Each monitoring well/piezometer was surveyed for horizontal location and elevation data by a surveyor licensed in the State of Michigan. Top of casing and ground surface elevations were recorded to the nearest 0.01 foot.

4.0 CCR GROUNDWATER MONITORING SYSTEM DESCRIPTION

Based on site-specific hydrogeologic information and groundwater flow, the CCR groundwater monitoring system for the inactive Scrubber Basins (a combined CCR unit) consists of six (6) monitoring wells: BKG-1, MW-1, MW-2, MW-3, MW-4, and MW-5. None of the wells is designated as upgradient or downgradient due to the indeterminate nature of groundwater flow conditions on site.

The number, spacing, and depth of monitoring wells was based on a thorough characterization of the hydrogeologic factors included in § 257.91 (b)(1)&(2). As noted in Section 2.1 above, each well was installed into the uppermost water-bearing zone underlying the site. This zone underlies 100 feet or more of glacial till, and is comprised of a relatively porous and permeable zone in the lowermost till and the upper weathered portions of bedrock. Each well has a dedicated bladder pump system and tubing installed for sampling purposes.

5.0 CCR GROUNDWATER MONITORING SYSTEM CERTIFICATION

AECOM ("Consultant") has been retained by DTE Energy to provide certification of the groundwater monitoring system as required under 40 CFR § 257.91(f) of the HAZARDOUS AND SOLID WASTE MANAGEMENT SYSTEM; DISPOSAL OF COAL COMBUSTION RESIDUALS FROM ELECTRIC UTILITIES; FINAL RULE, 80 Fed. Reg. 21302 (Apr. 17, 2015) ("CCR Rule") for the CCR unit(s) identified by DTE Energy at their St. Clair Plant located in East China, Michigan.

Requirements

Pursuant to 40 CFR § 257.90(b)(1), by April 17, 2019, the owner or operator of a CCR unit must install a groundwater monitoring system that meets the requirements of 40 CFR § 257.91. The groundwater monitoring system must meet the CCR Rule's performance standard, which requires the system to consist of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that accurately represent the quality of:

(1) background groundwater that has not been affected by leakage from a CCR unit; and

(2) groundwater passing the waste boundary of the CCR unit and monitoring all potential contaminant pathways.

The CCR unit identified at the site is the Inactive Scrubber Basins. The CCR Rule groundwater monitoring system requirement is addressed by a single system consisting of six (6) monitoring wells and one well used for potentiometric evaluation only. Information regarding the groundwater monitoring system design and construction has been provided to the qualified professional engineer as required by 40 CFR § 257.91(e)(1) and is included in the facility operating record per 40 CFR § 257.91(e)(1).

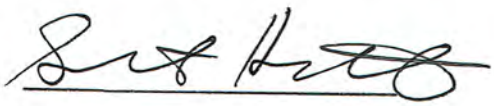
Limitations

The signature of Consultant's authorized representative on this document represents that to the best of Consultant's knowledge, information, and belief in the exercise of its professional judgment, it is Consultant's professional opinion that the aforementioned information is accurate as of the date of such signature. Any opinion or decisions by Consultant are made on the basis of Consultant's experience, qualifications, and professional judgment and are not to be construed as warranties or guaranties. In

addition, opinions relating to environmental, geologic, and geotechnical conditions or other estimates are based on available data, and actual conditions may vary from those encountered at the times and locations where data are obtained, despite the use of due care.

6.0 CERTIFICATION

I, Scott Hutsell, being a Registered Professional Engineer, in accordance with the State of Michigan Professional Engineer's Registration program, possessing the technical knowledge and experience to make the specific technical certifications required under 40 Code of Federal Regulations (CFR) Part 257, Subpart D, Standards for the Disposal of Coal Combustion Residuals (CCRs) in Landfills and Surface Impoundments, and being licensed in the state where the CCR unit(s) is located, do hereby certify to the best of my knowledge, information, and belief, that the groundwater monitoring system that is the subject of this certification has been designed and constructed to meet the requirements of 40 CFR § 257.91.

Signature: 

Date: 04/15/19

License No.: 43961

License Renewal Date: 10/31/20

TABLE

TABLE 1
DTE ENERGY
ST. CLAIR POWER POWER PLANT
MONITORING WELL CONSTRUCTION SUMMARY

Well ID	Easting	Northing	Well Installation Date	TOC Elevation (ft MSL)	Ground Surface Elevation (ft MSL)	Total Depth (ft BTOC)	Bottom Elevation (ft MSL)	Screen Length (feet)	Top of Screen (feet BTOC)	Bottom of Screen (ft BTOC)	Top of Screen Elevation (ft MSL)	Bottom of Screen Elevation (ft MSL)	Pump Depth (ft BTOC)	Well Casing Material	Well Screen Material and Slot Size	Program Use
MW-1	13629714.33	467065.76	5/25/2018	591.29	591.41	144.88	446.41	10	125.88	135.88	465.41	455.41	130.88	2-inch Schedule 40 PVC	2-inch Schedule 40 PVC and 0.01-inch slot	Detection
MW-2	13629658.84	466770.78	6/12/2018	589.94	590.25	143.69	446.25	10	127.19	137.19	462.75	452.75	132.19			
MW-3	13629561.07	466489.65	6/7/2018	589.02	589.20	139.82	449.20	10	127.32	137.32	461.70	451.70	132.32			
MW-4	13629419.29	466246.85	5/30/2018	589.16	589.43	141.73	447.43	10	124.73	134.73	464.43	454.43	129.73			
MW-5	13629265.70	465857.83	5/31/2018	590.06	590.31	143.25	446.81	10	131.75	141.75	458.31	448.31	136.75			
BKG-1	13627846.63	467758.47	5/23/2018	590.02	587.48	147.54	442.48	10	127.54	137.54	462.48	452.48	132.54			
BKG-2	13627689.14	467523.50	6/5/2018	591.31	588.62	147.69	443.62	10	129.69	139.69	461.62	451.62	132.05			Potentiometry

TOC - Top of Casing
ft MSL - feet above Mean Sea Level
ft BTOC - feet below top of casing
PVC - Polyvinyl Chloride

FIGURES

LEGEND:

Approximate Boundary of Interactive Scrubber Basins

N

0 500 1,000

Feet

BASE MAP SOURCE: © 2019 Microsoft Corporation © 2019 DigitalGlobe ©CNES (2019) Distribution Airbus DS Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, ©

DTE Energy

DTE ST. CLAIR PLANT

FIGURE 1
SITE VICINITY MAP

SCALE: 1:2,400

DATE: 3/6/2019

CHECKED BY:

AECOM

Document Path: G:\Cincinnati\DCS\GIS\ArcMap_GeoDB_Projects\DTE\DTE-Monroe Plant\Project Management\St Clair RFP\GIS\Figure1_Site_Vicinity_DTE_St_Clair_Plant.mxd

LEGEND:

CCR Monitoring Well

Non-CCR Monitoring Well

N

0 200 400

Feet

BASE MAP SOURCE: © 2019 Microsoft Corporation © 2019 DigitalGlobe ©CNES (2019) Distribution Airbus DS Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, ©

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DTE ST. CLAIR PLANT

FIGURE 2
INACTIVE SCRUBBER BASINS
WELL LOCATION MAP
2019

SCALE: 1:2,400

DATE: 3/18/2019

CHECKED BY:

AECOM

Document Path: G:\Cincinnati\DCS\GIS\ArcMap_GeoDB_Projects\DTE\DTE-Monroe Plant\Project Management\St Clair RFP\GIS\Figure2_Well_Location_DTE_St_Clair_Plant.mxd

APPENDIX A

MONITORING WELL CONSTRUCTION LOG

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of BKG-1

Sheet 1 of 5

Date(s) Drilled	**5/22/2018 to 5/23/2018**	Logged By	**T. George**	Checked By	**WBL**
Drilling Method	**Sonic**	Drill Bit Size/Type	**6" OD casing**	Total Depth of Borehole	**141 ft**
Drill Rig Type	**ProSonic 600**	Drilling Contractor	**Cascade**	Surface Elevation	**587.48 ft msl**
Borehole Backfill	**Monitoring Well**	Sampling Method(s)	**Sonic**	Top of Casing Elevation	**590.02 ft msl**
Boring Location	**467758.47, 13627846.63**	Groundwater Level(s)	**9.94 ft. measured 06/25/2018**		

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Well Diagram	REMARKS AND OTHER DETAILS
	0					TOPSOIL		Hand Augered to 4.5 feet
						Brown and gray lean CLAY (CL), trace sand, trace gravel, trace root fibers, stiff, moist		
585		4.5	0	0		Becomes brownish-gray with gravel Brown lean CLAY (CL) with gray mottling, trace sand, trace gravel, whiteish-gray calcareous staining, hard, moist		
						Becomes very stiff		
	5	1.5	1.5	100				
580						Becomes stiff		
	10	10	10	100				
575						Becomes medium stiff		
	15					Brown lean CLAY (CL) with trace coarse sand, no gravel, dark gray mottling, medium stiff, moist		Bentonite Grout
570						Becomes with trace to no sand, no gravel, soft to medium stiff		
	20	10	10	100				
565						Becomes soft		
	25							2" Sch 40 PVC Riser
560		10	10	100		Grayish-brown lean CLAY (CL), without sand and gravel, soft, moist		
	30							

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of BKG-1

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
	30						
555		10	10	100			
	35						2" Sch 40 PVC Riser
550							
	40					Grayish-brown lean CLAY (CL), trace to no sand, no gravel, soft, moist	
		10	10	100			
545						Becomes with trace bluish-gray	
	45						Bentonite Grout
540							
	50	10	10	100			
535							
	55					Brownish-gray lean CLAY (CL), trace sand, trace gravel, medium stiff, moist (glacial till)	
530							
	60	10	10	100			
525							
	65						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of BKG-1

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
		10	10	100			
520							
	70	10	10	100		Grayish-brown silty-CLAY (CL-ML) to lean CLAY (CL) with sand, trace gravel, medium stiff to stiff, moist	
515							
	75					Becomes medium stiff	2" Sch 40 PVC Riser
510							
	80	10	10	100			
505						Grayish-brown lean CLAY (CL) with sand, trace gravel, medium stiff, moist (glacial till)	
	85						Bentonite Grout
500							
	90	10	10	100			
495							
	95						
490		10	10	100			
	100						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of BKG-1

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
485	105	10	10	100			
480	110	10	10	100		Grayish-brown lean CLAY (CL), trace sand, trace gravel, medium stiff, moist	2" Sch 40 PVC Riser
475	115					Becomes soft	Bentonite Grout
470	120	10	10	100		Grayish-brown lean CLAY (CL), trace to no sand, no gravel, soft to medium soft, moist	Bentonite Chips (3/8")
465	125						No. 40 Red Flint Sand
460	130	10	10	100		Grayish to brown silty-CLAY (CL-ML) with silt laminae, very soft, wet	0.010" Slotted Screen (sch 40 PVC)
455	135					Clayey SAND (SC) to sandy silty-CLAY (CL-ML) with gravel, very soft, loose to very loose, wet	
						Brownish-gray sandy silty-CLAY (CL-ML) with gravel, stiff, moist (glacial till)	

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of BKG-1

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
		10	10	100		Dark to medium gray SHALE, residuum to completely weathered, extremely weak, partial horizontal bedding, moist to damp with depth	
450						Becomes highly weathered, very weak, trace horizontal bedding	
		5	5	100			← No. 40 Red Flint Sand
	140						
						Total Boring Depth 141 feet below ground surface	
445							
	145						
440							
	150						
435							
	155						
430							
	160						
425							
	165						
420							
	170						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of BKG-2

Sheet 1 of 5

Date(s) Drilled	**06/05/2018 to 6/5/2018**	Logged By	**T. George**	Checked By	**WBL**
Drilling Method	**Sonic**	Drill Bit Size/Type	**6" OD casing**	Total Depth of Borehole	**145 ft**
Drill Rig Type	**ProSonic 600**	Drilling Contractor	**Cascade**	Surface Elevation	**588.62 ft msl**
Borehole Backfill	**Monitoring Well**	Sampling Method(s)	**Sonic**	Top of Casing Elevation	**591.31 ft msl**
Boring Location	**467523.50, 13627689.14**	Groundwater Level(s)	**10.96 ft. measured 06/25/2018**		

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Well Diagram	REMARKS AND OTHER DETAILS
	0	5	0	0		TOPSOIL Brown lean CLAY (CL) with sand, trace gravel, very stiff, moist (FILL) FILL Dark brown TOPSOIL, medium stiff, moist (FILL) Brown lean CLAY (CL) with gray mottling, with sand, trace gravel, stiff, moist		**Hand augered to 5 feet**
585						Brown gravelly clayey SAND (SC), moist		
	5	2.5	2.5	100		Brown lean CLAY (CL) with gray mottling, trace coarse sand, trace gravel, hard, moist Becomes with light gray calcareous veins		
580								
	10	10	10	100		Becomes stiff Becomes grayish brown and medium brown Becomes medium stiff		**2" Sch 40 PVC Riser** **Bentonite Grout**
575								
	15							
570						Grayish-brown lean CLAY (CL), trace isolated coarse sand, trace isolated gravel, soft, moist		
	20	10	10	100				
565								
	25							
560		10	10	100		Grayish-brown lean CLAY (CL), trace to no isolated coarse sand, no gravel, soft, moist		
	30							

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of BKG-2

Sheet 2 of 5

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
	30						
555		10	10	100			
	35						2" Sch 40 PVC Riser
550							
	40	10	10	100			
545							
	45						Bentonite Grout
540						Becomes medium stiff, trace isolated coarse sand (glacial till)	
	50	10	10	100			
535							
	55					Brownish-gray clayey SAND (SC) with gravel, loose to medium dense, moist (glacial till)	
530						Brownish-gray lean CLAY (CL) with sand, trace gravel, medium stiff, moist (glacial till)	
	60	10	10	100			
525							
	65						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of BKG-2

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
		10	10	100			
520	70	10	10	100		Brownish-gray lean CLAY (CL) with sand, trace gravel, medium stiff, moist	
515	75						Bentonite Grout
		10	10	100		Becomes with increasing gravel	
510	80						
505	85					5" boulder	2" Sch 40 PVC Riser
		10	10	100			
500	90						
495	95						
		10	10	100			
490	100						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of BKG-2

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
485	105	10	10	100			2" Sch 40 PVC Riser
480	110	10	10	100			Bentonite Grout
475	115					Becomes soft	
470	120	10	10	100		Brownish-gray lean CLAY (CL), trace sand, trace gravel, soft to medium stiff, moist	Bentonite Chips
465	125						No. 40 Red Flint Sand
460	130	10	10	100		Grayish-brown silty-CLAY (CL-ML) with silt laminae, soft, wet Brownish-gray silty-CLAY (CL) with sand, trace gravel, soft, moist Grayish-brown silty-CLAY (CL-ML) with silt laminae, soft, wet	
455	135					Gray clayey SAND (SC) to sandy SILT (ML), very loose, very wet Gray silty-CLAY (CL-ML), soft, moist Becomes with sand, trace gravel, hard, moist Dark gray sandy silty-CLAY (CL-ML), trace gravel, stiff, moist	0.010" Slotted Screen (Sch 40 PVC)

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of BKG-2

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
		10	10	100			
450	140	7.5	7.5	100		Gray SHALE, completely to highly weathered, very weak, damp Becomes highly to moderately weathered	No. 40 Red Flint Sand Natural Collape
445	145					Total Boring Depth 145 feet below ground surface	
440	150						
435	155						
430	160						
425	165						
420	170						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-1

Sheet 1 of 5

Date(s) Drilled	**5/24/2018 to 5/25/2018**	Logged By	**T. George**	Checked By	**WBL**
Drilling Method	**Sonic**	Drill Bit Size/Type	**6" OD casing**	Total Depth of Borehole	**145 ft**
Drill Rig Type	**ProSonic 600 Truck Mount**	Drilling Contractor	**Cascade**	Surface Elevation	**591.41 ft msl**
Borehole Backfill	**Monitoring Well**	Sampling Method(s)	**Sonic**	Top of Casing Elevation	**591.29 ft msl**
Boring Location	**467065.76, 13629714.33**	Groundwater Level(s)	**7.67 ft. measured 06/25/2018**		

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Well Diagram	REMARKS AND OTHER DETAILS
	0					Coarse to fine silty SAND (SM) with gravel (FILL)		Hand augered 2.9 - 5.0 feet
590		2.9	2.9	100		Brown and Gray sandy silty CLAY (CL) with gravel, very stiff, moist (FILL)		
						Silty GRAVEL (GW) with slag (FILL)		
						Brown and gray lean CLAY (CL) with gravel, very stiff, moist		
						Brown lean CLAY (CL) with trace calcareous whitish-gray staining, gray mottling, very stiff, moist		
						No Recovery		
	5	5	0	0		Becomes hard		
585								
						Becomes very stiff		
	10	12	12	100				2" Sch 40 PVC Riser
580						Brown lean CLAY (CL) with trace to no sand, no gravel, gray mottling, stiff to very stIff, moist		
	15							Bentonite Grout
575						Brown lean CLAY (CL) with trace isolated coarse sand, gravel, gray mottling, very stiff becoming medium stiff, moist		
						Trace gravel present		
	20	10	10	100				
570						Brown lean CLAY (CL) with trace to no sand, no gravel, gray mottling, medium stiff, moist (glacial till)		
	25							
565						Brown lean CLAY (CL) with trace isolated gravel, stiff, moist		
		10	10	100				
	30					Brown lean CLAY (CL) with trace to no sand, no gravel, medium stiff, moist (glacial till)		

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-1

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
	30						
560		10	10	100		Becomes grayish-brown	
	35						2" Sch 40 PVC Riser
555						Becomes grayish-brown	
	40					Grayish-brown lean CLAY (CL) with trace to no sand, no gravel, medium stiff, moist	
550		10	10	100			
	45					Becomes soft to medium stiff	Bentonite Grout
545						Becomes soft	
	50						
540		10	10	100			
	55					Grayish-brown lean CLAY (CL) with trace to no sand, no gravel, soft to medium stiff, moist	
535						Becomes soft to medium soft with trace isolated coarse sand	
	60						
530		10	10	100			
	65						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-1

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
525		10	10	100		Brownish-gray lean CLAY (CL) with sand to trace sand, trace gravel, medium stiff, moist (glacial till)	
	70						2" Sch 40 PVC Riser
520		10	10	100			
	75						
515							
	80						Bentonite Grout
510		10	10	100			
	85						
505							
	90						
500		10	10	100			
	95						
495							
		10	10	100			
	100						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-1

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
490							
	105	10	10	100			2" Sch 40 PVC Riser
485							
	110						Bentonite Grout
480		10	10	100			
	115						
475							
	120						
470		10	10	100			Bentonite Chips
	125					Becomes grayish-brown with reddish-brown mottles	
465						Grayish-brown lean CLAY (CL) to silty-CLAY (CL-ML), trace isolated coarse sand, soft to medium stiff, moist	No. 40 Red Flint Sand
	130						0.010" Slotted Screen (Sch 40 PVC)
460		10	10	100		Becomes moist to wet	
						Grayish-brown sandy silty-CLAY (CL-ML), trace gravel, medium soft to soft, moist to wet	
	135						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-1

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
455		10	10	100		Brownish-gray clayey SAND (SC) with trace gravel, loose to very loose, wet to moist (glacial till)	
						Gray sandy silty-CLAY (CL-ML), trace gravel, hard, moist (glacial till)	
		4.5	4.5	100		Gray SHALE, completely weathered to highly weathered, extremely to very weak, damp	← No. 40 Red Flint Sand
	140					Becomes highly weathered, very weak	
450						Becomes moderately weathered	
						Total Boring Depth 141.5 feet below ground surface	
	145						
445							
	150						
440							
	155						
435							
	160						
430							
	165						
425							
	170						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-2

Sheet 1 of 5

Date(s) Drilled	**6/11/2018 to 6/12/2018**	Logged By	**T. George**	Checked By	**WBL**
Drilling Method	**Sonic**	Drill Bit Size/Type	**6" OD casing**	Total Depth of Borehole	**144 ft**
Drill Rig Type	**ProSonic 600 Truck Mount**	Drilling Contractor	**Cascade**	Surface Elevation	**590.25 ft msl**
Borehole Backfill	**Monitoring Well**	Sampling Method(s)	**Sonic**	Top of Casing Elevation	**589.94 ft msl**
Boring Location	**466770.78, 13629658.84**	Groundwater Level(s)	**5.94 ft. measured 06/25/2018**		

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Well Diagram	REMARKS AND OTHER DETAILS
590	0	5	0	0		Gray silty SAND (SM) with gravel; some sand and bottom ash; medium dense; moist (FILL)		Hand augered to 5 feet
						Brownish-gray silty GRAVEL (GW-GM) with sand, trace bottom ash and brick with slag (FILL)		
						Grayish-brown lean CLAY (CL); trace sand and gravel; very stiff; moist (FILL)		
585	5	2	2	100		Becomes brown with gray mottling Brown lean CLAY (CL); trace sand; gray mottling; very stiff to hard; moist (glacial till)		
580	10	10	10	100				2" sch 40 PVC Riser
575	15							
						Becomes grayish-brown, stiff		
570	20	10	10	100		Grayish-brown lean CLAY (CL); trace sand; no gravel; medium stiff; moist		Bentonite Grout
565	25	10	10	100				
	30							

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Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-2

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
560	30	10	10	100		Trace isolated gravel	
555	35					Becomes soft	
550	40	10	10	100			2" sch 40 PVC Riser
545	45						
540	50	10	10	100		Becomes brownish-gray	Bentonite Grout
535	55					Becomes medium stiff	
530	60	10	10	100		Brownish-gray lean CLAY (CL) with sand; trace gravel; medium stiff; moist (glacial till)	
	65						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-2

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
525		10	10	100			
520	70	10	10	100			
515	75						2" sch 40 PVC Riser
510	80	10	10	100			
505	85						Bentonite Grout
500	90	10	10	100			
495	95	10	10	100			
	100						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-2

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
490							
		10	10	100			
485	105						2" sch 40 PVC Riser
						Becomes medium stiff to soft	
480	110	10	10	100			
						Brownish-gray lean CLAY(CL); trace sand; no gravel; soft; moist (glacial till)	
475	115						Bentonite Grout
		10	10	100			
470	120					Trace gravel	Bentonite Chips
						Brownish-gray lean CLAY (CL) with sand; trace gravel; soft, moist	
465	125						No. 40 Red Flint Sand
		10	10	100		Brownish-gray silty CLAY (CL/ML); trace sand; moist to wet	
						Becomes with trace reddish-brown	
460	130					Brownish-gray to reddish-brown silty CLAY (CL/ML); with sand; trace gravel; soft to very soft; moist to wet (glacial till)	0.010" Slotted Screen (sch 40 PVC)
						Silty CLAY (CL/ML) with no gravel or sand, moist	
	135						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-2

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
455		10	10	100		Brownish-gray sandy SILT (ML) with clayey SAND (SC); loose to very loose; wet Gray sandy-silty CLAY (CL/ML); with gravel; very stiff; moist	
						Gray gravelly, silty CLAY (CL/ML); weather shale present; hard; moist	
450	140	7	7	100		Gray SHALE bedrock; weathered; weak; damp Becomes completely to highly weathered, very weak to extremely weak Becomes highly to moderately weathered, very weak	← No. 40 Red Flint Sand
445	145					Total Boring Depth 144 feet below ground surface	
440	150						
435	155						
430	160						
425	165						
	170						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-3

Sheet 1 of 5

Date(s) Drilled	**6/7/2018 to 6/7/2018**	Logged By	**T. George**	Checked By	**WBL**
Drilling Method	**Sonic**	Drill Bit Size/Type	**6" OD casing**	Total Depth of Borehole	**140 ft**
Drill Rig Type	**ProSonic 600 Truck Mount**	Drilling Contractor	**Cascade**	Surface Elevation	**589.20 ft msl**
Borehole Backfill	**Monitoring Well**	Sampling Method(s)	**Sonic**	Top of Casing Elevation	**589.02 ft msl**
Boring Location	**466489.65, 13629561.07**	Groundwater Level(s)	**6.21 ft. measured 06/25/2018**		

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Well Diagram	REMARKS AND OTHER DETAILS
	0					Brownish-gray coarse to fine grained SAND (SW/SM); with gravel; some slag and bottom ash (FILL)		Hand augered to 5 feet
		5	0	0		Gray lean CLAY (CL) with peat seams; stiff; moist Becomes without peat seams, bluish-gray Becomes bluish-gray with trace brown, increasing with depth		
585						Brown CLAY (CL); gray mottling; stiff; moist		
	5	2.5	2.5	100		Becomes with light gray calcareous blotches Brown lean CLAY (CL); gray mottling; trace sand; hard; moist (glacial till)		
						Becomes with trace gravel		
580								
	10	10	10	100		Gravelly lean CLAY (CL) with sand layer, very stiff Brown lean CLAY (CL); gray mottling; trace sand; hard; moist (glacial till)		2" sch 40 PVC riser
						Gravelly lean CLAY (CL) with sand layer Brown lean CLAY (CL) with trace sand; gray mottling; stiff; moist		
575								
	15							
						Grayish-brown lean CLAY (CL); trace coarse sand; no gravel; soft; moist		
570								
	20							Bentonite Grout
		10	10	100				
565								
	25							
		10	10	100				
560								
	30							

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-3

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
	30						
555		10	10	100			
	35						2" sch 40 PVC riser
550							
	40	10	10	100			
545							
	45						Bentonite Grout
540						Grayish-brown lean CLAY (CL); mottled; trace coarse sand; soft; moist	
	50	10	10	100		Increased coarse sand content	
535							
	55						
530						Brownish-gray CLAY (CL); trace sand and gravel; medium stiff; moist (glacial till)	
	60	10	10	100			
525							
	65						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-3

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
		10	10	100			
520	70	10	10	100			
515	75					Increased sand content	2" sch 40 PVC riser
510	80	10	10	100			
505	85						Bentonite Grout
500	90	10	10	100			
495	95						
490	100	10	10	100			

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-3

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
485	105	10	10	100			2" sch 40 PVC riser
480	110	10	10	100		Becomes soft to medium stiff; trace sand and gravel	Bentonite Grout
475	115						
470	120	10	10	100			Bentonite Chips
465	125						No. 40 Red Flint Sand
460	130	10	10	100		Brownish-gray silty CLAY (CL/ML); silt laminae; trace gravel; soft to very soft; wet (glacial till)	0.010" Slotted Screen (sch 40 PVC)
455	135					Brownish-gray clayey SAND (SC); loose to very loose; wet Brownish-gray silty CLAY (CL/ML); with sand; trace gravel soft to very soft; wet (glacial till)	

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-3

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
		10	10	100		Gray sandy, silty CLAY (CL/ML); trace gravel; hard; moist (glacial till)	
						Dark gray gravelly, silty CLAY (CL/ML); weather bedrock fragments (shale); hard; moist	
		2.5	2.5	100		Gray SHALE bedrock; weathered; very weak; damp	← Natural Collapse
450	140					Total Boring Depth 140 feet below ground surface	
445	145						
440	150						
435	155						
430	160						
425	165						
420	170						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-4

Sheet 1 of 5

Date(s) Drilled	**5/29/2018 to 5/30/2018**	Logged By	**T. George**	Checked By	**WBL**
Drilling Method	**Sonic**	Drill Bit Size/Type	**6" OD casing**	Total Depth of Borehole	**142 ft**
Drill Rig Type	**ProSonic 600 Truck Mount**	Drilling Contractor	**Cascade**	Surface Elevation	**589.43 ft msl**
Borehole Backfill	**Monitoring Well**	Sampling Method(s)	**Sonic**	Top of Casing Elevation	**589.16 ft msl**
Boring Location	**466246.85, 13629419.29**	Groundwater Level(s)	**6.31 ft. measured 06/25/2018**		

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Well Diagram	REMARKS AND OTHER DETAILS
	0	3.5	3.5	100		Clay/Sand/Gravel mixture; dense, moist; trace brick fragments (FILL)		Hand augered 3.5 feet to 5 feet below ground surface
						Blue gray CLAY (CL) with decayed organic materials; mottled; trace sand		
585		1.5	0	0		Brown CLAY (CL); trace sand; gray mottling; stiff		
	5	2	2	100			▼	
						Becomes very stiff to hard		
580								
	10	10	10	100		Becomes stiff		
						Isolated coal seam		
						Grades to grayish brown		
575								
	15							2" sch 40 PVC Riser
						Grayish Brown CLAY (CL); trace coarse sand; soft; moist		
570								
	20	10	10	100				Bentonite Grout
565								
	25							
		10	10	100				
560								
	30							

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Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-4

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION		REMARKS AND OTHER DETAILS
	30	10	10	100		Grayish Brown CLAY (CL); trace coarse sand; soft; moist		
555	35							
550	40	10	10	100				2" sch 40 PVC Riser
545	45							
540	50	10	10	100				Bentonite Grout
535	55					Becomes trace gravel, medium stiff		
530	60	10	10	100				
525	65							

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-4

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
		10	10	100			
520	70	10	10	100		Brownish gray CLAY(CL); trace to some sand; trace gravel; stiff; moist (glacial till)	
515	75						2" sch 40 PVC Riser
		10	10	100		Brownish gray CLAY(CL) with sand; trace gravel; medium stiff; moist (glacial till)	
510	80						
505	85						Bentonite Grout
		10	10	100			
500	90						
495	95						
		10	10	100			
490	100						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-4

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
485	105	10	10	100			2" sch 40 PVC Riser
480	110	10	10	100		Brownish gray CLAY(CL); trace sand; trace gravel; medium stiff; moist (glacial till)	Bentonite Grout
475	115						
470	120	10	10	100		Becomes soft to medium stiff	Bentonite Chips
465	125						No. 40 Red Flint Sand
460	130	10	10	100		Grayish brown CLAY (CL) and silty CLAY (CL/ML); trace sand; silt laminae; soft; moist Reddish-brown silty CLAY (CL/ML) with sand; trace gravel; soft; wet	0.010" Slotted Screen (sch 40 PVC)
455	135					Gray clayey SAND (SC); trace gravel; loose to very loose; wet Gray silty CLAY (CL/ML); trave gravel; stiff to very stiff; moist (glacial till)	

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-4

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
		10	10	100			No. 40 Red Flint Sand
450	140	5	7	100		Gray CLAY (CL); with sand; hard; moist; shale fragments Gray SHALE bedrock; highly weathered; damp Gray SHALE bedrock; moderately weathered; weathering increase with depth; damp	
						Total Boring Depth 142 feet below ground surface	
445	145						
440	150						
435	155						
430	160						
425	165						
420	170						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-5

Sheet 1 of 5

Date(s) Drilled	**5/31/2018 to 5/31/2018**	Logged By	**T. George**	Checked By	**WBL**
Drilling Method	**Sonic**	Drill Bit Size/Type	**6" OD casing**	Total Depth of Borehole	**143.5 ft**
Drill Rig Type	**ProSonic 600 Truck Mount**	Drilling Contractor	**Cascade**	Surface Elevation	**590.31 ft msl**
Borehole Backfill	**Monitoring Well**	Sampling Method(s)	**Sonic**	Top of Casing Elevation	**590.06 ft msl**
Boring Location	**465857.83, 13629265.70**	Groundwater Level(s)	**50.15 ft. measured 06/25/2018**		

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Well Diagram	REMARKS AND OTHER DETAILS
590	0	5.5	5.5	100		Brownish-gray coarse to fine grained SAND (SW/SM); with gravel; some slag and bottom ash (FILL)		**Hand augered to 5.5 feet**
						Brownish-gray clayey GRAVEL (GM); with sand (FILL)		
585	5					Greenish-gray fat CLAY (CH); mottled; trace fine sand laminae; medium stiff; some decayed oranics (peat)		
		11.5	11.5	100		Brown lean CLAY (CL); gray mottling; trace to no sand; very stiff; moist (glacial till) Some calcareous zones		
580	10							**2" sch 40 PVC Riser**
575	15					Becomes medium stiff		
		10	10	100		Grayish-brown CLAY (CL); trace coarse sand; soft; moist		
570	20							**Bentonite Grout**
565	25	10	10	100		Grayish-brown lean CLAY (CL); trace to no sand; trace to no gravel; soft; moist		
	30							

Report: DTE_MONROE; File C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINT\PROJECTS\DTE ST. CLAIR.GPJ; 7/27/2018 12:51:24 PM

AECOM

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-5

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
560	30						
		10	10	100			
555	35						
		10	10	100			
550	40						2" sch 40 PVC Riser
		10	10	100			
545	45						
		10	10	100			
540	50						Bentonite Grout
		10	10	100			
535	55						
						Increasing coarse sand and gravel	
530	60	10	10	100			
	65						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-5

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
525		10	10	100			
	70					Grayish-brown lean CLAY (CL); trace isolated coarse sand; trace isolated gravel; medium stiff; moist (glacial till)	
520		10	10	100			
	75						2" sch 40 PVC Riser
515							
						Brownish-gray lean CLAY (CL) with sand; trace gravel; medium stiff; moist (glacial till)	
	80						
510		10	10	100			
	85						Bentonite Grout
505							
	90						
500		10	10	100			
	95						
495							
		10	10	100			
	100						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-5

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
490							
		10	10	100			
485	105						2" sch 40 PVC Riser
480	110	10	10	100			
475	115					Brownish CLAY (CL); trace coarse sand; trace gravel (glacial till)	Bentonite Grout
		10	10	100			
470	120					Becomes medium-stiff to soft	
465	125						Bentonite Chips
		10	10	100			
460	130						No. 40 Red Flint Sand
		10	10	100			
						Brownish-gray silty CLAY (CL/ML); silt interbeds; fine sand laminae; moist to wet (glacial till)	
	135						

Project: DTE-CCR Groundwater Investigation
Project Location: DTE St. Clair
Project Number: 6056402.3

Log of MW-5

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
455		10	10	100		Becomes interbedded with soft brownish-gray with reddish-brown mottles	0.010" Slotted Screen (sch 40 PVC)
						Grayish-brown silty CLAY (CL/ML); with sand; trace gravel; mottled; very soft; wet	
450	140	6.5	6.5	100		Gray sandy CLAY (CL/ML) with silt and gravel; medium to very stiff moist	No. 40 Red Flint Sand
						Gray SHALE bedrock; highly weathered; very weak; damp	
						Total Boring Depth 143.5 feet below ground surface	
445	145						
440	150						
435	155						
430	160						
425	165						
	170						

APPENDIX B

GEOLOGIC CROSS SECTIONS

LEGEND:

Monitoring Well Location

N

0 200 400

Feet

BASE MAP SOURCE: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

DTE Energy

DTE ST. CLAIR PLANT

APPENDIX B
INACTIVE SCRUBBER BASINS
CROSS SECTION LOCATION MAP

SCALE: 1:2,400

DATE: 3/5/2018

CHECKED BY:

AECOM

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A

A′

N

S

MW-1

MW-2

MW-3

MW-4

MW-5

585.13

585.75

586.24

586.17

585.38

600

580

560

540

520

500

480

460

440

FEET, MSL

0

100

200

300

400

500

600

700

800

900

1000

1100

1200

1300

1400

1500

FEET

LEGEND

Fill

Topsoil/Peat

Clay (Till)

Sandy Silty Clay (Till)

Clayey Sand (Till)

Shale

Water Bearing Zone

Potentiometric Surface Elevation (January 8, 2019)

MW-1 MONITORING WELL LOCATION ID

MONITORING WELL RISER

MONITORING WELL SCREEN

BACKFILL / COLLAPSE

20 feet

100 feet

(Vertical Exaggeration = 5x)

DRAFT

DTE St. Clair Plant
East China, Michigan

INACTIVE SCRUBBER BASINS

APPENDIX C
GEOLOGIC CROSS-SECTION A-A'

DATE	REV NO.	DWG. BY	CHKD. BY
03/05/19	0	MRH	WBL

JOB NO. 60580567

AECOM

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B W

B′ E

BKG-2

MW-2

581.45

585.79

Inactive Scrubber Basin
(Inferred Depth)

Inactive Scrubber Basins
(Inferred Depth)

Inactive Scrubber Basins

FEET, MSL

600
580
560
540
520
500
480
460
440

0 150 300 450 600 750 900 1050 1200 1350 1500 1650 1800 1950 2100 2250

FEET

LEGEND

- Sandy Silty Clay (Till)
- Clayey Sand (Till)
- Clay (Till)
- Shale
- Fill
- Water Bearing Zone
- Potentiometric Surface Elevation (January 8, 2019)

MW-2 — MONITORING WELL LOCATION ID

MONITORING WELL RISER

MONITORING WELL SCREEN

20 feet

150 feet

(Vertical Exaggeration = 7.5x)

DRAFT

DTE St. Clair Plant
East China, Michigan

INACTIVE SCRUBBER BASINS

APPENDIX C
GEOLOGIC CROSS-SECTION B-B'

DATE	REV NO.	DWG. BY	CHKD. BY
03/05/19	0	MRH	WBL

JOB NO. 60580567

AECOM

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APPENDIX C

POTENTIOMETRIC SURFACE MAPS

LEGEND:

Monitoring Well Location

N

0 200 400

Feet

BASE MAP SOURCE: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

DTE Energy

DTE ST. CLAIR PLANT

APPENDIX C
INACTIVE SCRUBBER BASINS
POTENTIOMETRIC SURFACE MAP
JULY 24, 2018

SCALE: 1:2,400

DATE: 3/5/2018

CHECKED BY:

AECOM

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LEGEND:

Monitoring Well Location

N

0 200 400

Feet

BASE MAP SOURCE: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

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DTE ST. CLAIR PLANT

APPENDIX C
INACTIVE SCRUBBER BASINS
POTENTIOMETRIC SURFACE MAP
JANUARY 8, 2019

SCALE: 1:2,400	AECOM
DATE: 3/5/2018	
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