Groundwater Monitoring System
Summary Report

DTE Electric Company
St. Clair Power Plant Bottom Ash Basins
Coal Combustion Residual Unit
4901 Pointe Drive
East China Township, Michigan

October 2017
Groundwater Monitoring System Summary Report

DTE Electric Company
St. Clair Power Plant Bottom Ash Basins
Coal Combustion Residual Unit

4901 Pointe Drive
East China Township, Michigan

October 2017

Prepared For
DTE Electric Company

Graham Crockford, C.P.G.
Senior Project Geologist

David B. McKenzie, P.E.
Senior Project Engineer
Table of Contents

1. Introduction ...................................................................................................................................... 1
   1.1 Background and Objective ................................................................................................... 1
   1.2 Site Location ........................................................................................................................... 1
   1.3 Description of SCPP CCR Unit............................................................................................ 1

2. Hydrogeology .................................................................................................................................. 3
   2.1 Regional Hydrogeologic Setting ......................................................................................... 3
   2.2 SCPP Hydrogeology ............................................................................................................. 3
      2.2.1 Uppermost Aquifer .................................................................................................. 4
      2.2.2 Groundwater Flow ................................................................................................... 5

3. Groundwater Monitoring System ................................................................................................. 7
   3.1 Groundwater Monitoring System Installation .................................................................. 7
      3.1.1 Soil Boring Advancement ....................................................................................... 7
      3.1.2 Monitoring Well Installation .................................................................................. 7
      3.1.3 Monitoring Well Development and Surveying ................................................... 8
      3.1.4 Detection Monitoring .............................................................................................. 8

4. Groundwater Monitoring System Certification .......................................................................... 9

List of Tables
Table 1 Monitoring Well Information Summary

List of Figures
Figure 1 Site Location Map
Figure 2 Site Plan
Figure 3 Cross Section Locator Map
Figure 4 Generalized Geologic Cross-Section A-A’
Figure 5 Generalized Geologic Cross-Section B-B’
Figure 6 Groundwater Potentiometric Surface Map – February 2017

List of Appendices
Appendix A Soil Boring and Monitoring Well Installation Logs
Section 1
Introduction

1.1 Background and Objective

The United States Environmental Protection Agency (U.S. EPA) established a comprehensive set of requirements for management and disposal of coal combustion residuals (CCR) in landfills and surface impoundments in the Final Rule: Disposal of CCR from Electric Utilities (CCR Rule) on April 17, 2015. The DTE Electric Company (DTE Electric) St. Clair Power Plant (SCPP) CCR bottom ash basins (BABs) unit is subject to the CCR Rule.

The objective of this report is to document and certify that the CCR Groundwater Monitoring System for the SCPP BABs CCR unit has been designed and constructed to meet the requirements of Title 40 Code of Federal Regulations (CFR) §257.91 (a)(1) and (2) of the CCR Rule. TRC Engineers Michigan, Inc. (TRC) was retained by DTE Electric to provide this report documenting the construction of the CCR groundwater monitoring system for the SCPP BABs.

1.2 Site Location

The SCPP BABs are located in Section 19, Township 4 North, Range 17 East, at 4901 Pointe Drive, East China Township in St. Clair County, Michigan (Figure 1). The SCPP including the BABs CCR unit was constructed in the early 1950s, just south of the DTE Electric SCPP. The power plant is located on the peninsula formed by the St. Clair and Belle Rivers, approximately three miles south of St. Clair, Michigan immediately to the west of the St. Clair River.

1.3 Description of SCPP CCR Unit

The property has been used continuously as a coal fired power plant since Detroit Edison Company (now DTE Electric) began power plant operations at SCPP in 1953 and is constructed over a natural continuous clay-rich soil base as shown in historical soil borings performed at the SCPP property. The BABs have been in operation at the SCPP since the plant began operation and have collected CCR bottom ash that is routinely cleaned out and either sold for beneficial reuse or disposed of at the Range Road Landfill (RRLF).

The SCPP BABs are two adjacent sedimentation basins that are incised CCR surface impoundments (Figure 2). The impoundments are sheet piled around the perimeters to approximately 13 feet below ground surface (feet-bgs) into the native clay-rich soil. The BABs are located south of the SCPP and adjacent to the St. Clair River and are used for receiving bottom ash and other process flow water from the power plant, which is first sent to the East BAB then to the West BAB through a connecting concrete canal. Discharge water from the
basins flows with other site wastewater into the Overflow Canal in accordance with an National Pollution Discharge Elimination System (NPDES) permit.

The West and East BABs are located south of the SCPP main building and run roughly north to south with the following approximate dimensions:

- The West BAB is approximately 300 feet long by 90 feet wide with a bottom elevation of approximately 572 feet (when fully cleaned out) relative to the North American Vertical Datum (NAVD) 1988 with an outflow weir elevation of approximately 579.3 feet relative to the NAVD 1988; and

- The East BAB is approximately 400 feet long by 70 feet wide with a bottom elevation of approximately 572 feet (when fully cleaned out) relative to the NAVD 1988 with an outflow weir elevation of approximately 579.4 feet relative to the NAVD 1988.
Section 2
Hydrogeology

2.1 Regional Hydrogeologic Setting

The geology of St. Clair County consists of approximately 101 to 400 feet of glacial deposits, primarily lacustrine deposits, till, and, to a lesser extent, sand and gravel outwash, overlying a variety of bedrock surfaces. The thicker glacial deposits are present toward the central portion of the county. Bedrock in the county includes the Michigan Formation, Marshall Sandstone, Coldwater Shale, Sunbury Shale, Berea Sandstone, Bedford Shale, and Antrim Shale.

In the vicinity of the site, the Devonian Bedford and/or Antrim Shale bedrock dips to the northwest and is generally covered by more than 100 feet of unconsolidated clay, silt, sand, and gravel. In this area, generally on the eastern side of the county, the glacial deposits are predominantly silty-clay till and lacustrine deposits with lenses of sand and gravel. Where present, unconsolidated sand and gravel deposits within the till and lacustrine deposits are generally used for water supply throughout the county. Approximately 85 percent of the water supply wells in St. Clair County are completed in the glacial deposits compared to approximately 13 percent installed in bedrock.

The current topography of the St. Clair area gently undulates reflecting floodplain, stream terrace, and lakeshore deposits. The St. Clair River is the major surface water body in the county and runs along the eastern boundary of the county. Regional groundwater and surface water flow would be expected to be to the east towards the St. Clair River.

2.2 SCPP Hydrogeology

The subsurface geology presented within this report is based on information from historical borings advanced during initial design and later expansion of the SCPP, in addition to the soil boring data collected from around the BABs during the groundwater monitoring system installation detailed in Section 3. Soil borings from the groundwater monitoring system are included in Appendix A and generalized geologic cross sections are provided in Figures 3 through 5.

This information documents that the SCPP CCR unit is underlain by glacial silty-clay till, with few isolated sand lenses, and a silt and clay-rich hardpan base directly overlying the shale bedrock (likely the Bedford Shale). The shale bedrock is generally encountered below

---

130 feet-bgs (see cross-sections in Figures 3 through 5). No significant soil or gravel intervals were encountered at any of the groundwater monitoring system well locations. However, during soil boring advancement for the groundwater monitoring system well locations, some signs of saturation were observed throughout a 5-foot interval along the interface between the overlying till/hardpan and the underlying shale bedrock. The underlying shale does not yield groundwater, rather it is an aquiclude that prevents groundwater flow (i.e., is not an aquifer). Although the encountered zone of saturation along the interface did not yield significant groundwater, it was conservatively interpreted as the first underlying saturated zone that would presumably become affected with CCR constituents, since it was saturated, and although the hydraulic conductivity was low, exhibited a much higher conductivity than the clay-rich soils between the bottom of the basin and the monitored zone.

No water supply wells are present within the unconsolidated sediment or bedrock within one mile of the SCPP. Surface water bodies present in the area of the SCPP include the Belle River (as close as 3,000 feet southwest of SCPP) and the St. Clair River (located immediately adjacent to the east of the SCPP BABs CCR unit).

2.2.1 Uppermost Aquifer

Definition

The 40 CFR §257.53 definitions of an aquifer and uppermost aquifer are as follows:

— Aquifer means a geologic formation, group of formations, or portion of a formation capable of yielding useable 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 the 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.

Site Uppermost Aquifer

As described above, the potential uppermost aquifer as defined in 40 CFR §257.53 was present beneath at least a 120 feet of vertically contiguous silty clay-rich till that serves as a natural confining hydraulic barrier that isolates the underlying uppermost potential aquifer (Figures 3 through 5). The overlying silty clay-rich low permeability clay-rich soil consistently has a hydraulic conductivity on the order of 2 to 3 x 10⁻⁸ centimeters per second (cm/s) as found in soil testing performed during the CCR monitoring well installation in the area of the BABs. The first underlying saturated zone that would presumably become affected with CCR constituent’s is located at the silty clay hardpan/shale bedrock interface (130.5 to 132 feet-bgs) and is limited to no more than five feet thick (Figures 3 through 5 and Appendix A).
2.2.2 Groundwater Flow

Groundwater Flow Direction

Groundwater flow is generally to the east-southeast based on potentiometric surface data measured during the collection of the first seven independent samples from the groundwater monitoring system in accordance with the CCR Rule since August 2016. The representative February 2017 potentiometric static water level elevations are displayed on Figure 6. As can be seen on Figure 6, CCR monitoring well MW-16-04 (up gradient) to the west of the BABs CCR unit has a slightly higher potentiometric elevation than the CCR monitoring wells MW-16-01, MW-16-02 and MW-16-03 (down gradient) to the east of the BABs CCR unit. These potentiometric groundwater elevations suggest that overall, beneath the more than 120 feet of clay-rich confining till, there is a potential horizontal groundwater flow direction to east-southeast with a mean hydraulic gradient of 0.0036 foot/foot in the area of the BABs CCR unit.

The elevation of CCR-affected water maintained within the BABs is similar to slightly higher than to the potentiometric surface elevations in the uppermost aquifer in the BABs CCR unit. Flow potential from the CCR unit to the surrounding area would likely be radially outward from all sides. However, with the very thick continuous silty clay-rich confining unit beneath the SCPP it is not possible for the uppermost aquifer to have been affected by CCR from SCPP operations that began in the 1950s (see vertical time of travel discussion below).

Uppermost Aquifer Hydraulic Conductivity

Hydraulic conductivities measured within the CCR monitoring wells using single well hydraulic conductivity tests (e.g., slug tests) range from approximately 0.009 to 0.017 feet/day with a mean of approximately 0.013 feet/day. These low hydraulic conductivities further demonstrate the low groundwater yield potential across the conservatively interpreted, potential uppermost aquifer encountered at the site.

Horizontal Time of Travel

Assuming an average porosity of 0.4 for the silt/clay-rich soil within the uppermost aquifer, the mean hydraulic conductivity of 0.013 feet/day and a hydraulic gradient of 0.0036 foot/foot for the potential upper aquifer, the potential horizontal groundwater flow rate is approximately 0.00012 feet/day or 0.044 feet/year. Given the low flow velocity of this zone, inter-well (upgradient to downgradient) statistical tests are inappropriate for detection monitoring of this basin.
**Vertical Time of Travel**

The SCPP is a natural silty-clay site, and the natural hydraulic barrier has been verified by numerous historical soil borings and further confirmed by the four soil borings installed as part of the CCR monitoring well installation program. Therefore, the geology and hydrogeology of the site provides a very high level of environmental protection of the potential uppermost aquifer. Based on the site geology and hydrogeology, there is extremely low potential for the impoundments to affect the off-site uppermost aquifer groundwater in the future. Groundwater present within the deep confined potential uppermost aquifer is protected from CCR constituents by the over 120 feet thick clay-rich aquitard with low hydraulic conductivity. Using the hydrogeologic information for the site, the time of travel for water from the base-grade elevation of the SCPP CCR unit down to the uppermost aquifer can be calculated using the following formula:

\[ V = \frac{K_i}{N_e} \]

Where:

- **V** = Velocity (feet/day)
- **K** = Hydraulic Conductivity \((3 \times 10^{-8} \text{ cm/s based on high end silty clay-rich soil geotechnical measurements})\)
- **i** = Downward Vertical Gradient (conservatively assumed to be one foot/foot)
- **N_e** = Effective Porosity (0.5 for clay-rich soil)

From the above formula, the maximum downward flow velocity through the silty-clay confining till unit to the uppermost aquifer is \(6 \times 10^{-8} \text{ cm/sec}\), or 0.063 feet/year (lower than typical hydraulic conductivity requirement of \(1 \times 10^{-7} \text{ cm/sec}\) for landfill liners). Therefore, the time of travel for liquid from the base of the SCPP through at least 120 feet of silty-clay (thinnest section of silty-clay confining unit found on SCPP above the potential uppermost aquifer) to the potential uppermost aquifer is approximately 1,900 years. Given that SCPP operations began in 1953, approximately 64 years ago, there is no potential for the uppermost aquifer CCR groundwater monitoring system wells to be affected from the SCPP CCR unit.
Section 3
Groundwater Monitoring System

3.1 Groundwater Monitoring System Installation
During 2016, TRC, on behalf of DTE Electric oversaw the installation and development of the groundwater monitoring system in accordance with the 40 CFR §257.91. Four monitoring wells (MW-16-01 through MW-16-04) were installed at the SCPP CCR unit by a Michigan-licensed well driller at the SCPP in order to establish the groundwater monitoring system as described below:

3.1.1 Soil Boring Advancement
In March and April 2016, four soil borings were advanced to evaluate the subsurface geology and to allow monitoring well installation using sonic drilling techniques with 4-inch and 6-inch tooling along to the west and east of the SCPP BABs. Soil samples were collected continuously in 10-foot sections from the ground surface to the termination of the soil boring. A TRC geologist was present to log each boring and describe the soil samples in accordance with the Unified Soil Classification System (USCS).

The soil borings were advanced to depths of approximately 138 feet-bgs through the unconsolidated clay-rich and hard pan deposits, and into the underlying shale bedrock encountered at depths ranging from 130.5 to 132 feet-bgs. The clay-rich deposits changed to a hard pan over the final interval of 5 to 5.5 feet above the shale bedrock. No significant sand-rich units were encountered within any of these soil borings. However, some saturation was noted at the clay-rich till or hard pan interface with the shale bedrock. As discussed above, this was the only interval where any significant saturation was encountered; therefore, the clay-rich till/shale bedrock interface is considered to be a potential uppermost aquifer for the SCPP CCR unit.

3.1.2 Monitoring Well Installation
Based on the saturation noted to be present, CCR monitoring wells MW-16-01 through MW-16-04 were screened at the clay till/shale bedrock interface. Screened intervals in these monitoring wells range from 125 to 131 feet-bgs to 127 to 132 feet-bgs, with three locations on the eastern side of the BABs (presumed down hydraulic gradient adjacent to the St. Clair River) and one to the west of the BABs (presumed up hydraulic gradient) (Figure 2). Given the presence of the natural clay-rich till hydraulic barrier and the relatively small footprint of the BABs, the horizontal spacing of the wells is adequate to detect constituents from the CCR unit.
Monitoring wells were constructed within each borehole using 2-inch-diameter, Schedule 40 PVC casing and 5-foot long screens with 0.010-inch factory cut slots. Monitoring well construction diagrams from the installed monitoring wells accompany the soil boring logs in Appendix A. Following well installation, the grout and bentonite seal materials were allowed to stabilize for more than 24-hours before monitoring well development began.

3.1.3 Monitoring Well Development and Surveying
Following installation, each CCR monitoring well was developed by air lifting methods. In addition, a Michigan-licensed surveyor located each monitoring well utilizing the Michigan State Plan South Zone-2113, North American Datum 1983, International feet. Vertical elevations of the ground surface at each soil boring and monitoring well location and the top of casing for each monitoring well were also surveyed in feet relative to the North American Vertical Datum of 1988 (NAVD 88). Monitoring well coordinates, elevations, screened intervals, and other monitoring well details are included in Table 1.

3.1.4 Detection Monitoring
The SCPP CCR unit groundwater monitoring system, as shown on Figure 2, will serve as the detection monitoring locations pursuant to Title 40 CFR §257.93 and §257.94 of the CCR Rule. Due to the relatively small footprint of the BABs, the low vertical and horizontal groundwater flow velocity, and the fact that the saturated unit being monitored is isolated by a laterally contiguous silty-clay unit which significantly impedes vertical groundwater flow thus preventing the monitored saturated zone from potentially being affected by CCR, monitoring of the SCPP CCR unit using intra well statistical methods is appropriate. As such, intra-well statistical approaches will be evaluated for use during detection monitoring. Using the data collected from the monitoring well system, a statistical evaluation plan is being developed to evaluate compliance with the CCR Rule.
Section 4

Groundwater Monitoring System Certification

Groundwater Monitoring System Certification per 40 CFR §257.91(f)
St. Clair Power Plant Bottom Ash Basins
East China Township, Michigan

The U.S. EPA's Disposal of Coal Combustion Residuals from Electric Utilities Final Rule Title 40 CFR Part 257 §257.91 requires that the owner or operator of an existing CCR unit install a groundwater monitoring system. The owner or operator must obtain a certification from a qualified professional engineer stating that the groundwater monitoring system has been designed and constructed to meet the requirements of Title 40 CFR §257.91.

CERTIFICATION

I hereby certify that the groundwater monitoring system presented within this document for the SCPP BABs CCR unit has been designed and constructed to meet the requirements of Title 40 CFR §257.91 of the Federal CCR Rule. This document is accurate and has been prepared in accordance with good engineering practices, including the consideration of applicable industry standards, and with the requirements of Title 40 CFR §257.91.

<table>
<thead>
<tr>
<th>Name</th>
<th>Expiration Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>David B. McKenzie, P.E.</td>
<td>October 31, 2017</td>
</tr>
</tbody>
</table>

Company: TRC Engineers Michigan, Inc.
Date: October 13, 2017
Stamp
## Table 1

Monitoring Well Information Summary
DTE Electric Company – St. Clair Power Plant
China Township, Michigan

<table>
<thead>
<tr>
<th>Well Location</th>
<th>Date Installed</th>
<th>Northing</th>
<th>Easting</th>
<th>Ground Surface Elevation (ft AMSL)</th>
<th>TOC Elevation (ft BGS)</th>
<th>Geologic Unit of Screen Interval</th>
<th>Well Construction</th>
<th>Screen Interval Depth (ft BGS)</th>
<th>Screen Interval Elevation (ft AMSL)</th>
<th>Borehole Terminus Depth (ft BGS)</th>
<th>Borehole Terminus Elevation (ft AMSL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>St. Clair Power Plant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MW-16-01</td>
<td>3/31/2016</td>
<td>465440.66</td>
<td>13631612.80</td>
<td>585.12</td>
<td>584.74</td>
<td>Silty Clay at 127-131.5 ft BGS, and Shale bedrock at 131.5-132 ft BGS</td>
<td>2&quot; PVC</td>
<td>127.0 to 132.0</td>
<td>458.1 to 453.1</td>
<td>138.0</td>
<td>447.1</td>
</tr>
<tr>
<td>MW-16-02</td>
<td>3/29/2016</td>
<td>465503.41</td>
<td>13632151.32</td>
<td>582.18</td>
<td>581.43</td>
<td>Silty Clay at 126-130.5 ft BGS, and Shale bedrock at 130.5-131 ft BGS</td>
<td>2&quot; PVC</td>
<td>126.0 to 131.0</td>
<td>456.2 to 451.2</td>
<td>138.0</td>
<td>444.2</td>
</tr>
<tr>
<td>MW-16-03</td>
<td>3/25/2016</td>
<td>465353.06</td>
<td>13632114.23</td>
<td>582.08</td>
<td>581.39</td>
<td>Silty Clay Hardpan and Shale</td>
<td>2&quot; PVC</td>
<td>127.0 to 132.0</td>
<td>455.1 to 450.1</td>
<td>138.0</td>
<td>444.1</td>
</tr>
<tr>
<td>MW-16-04</td>
<td>3/23/2016</td>
<td>465173.94</td>
<td>13632077.11</td>
<td>581.99</td>
<td>580.85</td>
<td>Silty Clay Hardpan and Shale</td>
<td>2&quot; PVC</td>
<td>127.0 to 132.0</td>
<td>455.0 to 450.0</td>
<td>138.0</td>
<td>444.0</td>
</tr>
</tbody>
</table>

**Notes:**
- Coordinates are Michigan State Plane South Zone-2113, International Feet.
- Elevation in feet above NAVD88.
- TOC: Top of well casing.
- ft AMSL: Feet above mean sea level.
- ft BGS: Feet below ground surface.
Figures
SITE LOCATION

BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

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

PROJECT: DTE ELECTRIC COMPANY
ST. CLAIR POWER PLANT
4901 POINTE DRIVE
EAST CHINA TOWNSHIP, MICHIGAN

TITLE: SITE LOCATION MAP

FILE: 265996-SLMMB.mxd

FIGURE 1
BOTTOM ASH BASINS

---

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO & PARTNERS, APRIL 2015.
2. WELL LOCATIONS SURVEYED BY BMJ ENGINEERS AND SURVEYORS INC. IN APRIL 2016.
BOTTOM ASH BASINS

NOTES
1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO & PARTNERS, APRIL 2015.
2. WELL LOCATIONS SURVEYED BY BMJ ENGINEERS AND SURVEYORS INC. IN APRIL 2016.
Appendix A

Soil Boring and Monitoring Well Installation Logs
**WELL CONSTRUCTION LOG**

**WELL NO. MW-16-01**

**Facility/Project Name:** DTE: Saint Clair Power Plant  
**Date Drilling Started:** 3/31/16  
**Date Drilling Completed:** 3/31/16  
**Project Number:** 231828.0004.0000

**Drilling Firm:** Stock Drilling  
**Drilling Method:** Sonic  
**Surface Elev. (ft):** 585.12  
**TOC Elevation (ft):** 584.74  
**Total Depth (ft bgs):** 138.0  
**Borehole Dia. (in):** 6  
**Drilling Equipment:** Terrasonic

**Boring Location:** S side of median, in parking lot W of ash basin.  
**N:** 465440.66  
**E:** 13031612.80

**Civil Town/City/Village:** Saint Clair  
**County:** Saint Clair  
**State:** MI  
**Water Level Observations:**

- **While Drilling:** Date/Time: 4/5/16 08:45  
- **After Drilling:** Date/Time: 4/5/16 08:45  

**Number and Type**

<table>
<thead>
<tr>
<th>Cs</th>
<th>Recovery (%)</th>
<th>Blow Counts</th>
<th>Depth in Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>95</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**LITHOLOGIC DESCRIPTION**

- **GRAVEL WITH SAND** mostly gravel, little sand, brown (10YR 5/3), no odor, moist.
- **CLAY** mostly clay, few silt, grayish brown (10YR 5/2), no odor, moist, dense.

- Change to medium dense at 10.0 feet.
- Change to soft to medium dense at 12.5 feet.

**Firm:** TRC Environmental Corporation  
**Address:** 1540 Eisenhower Place, Ann Arbor, Michigan  
**Telephone:** 734.971.7080  
**Fax:** 734.971.9022

**Signature:** For J. Reed  
**Checked By:** C. Sciascia
<table>
<thead>
<tr>
<th>NUMBER AND TYPE</th>
<th>RECOVERY (%)</th>
<th>BLOW COUNTS</th>
<th>DEPTH IN FEET</th>
<th>LITHOLOGIC DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 ST</td>
<td>100</td>
<td></td>
<td>43.0</td>
<td>CLAY mostly clay, few silt, grayish brown (10YR 5/2), no odor, moist, soft to medium dense. Change to few fine to coarse sand at 43.0 feet.</td>
</tr>
<tr>
<td>4 CS</td>
<td>100</td>
<td></td>
<td>50.0</td>
<td>Change to gray (10YR 5/1) at 50.0 feet.</td>
</tr>
<tr>
<td>5 CS</td>
<td>100</td>
<td></td>
<td>80.0</td>
<td>Sand seam, 8 inches thick, mostly coarse sand, black (10YR 2/1) at 80.25 feet.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>85.0</td>
<td>CLAY WITH SAND mostly clay, little fine to coarse sand, few silt, gray (10YR 5/1), no odor, medium dense.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>90.0</td>
<td>Change to few to little fine to coarse sand at 90.0 feet.</td>
</tr>
<tr>
<td>DEPTH IN FEET</td>
<td>LITHOLOGIC DESCRIPTION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>95</td>
<td>CLAY WITH SAND mostly clay, few to little fine to coarse sand, few silt, gray (10YR 5/1), no odor, medium dense.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>Change to soft at 120.0 feet.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>105</td>
<td>SILTY CLAY mostly clay, some silt, very dark gray, (10YR 3/1), no odor, dry to moist, hard.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>110</td>
<td>SHALE very dark gray (10YR 3/1) to light gray (10YR 7/1), no odor, moist.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>115</td>
<td>End of boring at 138.0 feet below ground surface.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
WELL CONSTRUCTION LOG

WELL NO. MW-16-02

Facility/Project Name: DTE: Saint Clair Power Plant
Date Drilling Started: 3/28/16
Date Drilling Completed: 3/28/16
Project Number: 231828.0004.0000

Drilling Firm: Stock Drilling
Drilling Method: Sonic
Surface Elev. (ft): 582.18
TOC Elevation (ft): 581.43
Total Depth (ft bgs): 138.0
Borehole Dia. (in): 6

Boring Location: NE side of ash basin.
N: 465503.41  E: 13632151.32
CIVIL TOWN/CITY/ VILLAGE: Saint Clair
COUNTY: Saint Clair
STATE: MI

Personnel
Logged By: A. Knutson
Driller: A. Goldsmith

Drilling Equipment: Terrasonic

WATER LEVEL OBSERVATIONS:
While Drilling: Depth (ft bgs) 1.76
After Drilling: Depth (ft bgs) 1.76

SAMPLE

NUMBER AND TYPE

RECOVERY (%)

BLOW COUNTS

DEPTH IN FEET

LITHOLOGIC
DESCRIPTION

GRAVEL mostly coarse gravel, few coarse sand, black (10YR
5/1), no odor, moist, loose.

SAND WITH GRAVEL mostly fine to coarse sand, some fine
to coarse gravel, brown (10YR 5/3), no odor, moist, loose.

CLAY mostly clay, few silt, grayish brown (10YR 5/1), no
odor, moist, stiff.

Change to soft at 8.0 feet.

Comments

U.S.C.S.

GRAPHIC LOG

WELL DIAGRAM

Signature: For A. Knutson
Firm: TRC Environmental Corporation
734.971.7080
1540 Eisenhower Place Ann Arbor, Michigan
Checked By: C. Scieszka
Fax 734.971.9022
<table>
<thead>
<tr>
<th>NUMBER AND TYPE</th>
<th>RECOVERY (%)</th>
<th>DEPTH IN FEET</th>
<th>LITHOLOGIC DESCRIPTION</th>
<th>USGS</th>
<th>GRAPHIC LOG</th>
<th>WELL DIAGRAM</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 CS</td>
<td>100</td>
<td>45</td>
<td>CLAY mostly clay, few silt, grayish brown (10YR 5/1), no odor, moist, soft.</td>
<td>CL</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 6 CS           | 100          | 50            | Change to few silt at 45.0 feet. 
Change to no silt at 46.0 feet. |      |             |              |          |
| 7 CS           | 100          | 55            | SILTY CLAY mostly silt, little clay, dark grayish brown (10YR 5/3), no odor, moist, stiff. | CL-ML |             |              |          |
| 8 CS           | 100          | 60            | Change to few fine to coarse sand at 73.5 feet. 
Change to no sand at 76.5 feet. |      |             |              |          |
<p>| 9 CS           | 100          | 65            |                          |      |             |              |          |</p>
<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>NUMBER AND TYPE</th>
<th>RECOVERY (%)</th>
<th>BLOW COUNTS</th>
<th>DEPTH IN FEET</th>
<th>LITHOLOGIC DESCRIPTION</th>
<th>USGS</th>
<th>GRAPHIC LOG</th>
<th>WELL DIAGRAM</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-8</td>
<td>GS</td>
<td>100</td>
<td></td>
<td>90</td>
<td>SILTY CLAY mostly silt, little clay, dark grayish brown (10YR 5/3), no odor, moist, stiff.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 CS</td>
<td>100</td>
<td></td>
<td></td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 CS</td>
<td>100</td>
<td></td>
<td></td>
<td>110</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 CS</td>
<td>80</td>
<td></td>
<td></td>
<td>120</td>
<td>SILTY CLAY mostly clay, some silt, very dark gray (10YR 3/1), no odor, dry, hard.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 CS</td>
<td>100</td>
<td></td>
<td></td>
<td>130</td>
<td>SHALE very dark gray (10YR 3/1) to light gray (10YR 7/1), no odor, moist.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>135</td>
<td>End of boring at 138.0 feet below ground surface.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### WELL CONSTRUCTION LOG

**WELL NO. MW-16-03**

**DTE: Saint Clair Power Plant**

- **Date Drilling Started:** 3/24/16
- **Date Drilling Completed:** 3/24/16
- **Surface Elev. (ft):** 582.08
- **TOC Elevation (ft):** 581.39
- **Total Depth (ft bgs):** 138.0
- **Borehole Dia. (in):** 6

**Drilling Firm:**

- **Stock Drilling**

**Drilling Method:** Sonic

**Boring Location:** E side of ash basin.

**Personnel**
- **Logged By:** J. Reed
- **Driller:** A. Goldsmith

**Civil Town/City/v Village:** Saint Clair

**County:** Saint Clair

**State:** MI

**Water Level Observations:**
- **While Drilling:** 48/16 08:35
- **After Drilling:** Depth (ft bgs) 2.18

**Drilling Equipment:** Terrasonic

---

**SAMPLE**

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>TYPE</th>
<th>RECOVERY (%)</th>
<th>BLOW COUNTS</th>
<th>DEPTH IN FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CS</td>
<td>95</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>CS</td>
<td>100</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>CS</td>
<td>100</td>
<td></td>
<td>23</td>
</tr>
<tr>
<td>4</td>
<td>CS</td>
<td>100</td>
<td></td>
<td>35</td>
</tr>
</tbody>
</table>

**LITHOLOGIC DESCRIPTION**

- **GRAVEL WITH SAND** mostly gravel, some sand, black (10YR 2/1), no odor, moist, loose.
- **SAND AND GRAVEL** brown (10YR 5/3), no odor, moist, loose.
- **CLAY** mostly clay, few to little silt, grayish brown (10YR 5/2), no odor, moist, stiff.

Change to medium stiff at 10.0 feet.

Change to trace to few sand at 30.0 feet.

Change to no sand at 32.5 feet.

---

**Signature:**

**Firm:** TRC Environmental Corporation

**Checked By:** C. Scieszka

**Firm Address:** 1540 Eisenhower Place Ann Arbor, Michigan

**Fax:** 734.971.9022

**Telephone:** 734.971.7080
<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>NUMBER AND TYPE</th>
<th>RECOVERY (%)</th>
<th>BLOW COUNTS</th>
<th>DEPTH IN FEET</th>
<th>LITHOLOGIC DESCRIPTION</th>
<th>USCS</th>
<th>GRAPHIC LOG</th>
<th>WELL DIAGRAM</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 ST</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CLAY mostly clay, few to little silt, grayish brown (10YR 5/2), no odor, moist, medium stiff.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 CS</td>
<td></td>
<td>100</td>
<td></td>
<td>45</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 CS</td>
<td></td>
<td>100</td>
<td></td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 CS</td>
<td></td>
<td>100</td>
<td></td>
<td>55</td>
<td>ASSY CLAY mostly clay, little silt, dark grayish brown (10YR 5/2), no odor, moist, dense.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 CS</td>
<td></td>
<td>100</td>
<td></td>
<td>60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 CS</td>
<td></td>
<td>100</td>
<td></td>
<td>65</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 CS</td>
<td></td>
<td>100</td>
<td></td>
<td>70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 CS</td>
<td></td>
<td>100</td>
<td></td>
<td>75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 CS</td>
<td></td>
<td>100</td>
<td></td>
<td>80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 CS</td>
<td></td>
<td>100</td>
<td></td>
<td>85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 CS</td>
<td></td>
<td>100</td>
<td></td>
<td>90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SILTY CLAY  mostly clay, little silt, dark grayish brown (10YR 5/2), no odor, moist, dense.

SILTY CLAY HARDPAN AND SHALE  very dark gray (10YR 3/1), no odor, dry to slightly moist, hard.

SHALE  very dark gray (10YR 3/1) to light gray (10YR 7/1), no odor, moist.

End of boring at 138.0 feet below ground surface.
**WELL CONSTRUCTION LOG**

**WELL NO. MW-16-04**

**Facility/Project Name:** DTE: Saint Clair Power Plant

**Drilling Firm:** Stock Drilling

**Drilling Method:** Sonic

**Surface Elev. (ft):** 581.99

**TOC Elevation (ft):** 580.95

**Total Depth (ft bgs):** 138.0

**Borehole Dia. (in):** 6

**Boring Location:** SE side of ash basin.

**N:** 465173.94 **E:** 13632077.11

**Civil Town/City/vor Village:** Saint Clair

**County:** Saint Clair

**State:** MI

**Date Drilling Started:** 3/22/16

**Date Drilling Completed:** 3/23/16

**Project Number:** 231828.0004.0000

**Personal:**

Logged By: J. Reed

Driller: A. Goldsmith

**Drilling Equipment:** Terrasonic

**Water Level Observations:**

While Drilling: Date/Time

After Drilling: Date/Time

4/8/16 00:00

**Depth (ft bgs):** 21.19

**Comments:**

- **LITHOLOGIC DESCRIPTION**

   - **GRAVEL** mostly gravel, few to little fine to coarse sand, very dark gray (10YR 3/1), no odor, moist.

   - **CLAY WITH SAND** mostly clay, little to some fine to coarse sand, dark grayish brown (10YR 4/2), no odor, moist, medium dense.

   - **SAND WITH CLAY** mostly sand, little to some clay, dark grayish brown (10YR 4/2), no odor, moist.

   - **CLAY WITH SAND** mostly clay, little to some fine to coarse sand, medium plasticity, dark grayish brown (10YR 4/2), no odor, moist, medium dense.

   - **CLAY** mostly clay, trace fine to medium sand, medium plasticity, grayish brown (10YR 5/2), no odor, moist, stiff.

   - Change to medium stiff at 25.0 feet.

**Firm:** TRC Environmental Corporation

1540 Eisenhower Place Ann Arbor, Michigan

734.971.7080

Fax 734.971.9022

**Signature:** For J. Reed

**Checked By:** C. Sciaska
Silty Clay: mostly clay, little to some silt, few fine to coarse sand, dark grayish brown (10YR 5/2), no odor, moist, medium stiff.

Clay: mostly clay, few to little silt, few fine to coarse sand, grayish brown (10YR 5/2), no odor, moist, medium stiff.

Change to wet at 79.5 feet.

Change to moist at 83.0 feet.
CLAY mostly clay, few to little silt, few fine to coarse sand, grayish brown (10YR 5/2), no odor, moist, medium stiff.

Silty Clay Hardpan/Shale mostly clay and silt, very dark gray (10YR 3/1), no odor, dry to moist, hard.

Shale light gray (10YR 7/1) to very dark gray (10YR 3/1), no odor, dry.

End of boring at 138.0 feet below ground surface.
**WELL CONSTRUCTION DIAGRAM**

**ELEVATION (BENCHMARK: USGS)**

<table>
<thead>
<tr>
<th>ELEVATION</th>
<th>DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)</th>
</tr>
</thead>
<tbody>
<tr>
<td>585.12</td>
<td>0.0 GROUND SURFACE</td>
</tr>
<tr>
<td>584.74</td>
<td>0.4 TOP OF CASING</td>
</tr>
<tr>
<td>126.6</td>
<td>1.5 CEMENT SURFACE PLUG</td>
</tr>
<tr>
<td></td>
<td>GROUT/BACKFILL MATERIAL</td>
</tr>
<tr>
<td></td>
<td>BENTONITE SLURRY</td>
</tr>
<tr>
<td></td>
<td>GROUT/BACKFILL METHOD</td>
</tr>
<tr>
<td></td>
<td>TREMIE</td>
</tr>
<tr>
<td>118.0</td>
<td>GROUT</td>
</tr>
<tr>
<td></td>
<td>BENTONITE SEAL MATERIAL</td>
</tr>
<tr>
<td></td>
<td>TIME RELEASE PELLETS</td>
</tr>
<tr>
<td>122.0</td>
<td>BENTONITE SEAL</td>
</tr>
<tr>
<td>127.0</td>
<td>TOP OF SCREEN</td>
</tr>
<tr>
<td></td>
<td>FILTER PACK MATERIAL</td>
</tr>
<tr>
<td></td>
<td>MEDIUM, WASHED SAND</td>
</tr>
<tr>
<td>132.0</td>
<td>BOTTOM OF SCREEN</td>
</tr>
<tr>
<td>132.0</td>
<td>BOTTOM OF FILTER PACK</td>
</tr>
<tr>
<td></td>
<td>NA BENTONITE PLUG</td>
</tr>
<tr>
<td>447.1</td>
<td>138.0 HOLE BOTTOM</td>
</tr>
</tbody>
</table>

**CASING AND SCREEN DETAILS**

| TYPE OF RISER:          | 2-INCH PVC                          |
| PIPE SCHEDULE:         | 40                                   |
| PIPE JOINTS:           | thread o-rings                       |
| SCREEN TYPE:           | 2-INCH PVC                           |
| SCR. SLOT SIZE:        | 0.01-INCH                            |

| BOREHOLE DIAMETER:     | 6 IN. FROM 0 TO 138 FT.              |
|                       | _ IN. FROM ____ TO ____ FT.          |
| SURF. CASING DIAMETER: | _ IN. FROM ____ TO ____ FT.          |

**WELL DEVELOPMENT**

DEVELOPMENT METHOD: SURGE AND PUMP

| TIME DEVELOPING: | 2.5 HOURS |

WATER REMOVED: 50 GALLONS
WATER ADDED: NA GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

| CLARITY BEFORE: | CLOUDY |
| COLOR BEFORE:   | GRAY   |
| CLARITY AFTER:  | SLIGHTLY CLOUDY |
| COLOR AFTER:    | CLEAR TO VERY LIGHT GRAY |

ODOR (IF PRESENT): NONE

**WATER LEVEL SUMMARY**

<table>
<thead>
<tr>
<th>MEASUREMENT (FEET)</th>
<th>DATE</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTB BEFORE DEVELOPING:</td>
<td>132.00</td>
<td>T/PVC</td>
</tr>
<tr>
<td>DTB AFTER DEVELOPING:</td>
<td>132.00</td>
<td>T/PVC</td>
</tr>
<tr>
<td>SWL BEFORE DEVELOPING:</td>
<td>--</td>
<td>T/PVC</td>
</tr>
<tr>
<td>SWL AFTER DEVELOPING:</td>
<td>13.70</td>
<td>T/PVC</td>
</tr>
<tr>
<td>OTHER SWL:</td>
<td></td>
<td>T/PVC</td>
</tr>
<tr>
<td>OTHER SWL:</td>
<td></td>
<td>T/PVC</td>
</tr>
</tbody>
</table>

**PROTECTIVE CASING DETAILS**

| PERMANENT, LEGIBLE WELL LABEL ADDED? | YES | NO |
| PROTECTIVE COVER AND LOCK INSTALLED? | YES | NO |
| LOCK KEY NUMBER:                    | 3120 |
WELL CONSTRUCTION DIAGRAM

PROJ. NAME: DTE EC: SCPP CCR MW Installation
PROJ. NO: 2381828.0004
DATE INSTALLED: 3/29/2016
INSTALLED BY: A. Knutson

ELEVATION (BENCHMARK: USGS)

<table>
<thead>
<tr>
<th>ELEVATION</th>
<th>DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)</th>
</tr>
</thead>
<tbody>
<tr>
<td>582.18</td>
<td>GROUND SURFACE</td>
</tr>
<tr>
<td>581.43</td>
<td>TOP OF CASING</td>
</tr>
<tr>
<td>125.3</td>
<td>CEMENT SURFACE PLUG</td>
</tr>
<tr>
<td>117.0</td>
<td>GROUT</td>
</tr>
<tr>
<td>121.0</td>
<td>BENTONITE SEAL</td>
</tr>
<tr>
<td>126.0</td>
<td>TOP OF SCREEN</td>
</tr>
<tr>
<td>5.0</td>
<td>FILTER PACK MATERIAL</td>
</tr>
<tr>
<td>456.2</td>
<td>TOP OF FILTER PACK</td>
</tr>
<tr>
<td>451.2</td>
<td>BENTONITE PLUG</td>
</tr>
<tr>
<td>444.2</td>
<td>HOLE BOTTOM</td>
</tr>
</tbody>
</table>

CASING AND SCREEN DETAILS

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

| BOREHOLE DIAMETER: | 6 IN. FROM 0 TO 138 FT. |
| SURF. CASING DIAMETER: | IN. FROM TO FT. |

WELL DEVELOPMENT

| DEVELOPMENT METHOD: | SURGE AND PUMP |
| TIME DEVELOPING: | 2.5 HOURS |
| WATER REMOVED: | 55 GALLONS |
| WATER ADDED: | NA GALLONS |

WATER CLARITY BEFORE / AFTER DEVELOPMENT

| CLARITY BEFORE: | CLOUDY |
| COLOR BEFORE: | GRAY |
| CLARITY AFTER: | SLIGHTLY CLOUDY |
| COLOR AFTER: | CLEAR TO VERY LIGHT GRAY |
| ODOR (IF PRESENT): | NONE |

WATER LEVEL SUMMARY

<table>
<thead>
<tr>
<th>MEASUREMENT (FEET)</th>
<th>DATE</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTB BEFORE DEVELOPING:</td>
<td>131.90 T/PVC</td>
<td>4/4/16 --</td>
</tr>
<tr>
<td>DTB AFTER DEVELOPING:</td>
<td>132.00 T/PVC</td>
<td>4/4/16 --</td>
</tr>
<tr>
<td>SWL BEFORE DEVELOPING:</td>
<td>1.40 T/PVC</td>
<td>4/4/16 --</td>
</tr>
<tr>
<td>SWL AFTER DEVELOPING:</td>
<td>1.10 T/PVC</td>
<td>4/8/16 838</td>
</tr>
<tr>
<td>OTHER SWL:</td>
<td>T/PVC</td>
<td></td>
</tr>
<tr>
<td>OTHER SWL:</td>
<td>T/PVC</td>
<td></td>
</tr>
</tbody>
</table>

PROTECTIVE CASING DETAILS

| PERMANENT, LEGIBLE WELL LABEL ADDED?: | YES |
| PROTECTIVE COVER AND LOCK INSTALLED?: | YES |
| LOCK KEY NUMBER: | 3120 |

REVISED 11/2013
**WELL CONSTRUCTION DIAGRAM**

**PROJ. NAME:** DTE EC: SCPP CCR MW Installation  
**DATE INSTALLED:** 3/25/2016  
**INSTALLED BY:** J. Reed

**ELEVATION**  
(BENCHMARK: USGS)

<table>
<thead>
<tr>
<th>Elevation</th>
<th>Ground Surface</th>
<th>Top of Casing</th>
<th>Cement Surface Plug</th>
<th>GROUT/BACKFILL MATERIAL</th>
<th>BENTONITE SLURRY</th>
<th>GROUT/BACKFILL METHOD</th>
<th>TREMIE</th>
</tr>
</thead>
<tbody>
<tr>
<td>582.08</td>
<td>0.0</td>
<td>0.7</td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>581.39</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>126.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>455.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>450.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>444.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**WELL DEVELOPMENT**

**DEVELOPMENT METHOD:** SURGE AND PUMP  
**TIME DEVELOPING:** 4 HOURS  
**WATER REMOVED:** 74 GALLONS  
**WATER ADDED:** NA GALLONS  
**WATER CLARITY BEFORE / AFTER DEVELOPMENT**  
**CLARITY BEFORE:** CLOUDY/SUSPENDED SAND  
**COLOR BEFORE:** GRAY  
**CLARITY AFTER:** SLIGHTLY CLOUDY  
**COLOR AFTER:** VERY LIGHT GRAY TO CLEAR  
**ODOR (IF PRESENT):** NONE

**WATER LEVEL SUMMARY**

<table>
<thead>
<tr>
<th>Measurement (Feet)</th>
<th>Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTB BEFORE DEVELOPING:</td>
<td>123.40 T/PVC</td>
<td>4/4/16</td>
</tr>
<tr>
<td>DTB AFTER DEVELOPING:</td>
<td>132.00 T/PVC</td>
<td>4/4/16</td>
</tr>
<tr>
<td>SWL BEFORE DEVELOPING:</td>
<td>1.00 T/PVC</td>
<td>4/4/16</td>
</tr>
<tr>
<td>SWL AFTER DEVELOPING:</td>
<td>1.47 T/PVC</td>
<td>4/8/16</td>
</tr>
</tbody>
</table>

**NOTES:**  
APPROXIMATELY 8.6 FEET OF MEDIUM, WASHED SAND WAS UNINTENTIONALLY PLACED IN WELL DURING INSTALLATION. THE SAND WAS REMOVED DURING WELL DEVELOPMENT.

**REVISED 11/2013**
**WELL CONSTRUCTION DIAGRAM**

**PROJ. NAME:** DTE EC: SCPP CCR MW Installation

**PROJ. NO:** 2381828.0004

**DATE INSTALLED:** 3/23/2016

**INSTALLED BY:** J. Reed

**CHECKED BY:** C. SCIESZKA

**WELL ID:** MW-16-04

---

**ELEVATION (BENCHMARK: USGS)**

<table>
<thead>
<tr>
<th>Elevation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>581.99</td>
<td>GROUND SURFACE</td>
</tr>
<tr>
<td>580.95</td>
<td>TOP OF CASING</td>
</tr>
<tr>
<td>126.0</td>
<td>CEMENT SURFACE PLUG</td>
</tr>
<tr>
<td>118.0</td>
<td>GROUT</td>
</tr>
<tr>
<td>122.0</td>
<td>BENTONITE SEAL</td>
</tr>
<tr>
<td>127.0</td>
<td>TOP OF SCREEN</td>
</tr>
<tr>
<td>455.0</td>
<td>FILTER PACK MATERIAL</td>
</tr>
<tr>
<td>450.0</td>
<td>BOTTOM OF SCREEN</td>
</tr>
<tr>
<td>132.0</td>
<td>BOTTOM OF FILTER PACK</td>
</tr>
<tr>
<td>138.0</td>
<td>HOLE BOTTOM</td>
</tr>
</tbody>
</table>

---

**DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)**

- 1.0: TOP OF CASING
- 1.5: CEMENT SURFACE PLUG
- 6: BOREHOLE DIAMETER
- 122.0: BENTONITE SEAL
- 132.0: BOTTOM OF SCREEN
- 138.0: HOLE BOTTOM

---

**WELL DEVELOPMENT**

**DEVELOPMENT METHOD:** SURGE AND PUMP

**TIME DEVELOPING:** 2 HOURS

**WATER REMOVED:** 40 GALLONS

**WATER ADDED:** NA GALLONS

**WATER CLARITY BEFORE / AFTER DEVELOPMENT**

**CLARITY BEFORE:** CLOUDY/GRAY

**COLOR BEFORE:** GRAY

**CLARITY AFTER:** SLIGHTLY CLOUDY

**COLOR AFTER:** LIGHT GRAY

**ODOR (IF PRESENT):** NONE

---

**WATER LEVEL SUMMARY**

<table>
<thead>
<tr>
<th>Measurement (Feet)</th>
<th>Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTB BEFORE DEVELOPING:</td>
<td>133.10</td>
<td>T/PVC</td>
</tr>
<tr>
<td>DTB AFTER DEVELOPING:</td>
<td>132.00</td>
<td>T/PVC</td>
</tr>
<tr>
<td>SWL BEFORE DEVELOPING:</td>
<td>1.01</td>
<td>T/PVC</td>
</tr>
<tr>
<td>SWL AFTER DEVELOPING:</td>
<td>1.15</td>
<td>T/PVC</td>
</tr>
<tr>
<td>OTHER SWL:</td>
<td>T/PVC</td>
<td></td>
</tr>
<tr>
<td>OTHER SWL:</td>
<td>T/PVC</td>
<td></td>
</tr>
</tbody>
</table>

---

**PROTECTIVE CASING DETAILS**

**PERMANENT, LEGIBLE WELL LABEL ADDED?** YES

**PROTECTIVE COVER AND LOCK INSTALLED?** YES

**LOCK KEY NUMBER:** 3120

---

**NOTES:**

- SURGE AND PUMP DEVELOPMENT
- GROUT DEVELOPMENT METHOD: TREMIE
- PIPE JOINTS: THREADED O-RINGS
- FILTER PACK MATERIAL: MEDIUM, WASHED SAND
- CASING AND SCREEN DETAILS:
- 2-INCH PVC RISER: 2-INCH PVC
- 2-INCH PVC CASING: 2-INCH PVC
- 0.01-INCH SCR. SLOT SIZE
- 6 IN. FROM 0 TO 138 FT. BOREHOLE DIAMETER
- CASING AND SCREEN DETAILS:
- FROM SURF. CASING DIAMETER: 0 IN. FROM 0 TO 0 FT.