REGION 5 RAC2

REMEDIAL ACTION CONTRACT FOR

Remedial, Enforcement Oversight, and
Non-Time Critical Removal Activities at Sites of Release or
Threatened Release of Hazardous Substances in Region 5

DATA EVALUATION REPORT
Velsicol Former Plant Site
Upgradient Slurry Wall Investigation
St. Louis, Michigan
WA No. 201-RDRD-0532/Contract No. EP-S5-06-01

August 2020

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PREPARED FOR

U.S. Environmental Protection Agency

PREPARED BY

ch2m.

FOR OFFICIAL USE ONLY

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Acronyms and Abbreviations

ANP	Adjacent or Nearby Properties
bgs	below ground surface
CH2M	CH2M HILL, Inc.
DDT	dichlorodiphenyltrichloroethane
DPT	direct-push technology
EGLE	Michigan Department of Environment, Great Lakes, and Energy
EPA	U.S. Environmental Protection Agency
FOP	Field Operating Procedure
FPS	Former Plant Site
FS	feasibility study
IP	injection point
MCC	Michigan Chemical Corporation
OU	operable unit
PID	photoionization detector
RA	remedial action
RD	remedial design
RDI	remedial design investigation
RI	remedial investigation
ROD	Record of Decision
UGSW	upgradient slurry wall
Velsicol	Velsicol Chemical Corporation
Weston	Weston Solutions of Michigan, Inc.

SECTION 1

Introduction

1.1 General

CH2M has prepared this data evaluation report for the U.S. Environmental Protection Agency (EPA) to describe the methods, procedures, and analytical results obtained from a remedial design investigation (RDI) completed at the Velsicol Chemical Corporation Superfund Site in St. Louis, Michigan. As described in the *Technical Memorandum, Upgradient Slurry Wall Investigation Work Plan* (CH2M 2019), a focused field investigation was performed to support the design of remedial components specified by the June 22, 2012, Former Plant Site Operable Unit (OU) 1 Record of Decision (ROD).

This report describes only the RDI activities associated with the upgradient slurry wall (UGSW) investigation. Tasks specific to remedial design for other site areas identified in the ROD have been, or will be, presented for agency approval independently. This work was performed under Work Assignment No. 201-RDRD-0532, Contract No. EP-S5-06-01, and in accordance with the approved *Technical Memorandum, Upgradient Slurry Wall Investigation Work Plan* (CH2M 2019).

1.2 Site Description

The Velsicol Chemical Corporation Superfund Site (National Superfund Database Identification Number MID00722439) encompasses approximately 100 acres in St. Louis, Michigan. The site includes the Former Plant Site (FPS) and a residential area referenced as the adjacent or nearby properties (ANP). The lead agency for the remedial investigation (RI)/feasibility study (FS) was the Michigan Department of Environment, Great Lakes, and Energy (EGLE). The EPA is the lead agency for the remedial design (RD) and remedial action (RA).

A chemical manufacturing plant formerly occupied the FPS from the mid-1930s until it was demolished in 1978. Industrial operations at the plant, which included manufacturing of pesticides and fire retardants, resulted in widespread contamination on the FPS. In 1982, the Velsicol Chemical Corporation entered into an administrative order of consent with the United States and the State of Michigan. Pursuant to the administrative order of consent , the Velsicol Chemical Corporation constructed a containment system for the FPS, which included the installation of a low-permeability cap and a 2-foot-thick low-permeability slurry wall around the entire 52-acre FPS.

The FPS is fenced and is bordered on the south and east by the ANP, with Washington Avenue (M-46) along the southern edge. Watson and North Street mark the eastern edge, and the Pine River and Mill Pond form the western and northern boundaries. The ANP spans approximately 12 blocks and is primarily composed of residential properties that lie south and east of the former plant boundary. A small number of commercial properties are also located south of the FPS, along M-46 and East Washington Avenue.

The site consists of four OUs, as shown in Figure 1-1. The OUs are described as follows:

- OU1—FPS and ANP, for which RD and RA activities are in progress.
- OU2—Pine River and Mill Pond sediment adjacent and upstream from the St. Louis hydroelectric dam, for which RA activities were completed in 2006.
- OU3—Pine River sediments stretching from the St. Louis hydroelectric dam to approximately 1.25 miles downstream of the dam, for which RI activities are ongoing.

- OU4—Pine River sediments stretching from approximately 1.25 miles downstream of the St. Louis hydroelectric dam to the confluence of the Pine, Chippewa, and Tittabawassee rivers, for which RI activities are ongoing.

The UGSW RDI activities and findings presented in this report were completed in OU1 within the FPS.

1.3 Site History

The FPS was used for industrial operations beginning in the mid-1930s until the chemical manufacturing plant closed in 1977. Historical operations at the site included a lumber mill, oil refinery, salt processing plant, and chemical manufacturing plant. The following is an abbreviated timeline of historical operations:

- In 1935, Michigan Chemical Corporation (MCC) purchased the property and operated a chemical manufacturing business.
- In 1965, Velsicol Chemical Corporation (Velsicol) gained a controlling interest in MCC.
- From 1936 through 1977, MCC manufactured a wide variety of products at the FPS, including various salts; magnesium oxide; rare earth metals fire retardants, including polybrominated biphenyls and tris(2,3-dibromopropyl) phosphate (TRIS); and the pesticide dichlorodiphenyltrichloroethane (DDT).
- In 1977, production operations were terminated, and by 1978, Velsicol initiated demolition and decommissioning of the facility. All aboveground infrastructure was demolished and buried onsite, including buildings, storage tanks, and process piping. Building and tank foundations were not removed, and a significant amount of debris from plant demolition remains buried within the confines of the FPS.

1.4 Previous Investigations

The slurry wall was installed in 1982. Since that time, several investigations have been completed to study the integrity of the slurry wall. Previous investigations are detailed in the following documents:

- Memphis Environmental Center, Inc. 1997. Final Containment System Assessment Report: Former Michigan Chemical Plant Site, St. Louis, Michigan. October.
- CH2M. 2002. Slurry Wall Assessment Memorandum Velsicol Chemical/Pine River Site, OU2 St. Louis, Michigan, Work Assignment No. 108-RARA-0532. January.
- Weston Solutions of Michigan, Inc. (Weston). 2006. Remedial Investigation Report for Operable Unit One, Velsicol Chemical Corporation Superfund Site, St. Louis, Gratiot County, Michigan. November.

1.5 Remedial Design Investigation Objectives

The purpose of this RDI was to evaluate the integrity and effectiveness of approximately 3,100 linear feet of slurry wall (referred to as the UGSW) bordering M-46 and the ANP. The information presented herein will be used to support future work associated with the design, installation, and operation of site remedy components specified in the 2012 ROD (EPA 2012).

SECTION 2

Remedial Design Investigation

CH2M conducted the UGSW RDI between September 2019 and May 2020. The work consisted of the following tasks:

- Locating the UGSW
- Installing additional piezometer clusters along the UGSW
- Surveying the location of the UGSW
- Conducting hydraulic conductivity testing of UGSW material
- Evaluating hydraulic gradients between interior (I) and exterior (X) piezometers
- Conducting focused groundwater elevation monitoring using electronic data loggers in select piezometers
- Performing a dye-tracer study along the UGSW

The following subsections outline the UGSW RDI approach.

2.1 Piezometer Locations and Installation

A total of 45 piezometer cluster locations were scheduled for installation as outlined in the investigation work plan. However, several proposed locations were adjacent to existing piezometer clusters WPZ-1, WPZ-2, WPZ-3, and WPZ-13, which were previously installed during the 2006 RI (Weston 2006). Therefore, three proposed RDI piezometer cluster locations were eliminated, and the four existing WPZ piezometers were incorporated into the groundwater elevation monitoring piezometer set.

In September 2019, Mateco Drilling of Rockford, Michigan, installed the piezometers using a direct-push technology (DPT) drill rig. Prior to installing the piezometers, the following tasks were completed to identify the location of the UGSW and establish the final piezometer locations based on the identified UGSW location:

- A ground-penetrating radar survey was conducted to help locate the UGSW.
- Exploratory DPT borings were installed to collect soil core samples and visually confirm UGSW alignment in 42 locations.
- A field survey was completed to document the UGSW alignment and determine the final interior (I) and exterior (X) piezometer installation locations along the UGSW.

Mateco installed piezometers using the DPT rig under the supervision of a CH2M geologist. A 3-inch-diameter, 5-foot-long core sampler was used to collect continuous subsurface soil core samples in each borehole until the till unit interface was reached. Piezometer clusters were installed such that one piezometer was located on the exterior (X) side of the slurry wall, and one was located on the interior (I) side of the wall. Injection point (IP) piezometers were also installed on the interior side of the slurry wall in selected locations to facilitate the dye-tracer study dye injections. Piezometers were installed approximately 2 to 7 feet from the interior (I) or exterior (X) edge of the slurry wall and were generally terminated at the till unit surface (approximately 9 to 20 feet below ground surface [bgs]). At locations identified for the dye-tracer study, the IP piezometers were installed approximately 5 feet further inside the FPS relative to the interior (I) piezometers.

All piezometers were constructed with 1-inch-diameter polyvinyl chloride riser pipe and 1-inch-diameter 0.010-slot polyvinyl chloride screen. The screened interval for each piezometer was selected by the CH2M

geologist, which was set to approximately match the shallow unit saturated thickness observed at each location. Construction of the annular space was completed with a medium silica sand filter pack placed to 1 foot above the top of the screen, with bentonite chips placed from the top of the filter pack to 1-foot bgs. The bentonite chips were hydrated with fresh water to effectively seal each borehole. The surface completion for each piezometer was composed of a concrete pad and a lockable metal protective cover.

All soil borings were characterized and logged continuously from ground surface to the boring terminus by a CH2M geologist in accordance with the Soil Boring Logging Field Operating Procedure (FOP). Soil cores were also field screened using a photoionization detector (PID), and visually inspected for potential signs of contamination.

Following installation, all piezometers were developed to remove fines from around the screen in accordance with the Monitoring Well Development FOP. Piezometer purging was performed with a peristaltic pump and clean disposable down-hole tubing. Development was considered complete once 10 casing volumes were purged. Appendix A contains the detailed soil boring logs and Appendix B contains a photo log representative of the drilling activities.

2.2 Upgradient Slurry Wall Survey

Following installation of the 42 piezometer clusters, a professional surveyor licensed in the State of Michigan (Rowe Professional Services Company) recorded the final piezometer horizontal locations, ground elevations and top-of-casing elevations. In addition, the final UGSW location was surveyed at each of the 42 piezometer cluster locations. Horizontal coordinates were obtained using the North American Datum of 1988 with an accuracy of ± 0.01 foot. The vertical component of all surveyed locations is expressed in feet above National Geodetic Vertical Datum of 1988 to an accuracy and resolution of 0.01 foot. Table 2-1 presents the piezometer survey data and Appendix C contains the Rowe Professional Services Company upgradient slurry wall investigation survey documentation.

2.3 Hydraulic Conductivity Testing

During drilling operations, slurry wall samples were collected from boring locations CPZ-4, CPZ-9, CPZ-17, CPZ-26, and CPZ-38 and submitted for hydraulic conductivity analysis. Samples were collected by the DPT rig equipped with 4.25-inch-diameter hollow-stem augers and 3-inch-diameter, 2-foot-long Shelby Tube samplers. The borehole at each sampling location was initially advanced to a minimum of 6 feet bgs using standard DPT macrocore samplers. Once the slurry wall was encountered, the borehole was over-drilled with hollow-stem augers to a minimum of 2 feet below the identified top of the slurry wall. A Shelby Tube sampler was then deployed through the augers (below the depth of the exploratory boring) to collect a section of slurry wall material. Following collection, Shelby Tube samples were sealed with wax and capped and stored vertically to prevent further material disturbance. The Shelby Tube samples were transported to Mateco's materials testing laboratory by Mateco personnel under standard chain-of-custody procedures and were subsequently analyzed for hydraulic conductivity in accordance with ASTM Method D5084 (flexible wall permeameter method).

2.4 Static Groundwater Elevation Measurement Events

Following the installation and development of all UGSW piezometers, five static groundwater elevation measurement events were conducted over a 6-month period. Static groundwater elevations were measured in piezometers on September 23, 2019, November 25, 2019, December 18, 2019, January 16, 2020, and February 11, 2020. For the September and November 2019 events, groundwater elevations were measured in all UGSW piezometer clusters. For subsequent events (beyond November 2019), the dye study piezometer clusters were not measured to reduce the risk of tracer dye cross-contamination.

Groundwater elevation measurements were conducted in accordance with the Groundwater Level and Total Depth Measurements FOP. Each event consisted of collecting static water-level measurements from each of the interior (I) and exterior (X) piezometers using an electronic water-level indicator.

Local precipitation was continuously monitored and recorded during the groundwater elevation monitoring period, and the data were used to identify precipitation-driven groundwater elevation fluctuations. Local precipitation was recorded by means of an onsite weather station capable of data logging and storage.

2.5 10-Week Transient Groundwater Elevation Monitoring Event

Twenty piezometers along the UGSW were used to monitor groundwater elevations for a 10-week period (March 13, 2020 through May 21, 2020). This monitoring event was conducted to further evaluate shallow groundwater flow patterns and hydraulic gradient "flattening" along the UGSW near piezometer cluster CPZ-28. The following piezometers were selected for this study based on whether the hydraulic gradients between the interior (I) and exterior (X) piezometers were irregular. In addition, several of these locations were selected to further aid in understanding the origin of the positive dye-tracer test result at CPZ-26X (refer to Section 3.4).

Interior	Exterior	Interior	Exterior
• CPZ-16I	• CPZ-16X	• CPZ-19I	• CPZ-19X
• CPZ-21I	• CPZ-21X	• CPZ-23I	• CPZ-23X
• CPZ-26I	• CPZ-26X	• CPZ-27I	• CPZ-27X
• CPZ-28I	• CPZ-28X	• CPZ-29I	• CPZ-29X
• CPZ-30I	• CPZ-30X	• CPZ-31I	• CPZ-31X

Pressure transducers were deployed on March 11, 2020, and began recording on March 13, 2020. Data were collected hourly, and the groundwater elevations were corrected for barometric pressure effects, calibrated against manual water-level data, and evaluated in context to recorded site precipitation.

2.6 Dye-Tracer Study Work Approach

Based on a review of the EGLE slurry wall evaluation presented in the RI report (Weston 2006) and an initial consultation with Crawford Hydrology Laboratory, CH2M developed the procedure for conducting the dye-tracer study. The following 15 piezometer clusters were used to complete the dye-tracer study:

• CPZ-01	• CPZ-04	• CPZ-08
• CPZ-09	• CPZ-12	• CPZ-14
• CPZ-17	• CPZ-20	• CPZ-23
• CPZ-26	• CPZ-29	• CPZ-32
• CPZ-36	• CPZ-38	• CPZ-40

The above clusters consist of 3 piezometers: 1 interior (I) slurry wall piezometer, 1 exterior (X) slurry wall piezometer, and an additional interior (I) slurry wall piezometer, which served as a dye IP (see Figure 2-1). Generally, every third piezometer cluster along the entire length of the UGSW (15 of the 42 clusters) was designated and used as a dye-tracer study location.

On October 7, 2019, charcoal dye receptors were installed in the designated piezometer clusters listed above (I and X piezometers only) to document and establish background dye concentrations (if any) of remnant dyes from previous investigations. The dye receptors were installed on nylon line (secured to the

piezometer casing cap) and deployed below the water table and within the screened interval of each piezometer. Weight packs were used to ensure the dye receptors remained submerged at the intended depth. On October 21, 2019, the background dye receptors were retrieved and shipped to Crawford Hydrology Laboratory for background dye analysis. The background receptors were analyzed for six industry standard dyes.

On December 3, 2019, CH2M installed new charcoal dye receptors in each of the 15 interior (I) and exterior (X) dye study piezometers to begin the dye trace phase of dye-tracer study. Once the receptors were installed, one gallon of D&C red 28 dye was added into each of the 15 IP piezometers. Following the initial dye injection, the receptors were retrieved and replaced with fresh receptors every 2 weeks for a period of 3 months (December 17, 2019 through February 24, 2020). The retrieved dye receptors were packaged and shipped under standard chain-of-custody procedures to Crawford Hydrology Laboratory, where they were analyzed for the presence of D&C red 28 dye.

2.7 Deviations from Work Plan

Deviations from the UGSW investigation work plan included the following items:

- The number of piezometer clusters decreased from 45 to 42.
- A 10-week transient groundwater elevation monitoring event was added to continuously collect groundwater elevations in select piezometers over time.
- Interior (I) and exterior (X) piezometers were placed from 2 to 7 feet on either side of the UGSW, not the minimum of 5 feet as stated in the work plan.

SECTION 3

Remedial Design Investigation Results

This section presents the findings of the UGSW RDI.

3.1 UGSW Geology and Subsurface Findings

During piezometer installation activities, the subsurface soil stratigraphy encountered adjacent to the UGSW was logged and recorded. A summary of the stratigraphic observations is presented below.

- **Clay cap—**The constructed clay cap consists of approximately 0.5 foot of topsoil, underlain by approximately 0.5 foot of fine sand, followed by approximately 2.5 to 5.0 feet of hard, and typically dry, silty clay to clayey silt. Materials consistent with cap construction were encountered in all borings installed during the investigation.
- **Interbedded sand, silt, and clay—**The materials underlying the cap are highly variable interbedded sand, silt, and clay layers with varying thicknesses as noted below.
  - Borings parallel to North Street (CPZ-1 to CPZ-13) and Watson Street (CPZ-14 to CPZ-18) have an abundance of fine- to coarse-grained sand present above the till. However, a greater abundance of silty sands and clays were encountered in the line of borings from CPZ-18 to CPZ-24.
  - Borings between CPZ-25 to CPZ-30 exhibited a notable increase in sand/gravel content; the continued presence of interbedded thin lenses of fine clay, silty clay, silty sand, and sandy clay was also observed.
  - Borings between CPZ-31 to CPZ-42 had a higher clay content with a decreasing sand content, except in borings from CPZ-35 to CPZ-38, where thicker sand layers were encountered.
- **Glacial till—**Glacial till is present at depths ranging from approximately 5.0 to 20.0 feet bgs along the UGSW. The till consists primarily of hard silty clay to clayey silt with trace to little amounts of variable size sand and trace amounts of gravel. Sand and silty sand seams are occasionally encountered within the till.
  - In the line of borings from CPZ-01 to CPZ-09, the till was generally encountered at elevations ranging from 13 to 19 feet bgs.
  - In the line of borings from CPZ-10 to CPZ-24, the till was generally encountered at higher elevations ranging from 8 to 13 feet bgs.
  - In the line of borings from CPZ-25 to CPZ-33, the till surface elevation decreases again, generally ranging from 15 to 20 feet bgs.
  - In the line of borings from CPZ-34 to CPZ-42, the till surface elevation increases again ranging from 10 to 13.0 feet bgs.

3.1.1 Notable Observations Related to Slurry Wall Integrity

While advancing the exploratory boring to locate the UGSW at piezometer cluster CPZ-28, the slurry wall was encountered between 5 to 15 feet bgs. However, at 15 feet bgs, it was observed that sand and gravel were present at the bottom of the core sampler. Based on field observations, an additional 5-foot soil core (15 to 20 feet bgs) was obtained to verify whether the UGSW was keyed into the till. The soil core consisted of fine- to coarse-grained sand with trace gravel, observed from 15 to 18.25 feet bgs, with the till identified at 18.25 feet bgs (see CPZ-28 Slurry Wall Boring Log in Appendix A). These observations indicate that the UGSW is not keyed into the till in the vicinity of piezometer cluster location CPZ-28.

3.2 Hydraulic Conductivity Testing Results

CH2M collected Shelby tubes from five piezometer cluster locations within the UGSW for hydraulic conductivity analysis. Exhibit 3-1 presents the laboratory results.

Exhibit 3-1. UGSW Hydraulic Conductivity Laboratory Results

Boring ID	Depth Interval (Feet bgs)	Hydraulic Conductivity (centimeters per second)	Hydraulic Conductivity (feet/day)
CPZ-04	9.0 – 11.0	$3.23E^{-8}$	0.000091
CPZ-09	7.5 – 9.5	$7.49E^{-6}$	0.021231
CPZ-17	6.0 – 8.0	$8.23E^{-7}$	0.002333
CPZ-26	6.0 – 8.0	$3.13E^{-7}$	0.000887
CPZ-38	8.0 – 10.0	$4.07E^{-7}$	0.001154

Laboratory results indicate that hydraulic conductivity values of 4 of the 5 slurry wall samples obtained are in the 10^{-7} centimeters per second (cm/sec) range or lower; this threshold is consistent with the design specifications established for the slurry wall installation (Memphis Environmental Center, Inc. 1997). The 10^{-7} cm/sec hydraulic conductivity value is generally representative of values for engineered low-permeable layers. The hydraulic conductivity value of the fifth sample (CPZ-09) was also low (10^{-6} cm/sec range); however, the measured value is outside the range of the slurry wall design criteria. Appendix D presents the laboratory hydraulic conductivity testing report.

3.3 Static Groundwater Elevation Measurement Results

CH2M manually measured and recorded static groundwater elevations in the UGSW piezometers over a 6-month period from September 2019 to February 2020. Results were used to compare groundwater levels inside and outside the UGSW and to evaluate slurry wall effects in containing shallow groundwater onsite and inhibiting lateral groundwater flow away from the site in the shallow unit. Groundwater elevations were used to calculate groundwater elevation differences across the UGSW over time for each piezometer cluster as presented in Graphs 3-1 through 3-4. Manual groundwater elevation measurements were not collected from the dye study piezometers beyond November 2020 to reduce the risk of dye cross-contamination. The manual groundwater elevation measurements are summarized in Table 3-1.

To help visualize groundwater elevation trends along the UGSW, the following graphs were generated using manually collected groundwater elevation data:

- Graph 3-1: CPZ-1 through CPZ-13
- Graph 3-2: CPZ-14 through CPZ-22
- Graph 3-3: CPZ-23 through CPZ-36
- Graph 3-4: CPZ-37 through CPZ-42

The graphs depict the groundwater elevation differences between paired interior (I) and exterior (X) piezometers from September 2019 to February 2020. The bars above 0 indicate a higher groundwater elevation in the interior (I) piezometer, which produces the desired outward hydraulic gradient (away from the site). Bars below 0 indicate higher groundwater elevation in the exterior (X) piezometer and a resulting inward hydraulic gradient (toward the site). The height of each bar above or below 0 is proportional to how "steep or shallow" the hydraulic gradient is across the UGSW at each piezometer pair location. Examination of the graphs indicates the following:

- Graph 3-1 shows a consistent outward hydraulic gradient at piezometer clusters CPZ-1 through CPZ-13 and WPZ-01. These groundwater level measurements indicate that shallow groundwater is mounding inside the site and along the representative section of the UGSW.
  - The results indicate that the wall is inhibiting lateral, offsite groundwater flow in the shallow aquifer unit in the noted monitoring locations.
- Graph 3-2 shows a consistent outward hydraulic gradient at a majority of piezometer clusters from CPZ-14 to CPZ-22. Locations CPZ-16, CPZ-19, and CPZ-22 are noted exceptions where short-term and temporary gradient reversals were measured in September 2019 and January 2020 at CPZ-19 and CPZ-22 and in December 2019 at CPZ-16.
  - Overall, the data indicate that shallow groundwater is mounding inside and along this section of the UGSW. These results indicate that the wall is functioning as it was intended in the specified monitoring locations to inhibit the flow of shallow groundwater offsite.
- Graph 3-3 shows a consistent outward hydraulic gradient at a majority of the piezometer clusters from CPZ-23 to CPZ-36. At locations CPZ-23, CPZ-27, CPZ-28, and CPZ-29, however, a definitive outward hydraulic gradient was not measured. At CPZ-23, a steep (inward) gradient was measured, which gradually transitioned to an outward and relatively flat hydraulic gradient at CPZ-27 and a flat hydraulic gradient at CPZ-28. A similar temporal observation was made at CPZ-29, where an initial outward hydraulic gradient transitioned to an inward hydraulic gradient.
  - These observations are consistent with those previously noted, in that shallow groundwater is mounding inside and along the UGSW and that the wall is inhibiting offsite groundwater flow as intended.
  - Groundwater elevations nearby CPZ-27 and CPZ-28, where the measured groundwater gradients are shallow to flat, suggest that the UGSW may not be functioning as intended.
- Graph 3-4 shows a consistent outward hydraulic gradient at piezometer clusters CPZ-37 through CPZ-42. Observations from piezometers WPZ-03 and CPZ-40 are noted exceptions where hydraulic gradient measurements in the shallow groundwater unit were consistently inward.
  - Despite the measured inward gradient in these locations, monitoring data support the conclusion that shallow groundwater is not migrating offsite and away from the UGSW.
  - Overall, the data are consistent with those previously noted in that shallow groundwater is mounding inside and along the UGSW and that the wall is inhibiting offsite groundwater flow as intended.

3.4 10-Week Transient Groundwater Elevation Monitoring Results

Between March 13, 2020, and May 21, 2020, groundwater levels were recorded automatically using data-logging pressure transducers in 20 piezometers (see Section 2.4.1 for locations) to evaluate temporal groundwater elevation trends in select areas along the UGSW. The piezometer clusters selected were based on hydraulic gradient trends observed during the monthly static groundwater elevation measuring events (see Section 3.3). Monitoring results are presented in Graphs 3-5 to 3-14, which depict groundwater elevation variations over time, including observed responses to site precipitation. Data trends and observations for each selected piezometer cluster are grouped according to similarity and are discussed in the following paragraphs.

CPZ-16 and CPZ-21: A consistent outward gradient was observed, except during significant precipitation events that resulted in a short-term hydraulic gradient reversal. In general, the outward gradient observed

in this location naturally reestablished 1 to 2 days following the precipitation events. Exterior (X) piezometers exhibited a significant response to the precipitation events, confirming that rapid surface water infiltration outside the site was occurring. Water-level increase was not measured with interior (I) piezometers during precipitation events, suggesting that the clay cap in the area surrounding the monitoring location was preventing surface infiltration and thereby functioning as intended.

CPZ-19 and CPZ-27: Hydraulic gradient observations in this location were consistent with CPZ-16 and CPZ-21 (above); however, gradient reversals were less pronounced and only occurred during the most significant precipitation event. During two smaller precipitation events recorded onsite, a short-term flattening of the gradient occurred rather than a reversal, and outward gradient conditions were quickly reestablished following precipitation (within 1 to 2 days). Rapid water-level rise was observed in the exterior (X) piezometer, indicating vertical infiltration readily occurred outside the site. Similarly, water-level elevation changes in the interior (I) piezometers were minimal, indicating vertical infiltration of surface water onsite is reduced by the clap cap in the area surrounding the monitoring location.

CPZ-25 and CPZ-26: A consistent outward gradient was observed throughout the monitoring period. Water elevation response to precipitation events was evident (roughly 1 to 1.5 feet), but the observed range was smaller in magnitude compared to responses observed for CPZ-16, CPZ-21, and CPZ-19. Gradient flattening or reversal was not observed in this monitoring location. No measurable effect from the precipitation events was observed in the interior (I) piezometers, indicating surface infiltration in the area surrounding the monitoring location is reduced by the clay cap.

CPZ-28: No gradient was measured throughout the monitoring period between the interior (I) and exterior (X) piezometer pair; groundwater levels at both locations were effectively the same regardless of precipitation events. Monitoring observations suggest that the interior (I) and exterior (x) piezometers may be hydraulically connected. The responses are less exaggerated and are more comparable to the attenuated responses seen for CPZ-25X and 26X (above). During precipitation events, measured groundwater levels increased roughly 0.5 to 1 foot; however, following precipitation events (around 7 days), groundwater elevations typically returned to static levels previously measured.

CPZ-29: A consistent inward gradient was observed throughout the monitoring period. Unlike most of the other exterior (X) piezometers monitored, CPZ-29X did not exhibit a measurable response to precipitation events. The interior (I) piezometer, however, did exhibit a minor response to precipitation (~0.5 to 1 foot). Groundwater elevations and response behavior measured in this piezometer cluster was inconsistent compared with surrounding piezometers and may be attributed to the consistent inward gradient detected at this location during this study.

CPZ-30: A consistent outward gradient was observed throughout the monitoring period. A slight response to the precipitation events measured in late March and May in both the interior (I) and exterior (X) piezometers was observed. However, during the late April precipitation event, the exterior (X) piezometer exhibited an abnormally large water elevation increase (greater than 5 feet), which temporarily resulted in an inward gradient for approximately 5 days. The rise in groundwater levels for the exterior (X) piezometer gradually decreased over a 2-week period and eventually returned to elevation levels consistent with measurements prior to the April precipitation event. The observed groundwater elevation response to site precipitation was inconsistent with other locations monitored during the study.

CPZ-31: A consistent inward gradient was observed throughout the monitoring period. A minor response to precipitation events in both the interior (I) and exterior (X) piezometers was observed; water elevation response was generally similar to temporal changes measured in CPZ-30, except the rapid changes noted in this location stemming from site precipitation in late April.

3.5 Dye-Tracer Study

The dye-tracer study was initiated in October 2019 with the completion of the background dye evaluation. The background dye receptors were deployed on October 7, 2019, in 15 interior (I) and exterior (X) piezometers to identify the potential presence of remnant dyes used in previous slurry wall dye investigations. Those receptors were retrieved 2 weeks later on October 21, 2019. Laboratory testing confirmed the absence of all 6 dyes in the 30 samples collected (Table 3-2). After consultation with the laboratory, CH2M proceeded with the dye-based tracer study on December 3, 2019, as described under Section 2.6. The final set of dye receptor packs was retrieved on February 24, 2020. Table 3-2 presents the dye-tracer study analytical results. Appendix E contains the analytical laboratory reports.

For the duration of the study (December 3, 2019, through February 24, 2020) all six sets of biweekly dye receptor packs deployed in the 6 interior (I) piezometers noted below were confirmed free of D&C red 28 dye by laboratory analysis:

- CPZ-04I
- CPZ-14I
- CPZ-17I
- CPZ-20I
- CPZ-29I
- CPZ-40I

The absence of dye detection in these locations indicates that groundwater flow in the nearby vicinity of these piezometers is either stagnant or moves away from the slurry wall. The absence of D&C red 28 dye was also confirmed by laboratory testing in six paired companion piezometers (the X piezometers) located outside the UGSW.

Dye receptor analysis completed from December 3, 2019, through February 24, 2020, in the nine interior (I) piezometers listed below confirmed the presence of D&C red 28 dye in one or more samples:

- CPZ-01I
- CPZ-08I
- CPZ-09I
- CPZ-12I
- CPZ-23I
- CPZ-26I
- CPZ-32I
- CPZ-36I
- CPZ-38I

Based on the presence of D&C red 28 dye in these interior (I) piezometer samples, it was determined that shallow groundwater generally flows toward the UGSW at each location. Companion exterior (X) piezometers located outside the UGSW were also monitored for the presence of dye. Laboratory results from eight of the nine exterior (X) monitoring locations confirmed the absence of dye outside the UGSW, indicating the wall was an effective barrier in most areas to prevent offsite dye transport in groundwater. At exterior (X) piezometer CPZ-26X, however, D&C red 28 dye was detected in several dye receptors, which confirmed that site groundwater is capable of migrating through or under the UGSW in this area.

SECTION 4

UGSW Conceptual Site Model Evaluation

This study employed several diagnostic and monitoring strategies to assess the performance UGSW as a hydraulic flow barrier for shallow unit groundwater in selected areas of the Velsicol Superfund Site. Manual groundwater elevation measurements periodically collected from paired piezometers located inside and outside the UGSW were used to determine the presence or absence of inward or outward hydraulic gradients. These measurements were supplemented with automated groundwater level measurements obtained by submersible pressure transducers with onboard data-logging capabilities to assess water-level changes over shorter time durations and specifically in response to site precipitation. The presence or absence of measurable hydraulic gradients across the wall and monitoring well pairs once again was the assumed basis for groundwater flow direction in each location. Finally, the introduction of dye to site groundwater and temporal monitoring for dye presence or absence in monitoring well pairs allowed direct measurement of UGSW integrity within the study area.

4.1 Data Evaluation

Assuming the boundary slurry wall was constructed to retain FPS groundwater in the shallow unit, groundwater elevation measurements in the shallow unit inside the FPS would be greater than those outside the UGSW alignment. Groundwater underlying the FPS would tend to mound up against the slurry wall, and an outward hydraulic gradient would exist between interior (I) and exterior (X) piezometer clusters, thus demonstrating barrier integrity. Conversely, the absence of measurable hydraulic gradient between piezometer clusters would suggest that the UGSW is no longer acting as an effective hydraulic barrier or it was never capable of meeting the original 1982 design specifications for slurry wall construction. Either situation would manifest in the potential connection of the shallow unit inside and outside of the slurry wall.

Based on UGSW RDI groundwater elevation trends, the following piezometer clusters indicate that the UGSW is performing as intended at these locations:

- CPZ: 1-15, 17, 18, 20-21, 24-25, 30-32, 34-39 and 41-42
- WPZ: 1, 2 and 13

Observations obtained through groundwater elevation monitoring were also supported by laboratory results obtained during the dye study.

4.1.1 Piezometer Clusters with Variable Gradients

Monthly static groundwater elevation measurements identified several piezometer clusters with a fluctuating (reversing) hydraulic gradient, inward hydraulic gradient, or a negligible hydraulic gradient. Accordingly, supplemental evaluation of investigation data was performed for locations where deviation from anticipated behaviors were recorded. This section provides supplemental discussion and evaluation of field observations compiled during the installation, monitoring, and dye testing of the piezometers in the following locations:

- CPZ: 16, 19, 22, 23, 26, 27, 28, 29, 33, 40
- WPZ: 3

Piezometer Installation. Prior to piezometer installation, several exploratory soil borings were advanced in the investigation area using DPT to verify UGSW location and aid placement of piezometer pairs. During UGSW exploratory borings nearby piezometer cluster CPZ-28, a fine- to coarse-grained sand lens

approximately 3.25 feet thick was encountered from 15 to 18.25 feet bgs, overlying the till surface. Based on this observation, it appears that the UGSW is not keyed into the till at this location. Rather, as shown in Figure 4-2, the sand lens fills a cut channel in the till; this location also represents the lowest till surface elevation measured by this study along the UGSW. The sand lens was similarly observed in borings CPZ-28I (west of UGSW) and CPZ-28X (east of UGSW). Field observations and elevation measurements obtained for each stratigraphic unit encountered, strongly suggests that the sand lens extends beneath the UGSW, resulting in an apparent "breach." The north-south extent of the breach is currently unknown, but likely extends beyond CPZ-28 in both directions.

Static Elevation Monitoring. Groundwater elevations from piezometers north and south of piezometer CPZ-28I were reviewed to further evaluate flow near the presumed CPZ-28 area breach. Static groundwater elevations measured on November 25, 2019, are included in Figures 4-1 and 4-2 to visually illustrate groundwater flow trends in piezometers near the breach. This monitoring event was chosen because the dataset included measurements from the 15 dye IPs and was considered most representative of field conditions given a December 3, 2019, collection date. Based on static groundwater levels measured in piezometers CPZ-24I, CPZ-25I, CPZ-26I, CPZ-27I, CPZ-28I, CPZ-29I, and CPZ-30I, shallow groundwater inside the FPS moves parallel to the UGSW and towards CPZ-28I. As noted previously, groundwater elevation in CPZ-28I was lower than surrounding conditions; direct measurement returned the lowest groundwater elevation measured during the study at 722.93 feet above mean sea level. The observed elevation measurements indicate that local shallow groundwater is flowing towards the suspected UGSW breach identified nearby CPZ-28I.

Dye originating from IP piezometers CPZ-26IP and/or CPZ-29IP might have migrated towards piezometer CPZ-28I and eventually exited the UGSW breach. At this point, the dye could potentially intermix with shallow groundwater outside of the UGSW and follow the general flow patterns previously identified (north-northeast) beneath the residential ANP. Dispersion effects could help spread the dye in the general direction of piezometer CPZ-26X, which therefore could have caused the positive D&C red 28 dye detection. The data indicate that the dye would have arrived within the initial 16-day period following injection. The data also indicate that the dye detected at CPZ-26X was dispersed and undetectable by January 2, 2020.

Transient Elevation Monitoring. From March 13, 2020, through May 21, 2020, groundwater elevations were automatically measured and recorded hourly in 10 piezometer clusters (CPZ-16, CPZ-19, CPZ-21, and CPZ-25 through CPZ-31) using electronic datalogger pressure transducers. Temporal groundwater elevation trends were previously discussed and are presented in Figures 3-5 through 3-14. The focus of this investigation was to evaluate flow near the suspected breach, including how precipitation events affect the hydraulic gradients between piezometers inside and outside the UGSW. The following conclusions were established following detailed water-level data review:

- During precipitation events, groundwater elevations inside and outside of the UGSW generally increase to varying degrees, but quickly subside soon thereafter.
- Hydraulic gradient reversals along the UGSW generally occur following heavy precipitation events; this observation is directly attributed to groundwater recharge in areas outside of the clay cap, which covers most areas on the Velsicol Superfund Site. Recharge is more pronounced in groundwater elevations measured in exterior (X) piezometers compared to interior (I) piezometers, and significant mounding of groundwater was measured at some exterior UGSW locations. These hydraulic gradient reversal events were common following precipitation events and are not indicative of slurry wall leakage or failure.
- Numerous piezometer clusters (CPZ-16, CPZ-19, CPZ-21 through CPZ-27, CPZ-30, CPZ-31, CPZ-33, and CPZ-40; and WPZ-3) indicate that the UGSW is performing as designed in these locations.

- Groundwater data collected during 10-week transient groundwater elevation monitoring at piezometer cluster CPZ-28 also supports the presence of a UGSW breach located between piezometer clusters CPZ-27 and CPZ-29. Water elevation measurements obtained by the pressure transducers (Graph 3-11) at CPZ-28 confirm that piezometers located inside and outside the FPS are in direct hydraulic connection.
- The apparent inward hydraulic gradient identified at piezometer cluster CPZ-29 may not fully reflect the local groundwater conditions due the proximity of the interior (I) piezometer (CPZ-29I) to the suspected UGSW breach area (CPZ-28). Unlike other interior locations studied, shallow groundwater at CPZ-29I is unable to mound up against the UGSW. Rather, groundwater elevation head in the area surrounding CPZ-29I is rapidly equalized, through the nearby breach, which provides an outlet for shallow groundwater discharge. This hypothesis further supports observation of higher groundwater elevation measurements in the exterior (X) piezometer at CPZ-29 over the entire continuous monitoring period.

Dye-Tracer Study. During the dye-tracer study, D&C red 28 dye was detected in charcoal dye receptors in exterior (X) piezometer CPZ-26X, which was deployed on December 3 and 17, 2019. The detection of dye outside the UGSW confirms the potential for migration of shallow groundwater through or beneath the barrier. The circumstances of dye detection suggest that the dye originated from its paired IP piezometer inside the wall, considering dye was also detected in piezometer CPZ-26I, which is located only 5 feet east of IP piezometer CPZ-26IP. On September 23, 2019, and November 25, 2019, prior to the dye injection event, groundwater elevation measurements from piezometer cluster CPZ-26 showed a significant difference between the interior (I) and exterior (X) locations. Differential groundwater elevations of 5.39 and 5.94 feet were measured at each monitoring date, respectively. Observation of steep and positive hydraulic gradient values strongly suggest that the UGSW is performing as designed in proximity to this monitoring location. Coincidental measurement of UGSW hydraulic conductivity nearby piezometer cluster CPZ-26 returned a value of $3.13E^{-7}$ cm/sec, which meets the 10^{-7} design specifications established for slurry wall construction. Although laboratory testing confirmed the presence of D&C red 28 dye outside the UGSW in exterior (X) piezometer CPZ-26X, it is unlikely that the dye migrated directly through the slurry wall from the associated IP (CPZ-26IP).

SECTION 5

Conclusions

Field observations and data collected during this RDI indicate that the UGSW is performing as designed in most locations evaluated. Specifically, water-level elevation measurements and dye testing results suggest that the UGSW acts as a hydraulic barrier to shallow groundwater flow in the areas characterized by piezometer clusters CPZ-1 through CPZ-27, and CPZ-29 through CPZ-42. Anomalies consistent with a potential breach in the UGSW, however, were observed during the investigation between piezometer clusters CPZ-27 and CPZ-29. The potential for an UGSW breach in this area of the site is supported by the following lines of evidence:

- The lithology encountered in UGSW boring "CPZ-28 Slurry Wall" includes a 3.25-foot-thick sand lens between the bottom of the slurry wall and the top the till. The sand lens observations indicate that the slurry wall is not keyed into the till at this location.
- Groundwater elevations from piezometers CPZ-24I to CPZ-28I and CPZ-30I to CXPZ-28I confirm shallow groundwater flow south and north, respectively. Groundwater flow is parallel to the UGSW in these piezometer groupings, allowing these streams to congregate towards piezometer CPZ-28I, where the presence of sand (beneath the UGSW) was confirmed by DPT boring "CPZ-28 Slurry Wall" (see Figure 4-1).
- Between September 2019 and February 2020, the hydraulic gradients calculated for the CPZ-28 interior (I) and exterior (X) piezometers were negligible, indicating that the piezometer pair may be in direct hydraulic connection despite their locations relative to UGSW alignment.
- Water-level measurements collected between March 13 and May 21 during a 10-week transient groundwater elevation monitoring investigation at CPZ-28I and CPZ-28X returned nearly identical results to the static level measurements previously described further supporting the conclusion these locations were hydraulically connected.
- The presence of D&C red 28 dye in exterior (X) piezometer CPZ-26X confirmed that the UGSW is not acting as a hydraulic barrier to groundwater flow near piezometer cluster CPZ-28. These piezometers are adjacent to the DPT boring location where the presence of sand was directly observed below the slurry wall. Collectively these data support the conclusion that D&C red 28 dye injected in piezometers CPZ-26IP and/or CPZ-29IP resulted in the positive dye test observation at piezometer CPZ-26X.

SECTION 6

Recommendations

Based on the results of the UGSW RDI, supplemental investigative work is recommended to: (1) define the origin and pathway(s) of the D&C 28 red dye identified in exterior (X) piezometer CPZ-26X, (2) define the lateral extent of the UGSW breach identified between piezometer clusters CPZ-27 and CPZ-29, and (3) gain a better understanding of groundwater flow trends near the UGSW breach. The supplemental work will likely include the following tasks:

- Installation of additional UGSW location borings to visually confirm the presence or absence of the slurry wall, sand lens, and till contact elevations.
- Installation of additional piezometer clusters in the focused study area of the UGSW.
- Collection of additional groundwater level measurements.
- Completion of long-term groundwater level measurements with data loggers.
- Completion of a focused dye-tracer study in the CPZ-28 area using new and existing piezometer pairs.

SECTION 7

References

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Tables

Table 2-1. UGSW Piezometer and Slurry Wall Location Survey Data

Velsicol Chemical Corporation Superfund Site

Location ID	Northing	Easting	Elevation
CPZ-1X	697011.81	13058067.28	730.26
CPZ-1I	697011.69	13058063.75	730.62
CPZ-1IP	697011.86	13058061.57	730.61
Slurry Wall1	697012.11	13058065.75	727.44
CPZ-2X	696941.49	13058071.74	730.98
CPZ-2I	696942.10	13058061.56	731.55
Slurry Wall2	696941.85	13058066.66	728.46
CPZ-3X	696878.63	13058047.06	728.69
CPZ-3I	696889.10	13058046.17	732.02
Slurry Wall3	696883.76	13058047.07	729.00
CPZ-4X	696879.73	13057979.41	732.52
CPZ-4I	696885.88	13057978.84	733.11
CPZ-4IP	696888.15	13057978.72	733.00
Slurry Wall4	696882.38	13057978.95	729.72
CPZ-5X	696878.43	13057907.14	732.48
CPZ-5I	696888.26	13057906.05	733.39
Slurry Wall5	696883.48	13057907.21	730.10
CPZ-6X	696877.09	13057837.32	732.08
CPZ-6I	696886.68	13057839.95	733.20
Slurry Wall6	696882.45	13057837.01	729.80
CPZ-7X	696876.51	13057773.63	731.78
CPZ-7I	696886.75	13057774.13	732.60
Slurry Wall7	696881.90	13057773.78	729.51
CPZ-8X	696881.11	13057673.30	732.45
CPZ-8I	696884.32	13057672.61	732.58
CPZ-8IP	696886.37	13057672.01	729.86
Slurry Wall8	696882.54	13057672.83	729.69
CPZ-9X	696877.82	13057534.13	731.99
CPZ-9I	696883.86	13057534.04	732.63
CPZ-9IP	696886.00	13057533.87	732.69
Slurry Wall9	696881.18	13057534.04	729.36
CPZ-10X	696875.07	13057463.37	731.47
CPZ-10I	696884.00	13057462.42	732.71
Slurry Wall10	696879.66	13057462.84	729.27
CPZ-11X	696873.41	13057384.83	731.35
CPZ-11I	696883.44	13057385.41	732.67
Slurry Wall11	696878.19	13057385.06	729.27
CPZ-12X	696877.64	13057314.31	732.02
CPZ-12I	696882.01	13057314.24	732.45
CPZ-12IP	696884.15	13057313.96	732.74
Slurry Wall12	696879.59	13057314.03	729.28

Table 2-1. UGSW Piezometer and Slurry Wall Location Survey Data

Velsicol Chemical Corporation Superfund Site

Location ID	Northing	Easting	Elevation
CPZ-13X	696874.46	13057248.72	731.58
CPZ-13I	696883.98	13057247.66	732.71
Slurry Wall13	696879.49	13057248.17	729.33
CPZ-14X	696833.88	13057211.13	731.94
CPZ-14I	696835.12	13057207.06	732.44
CPZ-14IP	696835.71	13057205.47	732.60
Slurry Wall14	696834.15	13057209.58	729.14
CPZ-15X	696749.84	13057214.69	731.26
CPZ-15I	696751.13	13057204.91	732.03
Slurry Wall15	696750.40	13057209.68	728.59
CPZ-16X	696696.26	13057214.32	730.79
CPZ-16I	696697.12	13057207.27	731.25
Slurry Wall16	696696.39	13057208.96	728.27
CPZ-17X	696622.96	13057212.01	729.93
CPZ-17I	696623.13	13057207.96	730.36
CPZ-17IP	696623.13	13057205.68	730.43
Slurry Wall17	696623.27	13057209.26	727.29
CPZ-18X	696553.29	13057213.03	729.75
CPZ-18I	696554.41	13057203.09	730.73
Slurry Wall18	696554.53	13057208.04	727.35
CPZ-19X	696491.35	13057213.16	730.11
CPZ-19I	696492.37	13057203.16	730.92
Slurry Wall19	696491.95	13057207.95	727.68
CPZ-20X	696421.92	13057213.78	727.99
CPZ-20I	696422.18	13057207.65	731.31
CPZ-20IP	696422.06	13057205.46	731.50
Slurry Wall20	696421.80	13057210.76	728.25
CPZ-21X	696399.37	13057189.72	731.24
CPZ-21I	696409.23	13057190.86	731.65
Slurry Wall21	696404.51	13057190.47	728.49
CPZ-22X	696396.21	13057125.41	731.12
CPZ-22I	696404.68	13057125.16	732.07
Slurry Wall22	696403.29	13057125.74	729.04
CPZ-23X	696386.05	13057055.33	733.01
CPZ-23I	696386.56	13057049.04	733.72
CPZ-23IP	696386.99	13057047.10	733.84
Slurry Wall23	696385.74	13057052.61	730.39
CPZ-24X	696318.28	13057058.34	733.42
CPZ-24I	696318.45	13057048.78	734.16
Slurry Wall24	696318.03	13057053.39	731.02
CPZ-25X	696239.87	13057057.55	734.40

Table 2-1. UGSW Piezometer and Slurry Wall Location Survey Data

Velsicol Chemical Corporation Superfund Site

Location ID	Northing	Easting	Elevation
CPZ-25I	696240.30	13057047.92	735.05
Slurry Wall25	696239.73	13057052.97	731.77
CPZ-26X	696169.83	13057054.51	731.73
CPZ-26I	696169.96	13057048.51	735.15
CPZ-26IP	696169.87	13057046.37	735.08
Slurry Wall26	696170.08	13057052.19	731.99
CPZ-27X	696097.76	13057054.07	734.59
CPZ-27I	696098.26	13057047.67	735.06
Slurry Wall27	696098.12	13057052.21	731.71
CPZ-28X	696027.12	13057056.18	734.89
CPZ-28I	696027.09	13057052.28	735.29
Slurry Wall28	696027.44	13057053.96	732.36
CPZ-29X	695955.38	13057057.72	735.92
CPZ-29I	695955.43	13057052.33	736.60
CPZ-29IP	695955.52	13057048.70	736.52
Slurry Wall29	695955.85	13057054.67	733.20
CPZ-30X	695884.81	13057059.91	735.84
CPZ-30I	695884.99	13057049.92	736.82
Slurry Wall30	695885.79	13057054.84	733.41
CPZ-31X	695816.87	13057059.16	736.13
CPZ-31I	695815.77	13057052.43	736.83
Slurry Wall31	695816.57	13057055.23	733.78
CPZ-32X	695738.82	13057058.44	736.53
CPZ-32I	695738.55	13057052.43	737.59
CPZ-32IP	695738.50	13057050.81	737.81
Slurry Wall32	695739.09	13057055.35	733.99
CPZ-33X	695674.21	13057061.68	736.35
CPZ-33I	695673.74	13057053.93	737.41
Slurry Wall33	695674.06	13057056.75	734.00
CPZ-34X	695608.38	13057059.29	737.15
CPZ-34I	695609.46	13057049.34	738.21
Slurry Wall34	695608.68	13057054.95	734.52
CPZ-35X	695541.79	13057060.37	737.71
CPZ-35I	695542.26	13057051.46	738.41
Slurry Wall35	695542.59	13057053.74	735.36
CPZ-36X	695477.24	13057054.87	737.80
CPZ-36I	695477.12	13057048.74	737.83
CPZ-36IP	695476.87	13057046.93	735.30
Slurry Wall36	695476.54	13057051.82	734.94
CPZ-37X	695456.61	13057018.88	738.74
CPZ-37I	695466.49	13057018.54	739.17

Table 2-1. UGSW Piezometer and Slurry Wall Location Survey Data

Velsicol Chemical Corporation Superfund Site

Location ID	Northing	Easting	Elevation
Slurry Wall37	695461.74	13057019.41	735.88
CPZ-38X	695458.04	13056885.14	734.71
CPZ-38I	695464.52	13056884.32	737.41
CPZ-38IP	695466.87	13056884.03	737.49
Slurry Wall38	695461.75	13056885.72	734.82
CPZ-39X	695455.36	13056815.97	736.77
CPZ-39I	695465.36	13056816.47	736.82
Slurry Wall39	695460.14	13056816.02	733.88
CPZ-40X	695458.20	13056726.99	735.79
CPZ-40I	695464.27	13056726.83	735.78
CPZ-40IP	695466.67	13056726.65	735.67
Slurry Wall40	695461.71	13056727.00	732.74
CPZ-41X	695457.11	13056654.90	734.56
CPZ-41I	695466.88	13056656.24	735.06
Slurry Wall41	695462.16	13056656.09	731.95
CPZ-42X	695454.99	13056630.51	733.91
CPZ-42I	695469.17	13056627.90	735.20
Slurry Wall42	695462.33	13056630.50	731.52

Notes:
Coordinates and elevations based on provided CP 105005 and CP 105004.
Survey date: November 7, 2019.

Table 3-1. Static Groundwater Elevation Data

Velsicol Chemical Corporation Superfund Site

	Groundwater Elevation (feet)						
Well ID	**8/16/2018**	**8/19/2019**	**9/23/2019**	**11/25/2019**	**12/18/2019**	**1/16/2020**	**2/11/2020**
WPZ-01I	NM	725.68	NM	725.06	724.42	724.02	724.08
WPZ-01X	720.93	720.83	NM	721.09	721.13	721.32	721.18
WPZ-02I	723.99	725.45	NM	725.23	724.66	724.35	724.63
WPZ-02X	721.54	721.63	NM	722.49	722.39	722.82	722.46
WPZ-03I	727.18	727.28	NM	727.44	727.39	727.35	727.74
WPZ-03X	725.38	725.57	NM	728.57	727.57	728.56	727.99
WPZ-13I	723.73	724.90	NM	725.62	725.02	726.50	725.32
WPZ-13X	721.22	721.30	NM	724.63	724.33	723.90	724.59
CPZ-02I	NM	NM	725.85	725.07	724.41	723.98	724.29
CPZ-02X	NM	NM	719.76	719.74	719.71	719.97	719.75
CPZ-03I	NM	NM	725.85	725.08	724.44	724	724.27
CPZ-03X	NM	NM	717.05	717.15	717.16	717.36	717.19
CPZ-05I	NM	NM	725.86	725.13	724.45	723.99	724.24
CPZ-05X	NM	NM	720.46	720.5	720.55	720.85	720.61
CPZ-06I	NM	NM	725.86	725.16	724.49	724.01	724.27
CPZ-06X	NM	NM	720.7	720.65	720.35	721.03	720.8
CPZ-07I	NM	NM	725.9	725.14	724.50	724.07	724.29
CPZ-07X	NM	NM	720.77	719.8	720.83	720.13	720.9
CPZ-10I	NM	NM	726.15	725.08	724.49	724.07	724.23
CPZ-10X	NM	NM	722.02	721.71	721.72	721.93	721.77
CPZ-11I	NM	NM	726.12	725	724.44	724.01	724.22
CPZ-11X	NM	NM	722.51	721.98	721.98	722.25	722.06
CPZ-13I	NM	NM	725.9	725.08	724.51	724.12	724.4
CPZ-13X	NM	NM	723.33	722.56	722.45	722.79	722.54
CPZ-15I	NM	NM	725.77	725.76	725.10	724.93	725.16
CPZ-15X	NM	NM	723.6	723.14	722.83	723.37	722.95
CPZ-16I	NM	NM	725.71	725.81	725.13	725.01	725.29
CPZ-16X	NM	NM	724.36	723.91	725.70	724.15	723.41
CPZ-18I	NM	NM	725.06	725.7	725.14	725.04	725.23
CPZ-18X	NM	NM	722.79	725.16	724.66	724.95	724.83
CPZ-19I	NM	NM	725.02	725.83	725.27	725.23	725.52
CPZ-19X	NM	NM	725.2	725.42	724.71	725.3	724.99
CPZ-21I	NM	NM	725.58	725.79	725.12	725.36	726.47
CPZ-21X	NM	NM	724.31	723.52	723.37	723.95	723.54
CPZ-22I	NM	NM	725.43	725.84	725.24	725.33	725.53
CPZ-22X	NM	NM	726.96	724.31	723.65	725.96	723.88
CPZ-24I	NM	NM	725.3	725.77	725.63	725.6	726.02
CPZ-24X	NM	NM	723.92	723.47	723.19	723.87	723.3
CPZ-25I	NM	NM	725.35	725.71	725.63	725.67	726
CPZ-25X	NM	NM	722.99	722.72	722.75	722.9	722.75

Table 3-1. Static Groundwater Elevation Data

Velsicol Chemical Corporation Superfund Site

	Groundwater Elevation (feet)						
Well ID	**8/16/2018**	**8/19/2019**	**9/23/2019**	**11/25/2019**	**12/18/2019**	**1/16/2020**	**2/11/2020**
CPZ-27I	NM	NM	724.9	725.18	725.18	725.51	725.69
CPZ-27X	NM	NM	730.07	725.23	724.64	725.45	724.95
CPZ-28I	NM	NM	722.9	722.93	722.99	723.07	723
CPZ-28X	NM	NM	722.88	722.89	722.98	723.06	722.97
CPZ-30I	NM	NM	732.98	729.18	725.95	726.42	726.22
CPZ-30X	NM	NM	727.46	724.1	723.97	724.18	724.15
CPZ-31I	NM	NM	725.61	726.87	726.88	727.18	727.56
CPZ-31X	NM	NM	721.29	723.04	722.96	723.14	723.11
CPZ-33I	NM	NM	725.5	726.12	726.18	726.25	726.83
CPZ-33X	NM	NM	Dry	722.66	724.02	731.35	727.74
CPZ-34I	NM	NM	726.85	727.18	727.09	726.96	727.48
CPZ-34X	NM	NM	722.74	724.38	724.33	724.41	724.43
CPZ-35I	NM	NM	727.52	728.06	727.93	727.78	728.31
CPZ-35X	NM	NM	Dry	724.68	724.76	724.73	724.83
CPZ-37I	NM	NM	726.89	728.08	728.01	728.08	728.32
CPZ-37X	NM	NM	Dry	725.37	725.36	725.49	725.47
CPZ-39I	NM	NM	724.14	727.63	727.77	727.83	728.03
CPZ-39X	NM	NM	723.49	726.08	725.51	726.71	726.05
CPZ-41I	NM	NM	723.67	728.1	727.39	728.54	727.64
CPZ-41X	NM	NM	721.72	724.92	724.67	725.57	725
Dye Test Piezometers							
CPZ-01I	NM	NM	725.83	725.04	NM	NM	NM
CPZ-01X	NM	NM	719.82	719.54	NM	NM	NM
CPZ-04I	NM	NM	725.83	725.11	NM	NM	NM
CPZ-04X	NM	NM	720.24	720.29	NM	NM	NM
CPZ-08I	NM	NM	726.03	725.12	NM	NM	NM
CPZ-08X	NM	NM	721.52	721.55	NM	NM	NM
CPZ-09I	NM	NM	726.18	725.16	NM	NM	NM
CPZ-09X	NM	NM	721.84	721.43	NM	NM	NM
CPZ-12I	NM	NM	725.94	724.74	NM	NM	NM
CPZ-12X	NM	NM	722.98	722.18	NM	NM	NM
CPZ-14I	NM	NM	725.76	725.56	NM	NM	NM
CPZ-14X	NM	NM	723.49	722.74	NM	NM	NM
CPZ-17I	NM	NM	724.82	725.48	NM	NM	NM
CPZ-17X	NM	NM	723.87	724.75	NM	NM	NM
CPZ-20I	NM	NM	722.68	725.84	NM	NM	NM
CPZ-20X	NM	NM	722.28	721.77	NM	NM	NM
CPZ-23I	NM	NM	725.34	725.79	NM	NM	NM
CPZ-23X	NM	NM	728.27	727.56	NM	NM	NM
CPZ-26I	NM	NM	725.41	725.67	NM	NM	NM

Table 3-1. Static Groundwater Elevation Data

Velsicol Chemical Corporation Superfund Site

	Groundwater Elevation (feet)						
Well ID	**8/16/2018**	**8/19/2019**	**9/23/2019**	**11/25/2019**	**12/18/2019**	**1/16/2020**	**2/11/2020**
CPZ-26X	NM	NM	720.02	719.73	NM	NM	NM
CPZ-29I	NM	NM	723.14	723.31	NM	NM	NM
CPZ-29X	NM	NM	720.41	725.32	NM	NM	NM
CPZ-32I	NM	NM	725.7	726.88	NM	NM	NM
CPZ-32X	NM	NM	722.82	723.14	NM	NM	NM
CPZ-36I	NM	NM	727.2	728.21	NM	NM	NM
CPZ-36X	NM	NM	Dry	724.32	NM	NM	NM
CPZ-38I	NM	NM	727.7	728.06	NM	NM	NM
CPZ-38X	NM	NM	724.9	726.90	NM	NM	NM
CPZ-40I	NM	NM	720.58	727.82	NM	NM	NM
CPZ-40X	NM	NM	722.3	728.70	NM	NM	NM

NM = not measured

Table 3-2. Dye-Tracer Study Results

Velsicol Chemical Corporation Superfund Site

Test Location	Date	Time	Result	Concentration (ppb)	Peak Center (nm)
CPZ-01I	10/21/19	10:06	ND		
	12/17/19	10:06	ND		
	01/02/20	10:31	+++	5,131	565.2
	01/15/20	10:03	+++	11,130	565.4
	01/29/20	10:15	+++	3,646	565.2
	02/10/20	9:25	+++	15,146	565.2
	02/24/20	14:36	+++	67,542	565.2
CPZ-01X	10/21/19	10:05	ND		
	12/17/19	10:05	ND		
	01/02/20	10:28	ND		
	01/15/20	10:09	ND		
	01/29/20	10:20	ND		
	02/10/20	9:32	ND		
	02/24/20	14:41	ND		
CPZ-04I	10/21/19	10:11	ND		
	12/17/19	10:11	ND		
	01/02/20	10:40	ND		
	01/15/20	10:16	ND		
	01/29/20	10:24	ND		
	02/10/20	9:40	ND		
	02/24/20	14:45	ND		
CPZ-04X	10/21/19	10:10	ND		
	12/17/19	10:10	B	0.012	560.0,POR
	01/02/20	10:37	ND		
	01/15/20	10:22	ND		
	01/29/20	10:30	ND		
	02/10/20	9:47	ND		
	02/24/20	14:51	B	0.017	568.8
CPZ-08I	10/21/19	10:18	ND		
	12/17/19	10:18	+++	137,685	565.4
	01/02/20	10:55	+++	1,001,330	565.2
	01/15/20	10:30	+++	428,280	565.4
	01/29/20	10:37	+++	745,920	565.2
	02/10/20	9:52	+++	550,970	565.2
	02/24/20	14:57	+++	1,321,250	565.4
CPZ-08X	10/21/19	10:16	ND		
	12/17/19	10:16	ND		
	01/02/20	10:50	ND		
	01/15/20	10:30	ND		
	01/29/20	10:43	+?	0.857	565.0

Table 3-2. Dye-Tracer Study Results

Velsicol Chemical Corporation Superfund Site

Test Location	Date	Time	Result	Concentration (ppb)	Peak Center (nm)
	02/10/20	10:00	ND		
	02/24/20	15:01	+?	0.450	564.6
CPZ-09I	10/21/19	10:27	ND		
	12/17/19	10:27	+++	51.313	565.2
	01/02/20	11:00	+++	37.590	565.2
	01/15/20	10:41	+++	36.143	565.2
	01/29/20	10:54	+++	433.0	565.4
	02/10/20	10:20	+++	190.5	565.0
	02/24/20	15:04	++	1.319	565.0
CPZ-09X	10/21/19	10:26	ND		
	12/17/19	10:26	ND		
	01/02/20	10:55	ND		
	01/15/20	10:50	ND		
	01/29/20	11:01	ND		
	02/10/20	10:27	ND		
	02/24/20	15:04	ND		
CPZ-12I	10/21/19	10:33	ND		
	12/17/19	10:33	+++	11,229	565.4
	01/02/20	11:04	+++	5,419	565.2
	01/15/20	10:58	+++	1,223	565.2
	01/29/20	11:07	+++	18,499	565.2
	02/10/20	10:36	+++	7,327	565.0
	02/24/20	15:14	+++	21,231	565.2
CPZ-12X	10/21/19	10:31	ND		
	12/17/19	10:31	ND		
	01/02/20	11:00	ND		
	01/15/20	11:07	ND		
	01/29/20	11:14	ND		
	02/10/20	10:42	ND		
	02/24/20	15:18	ND		
CPZ-14I	10/21/19	10:35	ND		
	12/17/19	10:35	ND		
	01/02/20	11:11	ND		
	01/15/20	11:15	ND		
	01/29/20	11:21	ND		
	02/10/20	10:50	ND		
	02/24/20	15:23	ND		
CPZ-14X	10/21/19	10:33	ND		
	12/17/19	10:33	ND		
	01/02/20	11:08	ND		

Table 3-2. Dye-Tracer Study Results

Velsicol Chemical Corporation Superfund Site

Test Location	Date	Time	Result	Concentration (ppb)	Peak Center (nm)
	01/15/20	11:21	+?	5.367	565.2
	01/29/20	11:27	ND		
	02/10/20	10:56	ND		
	02/24/20	15:27	ND		
	10/21/19	10:41	ND		
	12/17/19	10:41	ND		
	01/02/20	11:19	ND		
CPZ-17I	01/15/20	11:29	ND		
	01/29/20	11:34	ND		
	02/10/20	11:01	ND		
	02/24/20	15:32	ND		
	10/21/19	10:40	ND		
	12/17/19	10:40	ND		
	01/02/20	11:13	ND		
CPZ-17X	01/15/20	11:35	ND		
	01/29/20	11:40	ND		
	02/10/20	11:10	ND		
	02/24/20	15:37	ND		
	10/21/19	10:47	ND		
	12/17/19	10:47	ND		
	01/02/20	11:31	ND		
CPZ-20I	01/15/20	11:45	B	0.027	564.0
	01/29/20	11:48	ND		
	02/10/20	11:17	ND		
	02/24/20	15:42	ND		
	10/21/19	10:45	ND		
	12/17/19	10:45	ND		
	01/02/20	11:28	ND		
CPZ-20X	01/15/20	11:54	ND		
	01/29/20	11:53	ND		
	02/10/20	11:23	ND		
	02/24/20	15:46	ND		
	10/21/19	10:56	ND		
	12/17/19	10:56	ND		
	01/02/20	11:43	+++	78,335	565.2
CPZ-23I	01/15/20	12:02	+++	22,155	565.4
	01/29/20	11:59	+++	4,954	565.2
	02/10/20	11:29	+++	2,222	565.2
	02/24/20	15:50	+++	1,963	565.2

Table 3-2. Dye-Tracer Study Results

Velsicol Chemical Corporation Superfund Site

Test Location	Date	Time	Result	Concentration (ppb)	Peak Center (nm)
CPZ-23X	10/21/19	10:54	ND		
	12/17/19	10:54	ND		
	01/02/20	11:37	ND		
	01/15/20	12:09	ND		
	01/29/20	12:08	ND		
	02/10/20	11:35	ND		
	02/24/20	15:55	ND		
CPZ-26I	10/21/19	11:01	ND		
	12/17/19	11:01	+++	105,051	565.4
	01/02/20	11:49	+++	459,900	565.2
	01/15/20	12:15	+++	35,270	565.4
	01/29/20	12:14	+++	117,700	565.2
	02/10/20	11:42	+++	1,904	565.4
	02/24/20	15:59	+++	13,873	565.2
CPZ-26X	10/21/19	10:59	ND		
	12/17/19	10:59	+	0.198	563.4
	01/02/20	11:42	++	2.145	565.2
	01/15/20	12:23	ND		
	01/29/20	12:22	ND		
	02/10/20	11:50	ND		
	02/24/20	16:02	ND		
CPZ-29I	10/21/19	11:09	ND		
	12/17/19	11:09	+?	0.388	565.0
	01/02/20	11:58	B	0.083	564.4
	01/15/20	12:30	B	0.015	563.0
	01/29/20	12:29	+?	0.108	564.4
	02/10/20	11:58	B	0.034	566.2
	02/24/20	16:06	ND		
CPZ-29X	10/21/19	11:07	ND		
	12/17/19	11:07	B	0.060	563.4
	01/02/20	11:55	B	0.064	563.4
	01/15/20	12:35	ND		
	01/29/20	12:36	ND		
	02/10/20	12:06	ND		
	02/24/20	16:11	ND		
CPZ-32I	10/21/19	11:15	ND		
	12/17/19	11:15	+++	65,408	565.4
	01/02/20	12:10	+++	247,350	565.2
	01/15/20	12:44	+++	116,670	565.4
	01/29/20	12:42	+++	69,060	565.2

Table 3-2. Dye-Tracer Study Results

Velsicol Chemical Corporation Superfund Site

Test Location	Date	Time	Result	Concentration (ppb)	Peak Center (nm)
	02/10/20	12:16	+++	88,320	565.2
	02/24/20	16:17	+++	212,960	565.4
CPZ-32X	10/21/19	11:14	ND		
	12/17/19	11:14	B	0.07	564.6
	01/02/20	12:05	+?	0.259	564.8
	01/15/20	12:51	B	0.027	562.6
	01/29/20	12:47	ND		
	02/10/20	12:23	ND		
	02/24/20	16:21	+?	0	563.8
CPZ-36I	10/21/19	11:23	ND		
	12/17/19	11:23	B	0.034	564.0
	01/02/20	12:19	++	3.166	565.2
	01/15/20	12:56	+++	1,299	565.4
	01/29/20	12:54	+++	7436	565.2
	02/10/20	12:37	+++	20634	565.0
	02/24/20	16:24	+++	8,562	565.2
CPZ-36X	10/21/19	11:19	ND		
	12/17/19	11:19	B	0.084	565.2
	01/02/20	12:13	ND		
	01/15/20	13:01	B	0.072	565.8
	01/29/20	13:02	B	0.034	566.2
	02/10/20	12:44	ND		
	02/24/20	16:27	+?	0	565.8
CPZ-38I	10/21/19	11:30	ND		
	12/17/19	11:30	ND		
	01/02/20	12:27	++	2.635	565.2
	01/15/20	13:06	++	3.609	565.0
	01/29/20	13:09	+	0.975	565.2
	02/10/20	12:15	+	0.382	565.0
	02/24/20	16:32	+	0.342	565.0
CPZ-38X	10/21/19	11:28	ND		
	12/17/19	11:28	ND		
	01/02/20	12:22	ND		
	01/15/20	13:14	ND		
	01/29/20	13:14	ND		
	02/10/20	12:23	ND		
	02/24/20	16:37	B	0.015	560.2,POR
CPZ-40I	10/21/19	11:43	ND		
	12/17/19	11:43	ND		

Table 3-2. Dye-Tracer Study Results

Velsicol Chemical Corporation Superfund Site

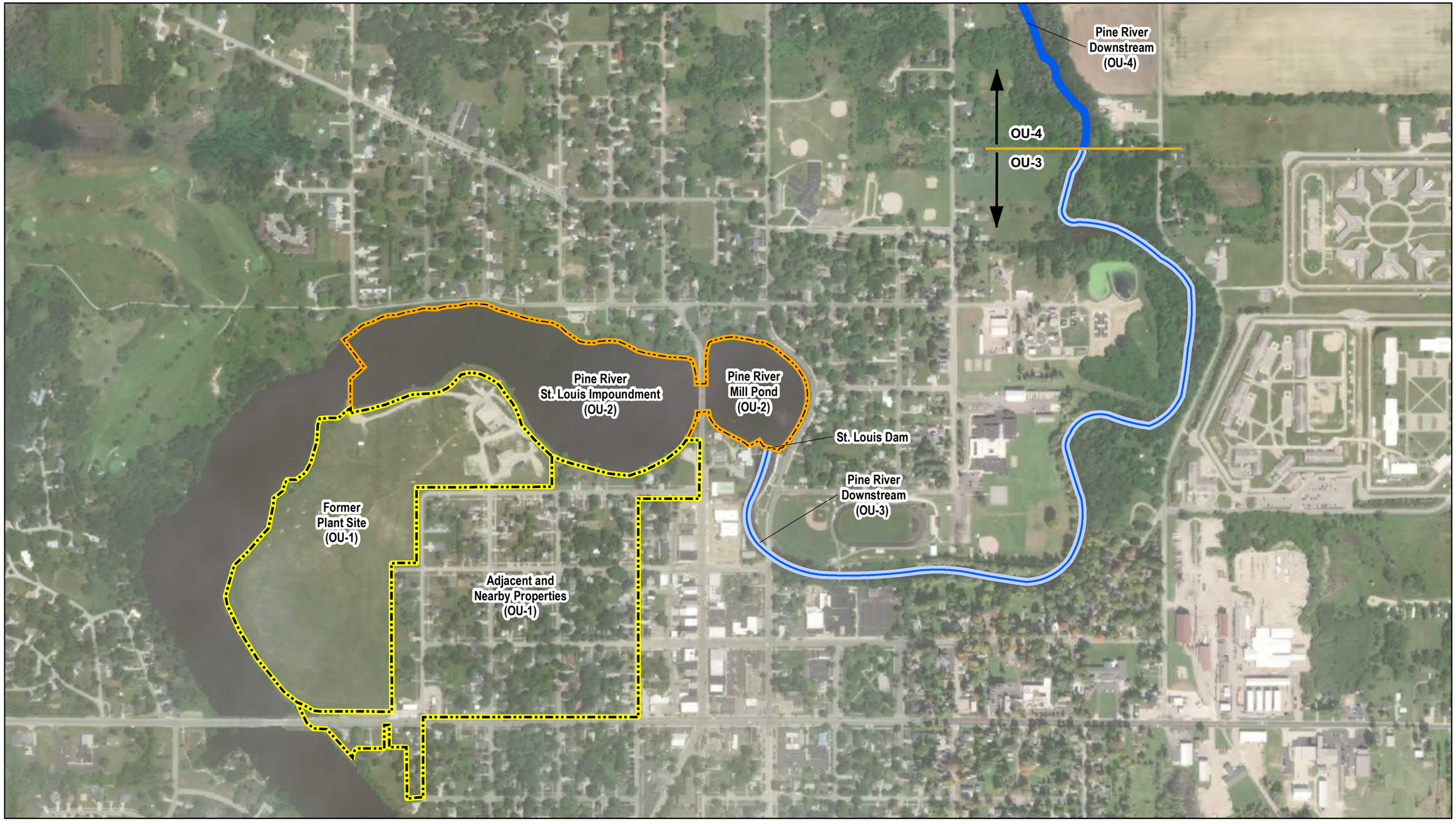
Test Location	Date	Time	Result	Concentration (ppb)	Peak Center (nm)
	01/02/20	12:35	ND		
	01/15/20	13:19	ND		
	01/29/20	13:20	ND		
	02/10/20	12:32	B	0.050	562.2
	02/24/20	16:42	ND		
	10/21/19	11:41	ND		
	12/17/19	11:41	B	0.056	564.4
	01/02/20	12:30	B	0.012	563.4
CPZ-40X	01/15/20	13:29	B	0.033	564.6
	01/29/20	13:26	ND		
	02/10/20	12:41	ND		
	02/24/20	16:48	ND		

Notes:

B = Background (<10 times background or lowest detection limit)
POR = Peak Out of Range (>5nm, <10nm from dye peak center)
ND = No Detection

+ = Positive (10 times background or lowest detection limit)
++ = Very positive (100 times background or lowest detection limit)
+++ = Extremely positive (1000 times background or lowest detection limit)
+? = Questionable Positive, needs two hits in a row to equal +

Figures



Legend

- Former Plant Site and Adjacent and Nearby Properties (OU-1)
- Pine River - St. Louis Impoundment (OU-2)
- Pine River (OU-3)
- Pine River (OU-4)

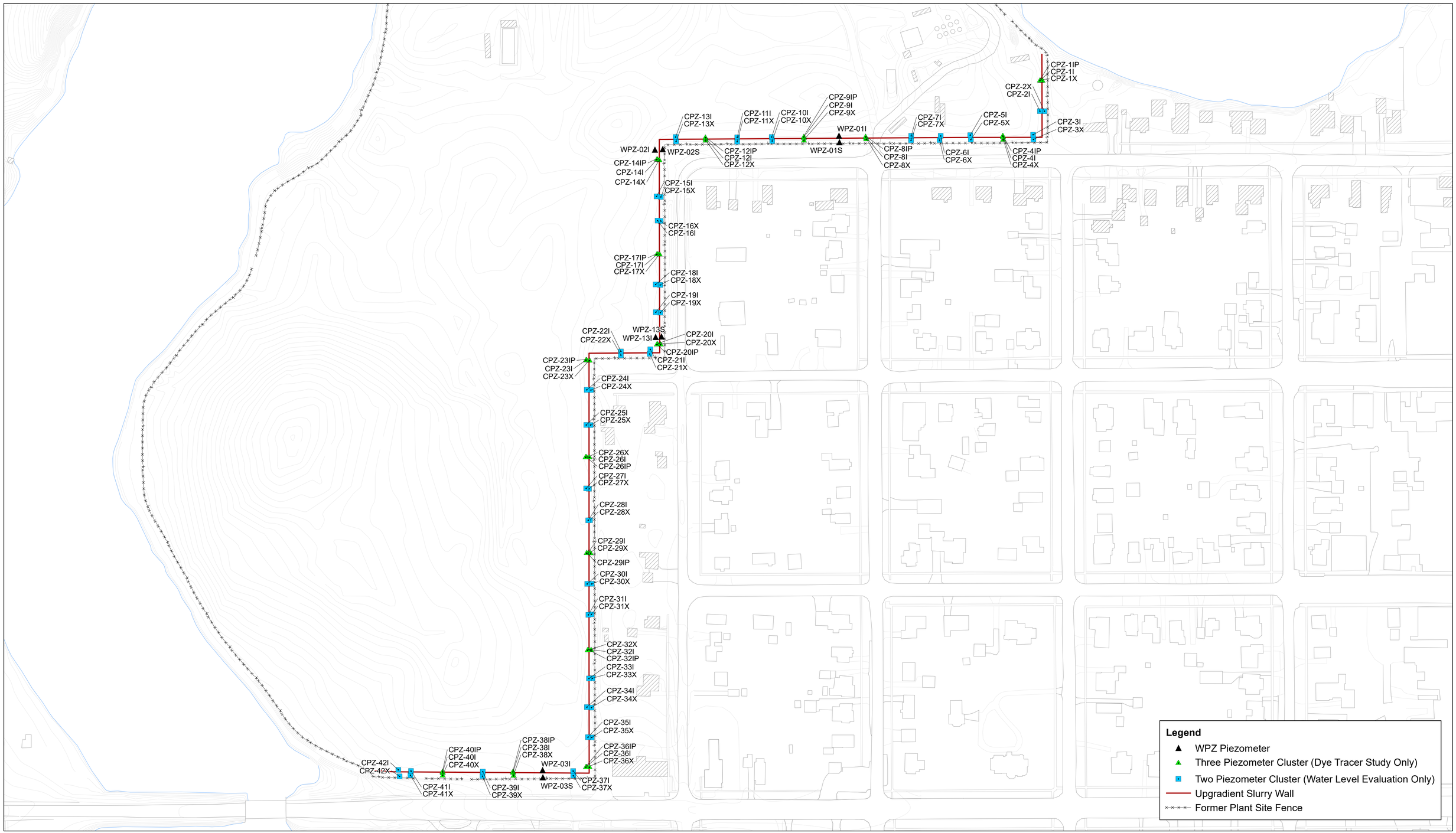
N

0 300 600

Feet

Figure 1-1
Study Areas and Operable Units
Upgradient Slurry Wall Investigation
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

ch2m.



0 100 200
Feet

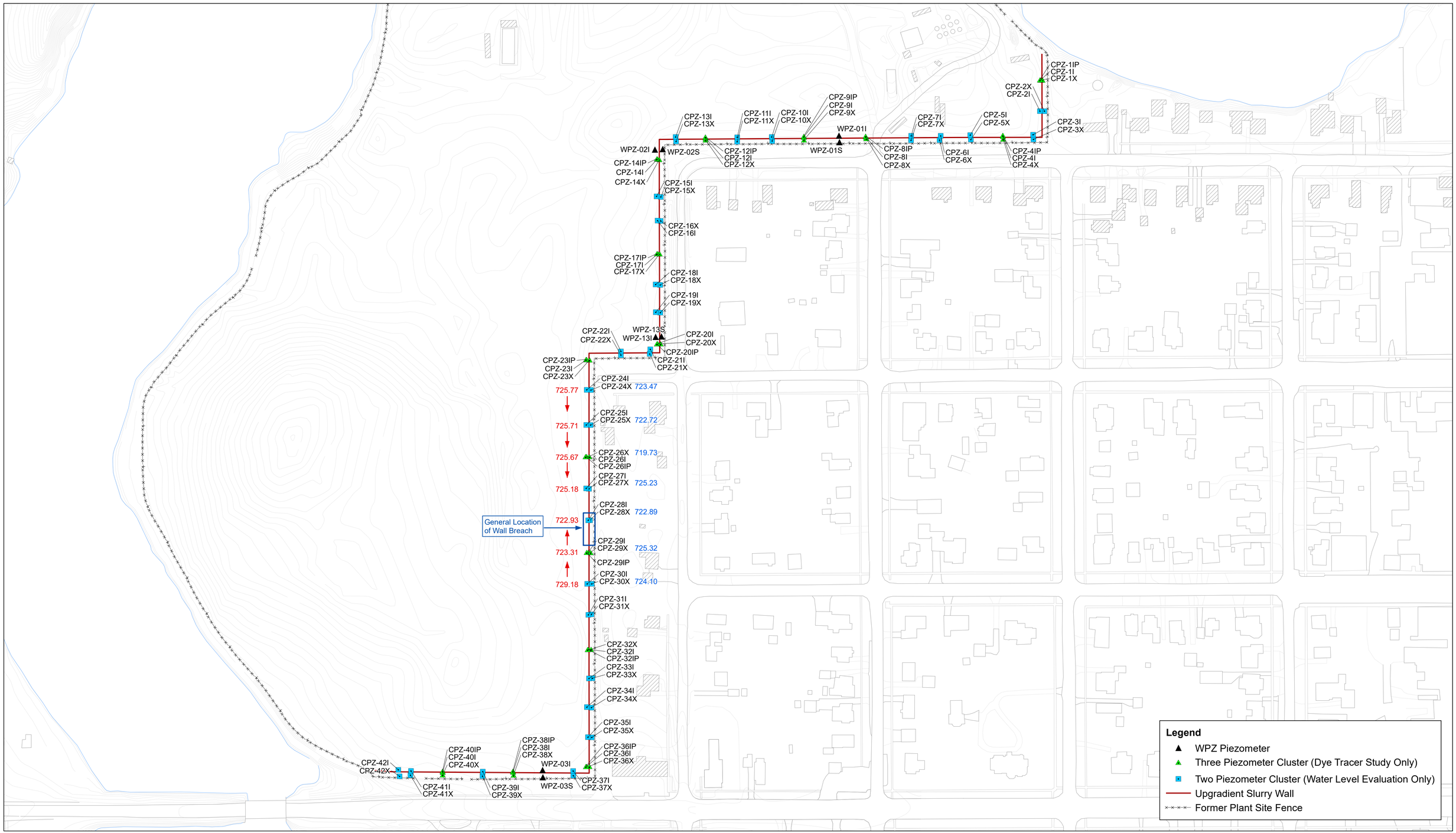
N

NOTES:

1. BASE MAP PROVIDED BY WESTON SOLUTIONS OF MICHIGAN, INC.
2. LAND SURVEY ELEVATIONS WERE REFERENCED TO NAVD OF 1988 FEET MSL. THE HORIZONTAL LOCATIONS WERE REFERENCED TO THE MICHIGAN STATE PLANE COORDINATE SYSTEM NAD83, INTERNATIONAL FEET - SOUTH (2113) ZONE.

FIGURE 2-1
Piezometer Locations
Upgradient Slurry Wall Investigation
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

ch2m



NOTES:

1. BASE MAP PROVIDED BY WESTON SOLUTIONS OF MICHIGAN, INC.
2. GROUNDWATER ELEVATIONS SHOWN WERE MEASURED ON 11/25/2019.
3. LAND SURVEY ELEVATIONS WERE REFERENCED TO NAVD OF 1988 FEET MSL. THE HORIZONTAL LOCATIONS WERE REFERENCED TO THE MICHIGAN STATE PLANE COORDINATE SYSTEM NAD83, INTERNATIONAL FEET - SOUTH (2113) ZONE.

Figure 4-1
Shallow Groundwater Flow between Piezometers CPZ-24I and CPZ-30I
Upgradient Slurry Wall Investigation
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

Document Path: \\dc1vs01\GIS\Proj\EIEPA\Velsicol_SuperfundSite\Reports\2019\UpgradientSlurryWallInvestigation\Maps\ReportIS_Chumney\Ver_6_1\Fig4_1_Vel_UpgradientSlurryWallInvestigation.mxd User Name: SCUTLER1 Date: 7/16/2020 Time: 8:47:42 AM

South

North

Elevation (Feet AMSL)

735
730
725
720
715
710

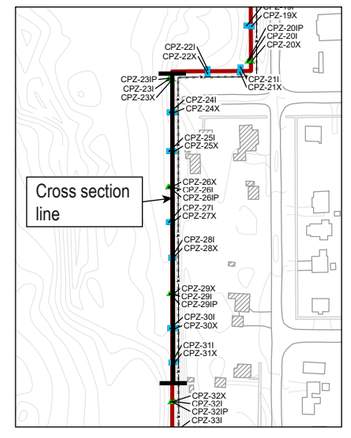
CPZ-31I
CPZ-30I
CPZ-29I
CPZ-28I
CPZ-27I
CPZ-26I
CPZ-25I
CPZ-24I
CPZ-23I

LEGEND

- Silty Clay to Clayey Silt - Cap Material
- Interbedded silty clay, sandy clay and clayey sand; with occasional thin (<2") sand seams (fine grain) present
- Sand - Primarily fine to medium sand with occasional layers of fine to coarse sand and silty sand
- Sandy Silt
- Silty Clay to Clayey Silt with occasional sand and silty sand seams - till
- Soil Boring
- Piezometer Screen Location
- Water Table (Approximate)
- General groundwater flow direction
- Slurry wall vertical extent shown. This boring located 5' east of CPZ-28I
- Extrapolated slurry wall vertical and horizontal extent

Static water table measurements taken on 11/25/2019

Horizontal : 1" = 50'
Vertical: 1.4" = 5'
V.E. = 10x



Note: Stratigraphy lines are based on interpretations between soil borings and represent approximate boundaries. Actual transitions between soil boring locations may vary from those presented in this cross section.

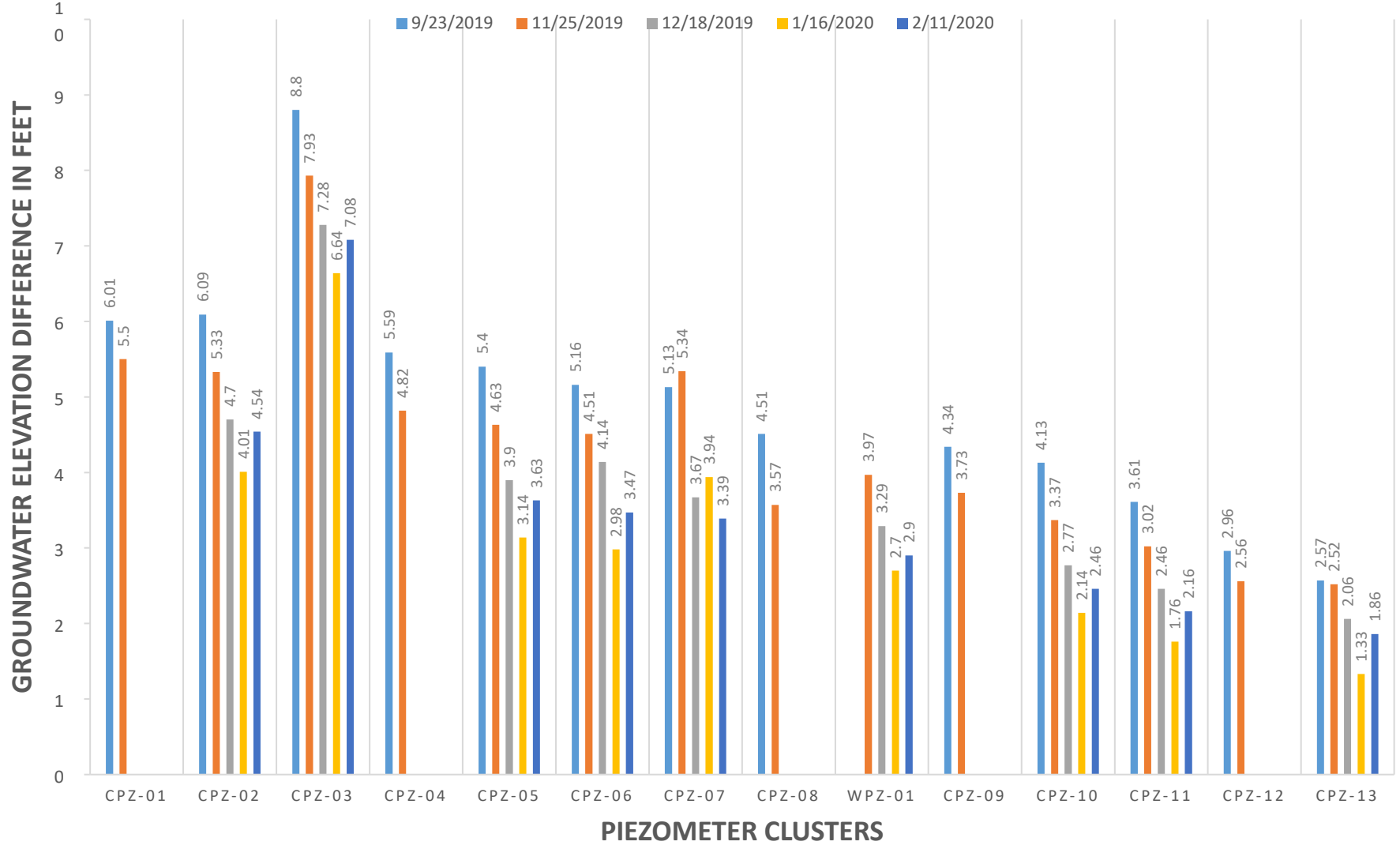
Figure 4-2

North-South Hydrogeologic Cross Section
Upgradient Slurry Wall Investigation
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

ch2m:

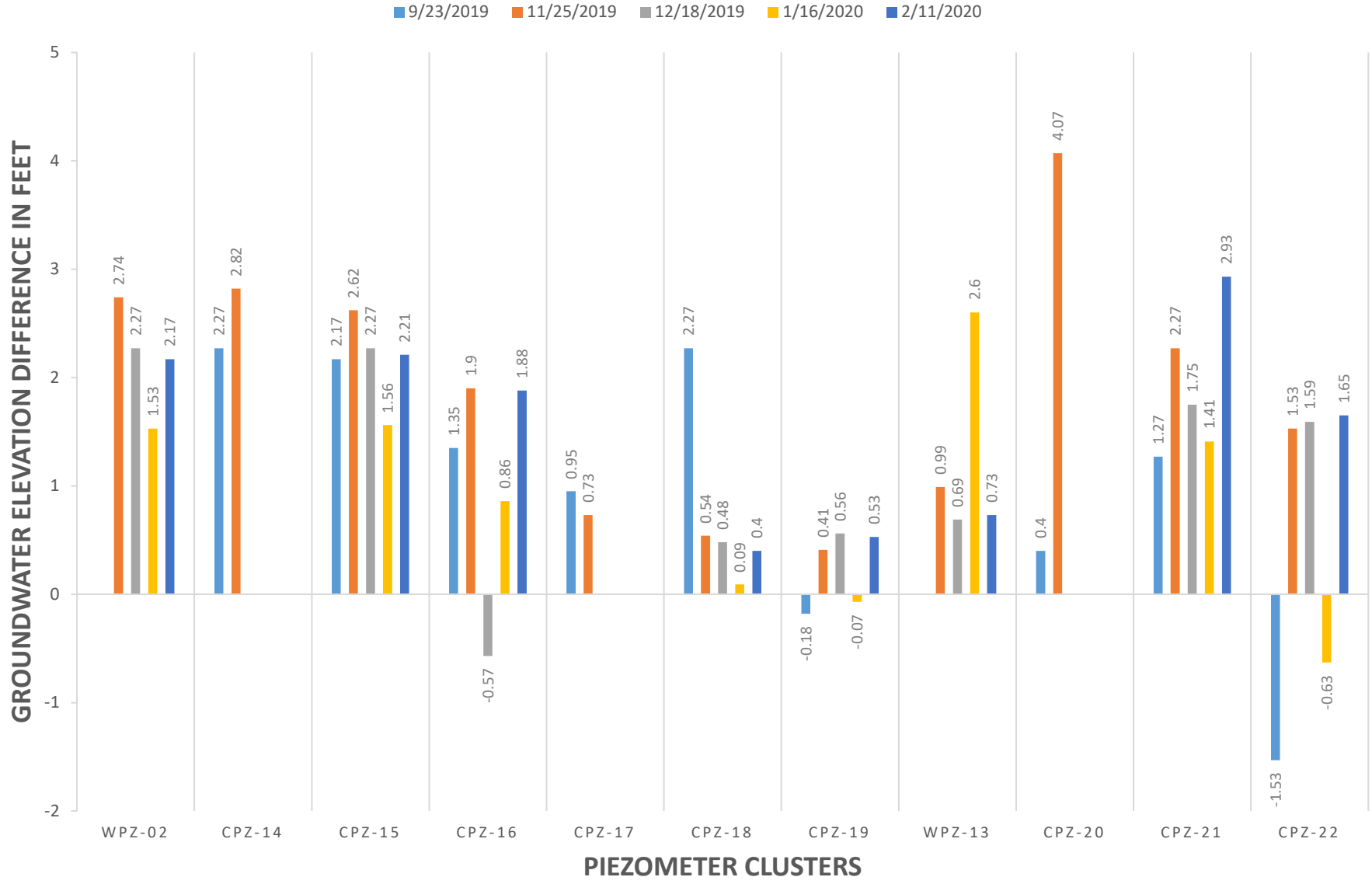
Graphs

GRAPH 3-1 - GROUNDWATER ELEVATION DIFFERENCE
INTERIOR (I) VS EXTERIOR (X) UGSW PIEZOMETERS CLUSTERS 1-13



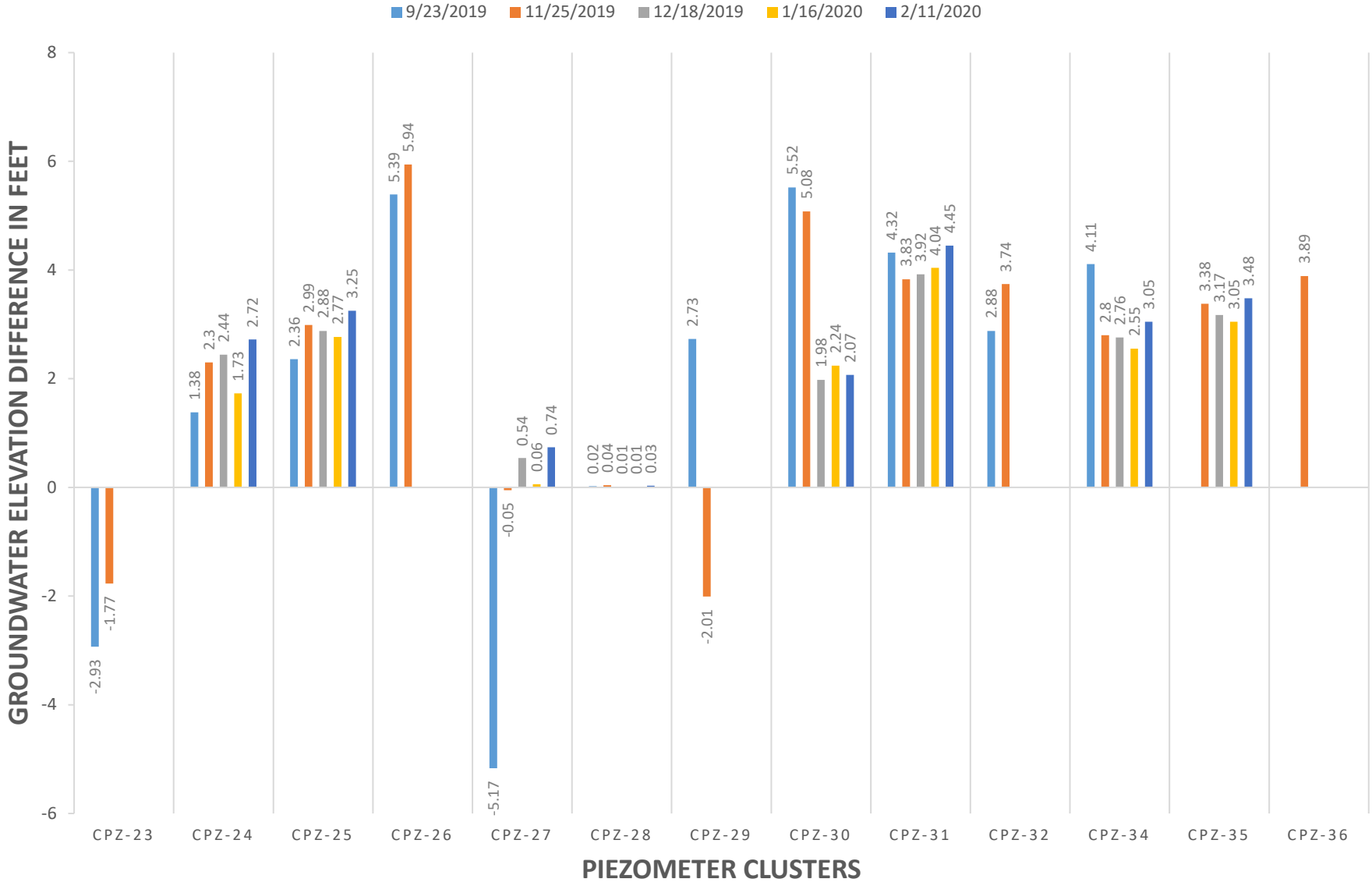
+ Positive value indicates an outward hydraulic gradient (away from the FPS)
- Negative value indicates an inward hydraulic gradient (toward the FPS)

GRAPH 3-2 - GROUNDWATER ELEVATION DIFFERENCE
INTERIOR (I) VS EXTERIOR (X) UGSW PIEZOMETERS CLUSTERS 14-22



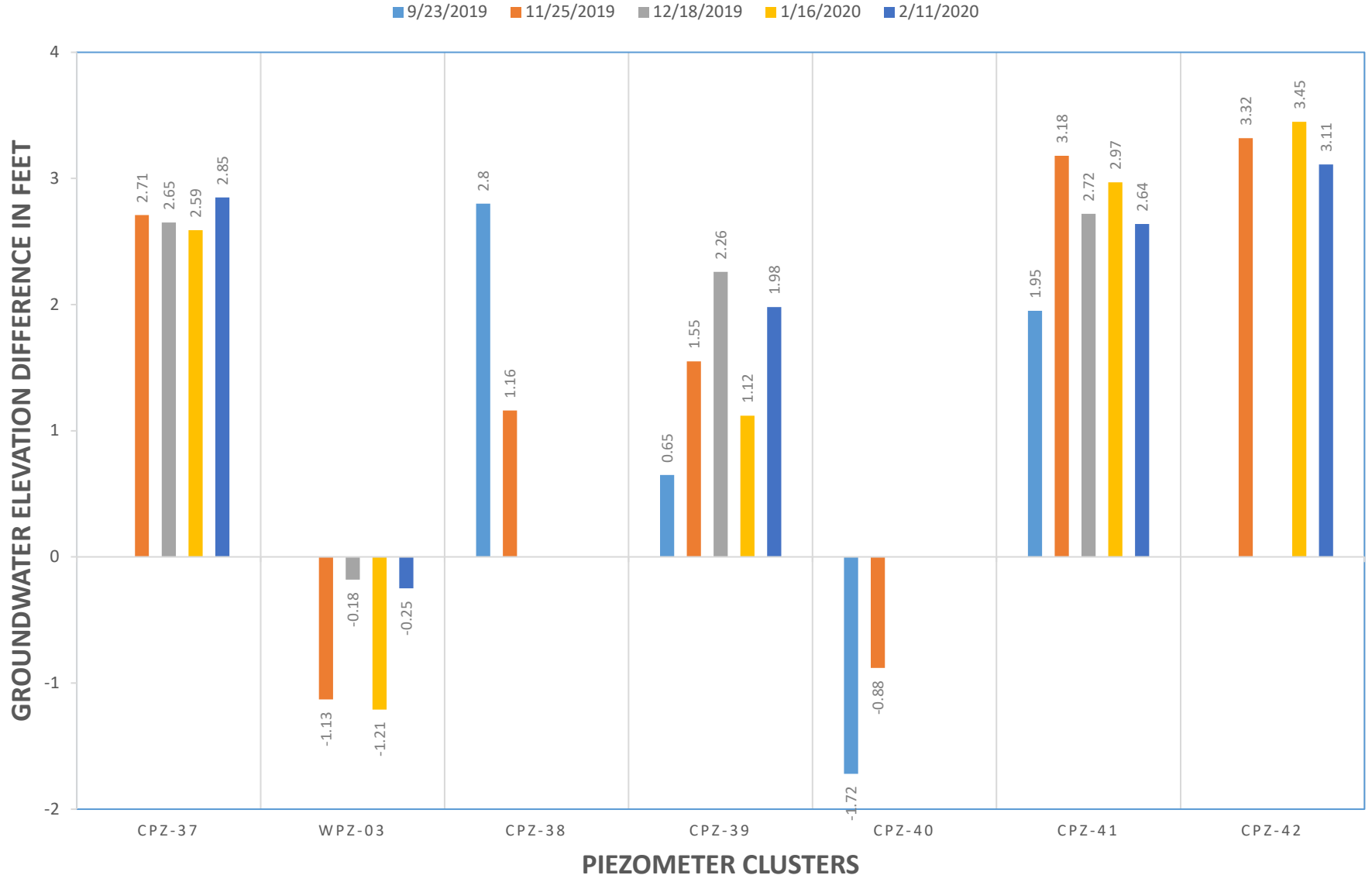
+ Positive value indicates an outward hydraulic gradient (away from the FPS)
- Negative value indicates an inward hydraulic gradient (toward the FPS)

GRAPH 3-3 - GROUNDWATER ELEVATION DIFFERENCE
INTERIOR (I) VS EXTERIOR (X) UGSW PIEZOMETER CLUSTERS 23-36



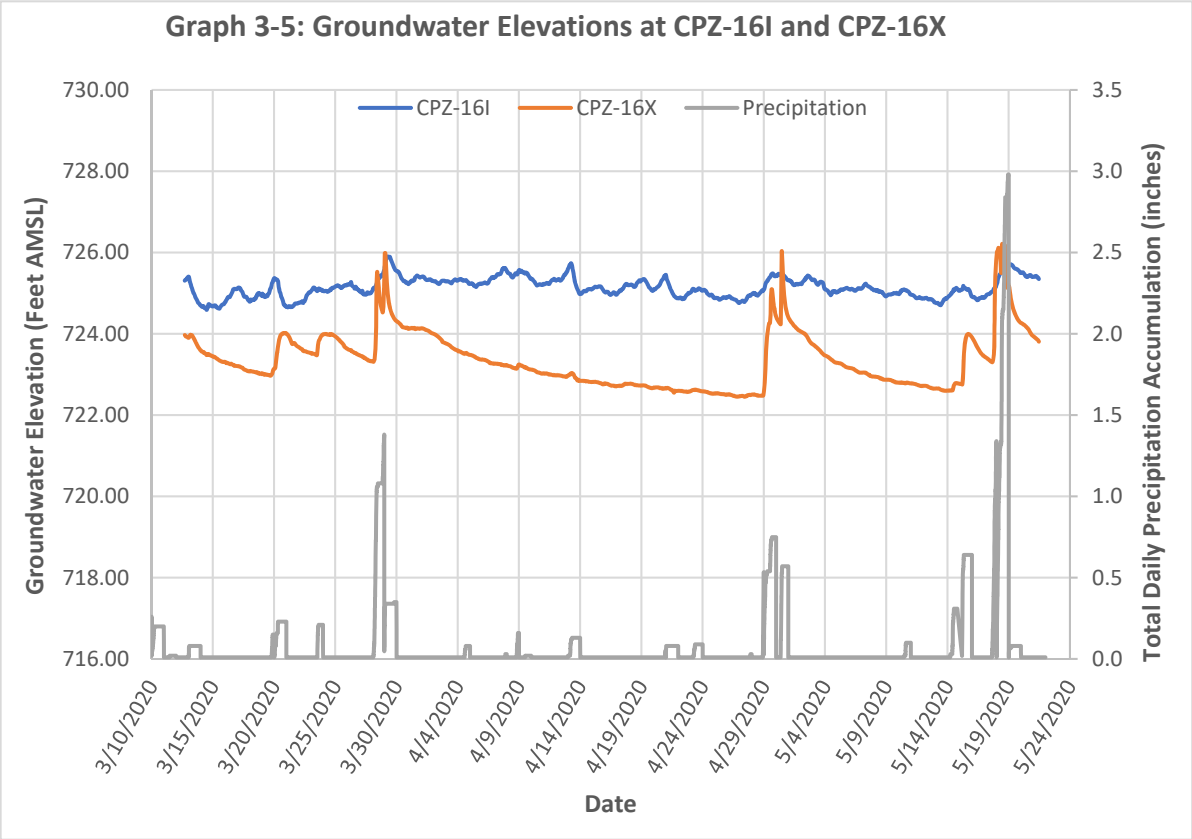
+ Positive value indicates an outward hydraulic gradient (away from the FPS)
- Negative value indicates an inward hydraulic gradient (toward the FPS)

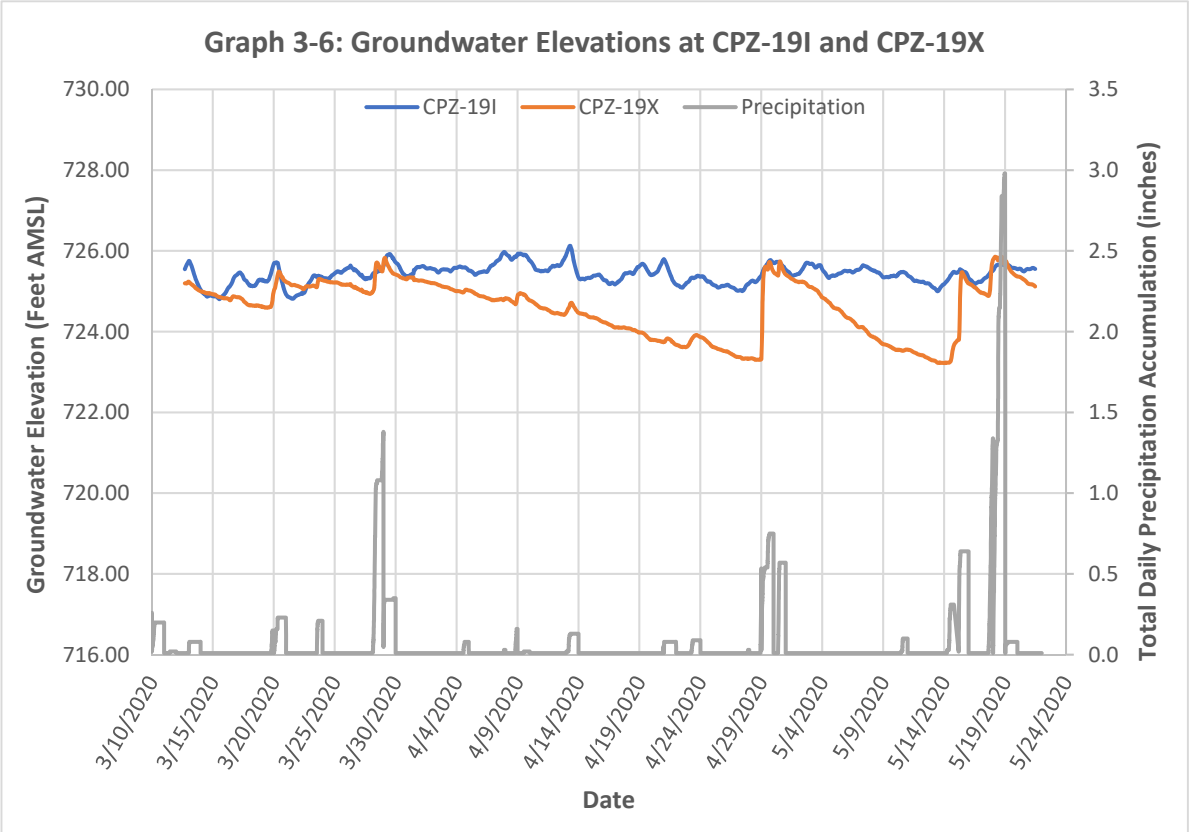
GRAPH 3-4 - GROUNDWATER ELEVATION DIFFERENCE INTERIOR (I) VS EXTERIOR (X) UGSW PIEZOMETERS 37-42

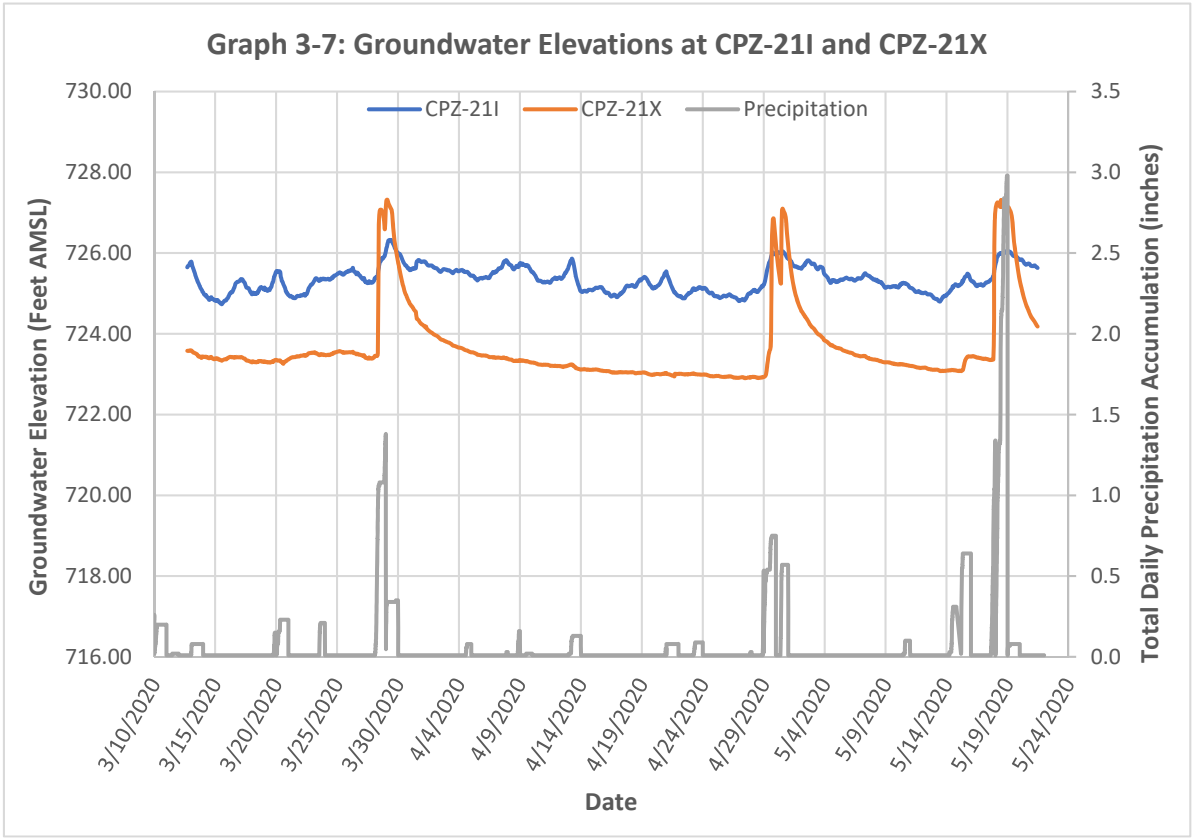


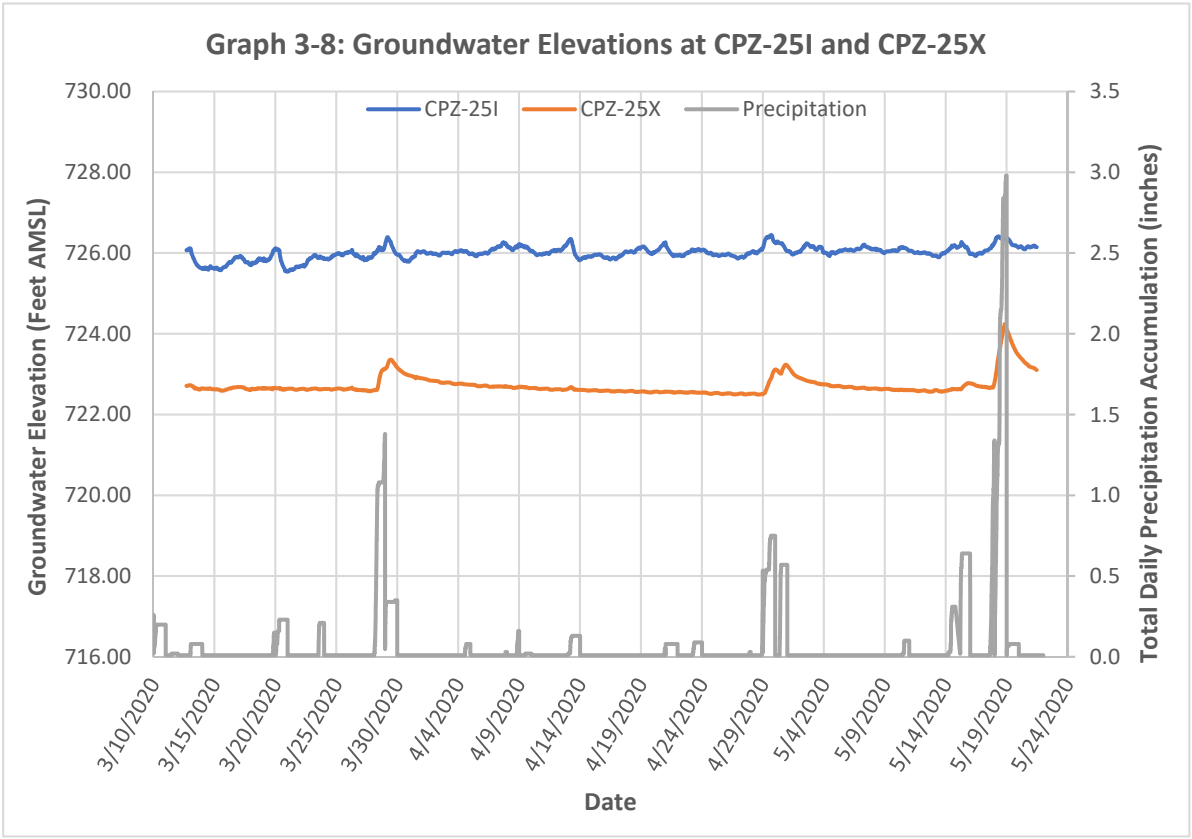
\+ Positive value indicates an outward hydraulic gradient (away from the FPS)

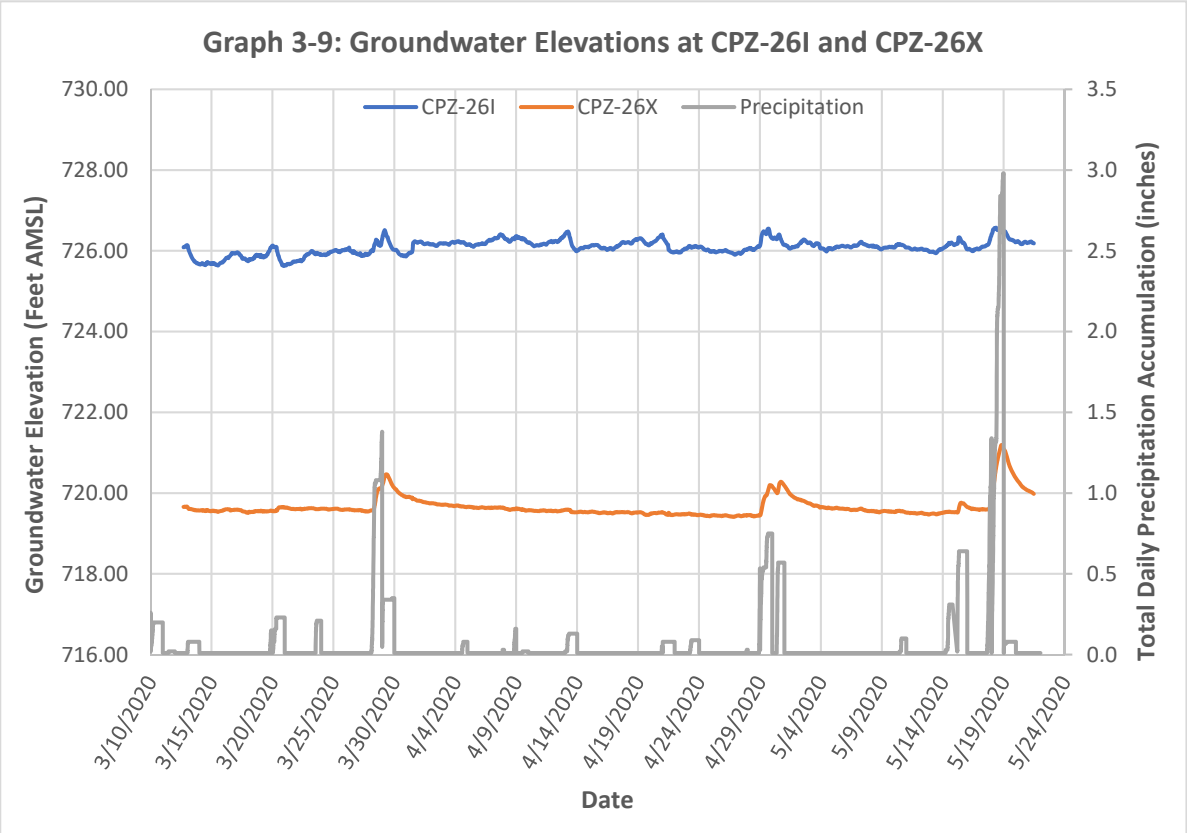
\- Negative value indicates an inward hydraulic gradient (toward the FPS)

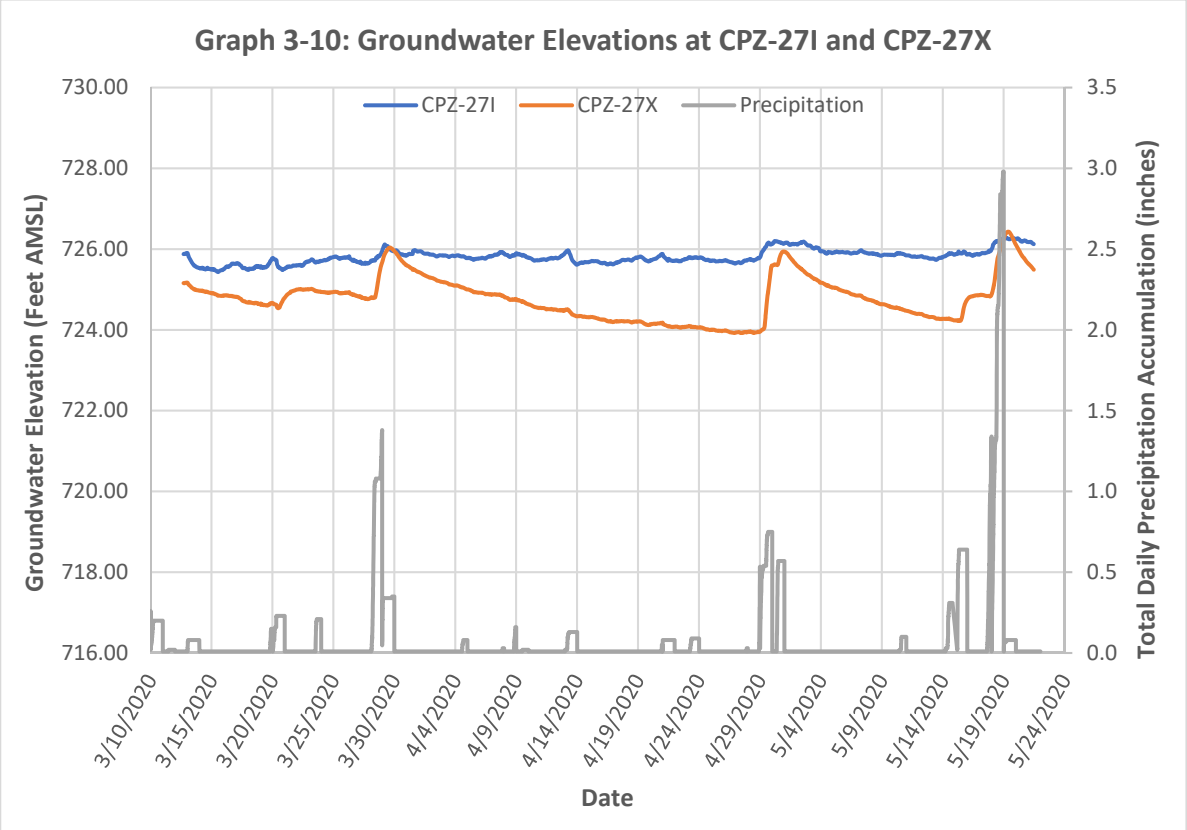

Graph 3-5: Groundwater Elevations at CPZ-16I and CPZ-16X
CPZ-16I
CPZ-16X
Precipitation
Groundwater Elevation (Feet AMSL)
Total Daily Precipitation Accumulation (inches)
730.00
728.00
726.00
724.00
722.00
720.00
718.00
716.00
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
3/10/2020
3/15/2020
3/20/2020
3/25/2020
3/30/2020
4/4/2020
4/9/2020
4/14/2020
4/19/2020
4/24/2020
4/29/2020
5/4/2020
5/9/2020
5/14/2020
5/19/2020
5/24/2020
Date

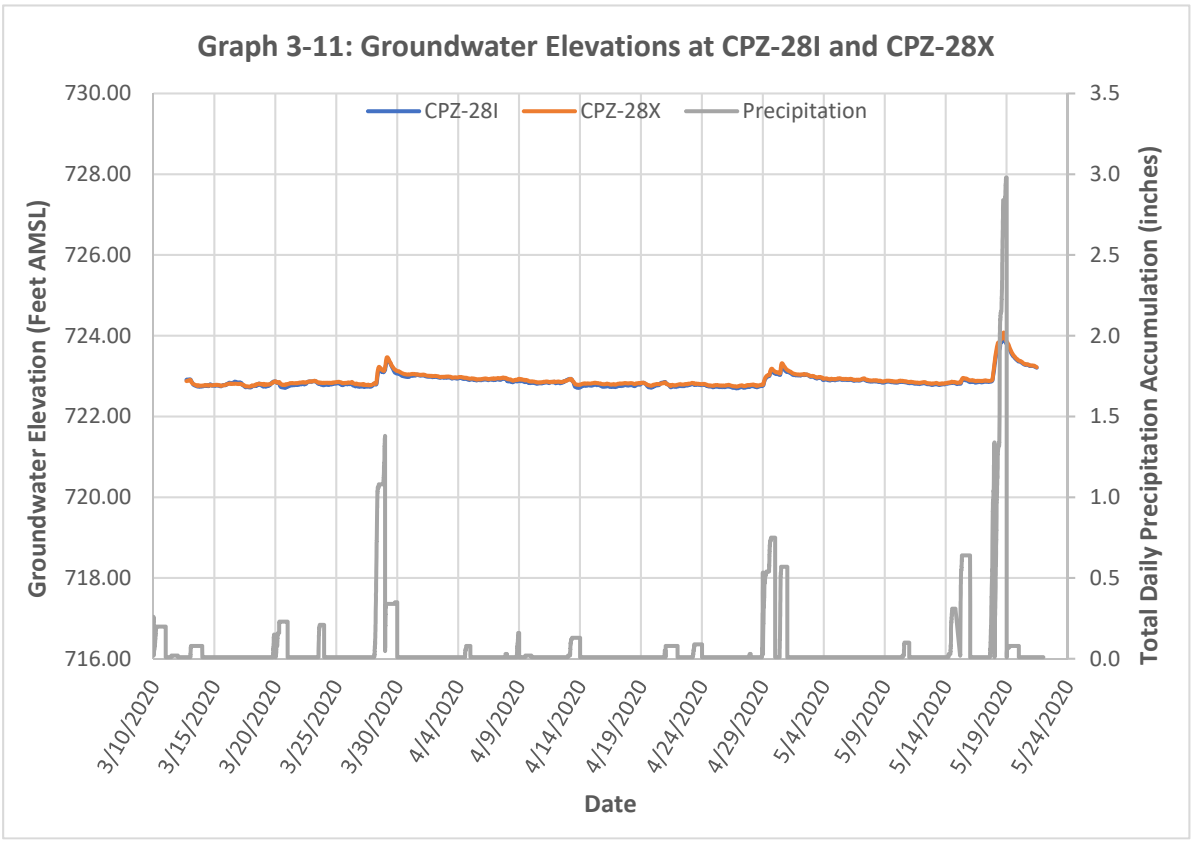

Graph 3-6: Groundwater Elevations at CPZ-19I and CPZ-19X
CPZ-19I
CPZ-19X
Precipitation
Groundwater Elevation (Feet AMSL)
Total Daily Precipitation Accumulation (inches)
730.00
728.00
726.00
724.00
722.00
720.00
718.00
716.00
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
3/10/2020
3/15/2020
3/20/2020
3/25/2020
3/30/2020
4/4/2020
4/9/2020
4/14/2020
4/19/2020
4/24/2020
4/29/2020
5/4/2020
5/9/2020
5/14/2020
5/19/2020
5/24/2020
Date

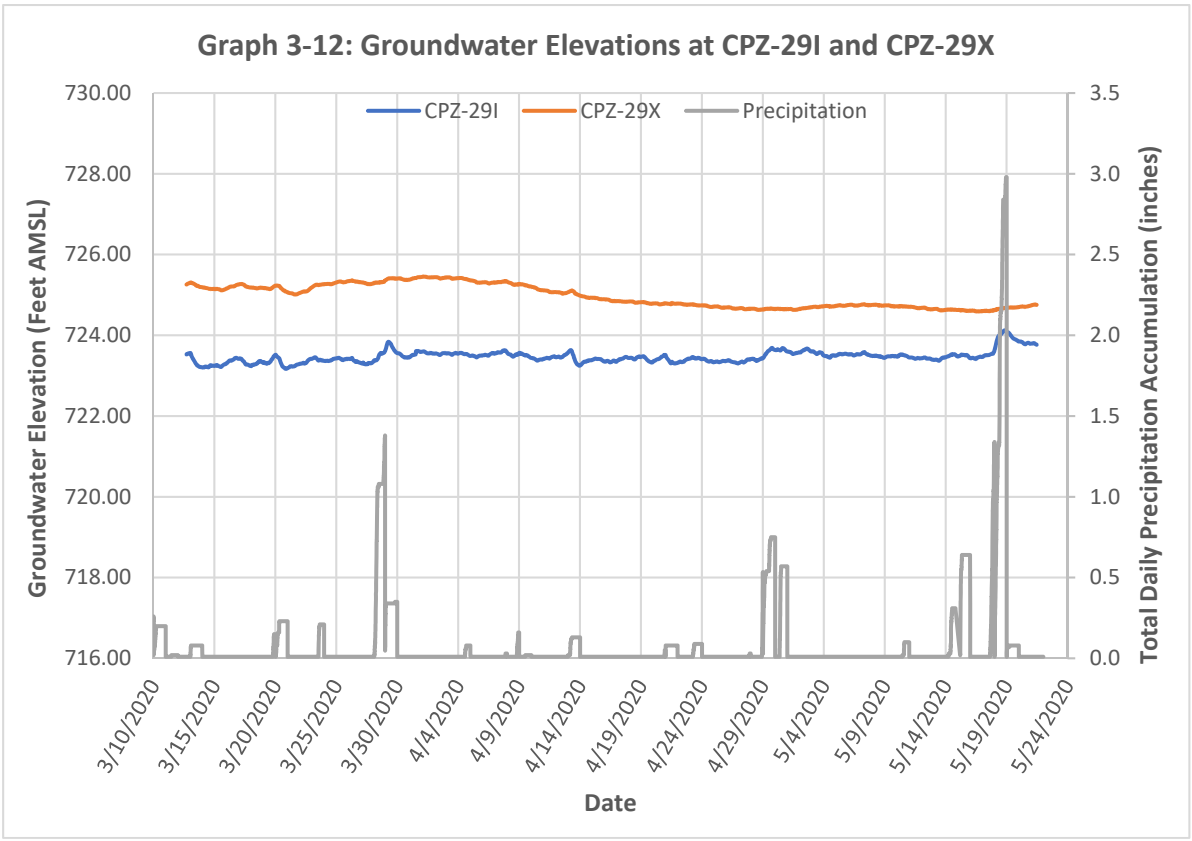

Graph 3-7: Groundwater Elevations at CPZ-21I and CPZ-21X
CPZ-21I
CPZ-21X
Precipitation
Groundwater Elevation (Feet AMSL)
Total Daily Precipitation Accumulation (inches)
730.00
728.00
726.00
724.00
722.00
720.00
718.00
716.00
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
3/10/2020
3/15/2020
3/20/2020
3/25/2020
3/30/2020
4/4/2020
4/9/2020
4/14/2020
4/19/2020
4/24/2020
4/29/2020
5/4/2020
5/9/2020
5/14/2020
5/19/2020
5/24/2020
Date

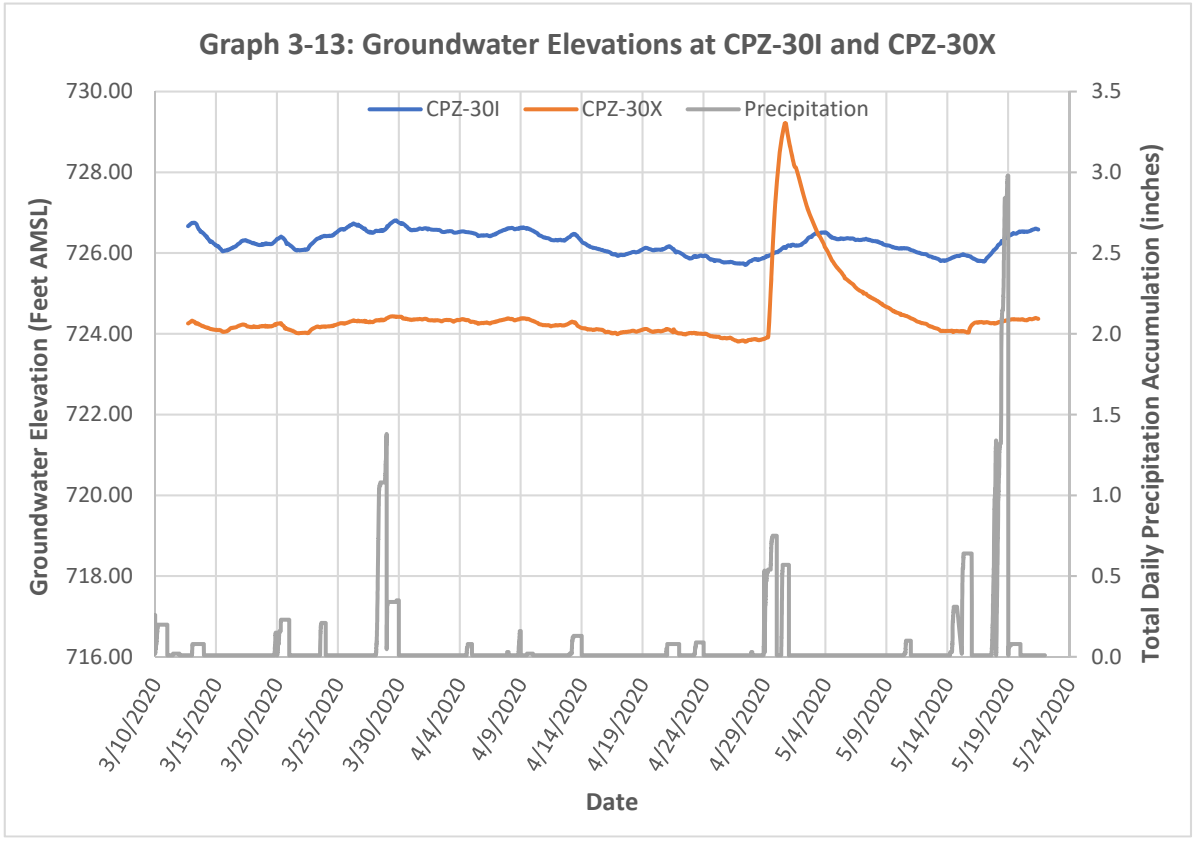

Graph 3-8: Groundwater Elevations at CPZ-25I and CPZ-25X
CPZ-25I
CPZ-25X
Precipitation
Groundwater Elevation (Feet AMSL)
Total Daily Precipitation Accumulation (inches)
730.00
728.00
726.00
724.00
722.00
720.00
718.00
716.00
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
3/10/2020
3/15/2020
3/20/2020
3/25/2020
3/30/2020
4/4/2020
4/9/2020
4/14/2020
4/19/2020
4/24/2020
4/29/2020
5/4/2020
5/9/2020
5/14/2020
5/19/2020
5/24/2020
Date

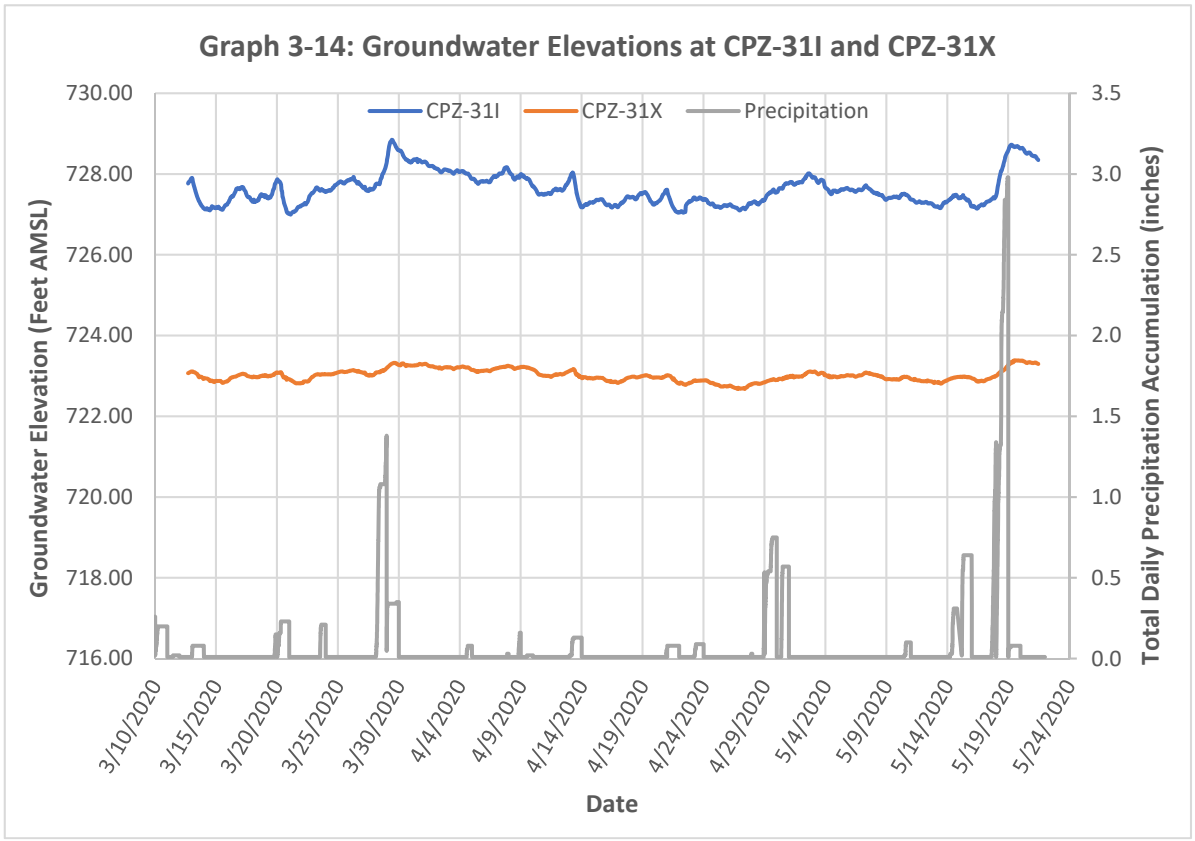

Graph 3-9: Groundwater Elevations at CPZ-26I and CPZ-26X
CPZ-26I
CPZ-26X
Precipitation
730.00
728.00
726.00
724.00
722.00
720.00
718.00
716.00
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Groundwater Elevation (Feet AMSL)
Total Daily Precipitation Accumulation (inches)
3/10/2020
3/15/2020
3/20/2020
3/25/2020
3/30/2020
4/4/2020
4/9/2020
4/14/2020
4/19/2020
4/24/2020
4/29/2020
5/4/2020
5/9/2020
5/14/2020
5/19/2020
5/24/2020
Date


Graph 3-10: Groundwater Elevations at CPZ-27I and CPZ-27X
CPZ-27I
CPZ-27X
Precipitation
730.00
728.00
726.00
724.00
722.00
720.00
718.00
716.00
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Groundwater Elevation (Feet AMSL)
Total Daily Precipitation Accumulation (inches)
3/10/2020
3/15/2020
3/20/2020
3/25/2020
3/30/2020
4/4/2020
4/9/2020
4/14/2020
4/19/2020
4/24/2020
4/29/2020
5/4/2020
5/9/2020
5/14/2020
5/19/2020
5/24/2020
Date


Graph 3-11: Groundwater Elevations at CPZ-28I and CPZ-28X
CPZ-28I
CPZ-28X
Precipitation
Groundwater Elevation (Feet AMSL)
Total Daily Precipitation Accumulation (inches)
730.00
728.00
726.00
724.00
722.00
720.00
718.00
716.00
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
3/10/2020
3/15/2020
3/20/2020
3/25/2020
3/30/2020
4/4/2020
4/9/2020
4/14/2020
4/19/2020
4/24/2020
4/29/2020
5/4/2020
5/9/2020
5/14/2020
5/19/2020
5/24/2020
Date


Graph 3-12: Groundwater Elevations at CPZ-29I and CPZ-29X
CPZ-29I
CPZ-29X
Precipitation
Groundwater Elevation (Feet AMSL)
Total Daily Precipitation Accumulation (inches)
730.00
728.00
726.00
724.00
722.00
720.00
718.00
716.00
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
3/10/2020
3/15/2020
3/20/2020
3/25/2020
3/30/2020
4/4/2020
4/9/2020
4/14/2020
4/19/2020
4/24/2020
4/29/2020
5/4/2020
5/9/2020
5/14/2020
5/19/2020
5/24/2020
Date


Graph 3-13: Groundwater Elevations at CPZ-30I and CPZ-30X
CPZ-30I
CPZ-30X
Precipitation
Groundwater Elevation (Feet AMSL)
Total Daily Precipitation Accumulation (inches)
730.00
728.00
726.00
724.00
722.00
720.00
718.00
716.00
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
3/10/2020
3/15/2020
3/20/2020
3/25/2020
3/30/2020
4/4/2020
4/9/2020
4/14/2020
4/19/2020
4/24/2020
4/29/2020
5/4/2020
5/9/2020
5/14/2020
5/19/2020
5/24/2020
Date


Graph 3-14: Groundwater Elevations at CPZ-31I and CPZ-31X
CPZ-31I
CPZ-31X
Precipitation
Groundwater Elevation (Feet AMSL)
Total Daily Precipitation Accumulation (inches)
730.00
728.00
726.00
724.00
722.00
720.00
718.00
716.00
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
3/10/2020
3/15/2020
3/20/2020
3/25/2020
3/30/2020
4/4/2020
4/9/2020
4/14/2020
4/19/2020
4/24/2020
4/29/2020
5/4/2020
5/9/2020
5/14/2020
5/19/2020
5/24/2020
Date

Appendix A
Piezometer Boring/Construction Logs

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-01I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/5/19 14:40 END : 9/5/19 15:00 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0'-5'	3'/5'		0'-0.5' topsoil, dark brown, silty, organics 0.5'-2.5' poor recovery; gravely sand noted 2.5'-5' cap material - silty dry gray-brown clay with gravel (ML) grading into slurry wall-like gray clayey sand (SC)	
5	5'-10'	2'/5'		5'-8.5' cap material - silty dry gray-brown clay with gravel (ML) grading into slurry wall-like gray clayey sand (SC), poor recovery 8.5'-10' coarse sand, wet, trace gravel, brown (SP)	Water table at 8.5 feet bgs
10	10'-15'	1.5'/5'		10'-15' coarse sand, wet, trace gravel, brown (SP), poor recovery. Till at 15' - gray-brown silty clay with trace gravel, hard, moist.	
15				End of Boring at 15 feet bgs	CPZ-01I set at 15' bgs with 10' screen K&E medium well gravel 15'-4' bgs Bentonite chips 4' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-01IP	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/5/19 END : 9/5/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				Blind drilled. See log for CPZ-01I	
15				End of Boring at 15 feet bgs	CPZ-01IP set at 15' bgs with 10' screen K&E medium well gravel 15'-4' bgs Bentonite chips 4' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-01X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/5/19 14:10 END : 9/5/19 14:25 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
	0'-5'	3.5'/5'		0'-0.5' topsoil, dark brown, organics 0.5'-2.0' little recovery, silty sand observed 2.0'-4.5' cap material - clayey silt with gravel, hard, dry (ML)	
5				4.5'-5' fine to medium sand with trace gravel, brown (SF	
	5'-10'	2'/5'		5'-9' fine to medium sand with trace gravel, brown (SP)	
10				9'-10' medium to coarse sand, brown, wet, trace gravel (SP)	Water table at 9.5 feet bgs
	10'-15'	4'/5'		10'-13' medium to coarse sand, brown, wet, trace gravel (SP) 13'-15' till - brown to gray-brown silty clay, hard, moist, trace gravel	
15				End of Boring at 15 feet bgs	CPZ-01X set at 13' bgs with 10' screen K&E medium well gravel 13'-2' bgs Bentonite chips 2' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-02I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/5/19 END : 9/5/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
	0'-5'	4'/5'		0'-0.5' topsoil, dark brown, silty, organics 0.5'-1.5' poor recovery; sand (SP) observed 1.5'-3' cap - clayey silt (ML) with gravel 3'-3.5' - stained dark brown sandy silt (ML) 3.5'-5' medium to coarse sand, brown, wet (SP)	Water table at 3.5 feet bgs
5	5'-10'			5'-10' medium to coarse sand, brown, wet (SP)	
10	10'-15'			10'-13.5' medium to coarse sand, brown, wet (SP) 13.5'-15' till - silty clay, brown-gray, trace gravel, hard, moist (CL)	
15				End of Boring at 15 feet bgs	CPZ-02I set at 13.5' bgs with 10' screen K&E medium well gravel 13.5'-2.5' bgs Bentonite chips 2.5' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-02X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/5/19 11:00 END : 9/5/19 11:15 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0'-5'	4'/5'		0'-0.5' topsoil, dark brown, organics 0.5'-2.5' little recovery, silty sand observed 1.5'-4.5' cap - clayey silt with gravel, hard, dry (ML) 4.5'-5' fine to medium sand with trace gravel, brown (SF	
5	5'-10'	2.5'/5'		5'-9' fine to medium sand with trace gravel, brown (SP) 9'-10' medium to coarse sand, brown, wet, trace gravel (SP)	Water table at 9 feet bgs
10	10'-15'	4'/5'		10'-13' medium to coarse sand, brown, wet, trace gravel (SP) 13'-15' till - medium brown to gray silty clay with trace gravel (CL)	
15				End of Boring at 15 feet bgs	CPZ-02X set at 13' bgs with 10' screen K&E medium well gravel 13'-2' bgs Bentonite chips 2' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-03I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/5/19 9:45 END : 9/5/19 10:06 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
	0'-5'	2.5'/5'		0'-0.5' topsoil, dark brown, roots and woodchips 0.5'-3' very poor recovery 3'-4.5' cap - clayey silt with trace gravel, dark brown, dry (ML) 4.5'-5' fine-medium sand, brown, trace gravel (SP)	
5	5'-10'	2/5		5'-7' fine-medium sand, brown, trace gravel (SP) 7'-10' medium-coarse sand with trace gravel, brown, wet (SP)	Water table 7-8 feet bgs
10	10'-15'	5/5		10'-14' medium-coarse sand with trace gravel, brown, wet (SP) 14'-15' till - brown-gray silty clay with trace gravel, hard, moist (SP)	
15				End of Boring at 15 feet bgs	CPZ-03I set at 14' bgs with 10' screen K&E medium well gravel 14'-3' bgs Bentonite chips 2' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-03X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/5/19 9:15 END : 9/5/19 9:30 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
	0'-5'	3.5'/5'		0'-0.5' topsoil, dark brown, organics/roots 0.5'-2' poor recovery; medium brown silty sand with gravel observed 2'-4.5' cap material - clayey silt with trace gravel, dry, gray-brown (ML) 4.5'-5' fine-medium sand, light brown, trace gravel (SP)	
5	5'-10'	2.5/5		5'-9.5' fine-medium sand, light brown, trace gravel (SP) 9.5'-10' coarse sand, light brown, trace gravel, wet (SP)	Water table at 9.5 feet bgs
10	10'-15'	3.5/5		10'-14' coarse sand, light brown, trace gravel, wet (SP) 14'-15' till - silty clay, gray-brown, hard, moist, trace gravel (CL)	
15				End of Boring at 15 feet bgs	CPZ-03X set at 14' bgs with 10' screen K&E medium well gravel 14'-3' bgs Bentonite chips 2' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-04I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/4/19 END : 9/4/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil, dark brown, organics/roots	
	0'-5'	3.5'/5'		0.5'-2' poor recovery, some fine sand observed 2'-5' cap material - gray-brown clayey silt, little gravel, hard, dry (ML)	
5					
	5'-10'	2/5		5'-9' poor recovery, softer dark brown-gray clay with fine sand and trace gravel, wet (CL) 9'-10' coarse brown sand with trace gravel, wet (SP)	
10					
	10'-15'	3/5		10'-15' coarse brown sand with trace gravel, wet (SP). Till encountered at 15' bgs; brown, silty clay with trace gravel (CL)	
15					
				End of Boring at 15 feet bgs	CPZ-04I set at 15' bgs with 10' screen K&E medium well gravel 15'-4' bgs Bentonite chips 4' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-04IP	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/4/19 END : 9/4/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				Blind drilled. See log for CPZ-04I	
15				End of Boring at 15 feet bgs	CPZ-01IP set at 15' bgs with 10' screen K&E medium well gravel 15'-4' bgs Bentonite chips 4' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-04X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/4/19 15:30 END : 9/4/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
	0'-5'	3.5'/5'		0'-0.5' topsoil, dark brown 0.5'-1.5' poor recovery 1.5'-5' cap material - light gray clayey silt with trace gravel, dry (ML)	
5	5'-10'	2.5/5		5'-9.5' cap material - light gray clayey silt with trace gravel, dry (ML) 9.5'-10' coarse sand, light brown, trace gravel, wet (SP)	Water table at 9.5 feet bgs
10	10'-15'	3.5/5		10'-14' coarse sand, light brown, trace gravel, wet (SP) 14'-15' till - silty clay, gray-brown, hard, moist, trace gravel (CL)	
15				End of Boring at 15 feet bgs	CPZ-04X set at 14' bgs with 10' screen K&E medium well gravel 14'-3' bgs Bentonite chips 2' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-05I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/4/19 14:20 END : 9/4/19 14:45 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0'-5'	3.5'/5'		0'-0.5' topsoil, dark brown 0.5'-2' poor recovery 2'-4.5' cap - gray-brown clayey silt, hard, dry, trace gravel (ML) 4.5'-5.0' stained black medium sand, trace gravel (SP)	Driller spilled top ~6 in. of recovered material on ground
5	5'-10'	2/5		5'-10' sand, coarse, light brown, wet, trace gravel (SP)	Water table at 8 feet bgs
10	10'-15'	4/5		10'-15' sand, coarse, light brown, wet, trace gravel (SP); fine sand seam 13.5'-13.75'	
15		5/5		15'-20' till, gray-brown silty clay with trace gravel, hard, moist (CL)	CPZ-05I set at 15' bgs with 10' screen K&E medium well gravel 15'-4' bgs Bentonite chips 4' bgs-surface
20				End of Boring at 20 feet bgs	

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-05X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/4/19 13:30 END : 9/4/19 13:55 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil, dark brown	
				0.5'-1.5' poor recovery	
	0'-5'	4'/5'		1.5'-5' cap - clayey silt, hard, dry, trace gravel (ML)	
5					
	5'-10'	2.5/5		5'-9.5' fine to medium sand, brown, trace gravel (SP)	
10				9.5'-10' medium to coarse sand, wet, trace gravel (SP)	Water table at 10 feet bgs
	10'-15'	3.5/5		10'-13.5' medium to coarse sand, wet, trace gravel (SP)	
15				14'-15' till - silty clay, gray, hard, moist (CL)	
				End of Boring at 15 feet bgs	CPZ-05X set at 14' bgs with 10' screen K&E medium well gravel 14'-3' bgs Bentonite chips 3' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-06I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/4/19 11:40 END : 9/4/19 11:55 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
	0'-5'	3.5'/5'		0'-0.5' topsoil, dark brown 0.5'-2' poor recovery, some poorly sorted light brown sand and gravel observed 2'-3.5' cap material - clayey silt, very light gray, dry, hard (ML) 3.5'-5.0' fine-medium sand, light brown, trace gravel (SP)	
5	5'-10'	2/5		5'-7' fine-medium sand, light brown, trace gravel (SP) 7'-10' coarse sand, brown, wet, trace gravel (SP)	Water table at 7 feet bgs
10	10'-15'			10'-14' coarse sand, brown, wet, trace gravel (SP); sand becoming coarser around 12' bgs 14'-15' till - silty clay, gray-brown, trace gravel, hard, moist (CL)	
15				End of Boring at 15 feet bgs	CPZ-06I set at 15' bgs with 10' screen K&E medium well gravel 15'-4' bgs Bentonite chips 4' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-06X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/4/19 END : 9/4/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil, dark brown, moist, roots	
				0.5'-1.5' poor recovery; sandy silt observed	
	0'-5'	4'/5'		1.5'-5' cap material, light gray-brown clayey silt, trace sand and gravel (ML)	
5					
	5'-10'	2.5/5		5'-9.5' medium sand, brown, trace gravel (SP)	
10				9.5'-10' coarse sand, trace gravel, brown, wet (SP)	Water table at 9.5 feet bgs
				10'-12.5' coarse sand, trace gravel, brown, wet (SP)	
	10'-15'	4/5		12.5'-15' till - gray-brown silty clay, trace gravel, hard, moist (CL)	
15					
				End of Boring at 15 feet bgs	CPZ-06X set at 15' bgs with 10' screen K&E medium well gravel 15'-4' bgs Bentonite chips 4' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-07I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/4/19 END : 9/4/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0'-5'	3.5'/5'		0'-0.5' topsoil, dark brown 0.5'-2' poor recovery, sandy silt observed 2'-3.5' cap material - light gray-brown clayey silt, dry, trace sand and gravel (ML) 3.5'-5.0' medium sand, brown with dark brown/black staining @ 3.5', wet, trace gravel (SP)	Water table at 4 feet bgs
5	5'-10'	2'/5'		5'-10' coarse sand, brown, trace gravel, wet (SP)	
10	10'-15'	1'/5'		10'-15' coarse sand, brown, trace gravel, wet (SP)	
15	15'-20'	5'/5'		15'-20' till - brown-gray silty clay, trace sand and gravel, hard, slightly moist (CL)	CPZ-07I set at 15' bgs with 10' screen K&E medium well gravel 15'-4' bgs Bentonite chips 4' bgs-surface
20				End of Boring at 20 feet bgs	

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-07X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/4/19 END : 9/4/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0'-5'	4'/5'		0'-0.5' topsoil, dark brown, moist 0.5'-2' poor recovery, sandy silt observed 2'-4.5' cap material, clayey silt, dry, gray-brown, trace sand and gravel (ML) 4.5'-5' medium fine sand, light brown, trace gravel (SP)	
5	5'-10'	2.5/5		5'-9' medium fine sand, light brown, trace gravel (SP) 9'-10' coarse sand, light brown, wet, trace gravel (SP)	Water table at 8.5 feet bgs
10	10'-15'	3.5/5		10'-12.5' coarse sand, light brown, wet, trace gravel (SP) 12.5'-14' silty clay, moist, gray (CL) 14'-15' sandy silt, trace gravel, wet (ML)	
15	15'-20'	5/5		15'-20' till, gray-brown clayey silt, trace gravel, hard, slightly moist (CL)	CPZ-07X set at 15' bgs with 10' screen K&E medium well gravel 15'-4' bgs Bentonite chips 4' bgs-surface
20				End of Boring at 20 feet bgs	

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-08I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/6/19 9:00 END : 9/6/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0'-5'	2'/5'		0'-0.5' topsoil, dark brown, silty 0.5'-3.5' poor recovery, some light brown sand observed 3.5'-5.0' cap material, dry gray-brown sandy silt with trace gravel (ML)	
5	5'-10'	2'/5'		5'-8.5' poor recovery, cap material, dry gray-brown sandy silt with trace gravel (ML) 8.5'-10' medium to coarse sand with trace gravel, wet (SP)	Water table at 8 feet bgs
10	10'-15'	1'/5'		10'-13.5' medium to coarse sand with trace gravel, wet (SP) 13.5'-15' till - gray-brown silty clay with trace gravel, hard, moist (CL)	
15				End of Boring at 15 feet bgs	CPZ-08I set at 13.5' bgs with 10' screen K&E medium well gravel 13.5'-2.5' bgs Bentonite chips 2.5' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-08IP	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/6/19 9:55 END : 9/6/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				Blind drilled. See log for CPZ-08I	
5					
10					
15				End of Boring at 13.5 feet bgs	CPZ-08I set at 13.5' bgs with 10' screen K&E medium well gravel 13.5'-2.5' bgs Bentonite chips 2.5' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-08X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW — LOCATION : St Louis, MI

ELEVATION : — DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : — START : 9/6/19 8:00 — END : 9/6/19 8:50 — LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0'-5'			0'-0.5' topsoil, dark brown, organics Blind drill	
5	5'-10'			Blind drill	
10	10'-15'			Blind drill	
15	15'/20'	4.5'/5'		15'-18.5' till, silty clay with trace gravel, hard, moist, gray-brown (CL) 18.5'-19.5' wet, silty sand and gravel (SP) 19.5'-20' till, silty clay with trace gravel, hard, moist, gray-brown (CL)	
20				End of Boring at 20 feet bgs	CPZ-08X set at 20' bgs with 15' screen K&E medium well gravel 20'-4' bgs Bentonite chips 4' bgs-surface

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-09I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/6/19 13:55 END : 9/6/19 14:05 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0'-5'	3.5'/5'		0'-0.5' topsoil, clayey, dark brown 0.5'-2' poor recovery, some light brown sand observed 2'-5' cap material, hard, dry, light gray-brown clayey silt with trace gravel (ML)	
5	5'-10'	2'/5'		5'-10' poor recovery, medium to coarse brown sand with trace gravel (SW), 2-4' of black staining at 9 feet bgs (SP)	Water table at 8 feet bgs
10	10'-15'	4'/5'		10'-13' poor recovery, medium to coarse brown sand with trace gravel (SW) 13'-15' till - dark gray-brown silty clay with trace gravel, hard, moist (CL)	
15				End of Boring at 15 feet bgs	CPZ-09I set at 13' bgs with 10' screen K&E medium well gravel 13'-3' bgs Bentonite chips 3' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-09IP	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/6/19 END : 9/6/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				Blind drilled. See log for CPZ-09I.	
5					
10					
15					CPZ-09IP set at 13' bgs with 10' screen K&E medium well gravel 13'-3' bgs Bentonite chips 3' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-09X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/6/19 13:00 END : 9/6/19 13:45 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
	0'-5'			0'-0.5' topsoil, silty, roots/organics 0.5'-2' poor recovery 2'-4.5' cap material - clayey silt with trace gravel, hard, brown (ML) 4.5'-5' fine brown sand and trace gravel (SP)	
5	5'-10'			5'-9' fine brown sand and trace gravel (SP) 9'-10' wet medium to coarse sand, light brown, trace gravel (SP)	Water table at 8.5 feet bgs
10	10'-15'			10'-12.5' wet medium to coarse sand, light brown, trace gravel (SP) 13'-15' till - dark gray-brown silty clay with trace gravel, hard, moist (CL)	
15				End of Boring at 15 feet bgs	CPZ-09X set at 13' bgs with 10' screen K&E medium well gravel 13'-2' bgs Bentonite chips 2' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-10I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/6/19 13:55 END : 9/6/19 14:05 LOGGER : Steve Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
	0'-5'	5'/5'		0'-0.4' silty clayey topsoil (OL), some organics, moist, d 0.4'-0.8' silty clay (CL), brown, medium Stiff, moist, little gravel 0.8-1.0 sand (SP), fine to medium, brown, medium dense, moist 1'-4' clayey silt (ML), grey, very stiff, slightly moist to dry, little and and gravel (cap material) 4'-5' silty clay (CL), greyish brown, moist, medium Stiff, little fine sand, trace gravel	
5	5'-10'	3'/5'		5'-6' silty clay (CL), greyish brown, moist, medium Stiff, little fine sand, trace gravel 6'-10' sand (SP), light brown, fine, to medium, medium dense, wet, trace gravel and coarse sand, dark orange coloration 8-10'.	Water table at 6 feet bgs
10	10'-15'	5'/5'		10'-12'.5 sand (SP), light brown, fine, to medium, medium dense, wet, trace gravel and coarse sand, grading toward more coarse sand 12.5'-13.5' sand (SW) light grey and brown, fine to coarse, medium dense, wet, trace grave. 13.5'-15' silty clay (CL), greyish brown, stiff, moist, trace sand and gravel	
15				End of Boring at 15 feet bgs	CPZ-10I set at 14' bgs with 10' screen K&E medium well gravel 14'-3' bgs Bentonite chips 3' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-10X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : 8.5' bgs START : 9/9/19 END : 9/9/19 LOGGER : Steve Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION	COMMENTS
				SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' clayey/silty topsoil (OL) with organics	
	0'-5'			0.5'-1.5' sandy/silty clay (CL), gray and brown, moist, medium Stiff, trace sand and gravel	
				1.5'-4' silt (ML), brownish grey, stiff, slightly moist, little sand and gravel and clay	
5					
	5'-10'			4'-8.5' sand (SP), orange-brown, fine, dry, trace gravel becoming moist	
					Water table at 8.5 feet bgs
10				8.5'-10' sand (SP), fine to medium, grayish brown, wet, medium dense, trace gravel	
	10'-15'			11'-12' sand (SW), light brown, fine to coarse, little gravel, wet, medium Dense	
				12'-14' silty clay (CL), gray, stiff, moist, trace sand and gravel - till	
15				14'-15' sandy silt (ML), gray, stiff, moist, trace gravel and clay - till	
				End of Boring at 15 feet bgs	CPZ-09X set at 13' bgs with 10' screen K&E medium well gravel 13'-2' bgs Bentonite chips 2' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-11I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS 7.8' START : 9/9/19 END : 9/9/19 LOGGER : Steve Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0'-5'	4/5		0'-0.8' silty topsoil (OL) dark brown moist, firm, some clay, little fine sand - becoming clayey silt with depth 0.8'-5' clayey silt (ML) light gray and brown, very stiff, slightly moist to dry, trace sand and gravel	
5	5'-10'	4/5		5'-7.8' clayey silt (ML) light gray and brown, very stiff, slightly moist, trace sand and gravel 7.8'-10' sand (SP) orange/brown becoming light gray at 9.3', medium to medium dense, wet, little coarse sand, trace gravel	Water table at 7.8 feet bgs
10	10'-15'	4/5		10'-13.7' sand (SP) light gray, medium to medium dense, wet, little coarse sand, trace gravel, becoming (SW) 13.7'-15' till - brown-gray silty clay (CL) with trace sand and gravel, stiff, moist	
15				End of Boring at 15 feet bgs	CPZ-11I set at 14' bgs with 10' screen K&E medium well gravel 14'-3' bgs Bentonite chips 3' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-11X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS 8.5' START : 9/9/19 END : 9/9/19 LOGGER : Steve Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0		5/5		0'-0.6' clayey silty topsoil dark brown, moist 0.6'-3.0 clayey silt (ML) brown and gray, stiff, slightly moist to dry, little fine sand, trace gravel	
5		3/5		3.0'-8.5' sand (SP) brown to orange/brown, fine, dry to moist, trace gravel	Water table at 8.5 feet bgs
10		5/5		8.5'-10' sand (SP) light brown, fine to medium, medium dense, wet, trace coarse sand and gravel 10'-11.5' sand (SP) light brown, fine to medium, medium dense, wet, little coarse sand and trace gravel 11.5;-12.8' sand (SW) light brown to light gray, fine to coarse , medium dense, wet, little gravel 12.8'-15' silty clay (CL) grayish brown, very stiff, moist, trace sand and gravel - till	
15				End of Boring at 15 feet bgs	CPZ-11X set at 13' bgs with 10' screen K&E medium well gravel 13'-2' bgs Bentonite chips 2' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-12I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : 9' START : 9/9/19 END : 9/9/19 LOGGER : Steve Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0		3/5	DP-1	0'-0.5' silty topsoil with clay (OL), dark brown, moist, some organics 0.5'-1.5' Sand (SP), light brown, medium dense, moist, trace gravel 1.5'-5' clayey silt (ML) light gray, hard, slightly moist to dry, little fine sand, trace gravel	
5		3/5	DP-2	5'-8.2' poor recovery, some sandy clay overlaying fine sand (approximately 6 inches of material) 8.2'-9.4 slurry material, soft, sandy clay (bentonite), moist 9.4'-10' sand (SP) light brown, fine to medium, medium dense, wet	
10		4/5	DP-3	10'-14.2' sand (SP) light brown and gray, medium dense, wet, more coarse with depth, trace gravel 14.2'-15' silty clay (CL) brownish gray, stiff, moist, trace sand and gravel - till	
15				End of Boring at 15 feet bgs	CPZ-12I set at 15' bgs with 10' screen K&E medium well gravel 15'-4' bgs Bentonite chips 4' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-12X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS 8.5' bgs START : 9/9/19 END : 9/9/19 LOGGER : Steve Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
		5/5	DP-1	0'-5' clayey silt (ML) light grayish brown, slightly moist to dry, hard, little sand and gravel	
5					
		3/5	DP-2	5'-8.5' silty clay (CL) gray and brown, medium stiff, moist, trace sand and gravel	
					Water table at 8.5 feet bgs
10				8.5'-10' sand (SP) dark gray becoming light brown with depth (slight staining) fine to medium, medium dense, wet, trace coarse sand and gravel	
		3/5	DP-3	10'-13.4' sand (SP) dark gray becoming light brown with depth (slight staining) fine to medium, medium dense, wet, trace gravel; becoming more coarse with depth (SW from 13'-13.4')	
15				13.4'-15.0 silty clay (CL) brownish gray, stiff, moist, trace sand and gravel - till	
				End of Boring at 15 feet bgs	CPZ-12X set at 14' bgs with 10' screen Sand to 3 feet bgs and Bentonite chips to surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-12IP	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : END : LOGGER : Steve Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				Blind drilled - see CPZ-12I	
5					
10					
15				End of Boring at 15 feet bgs	CPZ-12I set at 15' bgs with 10' screen K&E medium well gravel 15'-4' bgs Bentonite chips 4' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-13I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/9/19 END : 9/9/19 LOGGER : Steve Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
		5/5	DP-1	0'-0.5' clayey/silty topsoil (OL) 0.5'-1.5' silty sandy clay (CL) brown, medium stiff moist 1.5'-3.7' silt (ML) light gray, hard, dry, little sand, trace gravel	
				3.7'-6' silty clay (CL) grayish brown, stiff, moist, little sand trace gravel	
5					Water table at 5 feet bgs
		4/5	DP-2	6'-10' sand (SP) light orange brown to light brown, fine to medium, medium dense, wet, little coarse sand, trace gravel	
10				10'-12.5' sand (SP) light orange brown to light brown, fine to medium, medium dense, wet, little coarse sand, trace gravel	
		5/5	DP-3	12.5'-13.5' sand (SW) light gray and brown, fine to coarse, medium dense, wet, little fine gravel 13.5'-15' silty clay (CL) gray stiff, moist, trace sand and gravel - till	
15				End of Boring at 15 feet bgs	CPZ-13I set at 13.5' bgs with 10' screen Sand to 2.5 feet bgs and Bentonite chips to surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-13X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : 8.8' START : 9/9/19 END : 9/9/19 LOGGER : Steve Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0				0'-0.8' silty/clayey topsoil	
		5/5	DP-1	0.8'-5' clayey silt (ML) light gray, slightly moist becoming dry, hard, little fine sand, trace gravel	
5				5'-8.8' silty clay (CL) grayish brown, moist, stiff	
		3/5	DP-2	8.8'-9.3' sandy silt (ML) dark gray (staining) and brown, medium stiff, wet, little dry, faint hydrocarbon odor	
				9.3'-10' sand (SP) light orange brown, fine to medium, medium dense, wet, trace coarse sand and gravel	
10				10'-12.7' sand (SP) light orange brown, fine to medium, medium dense, wet, trace coarse sand and gravel becoming fine to coarse with depth (SW) little gravel 12.2' - 12.7'	
		5/5	DP-3		
				12.7'-15 silty clay (CL) brownish gray, stiff, moist, trace sand and gravel - till	
15				End of Boring at 15 feet bgs	CPZ-13X set at 13' bgs with 10' screen Sand to 2 feet bgs and Bentonite chips to surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-14I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/10/19 END : 9/10/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-1' poor recovery	
	0-5'	4/5		1'-5' clayey silt cap material (ML), hard, dry, brown-gray, trace gravel and sand	
5					
				5'-7' poor recovery	
	5-10'	3/5		7'-8' poorly sorted fine sand and gravel, light brown (SW)	Water table at 8 feet bgs
				8'-10' coarse/medium sand with trace gravel, wet, light brown (SW)	
10					
				10'-13.5' coarse/medium sand with trace gravel, wet, light brown (SW)	
	10-15'	3/5			
				13.5'-15' till - silty clay, hard, moist, brown-gray, trace gravel (CL)	
15					
				End of Boring at 15 feet bgs	CPZ-14I set at 13.5' bgs with 10' screen K&E medium well gravel 13.5'-2.5' bgs Bentonite chips 2.5' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-14X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/10/19 END : 9/10/19 LOGGER : Steve Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0				0'-0.5' topsoil - silty, dark brown, organics	
	0-5'	4.5/5		0.5'-5' cap material - gray/brown sandy clayey silt with trace gravel (ML)	
5					
	5-10'	3/5		5'-8.5' sand, fine, light brown, trace gravel, some brown and black staining (SP)	Water table at 8.5 feet bgs
				8.5'-10' coarse/medium brown sand and gravel, wet (SW)	
10					
				10'-11.6' coarse/medium brown sand and gravel, wet (SW)	
	10-15'	4/5		11.6'-15' till - silty clay with trace gravel, gray brown, hard, moist (CL)	
15				End of Boring at 15 feet bgs	CPZ-14X set at 13' bgs with 10' screen K&E medium well gravel 13'-2' bgs Bentonite chips 2' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-14IP	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/10/19 END : 9/10/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION	COMMENTS
				SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				See log for CPZ-14I	
5					
10					
15				End of Boring at 15 feet bgs	CPZ-14I set at 13.5' bgs with 10' screen K&E medium well gravel 13.5'-2.5' bgs Bentonite chips 2.5' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-15I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/10/19 END : 9/10/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil, brown, silty	
				0.5'-2.5' poor recovery	
	0'-5'	3/5		2.5'-4.5' cap material - sandy silt, light brown, trace gravel, dry, hard, becoming soft at 3.5 feet bgs	
5					
	5'-10'	3.5/5		4.5'-10' sand, medium, gray-brown, trace gravel, becoming wet at 8 feet bgs (SW)	Water table at 8 feet bgs
10					
	10'-15'	4.5/5		10'-15' till - hard, moist gray-brown silty clay (CL)	
15					
				End of Boring at 15 feet bgs	CPZ-15I set at 13' bgs with 10' screen Sand placed from 13' to 2' bgs Bentonite chips place from 2' bgs to surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-15X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/10/19 END : 9/10/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil, dark brown, clayey	
	0'-5'	4.5/5		0.5'-5' cap material - sandy clayey silt with trace gravel, light brown-gray, hard, dry (ML)	
5				5'-7' cap material - sandy clayey silt with trace gravel, light brown-gray, hard, dry (ML), poor recovery	
	5'-10'	3/5		7'-7.5' fine sand, light brown, trace gravel (SP)	Water table at 7.5 feet bgs
				7.5'-9.5' medium to coarse sand and gravel, brown, wet (SW)	
10					
				9.5'-15' till, silty clay, gray, trace gravel, hard, moist	
15				End of Boring at 15 feet bgs	CPZ-15X set to 13 feet bgs K&E well sand placed from 13' to 2' bgs Bentonite chips placed from 2' bgs to surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-16I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/10/19 END : 9/10/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0				0'-0.5' topsoil, brown, organics	
	0-5'	3.5/5		0.5'-7' cap material - hard, dry, light brown, clayey silt (ML) with trace gravel	
5					Water table at 7 feet bgs
	5-10'	3.5/5		7'-10.5' sand, medium to coarse with trace gravel (SW), light brown, wet	
10					
	10-15'	4.5/5		10.5'-15' till - silty clay with trace gravel, gray-brown, wet, hard (CL)	
15				End of Boring at 15 feet bgs	CPZ-16I set at 13' bgs with 10' screen K&E medium well gravel 13'-2' bgs Bentonite chips 2' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-16X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/10/19 END : 9/10/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil	
	0-5'	4/5		0.5-5' cap material; clayey silt, light brown/gray, hard, dry, trace gravel (ML)	
5				5'-6.5' poor recovery, fine sand and silt, (SP)	Water table at 7 feet bgs
	5-10'	3.5/5		6.5'-9.5' coarse sand and gravel, light brown, wet (SW)	
10					
	10-15'	5/5		9.5'-15' till - gray/brown silty clay with trace gravel, hard moist	
15				End of Boring at 15 feet bgs	CPZ-16X set at 13' bgs with 10' screen K&E medium well gravel 13'-2' bgs Bentonite chips 2' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-17I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/11/19 END : 9/11/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil, dark brown, silty	
				0.5'-1.5' poor recovery	
	0-5'	4/5		1.5'-5' cap material - clayey silt with fine sand (ML), dry, hard, light gray-brown	
5					
				5'-8.5' fine sand with trace gravel, brown, slightly moist, stained black from 6' -7' bgs (SP)	
	5-10'	4/5			
				8.5'-10' till - hard, moist gray/brown silty clay with trace gravel	
10					
				End of Boring at 10 feet bgs	CPZ-17I set at 8.5' bgs with 5' screen K&E medium well gravel 8.5'-2.5' bgs Bentonite chips 2.5' bgs-surface
15					
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-17X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/11/19 8:25 am END : 9/11/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0				0'-0.5' topsoil, clayey, dark brown	
				0.5'-2' poor recovery, brown sandy silt	
	0-5'	4/5		2'-5' cap material, dry, gray/brown, clayey silt with trace sand and gravel (ML)	
5					
				5'-8.5' sand, fine, trace gravel, dark gray/brown, slightly wet (SP)	
	5-10'	3/5			
10					
				8.5'-15' till, dark gray-brown silty clay, trace gravel, hard, slightly moist (CL	
	10-15'	5/5			
15					
				End of Boring at 15 feet bgs	CPZ-17X set at 8.5' bgs with 5' screen K&E medium well gravel 8.5'-2.5' bgs Bentonite chips 2.5' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-17IP	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/11/19 9:25 am END : 9/11/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				see log for CPZ-17I	
5					
10				End of Boring at 10 feet bgs	CPZ-17IP set at 8.5' bgs with 5' screen K&E medium well gravel 8.5'-2.5' bgs Bentonite chips 2.5' bgs-surface
15					
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-18I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : END : LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0-5'	4/5		0.0'-0.5' topsoil, clayey/silty, dark brown 0.5'-2' poor recovery, fine/medium sand 2'-5' cap material - clayey silt with trace gravel, hard, dry (ML)	
5	5-10'	3.5/5		5'-7' poor recovery, cap material and sand 7'-8' clayey sand, fine, dark gray with some staining (SW) 8'-10' till - silty clay, gray brown, trace gravel, hard, slightly moist	
10				End of Boring at 10 feet bgs	CPZ-18I set at 9' bgs with 5' screen K&E medium well gravel 9'-3' bgs Bentonite chips 3' bgs-surface
15					
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-018X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/12/19 END : 9/12/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil, clayey/silty, brown	
	0-5'	4/5		0.5'-7.5' clayey silt, gray brown, trace gravel, cap material	
5					
	5-10'	4/5		7.5'-8.25' clayey sand, stained black/dark gray, fine, trace gravel (SW) 8.25'-10' silty clay, firm, gray brown, trace gravel (CL)	
10				End of Boring at 10 feet bgs	CPZ-18X set at 9' bgs with 5' screen K&E medium well gravel 9'-3' bgs Bentonite chips 3' bgs-surface
15					
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-19I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/12/19 END : 9/12/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0-5'	4/5		0'-0.5' topsoil, dark brown, clayey 0.5'-5' cap - clayey silt, gray brown, dry, trace gravel (ML)	
5	5-10'			5'-6.5' poor recovery, cap - clayey silt, gray brown, dry, trace gravel (ML) 6.5'-7' silty clay (CL) stained black 7'-8' silty clay (CL), trace gravel, gray brown, fine sand seam at 7.75 feet bgs 8'-9' very clayey fine sand, soft, moist, gray brown 9'-10' silty clay (CL), brown, trace gravel	
10				End of Boring at 10 feet bgs	CPZ-19I set at 9' bgs with 5' screen K&E medium well gravel 9'-3' bgs Bentonite chips 3' bgs-surface
15					
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-19X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW — LOCATION : St Louis, MI

ELEVATION : — DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : — START : 9/12/19 — END : 9/12/19 — LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0-5'	4.25/5		0-0.5' topsoil 0.5'-1.25' poor recovery, fine sand 1.25'-5' cap material, sandy clayey silt gray-brown, dry, trace gravel, black staining 4.9'-5' (ML)	
5	5-10'			5'-7.75' silty clay, gray-brown, trace gravel (CL) 7.75-7.85' fine sand (SP), brown 7.85'-8.4' clay, gray-brown, trace gravel (CL) 8.4'-8.5' gravelly coarse sand (SW) 8.5'-10' clay, gray-brown, trace gravel	
10				End of Boring at 10 feet bgs	CPZ-19X set at 9' bgs with 5' screen K&E medium well gravel 9'-3' bgs Bentonite chips 3' bgs-surface
15					
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-20I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/12/19 END : 9/12/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0-5'	4.25/5		0'-0.5' topsoil 0.5'-1.25' poor recovery, gravely sand 1.25'-4' clayey silt, gray-brown, hard, dry, trace gravel - cap (ML) 4'-4.75' silty clay with trace gravel, fine, gray-brown (CL) 4.75'-5' poorly sorted coarse brown sand with trace gravel (SW)	
5	5-10'	5/5		5'-10' till - silty clay, hard, brown-gray, trace gravel (CL)	
10				End of Boring at 10 feet bgs	CPZ-20I set at 9' bgs with 5' screen K&E medium well gravel 9'-3' bgs Bentonite chips 3' bgs-surface
15					
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-20X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/12/19 END : 9/12/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil	
				cap material - clayey silt, dry, hard, brown gray, trace gra	
	0-5'	4.5/5			
5				4.5'-5' sand, fine, brown with black staining, little clay (SP	
				" clay/silty clay, firm to hard, , gray--brown, trace gravel (	
	5-10'	5/5		7'-7.25 sand, fine, gray, wet (SP)	
				7.25'-10' silty clay, gray-brown, moist, trace gravel (CL)	
10				End of Boring at 10 feet bgs	CPZ-20X set at 9' bgs with 5' screen
					K&E medium well gravel 9'-3' bgs
					Bentonite chips 3' bgs-surface
15					
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-20IP	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/12/19 END : 9/12/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0				see log for CPZ-20I	
5					
10				End of Boring at 10 feet bgs	CPZ-20IP set at 9' bgs with 5' screen K&E medium well gravel 9'-3' bgs Bentonite chips 3' bgs-surface
15					
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-21I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/12/19 END : 9/12/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
5	0-5'	3.5/5		0'-0.5' topsoil 0.5'-2' poor recovery; coarse sand 2'-4' cap material, dry, gray-brown, silty clay with gravel and trace sand (ML) 4'-5' fine brown sand with black staining, trace gravel (SP) 5'-6.5' fine brown sand with black staining, trace gravel (SP)	
10	5-10'	3.5/5		6.5'-10' hard, gray-brown silty clay with trace gravel, moist, 2 inch fine sand seam at 8.5 feet bgs	
15				End of Boring at 10 feet bgs	CPZ-21I set at 9' bgs with 5' screen K&E medium well gravel 9'-3' bgs Bentonite chips 3' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-21X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/12/19 END : 9/12/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0-5'	4/5		0'-0.5' topsoil 0.5'-1.5' poor recovery, coarse sand 1.5'-4.5' cap material - clayey silt with trace gravel, hard, dry, brown-gray (ML) 4.5'-5' fine-grained sand stained black, slight hydrocarbon odor (SP)	
5	5-10'	3.5/5		5'-7' silty clay with trace gravel, gray-brown with black staining (CL) 7'-7.25' coarse brown sand (SP) 7.25'-7.75' silty clay with trace gravel (CL) 7.75'-8' fine sand stained black (SP) 8'-10' gray silty clay with trace gravel, hard, moist (CL)	
10				End of Boring at 10 feet bgs	CPZ-21X set at 9' bgs with 5' screen K&E medium well gravel 9'-3' bgs Bentonite chips 3' bgs-surface
15					
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-22I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/12/19 END : 9/12/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0				0'-0.5' topsoil	
				0.5'-1.5' poor recovery, coarse sand	
	0-5'	4/5		1.5'-5' cap material, hard, gray-brown clayey silt with trace gravel (ML)	
5					
				5'-8' poor recovery, coarse sand and gravel (SW)	
	5-10'	3.5/5		8'-10' till - hard gray-brown silty clay with trace gravel (CL)	
10				End of Boring at 10 feet bgs	CPZ-22I set at 9' bgs with 5' screen K&E medium well gravel 9'-3' bgs Bentonite chips 3' bgs-surface
15					
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-22X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/12/19 END : 9/12/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0-5'	4.5/5		0'-0.5' topsoil 0.5'-5' cap material, clayey silt with trace sand and gravel, hard, dry, gray-brown (ML)	
5	5-10'	3.5/5		5'-6' fine to coarse brown sand and gravel (SW) 6'-8.5' silty clay, gray, hard (CL) 8.5'-9' fine to coarse sand, gray-brown, trace gravel (SW) 9'-10' silty clay, gray-brown, hard, trace gravel (CL)	
10				End of Boring at 10 feet bgs	CPZ-22X set at 9' bgs with 5' screen K&E medium well gravel 9'-3' bgs Bentonite chips 3' bgs-surface
15					
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-23I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/16/19 END : 9/16/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
5	0-5'	4/5		0'-0.5' topsoil, clayey, dark brown, organics 0.5'-1.5' poor recovery, medium sand with gravel (SW) 1.5'-5' clayey silt, gray-brown, hard, trace gravel (ML)	0
10	5-10'			5'-7.75' clayey silt, gray-brown, hard, trace gravel (ML) 7.75'-8.25' coarse sand with trace gravel, light brown, moist (SW) 8.25'-9.5' silty clay, gray-brown, trace gravel, hard, moist, fine sand seam <0.5 inches at 9.25 feet bgs 9.5'-9.75' fine clayey sand, gray, wet (SP) 9.75'-10' clay/silty clay, gray-brown, hard, moist, trace gravel	0
15				End of Boring at 10 feet bgs	CPZ-23I set at 10' bgs with 5' screen K&E medium well gravel 10'-4' bgs Bentonite chips 4' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-23IP	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/16/19 END : 9/16/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION	COMMENTS
				SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				See log for CPZ-23I	
10				End of Boring at 10 feet bgs	CPZ-23I set at 10' bgs with 5' screen K&E medium well gravel 10'-4' bgs Bentonite chips 4' bgs-surface

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-23X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/16/19 END : 9/16/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
5	0-5'	3.5/5		0'-0.5' topsoil, clayey, dark brown, organics 0.5'-2' poor recovery, coarse gravelly brown sand (SW) 2'-3.75' cap material, gray-brown silty clay with trace gravel and fine sand (CL) 3.75'-4' medium to coarse brown sand with trace gravel (SW) 4'-5' silty clay, gray-brown, hard, trace gravel (CL)	0
10	5-10'	3.5/5		5'-7' silty clay, gray-brown, hard, trace gravel (CL) 7'-7.25' medium coarse brown sand with trace gravel (SW) 7.25'-8' gray-brown silty clay, hard, trace gravel (CL) 8'-9' fine clayey sand, brown with black staining, trace gravel 9'-10' silty clay, hard, moist, gray-brown, trace gravel (CL)	0
15				End of Boring at 10 feet bgs	CPZ-23X set at 9' bgs with 5' screen K&E medium well gravel 9'-3' bgs Bentonite chips 3' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-24I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/16/19 END : 9/16/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0				0'-0.5' topsoil, clayey, dark brown 0.5'-1.5' poor recovery, gravelly sand	
	0-5'	4/5		1.5'-5' clayey silt, gray-brown, hard, trace gravel (ML) fine sand seam <6 inches thick at 4 feet bgs	0
5				5'-7.5' clayey fine sand, dark brown, moist, trace gravel (SP)	
	5-10'	3.5/5		7.5'-9' medium to coarse sand with trace gravel, brown, moist (SW) 9'-10' silty clay, gray-brown, hard, moist, trace gravel (CL)	0
10				End of Boring at 10 feet bgs	CPZ-24I set at 9' bgs with 5' screen K&E medium well gravel 9'-3' bgs Bentonite chips 3' bgs-surface
15					
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-24X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/16/19 END : 9/16/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0				0'-0.5' topsoil, clayey, dark brown	
	0-5'	4/5		0.5'-5' clayey silty gray brown, hard, trace gravel (ML), fine brown sand seam (SP) <0.5" thick at 3.5 feet bgs, fine sand seam (SP) stained black at 4 feet bgs	0
5				5'-7' clayey silty gray brown, hard, trace gravel (ML)	
	5-10'	4/5		7'-8.5' sand, medium to coarse, light brown, moist, trace gravel (SW)	0
				8.5'-10' silty clay, hard, moist, gray-brown, trace gravel (CL)	
10				End of Boring at 10 feet bgs	CPZ-24X set at 9' bgs with 5' screen K&E medium well gravel 9'-3' bgs Bentonite chips 3' bgs-surface
15					
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-25I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/16/19 END : 9/16/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil, dark brown, clayey	
	0-5'	4/5		0.5'-4.25' cap material - silty clay/clayey silt with trace sand and gravel, gray-brown, hard (ML)	0
5				4.25'-5' fine to medium brown sand, damp, some black staining (SP)	
				5'-7.75' fine to medium brown sand, damp, some black staining (SP)	
	5-10'	4/5			0
				7.75'-9.25' medium to coarse brown sand and gravel, wet (SW)	
10				9.25'-10' silty clay, hard, damp, gray-brown, trace gravel (CL)	
				10'-12.25' silty clay, hard, damp, gray-brown, trace gravel (CL)	
	10-15'	5/5			0
				12.25'-13.75' fine sand, gray-brown, loose, wet (SP)	
				13.75'-15' silty clay, hard, wet, gray-brown, trace gravel	
15				End of Boring at 15 feet bgs	CPZ-25I set at 14' bgs with 10' screen K&E medium well gravel 14'-3' bgs Bentonite chips 3' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-25X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/16/19 END : 9/16/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0				0'-0.5' topsoil	
	0-5'	3.5/5		0.5'-4.75' cap material - silty clay/clayey silt, brown, hard, trace gravel (ML)	0
5				4.75'-5' fine to medium light brown sand with trace gravel (SW)	
				5'-7.5' fine to medium light brown sand with trace gravel (SW)	
	5-10'	4.5/5			0
10				7.5'-10' medium to coarse sand and gravel, light brown, slightly moist (SW)	
	10-15'	4/5		10'-15' silty clay, hard, moist, gray-brown, trace gravel, fine sand seam 6 inches thick at 12 feet bgs	0
15				End of Boring at 15 feet bgs	CPZ-25X set at 13' bgs with 10' screen K&E medium well gravel 13'-2' bgs Bentonite chips 2' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-26I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/17/19 END : 9/17/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
5	0-5'	3.5/5		0'-0.5' topsoil, clayey, dark brown, organics 0.5'-2' poor recovery, gravelly brown sand 2'-4.5' cap material - clayey silt with trace gravel, gray-brown, dry, hard (ML) 4.5'-5' fine silty orange-brown sand with black staining (SP)	0
10	5-10'	3/5		5'-8.25' fine silty orange-brown sand with black staining (SP) 8.25'-10' coarse sand with some fine sand and trace gravel, moist, light orange-brown to gray-brown (SP)	0
15	10-15'	4/5		10'-12' coarse sand with some fine sand and trace gravel, moist, light orange-brown to gray-brown (SP) 12'-12.5' fine clayey sand, wet, gray (SP) 12.5'-12.75' hard, wet, clay (CL) 12.75-13' fine clayey sand, wet, gray, trace gravel (SP) 13'-15' till - hard, gray-brown silty clay, moist, trace gravel (CL)	0
20				End of Boring at 15 feet bgs	CPZ-26I set at 13' bgs with 10' screen K&E medium well gravel 13'-2' bgs Bentonite chips 2' bgs-surface

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-26IP	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/17/19 END : 9/17/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION	COMMENTS
				SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				see log for CPZ-26I	
15				End of Boring at 15 feet bgs	CPZ-26I set at 13' bgs with 10' screen K&E medium well gravel 13'-2' bgs Bentonite chips 2' bgs-surface

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-26X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/17/19 END : 9/17/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0				0'-0.5' topsoil, clayey, dark brown 0.5'-1.5' poor recovery, coarse sand	
	0-5'	4/5		1.5'-4.5' cap material, clayey silt, hard, gray-brown, dry, trace gravel (ML)	0
5					
	5-10'	3.5/5		4.5'-10' fine sand, brown with black staining, trace gravel (SP)	0
10				10'-11.5' fine sand, brown with black staining, trace gravel (SP) 11.5'-12' sandy clay, firm, gray-brown (CL)	
	10-15'	2/5		12'-14.5' fine to medium sand, brown, trace gravel (SP)	0
15				14.5'-15' coarse sand with trace gravel, brown, moist (SP) 15--18' no recovery	
	15-20	5/5		18'-18.5' fine sand, brown, trace gravel, little clay (SP) 18.5'-19' coarse gravelly sand with trace fine sand, moist (SP) 19'-19.25' sandy clay, gray-brown, firm, trace gravel (CL) 19.25'-20' till - silty clay, hard, moist, gray-brown, trace gravel (CL)	CPZ-26X set at 14.5' bgs with 10' screen K&E medium well gravel 14.5'-3.5' bgs Bentonite chips 3.5' bgs-surface
20				End of Boring at 20 feet bgs	

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-27I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/17/19 END : 9/17/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0				0'-0.5' topsoil 0.5'-1' poor recovery - fine sand	
	0-5'	4.5/5		1'-4' cap material - clayey silt, hard, dry, gray-brown, trace sand and gravel (ML)	0
5				4'-5' fine brown sand with trace gravel, black staining at 4 feet bgs (SP) 5'-7.5' fine brown sand with trace gravel (SP)	
	5-10'	3.5/5		7.5'-8.25' medium sand with trace gravel, moist	0
10				8.25'-10' silty gray-brown clay with trace gravel, hard, moist, gray-brown, sand seams 1 inch thick at 8.75 and 9.5 feet bgs	
	10-15'	4/5		10'-13' silty gray-brown clay with trace gravel, hard, moist, gray-brown 13'-13.5' fine clayey gray-brown sand, wet (SP) 13.5'-15' hard, gray-brown silty clay with trace gravel	0
15				End of Boring at 15 feet bgs	CPZ-27I set at 13.5' bgs with 10' screen K&E medium well gravel 13.5'-2.5' bgs Bentonite chips 2.5' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-27X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/17/19 END : 9/17/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0-5'	4/5		0'-0.5' topsoil 0.5'-1.5' poor recovery, coarse sand 1.5'-3.75' cap material, hard, dry, gray-brown silty clay with trace gravel (ML) 3.75'-5' fine brown sand with little silt and trace gravel (SP)	0
5				5'-7.5' fine brown sand with little silt and trace gravel (SP) 7.5'-8.25' fine brown sand with little silt and trace gravel, wet (SP)	
	5-10'	3/5		8.25'-9.5' clay/silty clay, hard, moist, gray-brown, trace sand and gravel (CL) 9.5'-9.75' medium to coarse sand with trace gravel, wet, gray (SP)	0
10				9.75'-10' silty clay, hard, moist, gray-brown, trace gravel (CL) 10'-11.75' silty clay, hard, moist, gray-brown, trace gravel (CL) 11.75'-12' fine clayey sand, gray-brown (SP)	
	10-15'	5/5			0
15				12'-15' till, silty clay, gray-brown, trace gravel, hard, moist	
20				End of Boring at 15 feet bgs	CPZ-27X set at 13' bgs with 10' screen K&E medium well gravel 10'-2' bgs Bentonite chips 2' bgs-surface

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-28I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/17/19 END : 9/17/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm):	Comments:
				0'-0.5' topsoil 0.5'-1.5' poor recovery, medium to coarse sand		
	0-5'	4/5		1.5'-4' cap material, clayey silt with trace gravel and sand, hard, dry, gray-brown (ML)	0	
5				4'-5' cap material, clayey silt with trace gravel and sand, hard, dry, gray-brown (ML), becoming silty clay (CL)		
	5-10'	4/5		5'-10' cap material, clayey silt with trace gravel and sand, hard, dry, gray-brown , becoming silty clay (CL), sand seam, fine light brown, < 1 inch thick at 8.75'	0	
10						
	10-15'	3/5		10'-14' cap material, silty clay, with trace gravel and sand, hard, dry, gray-brown, becoming wet at 13 feet bgs (CL)	0	
15				14'-15' sand, medium to coarse, loose, wet, gray, trace gravel (SP)		
	15'-20'	2.5/5		15'-18.5' sand, medium to coarse, loose, wet, gray, trace gravel (SP)	0	CPZ-28I set at 18.5' bgs with 10' screen K&E medium well gravel 18.5'-7.5' bgs
20				18.5'-20' till - silty clay with trace gravel, gray-brown, hard, wet (CL)		Bentonite chips 7.5' bgs-surface

End of Boring at 20 feet bgs

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-28 Slurry Wall	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/17/19 END : 9/17/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil	
	0-5'	4/5		0.5'-5' cap material - clayey silt, dry, hard, gray-brown, trace gravel (ML)	
5					
	5-10'	1.5/5		5'-10' slurry wall - very soft clayey sand, gray	
10					
	10-15'	1.5/5		10'-15' slurry wall - very soft clayey sand, gray	
15					
	15'-20'	4/5		15'-18.25' sand, fine to coarse with trace gravel, angular, gray-brown, wet (SP)	
				18.25'-20' till - gray-brown silty clay with trace gravel, hard, moist (CL)	
20				End of Boring at 20 feet bgs	

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-28X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/17/19 END : 9/17/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0				0'-0.5' topsoil, clayey, dark brown 0.5'-1' poor recovery, fine orange-brown sand	
	0-5'	4.5/5		1'-5' cap material - clayey silt with trace gravel and fine sand, hard, dry, gray-brown (ML)	0
5				5'-7.25' silty clay, hard, gray-brown, moist (CL)	
	5-10'	3.5/5		7.25'-7.5' sand, fine to medium with trace gravel, dry (SP) 7.5'-10' silty clay, gray-brown, hard, slightly moist, trace gravel (CL)	0
10				10'-13' silty clay, gray-brown, hard, slightly moist, trace gravel (CL)	
	10-15'	3/5		13'-15' sand, fine to coarse with trace gravel, wet, angular, gray-brown, 3 inches clay lens at 13.75 feet bgs	0.3 at 15 feet bgs
15				15'-18.5' sand, fine to coarse with trace gravel, wet, angular, gray-brown, 3 inches clay lens at 13.75 feet bgs	
	15'-20'	4/5		18.5'-20' till - silty clay, gray-brown, hard, wet, trace gravel (CL)	0 CPZ-28X set at 18.5' bgs with 10' screen K&E medium well gravel 18.5'-7.5' bgs Bentonite chips 7.5' bgs-surface
20				End of Boring at 20 feet bgs	

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-29I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/16/2019 END : 9/16/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil, dark brown with organics	
				0.5'-2' poor recovery, coarse light brown sand with trace gravel	
	0-5'	4/5			0
5				2'-8.5' cap material - clayey silt, gray-brown, hard, dry, trace gravel (ML)	
	5-10'	3/5			0
				8.5'-9.5' silty clay, firm, gray-brown, trace gravel (CL)	
10				9.5'-10' fine silty sand, stained black (SP)	odor at 9.5 feet bgs
				10'-11.5' poor recovery, fine silty sand observed	
	10-15'	5/5			0
				11.5'-15' silty clay, gray-brown, firm, moist, trace gravel (CL)	
15				End of Boring at 15 feet bgs	CPZ-29I set at 13' bgs with 10' screen K&E medium well gravel 13'-2' bgs Bentonite chips 2' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-29IP	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/16/19 END : 9/16/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION	COMMENTS
				SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				see log for CPZ-29I	
15				End of Boring at 15 feet bgs	CPZ-29I set at 13' bgs with 10' screen K&E medium well gravel 13'-2' bgs Bentonite chips 2' bgs-surface

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-29X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/16/19 END : 9/16/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0				0'-0.5' topsoil	
				0.5'-2.5' poor recovery, coarse sand and gravel	
	0-5'	3/5			0
5				2.5'-5' cap material - clayey silt with trace gravel, brown, hard (ML)	
				5'-9' cap material - clayey silt with trace gravel, brown, hard, becoming softer (ML)	
	5-10'	3/5			0
				9'-9.5' sand, fine, light brown (SP)	
10				9.5'-10' clayey sand, fine, stained dark brown (SP)	odor at 9.5 feet bgs
				10'-12' very poor recovery	
	10-15'	3/5			0
				12'-15' till - silty clay, hard, gray-brown, moist, trace gravel	
15				End of Boring at 15 feet bgs	CPZ-29X set at 13' bgs with 10' screen K&E medium well gravel 13'-2' bgs Bentonite chips 2' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-30I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/18/19 END : 9/18/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0-5'	3.5/5		0'-0.5' topsoil 0.5'-2' poor recovery, coarse brown sand observed material - clayey silt with trace gravel, gray-brown, hard,	0
5				4'-5' silty clay, firm, gray-brown, dry, trace gravel (CL) own, dry, trace gravel (CL), sand seam coarse brown <0	
	5-10'	3.5/5			0
10				'-10' soft gray-brown silty clay with trace sand, moist (CL 0'-11' soft gray-brown silty clay with trace sand, moist (C 11'-15' silty clay, gray-brown, hard, trace gravel (CL) - till	
	10-15'	5/5			0
15				End of Boring at 15 feet bgs	CPZ-30I set at 13' bgs with 10' screen K&E medium well gravel 13'-2' bgs Bentonite chips 2' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-30X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/18/19 8:05 am END : 9/5/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0				0'-0.5' topsoil	
	0-5'	3.5/5		0.5'-5' silty clay/clayey silt, light gray/brown, hard, slightly moist to 4 feet bgs becoming drier (ML)	0
5					
	5-10'	3/5		5'-9' silty clay/clayey silt, light gray/brown, hard, moist (ML)	0
10				9'-10' silty clay, gray/brown, medium soft, moist, trace gravel (CL)	
	10-15'	3/5		10'-13' silty clay, gray/brown, medium soft, moist, trace gravel (CL)	0
15				13'-15' silty clay, gray/brown, hard, moist trace gravel (CL), till	
	15-20'	4/5		15'-20' silty clay, gray/brown, hard, moist trace gravel (CL), till	0
20					CPZ-30X set at 13' bgs with 10' screen K&E medium well gravel 13'-2' bgs Bentonite chips 2' bgs-surface

End of Boring at 20 feet bgs

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-31I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/18/19 END : 9/18/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil	
	0-5'	3.5/5		0.5'-4' cap material - hard, sandy and clayey silt with trace gravel, gray-brown (ML)	0
5				4'-5' cap material - hard, sandy and clayey silt with trace gravel, gray-brown, becoming more clayey and less sandy (CL)	
	5-10'	3/5		5'-9' cap material - hard, sandy and clayey silt with trace gravel, gray-brown, becoming more clayey and less sandy (CL)	0
10				9'-10' sandy silty clay, soft/plastic, moist, gray-brown (CL)	
				10'-12.25' silty clay, firm, trace gravel, gray-brown (CL)	0
	10-15'	4.5/5		12.25'-14' sandy clay, soft/plastic, gray-brown, coarse sandy lenses at 13.25 feet, 13.5 feet and 14 feet bgs	9.3 ppm at 13.5 feet bgs
15				14'-15' silty clay, hard, moist, trace gravel (CL) - till	0
				End of Boring at 15 feet bgs	CPZ-31I set at 14' bgs with 10' screen K&E medium well gravel 14'-3' bgs Bentonite chips from 3' to surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-31X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/18/2019 END : 9/18/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil	
	0-5'	4.25/5		0.5'-5' cap material - dry, clayey silt with trace sand and gravel, hard, gray-brown (ML)	0
5					
	5-10'	4/5		5'-8.75' cap material - dry, clayey silt with trace sand and gravel, hard, gray-brown (ML)	0
				8.75'-10' silty clay, firm, gray-brown, trace gravel, stained black with odor at 10 feet bgs (CL)	
10					6.4 at 10 feet bgs
					0
					0.1
	10-15'	4.25/5		10'-14' silty clay, firm, gray-brown, trace gravel (CL)	
					0
				14'-15' wet clayey/silty fine sand with trace gravel, gray (SP)	
15					
	15-20'	5/5		15'-20' hard, moist silty clay with trace gravel, brown-gray (CL) - till	0
					CPZ-31X set at 15' bgs with 10' screen K&E medium well gravel 13'-4' bgs Bentonite chips 4' bgs-surface
20					

End of Boring at 20 feet bgs

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-32I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/18/19 END : 9/18/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil	
5	0-5'	3.5/5		0.5'-5' cap material - clayey silt with trace sand and gravel, hard, dry, gray-brown (ML)	0
	5-10'	2/5		5'-9' poor recovery, cap material - clayey silt with trace sand and gravel, hard, dry, gray-brown (ML)	0
10				9'-10' silty clay with trace gravel, medium soft, moist, gray-brown (CL)	
	10-15'	2.5/5		10'-13.5' silty clay with trace gravel, medium soft, moist, gray-brown (CL), becoming wetter and more plastic from 13 feet to 13.5 feet bgs	0
				13.5'-14' sand, fine/medium with trace gravel, wet, stained black, strong odor (SP)	12.7
15				14'-15' silty clay, hard, moist, gray-brown, trace gravel (CL) - till	0
				End of Boring at 15 feet bgs	CPZ-32I set at 14' bgs with 10' screen K&E medium well gravel 14'-3' bgs Bentonite chips 3' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-32IP	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/18/19 END : 9/18/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION	COMMENTS
				SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				see log for CPZ-32I	
15				End of Boring at 15 feet bgs	CPZ-32IP set at 14' bgs with 10' screen K&E medium well gravel 14'-3' bgs Bentonite chips 3' bgs-surface

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-32X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/18/2019 END : 9/18/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil	
	0-5'	4/5		0.5'-5' clayey silt with trace sand and gravel (cap material), gray-brown, hard, dry (ML)	0
5				5'-8' very poor recovery, clayey silt with trace sand and gravel (cap material), gray-brown, hard, dry (ML)	
	5-10'	2.5/5		8'-8.5' silty clay, soft/plastic, gray-brown, moist (CL)	0
				8.5'-10' silty clay, hard, gray-brown, moist (CL)	
10				10'-13.75' silty clay, medium soft, moist, gray-brown (CL)	
	10-15'	3/5		13.75-14' coarse sand, clayey, gray-brown, wet (SP)	0
				14'-15' clay/silty clay, gray-brown, hard, trace gravel (CL) - till	
15				End of Boring at 15 feet bgs	CPZ-32X set at 14' bgs with 10' screen K&E medium well gravel 14'-3' bgs Bentonite chips 3' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-33I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/18/19 END : 9/18/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil	
				0.5'-2' poor recovery - light brown, medium sand	
	0-5'	3.5/5		2'-4' cap material - light gray-brown clayey silt with trace sand and gravel, hard, dry (ML)	0
5				4'-5' silty clay, gray-brown, trace gravel, firm (CL)	
	5-10'	1.5/5		5'-10' silty clay, gray-brown, trace gravel, firm (CL)	0
10				10'-14' soft, plastic, gray-brown silty clay, moist, trace gravel	
	10-15'	3.5/5			0
15				14'-14.25' fine clayey sand, wet, trace gravel (SP) 14.25'-15' hard gray-brown silty clay with trace gravel (CL) fine sand lenses at 14.5 feet, 14.75 feet, and 15 feet bgs	
				15' - 16.5' fine sand with silt and clay, gray-brown, wet (SP)	
	15-20'	5/5			0
				16.5'-20' till - hard, moist, gray-brown silty clay with trace gravel (CL)	
20				End of Boring at 20 feet bgs	

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-33X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/18/19 END : 9/18/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil	
	0-5'	4.25/5		0.5'-5' cap material - clayey silt with trace sand and gravel, hard, dry, gray-brown (ML)	0
5					
	5-10'	4/5		5'-9' silty clay, hard, gray-brown, trace gravel (CL)	0
					72 odor, black staining
				9'-10' silty clay, stiff 1 inch fine sand lens stained black at 9.5 feet bgs (CL)	0
10					5.3
				10'-12' silty clay, stiff 1 inch fine sand lens stained black at 11.5 feet and 12 feet bgs (CL)	0
					11.4
	10-15'	5/5			
				12'-15' till - silty clay with trace gravel, gray-brown, hard, moist (CL)	0
15					
				End of Boring at 15 feet bgs	
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-34I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/19/19 END : 9/19/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0-5'	4/5		0'-0.5' topsoil 0.5'-4.25' cap material - hard, dry, gray-brown, clayey sandy silty with trace gravel (ML)	0
5				4.25'-5' silty clay, hard, dry, brown, trace gravel (CL)	
	5-10'	4/5		5'-8' silty clay, hard, dry, brown, trace gravel (CL) 8'-8.5' fine to medium dark brown sand, little clay (SP) 8.5'-8.75' bluish gray silty clay (CL) 8.75'-9' very fine silty sand (SP)	0
10				9'-10' medium sand with trace gravel, brown, moist (SP) 10'-11.5' silty clay, brown, little sand and trace gravel (CL)	
	10-15'	4/5		11.5'-13' fine silty sand, wet, brown, trace gravel (SP) 13'-15' till, wet, hard, gray silty clay with trace gravel (CL)	0
15				End of Boring at 15 feet bgs	CPZ-34I set at 13' bgs with 10' screen K&E medium well gravel 13'-2' bgs Bentonite chips 2' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-34X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/19/19 END : 9/19/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0				0'-0.5' topsoil	
	0-5'	4/5		0.5'-5' cap material - gray-brown, hard, dry, clayey silt with trace gravel (ML) 3 inch sand layer fine brown from 3.5 feet to 3.75 feet bgs	0
5				5'-6.5' poor recovery, 6 inches loose coarse gray-brown gravelly sand (SP)	
	5-10'	4/5		6.5'-7.25' clay, hard, silty, gray-brown (CL) 7.25'-8' fine reddish brown silty sand with trace gravel (SP) 8'-9' silty clay, reddish brown, hard (CL)	0
10				9'-10' fine reddish brown sand with trace gravel (SP) 10'-11.25' clay, stiff, gray-brown with trace sand and gravel 11.25'-12' fine sand, brown, moist, somewhat cohesive, trace gravel (SP)	
	10-15'	3.75/5			0
15				12'-15' till - silty clay, hard, moist, grayish brown, trace gravel	
				End of Boring at 15 feet bgs	CPZ-34X set at 12' bgs with 5' screen K&E medium well gravel 12'-6' bgs Bentonite chips 6' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-35I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/19/19 END : 9/19/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil	
	0-5'	4.5/5		0.5'-5' cap material, hard, dry, gray-brown clayey silt with trace sand and gravel (ML)	0
5				5'-7' cap material, hard, dry, gray-brown clayey silt with trace sand and gravel (ML)	0
	5-10'	3/5		7'-10' fine sand, brown, black staining at 8 feet bgs (SP)	0.2 0
10				10'-12.25' poor recovery, brown silty clay with trace gravel, firm (CL)	0
	10-15'	3/5		12.25'-13' coarse sand and gravel, wet, angular, brown to black (SP)	0.1 0
				13'-15' till, silty clay, hard, moist, gray-brown (CL)	1 0
15				End of Boring at 15 feet bgs	CPZ-35I set at 13' bgs with 10' screen K&E medium well gravel 13'-2' bgs Bentonite chips 2' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-35X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/19/19 END : 9/19/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil	
	0-5'	5/5		0.5'-5' cap material - hard, dry, gray-brown clayey silt with trace sand and gravel (ML) black staining 4.75 to 5 feet bgs, strong odor	0
5					29
				5'-7.5' cap material - hard, dry, gray-brown clayey silt with trace sand and gravel (ML) black staining and odor 7 feet to 7.5 feet bgs	0 1.0 6.8 0.2
	5-10'	3.75/5			0
				7.5'-10' fine sand, brown, slightly moist, somewhat cohesive (SP)	0
10					
				10'-12' fine sand, brown, slightly moist, somewhat cohesive (SP), staining odor 11.75 to 12 feet bgs	0
	10-15'	3.5/5			0.3
				12'-15' till - gray-brown silty clay, stiff to hard, moist, trace gravel (CL)	0
15					
				End of Boring at 15 feet bgs	CPZ-35X set at 12' bgs with 5' screen K&E medium well gravel 12'-6' bgs Bentonite chips 6' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-36I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/19/19 END : 9/19/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0-5'	4.25/5		0'-0.5' topsoil 0.5'-0.75' fine sand with trace gravel (SP) 0.75'-5' clayey silt, hard, gray-brown, dry, trace gravel	0
5	5-10'	3.5/5		5'-8' clayey silt, hard, gray-brown, dry, trace gravel 8'-9' fine sand with little clay and trace gravel, brown, wet (SP) 9'-10' gravelly, medium to coarse sand, brown, wet	0
10	10-15'	5/5		10'-11' hard gray-brown silty clay with trace gravel (CL) 11'-12' coarse gray-brown sand with trace gravel, wet (SP) 12'-15' till, hard, moist gray-brown silty clay with trace gravel (CL)	0
15				End of Boring at 15 feet bgs	CPZ-36I set at 12' bgs with 5' screen K&E medium well gravel 12'-6' bgs Bentonite chips 6' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-36IP	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/19/19 END : 9/19/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION	COMMENTS
				SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				see log for CPZ-36I	
15				End of Boring at 15 feet bgs	CPZ-36I set at 12' bgs with 5' screen K&E medium well gravel 12'-6' bgs Bentonite chips 6' bgs-surface

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-36X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/19/19 END : 9/19/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
5	0-5'	3.5/5		0'-0.5' topsoil 0.5'-0.75' fine brown sand (SP) 0.75'-5' cap material - clayey silt, hard, gray-brown, dry, trace sand and gravel	0
	5-10'	4/5		5'-8' cap material - clayey silt, hard, gray-brown, dry, trace sand and gravel	0
10				8'-8.5' sand, fine to medium with trace gravel, cohesive, stained black, strong odor (SP)	80.8
				8.5'-10' sand, fine to medium with trace gravel, cohesive (SP), no staining, no odor	0
				10'-10.25' sand, fine to medium with trace gravel, cohesive (SP)	59.4
				10.25'-10.5' sand, fine to medium with trace gravel, cohesive (SP), stained black	0
	10-15'	5/5		10.5'-15' till, hard, moist, gray-brown silty clay with trace gravel (CL)	1.7
15					0
				End of Boring at 15 feet bgs	CPZ-36X set at 11' bgs with 5' screen K&E medium well gravel 11'-5' bgs Bentonite chips 5' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-37I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/19/19 END : 9/19/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil	
	0-5'	5/5		0.5'-5' cap material - clayey silt with trace sand and gravel, hard, dry, gray-brown	
5				5'-7.25' cap material - clayey silt with trace sand and gravel, hard, dry, gray-brown	
	5-10'	3.75/5		7.25'-9.25' silty clayey sand with trace gravel, fine, cohesive, dark gray-brown	
				9.25'-10' silty clayey sand with trace gravel, fine, cohesive, dark gray-brown, wet	
10				10'-11.25' silty clayey sand with trace gravel, fine, cohesive, dark gray-brown with small clay lenses	
				11.25'-12' silty clayey sand with trace gravel, fine, cohesive, dark gray-brown, looser	
	10-15'	4/5		12'-15' till - silty clay with trace gravel, moist, hard, gray-brown	
15				End of Boring at 15 feet bgs	CPZ-37I set at 13' bgs with 10' screen K&E medium well gravel 13'-2' bgs Bentonite chips 2' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-37X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/19/19 END : 9/19/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0				0'-0.5' topsoil, dark brown with organics	
	0-5'	4.5/5		0.5'-5' clayey silt with trace sand and gravel, dry, gray-brown, crumbly texture (ML)	0
5				5'-6' poor recovery, clayey silt with trace sand and gravel, dry, gray-brown, crumbly texture (ML)	
				6'-7.5' silty clay, brown-gray, firm to hard (CL)	
	5-10'	4/5		7.5'-10' sand, fine to medium with little silt and trace gravel, slightly moist, brown	0
10				10'-13' sand, fine to medium with little silt and trace gravel, slightly moist, brown	
	10-15'	3.25/5		13'-15' till, hard, moist gray-brown silty clay with trace gravel	0
15				End of Boring at 15 feet bgs	CPZ-37X set at 13' bgs with 10' screen K&E medium well gravel 13'-2' bgs Bentonite chips 2' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-38I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/18/19 END : 9/18/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0				0'-0.5' topsoil, dark brown	
	0-5'	4/5		0.5'-5' cap material, clayey silt with trace gravel, hard, dry, gray-brown (ML)	0
5				5'-7.75' poor recovery, little clayey silt	
	5-10'	2.5/5		7.75'-9.5' sand, fine to medium with trace gravel, loose, brown (SP)	0
10				9.5'-10' clay, stiff, moist, gray-brown, 1 inch lens approximately 1 inch from top of clay (CL)	
	10-15'	3/5		10'-12' poor recovery, fine brown sand with trace gravel observed (SP)	0
15				12'-15' silty clay, hard, dark gray-brown, moist, trace gravel (CL) till	
				End of Boring at 15 feet bgs	CPZ-38I set at 12' bgs with 5' screen K&E medium well gravel 12'-6' bgs Bentonite chips 6' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-38IP	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/18/19 END : 9/18/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION	COMMENTS
				SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				see log for CPZ-38I	
5					
10					
15				End of Boring at 15 feet bgs	CPZ-38I set at 12' bgs with 5' screen K&E medium well gravel 12'-6' bgs Bentonite chips 6' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-38X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/18/19 END : 9/18/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0				0'-0.5' topsoil, dark brown, clayey 0.5'-1.5' poor recovery, fine to medium brown sand	
	0-5'	4/5		1.5'-5' cap material, hard, gray-brown clayey silt with trace gravel (ML)	0
5				5'-8' poor recovery, gray-brown clayey silt with trace gravel	
	5-10'	2.5/5		8'-9' medium sand, light brown, trace coarse sand and gravel (SP) 9'-9.5' gravel and silt, gray-brown, dry (GP) 9.5'-10' clay, stiff brown, moist, trace gravel (CL)	0
10				10'-12' silty sand with little gravel, dry, clayey lens around 11.75 feet bgs (SP)	
	10-15'	5/5		12'-15' till - silty clay, trace gravel, gray, no odor (CL)	0
15				End of Boring at 15 feet bgs	CPZ-38X set at 11' bgs with 5' screen K&E medium well gravel 11'-5' bgs Bentonite chips 5' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-39I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/19/19 END : 9/19/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0-5'	4/5		0'-0.5' topsoil 0.5'-1.5' poor recovery, little fine to medium brown sand 1.5'-4' cap material, sandy/clayey gray-brown silt with trace gravel, dry, somewhat hard (ML) 4'-5' silty clay, brown, very stiff, dry, trace gravel (CL) 5'-6' silty clay, brown, very stiff, dry, trace gravel (CL)	0
5	5-10'	5/5		6' fine sand lens 6'-8' silty clay, hard, dry, gray-brown, trace gravel (CL) 8'-10' silty clay, hard, dry, gray-brown, trace gravel (CL), stiff, moist	0
10	10-15'	5/5		10'-15' silty clay, hard, dry, gray-brown, trace gravel (CL) hard, till	0
15				End of Boring at 15 feet bgs	CPZ-39I set at 10' bgs with 5' screen K&E medium well gravel 10'-4' bgs Bentonite chips 4' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-39X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/19/2019 END : 9/19/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
0	0-5'	4/5		0'-0.5' topsoil, dark brown, clayey 0.5'-1.5' poor recovery, little coarse brown sand 1.5'-5' cap material, clayey silt with trace sand and gravel, hard, dry, light brown (ML)	0
5	5-10'	5/5		5'-10' silty clay, gray-brown, very stiff, trace gravel (CL)	0
10	10-15'	5/5		10'-13.5' clay, silty, brown, very stiff, trace gravel (CL) 13.5'-13.75' clayey fine sand, brown, moist, cohesive (SP) 13.75'-15' till- grayish brown silty clay with trace gravel, hard, moist	0
15				End of Boring at 15 feet bgs	CPZ-39X set at 14' bgs with 10' screen K&E medium well gravel 14'-3' bgs Bentonite chips 3' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-40I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/19/19 END : 9/19/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
5	0-5'	4/5		0'-1' poor recovery 1'-1.25' sand, fine, gray-brown, trace gravel 1.25'-1.5' topsoil, dark brown, clayey with organics 1.5'-4' cap material, clayey sandy silt, dry, gray-brown, trace gravel (ML) 4'-5' silty clay, hard, gray-brown, trace gravel (CL)	0
10	5-10'	5/5		5'-10' silty clay, hard, gray-brown, trace gravel (CL)	0
15	10-15'	5/5		10'-15' silty clay, hard, gray-brown, trace gravel (CL)	0
20				End of Boring at 15 feet bgs	CPZ-40I set at 15' bgs with 10' screen K&E medium well gravel 15'-4' bgs Bentonite chips 4' bgs-surface

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-40IP	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/19/19 END : 9/19/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION	COMMENTS
				SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				see log for CPZ-40I	
15				End of Boring at 15 feet bgs	CPZ-40I set at 15' bgs with 10' screen K&E medium well gravel 15'-4' bgs Bentonite chips 4' bgs-surface

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-40X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/19/19 END : 9/19/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil	
				0.5'-1.5' poor recovery, gravelly sand	
	0-5'	4/5		1.5'-4' cap material, clayey sandy silt, gray-brown, dry, trace gravel (ML)	0
5				4'-5' silty clay, hard, gray-brown, dry, trace gravel (CL)	
	5-10'	5/5		5'-10' silty clay, hard, gray-brown, dry, trace gravel (CL)	0
10				10'-11' silty medium to coarse sand, gray-brown, wet, trace gravel (SP)	odor 0 0.1 0
	10-15'	5/5		11'-15' silty clay, hard, moist, gray-brown, trace gravel, till	0.3 0 0.1 0
15				End of Boring at 15 feet bgs	CPZ-40X set at 11' bgs with 5' screen K&E medium well gravel 11'-5' bgs Bentonite chips 5' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-41I	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/19/19 END : 9/19/19 LOGGER : Emily Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil	
				0.5'-2.75' poor recovery, fine brown sand	
	0-5'	2.75/5		2.75'-4.25' cap material, silty clay with trace gravel, dark brown, hard, dry (ML)	0
				4.25'-5' gravel, white, 1 to 2 inches	
5					
				5'-8.25' silty clay with trace gravel, hard, dry (CL)	0
	5-10'	5/5			
				8.25'-8.75' gravel and coarse sand, wet, stained black, strong odor	1.4
				8.75'-10' silty clay with trace gravel, hard, moist, brown (CL)	0
10					
				10'-10.25' silty clay with trace gravel, hard, moist, brown (CL)	0.5
				10.25'-11' gravel, wet, stained, black, strong odor	0 0.2
	10-15'	5/5			
				11'-15' till, silty clay, hard, gray-brown, moist, trace gravel	0
15					
				End of Boring at 15 feet bgs	CPZ-41I set at 11' bgs with 5' screen K&E medium well gravel 11'-5' bgs Bentonite chips 5' bgs-surface
20					

PROJECT NUMBER	BORING NUMBER	
677664CH	CPZ-41X	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Velsicol UGSW LOCATION : St Louis, MI

ELEVATION : DRILLING CONTRACTOR : Mateco

DRILLING METHOD AND EQUIPMENT USED : Geoprobe 7822DT

WATER LEVELS : START : 9/19/2019 END : 9/19/19 LOGGER : Emily Pasek

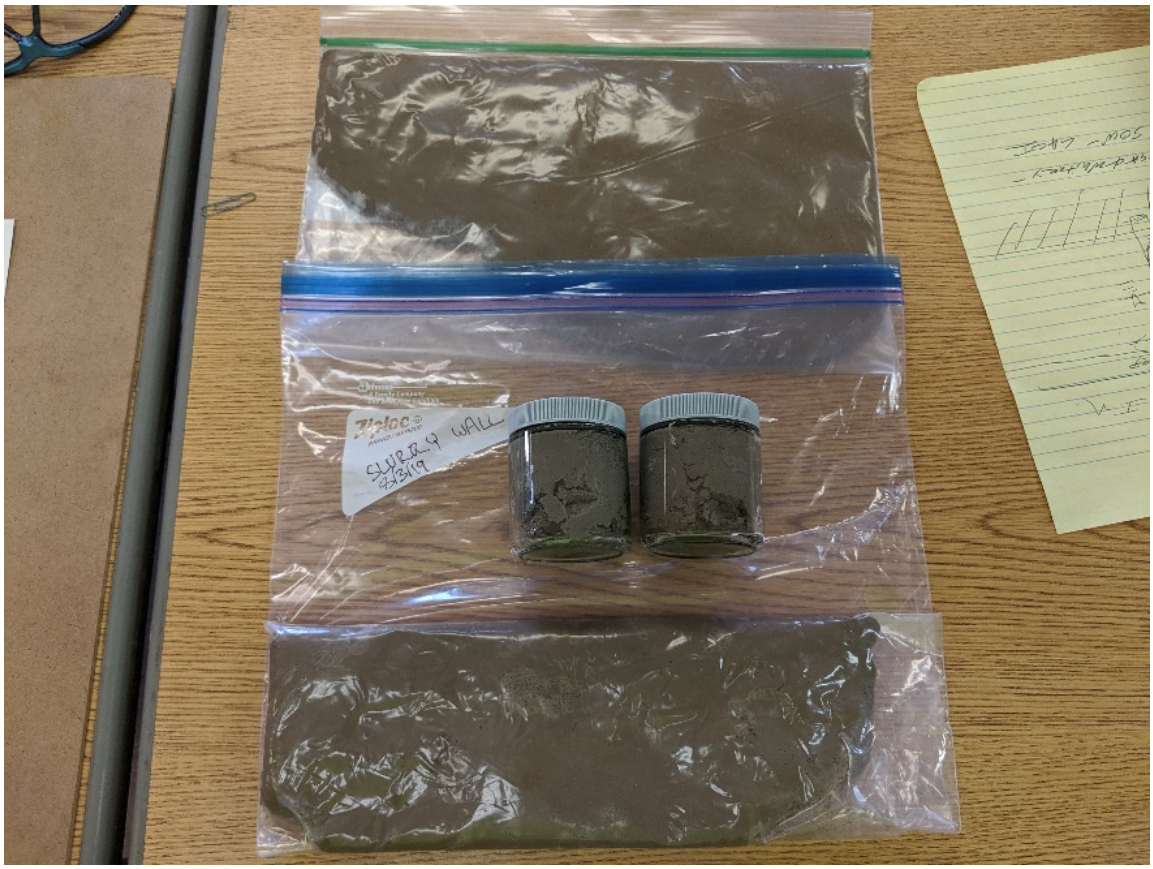
DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (FT)	#/TYPE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINEROLOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. PID (ppm): Comments:
				0'-0.5' topsoil	
5	0-5'	2.25/5		0.5'-5' cap material - clayey silt with trace sand and gravel, hard, dry, gray-brown (ML)	0
10	5-10'	5/5		5'-10' silty clay with trace gravel, gray-brown, slightly moist, hard (CL)	0
15	10-15'	5/5		10'-15' silty clay with trace gravel, gray-brown, slightly moist, hard (CL)	0
20				End of Boring at 15 feet bgs	CPZ-41X set at 15' bgs with 10' screen K&E medium well gravel 15'-4' bgs Bentonite chips 4' bgs-surface

Appendix B
Photo Log

Project Title	**Velsicol Former Plant Site Upgradient Slurry Wall Investigation**
Purpose	**Representative Photos of Piezometer Installation Activities**
Location	Velsicol Former Plant Site, St. Louis, Michigan
Date	August 2020

Photograph 1: CPZ-01 Cluster (09-05-2019)

Photograph 2: Slurry wall material core (09-03-2019)



Photograph 3: Slurry wall material sample (09-04-2019)

Photograph 4: CPZ-17 soil core (09-11-2019)

Photograph 5: CPZ-26 drilling activities (09-11-2019)

Photograph 6: CPZ-38 soil core (09-12-2019)

Appendix C
Survey Data

7-Nov-19

Rowe Professional Services Company, Job No. 19M0093

Client: CH2M Hill, Inc. / Jacobs

Project:

Velsicol Chemical Corporation Superfund Site

Upgradient Slurry Wall Investigation

St. Louis, Michigan

Professional Services Agreement Number: 148009444

Pt. No.	Northing	Easting	Elevation	Code	Description
1	697011.81	13058067.28	730.26	448	1X
101	697011.69	13058063.75	730.62	448	1I
201	697011.86	13058061.57	730.61	448	1IP
301	697012.11	13058065.75	727.44	56	Slurry Wall1
2	696941.49	13058071.74	730.98	448	2X
102	696942.10	13058061.56	731.55	448	2I
302	696941.85	13058066.66	728.46	56	Slurry Wall2
3	696878.63	13058047.06	728.69	448	3X
103	696889.10	13058046.17	732.02	448	3I
303	696883.76	13058047.07	729.00	56	Slurry Wall3
4	696879.73	13057979.41	732.52	448	4X
104	696885.88	13057978.84	733.11	448	4I
204	696888.15	13057978.72	733.00	448	4IP
304	696882.38	13057978.95	729.72	56	Slurry Wall4
5	696878.43	13057907.14	732.48	448	5X
105	696888.26	13057906.05	733.39	448	5I
305	696883.48	13057907.21	730.10	56	Slurry Wall5
6	696877.09	13057837.32	732.08	448	6X
106	696886.68	13057839.95	733.20	448	6I
306	696882.45	13057837.01	729.80	56	Slurry Wall6
7	696876.51	13057773.63	731.78	448	7X
107	696886.75	13057774.13	732.60	448	7I
307	696881.90	13057773.78	729.51	56	Slurry Wall7
8	696881.11	13057673.30	732.45	448	8X
108	696884.32	13057672.61	732.58	448	8I
208	696886.37	13057672.01	729.86	448	8IP
308	696882.54	13057672.83	729.69	56	Slurry Wall8
9	696877.82	13057534.13	731.99	448	9X

109	696883.86	13057534.04	732.63	448	9I
209	696886.00	13057533.87	732.69	448	9IP
309	696881.18	13057534.04	729.36	56	Slurry Wall9
10	696875.07	13057463.37	731.47	448	10X
110	696884.00	13057462.42	732.71	448	10I
310	696879.66	13057462.84	729.27	56	Slurry Wall10
11	696873.41	13057384.83	731.35	448	11X
111	696883.44	13057385.41	732.67	448	11I
311	696878.19	13057385.06	729.27	56	Slurry Wall11
12	696877.64	13057314.31	732.02	448	12X
112	696882.01	13057314.24	732.45	448	12I
212	696884.15	13057313.96	732.74	448	12IP
312	696879.59	13057314.03	729.28	56	Slurry Wall12
13	696874.46	13057248.72	731.58	448	13X
113	696883.98	13057247.66	732.71	448	13I
313	696879.49	13057248.17	729.33	56	Slurry Wall13
14	696833.88	13057211.13	731.94	448	14X
114	696835.12	13057207.06	732.44	448	14I
214	696835.71	13057205.47	732.60	448	14IP
314	696834.15	13057209.58	729.14	56	Slurry Wall14
15	696749.84	13057214.69	731.26	448	15X
115	696751.13	13057204.91	732.03	448	15I
315	696750.40	13057209.68	728.59	56	Slurry Wall15
16	696696.26	13057214.32	730.79	448	16X
116	696697.12	13057207.27	731.25	448	16I
316	696696.39	13057208.96	728.27	56	Slurry Wall16
17	696622.96	13057212.01	729.93	448	17X
117	696623.13	13057207.96	730.36	448	17I
217	696623.13	13057205.68	730.43	448	17IP
317	696623.27	13057209.26	727.29	56	Slurry Wall17
18	696553.29	13057213.03	729.75	448	18X
118	696554.41	13057203.09	730.73	448	18I
318	696554.53	13057208.04	727.35	56	Slurry Wall18
19	696491.35	13057213.16	730.11	448	19X
119	696492.37	13057203.16	730.92	448	19I
319	696491.95	13057207.95	727.68	56	Slurry Wall19

20	696421.92	13057213.78	727.99	448	20X
120	696422.18	13057207.65	731.31	448	20I
220	696422.06	13057205.46	731.50	448	20IP
320	696421.80	13057210.76	728.25	56	Slurry Wall20
21	696399.37	13057189.72	731.24	448	21X
121	696409.23	13057190.86	731.65	448	21I
321	696404.51	13057190.47	728.49	56	Slurry Wall21
22	696396.21	13057125.41	731.12	448	22X
122	696404.68	13057125.16	732.07	448	22I
322	696403.29	13057125.74	729.04	56	Slurry Wall22
23	696386.05	13057055.33	733.01	448	23X
123	696386.56	13057049.04	733.72	448	23I
223	696386.99	13057047.10	733.84	448	23IP
323	696385.74	13057052.61	730.39	56	Slurry Wall23
24	696318.28	13057058.34	733.42	448	24X
124	696318.45	13057048.78	734.16	448	24I
324	696318.03	13057053.39	731.02	56	Slurry Wall24
25	696239.87	13057057.55	734.40	448	25X
125	696240.30	13057047.92	735.05	448	25I
325	696239.73	13057052.97	731.77	56	Slurry Wall25
26	696169.83	13057054.51	731.73	448	26X
126	696169.96	13057048.51	735.15	448	26I
226	696169.87	13057046.37	735.08	448	26IP
326	696170.08	13057052.19	731.99	56	Slurry Wall26
27	696097.76	13057054.07	734.59	448	27X
127	696098.26	13057047.67	735.06	448	27I
327	696098.12	13057052.21	731.71	56	Slurry Wall27
28	696027.12	13057056.18	734.89	448	28X
128	696027.09	13057052.28	735.29	448	28I
328	696027.44	13057053.96	732.36	56	Slurry Wall28
29	695955.38	13057057.72	735.92	448	29X
129	695955.43	13057052.33	736.60	448	29I
229	695955.52	13057048.70	736.52	448	29IP
329	695955.85	13057054.67	733.20	56	Slurry Wall29
30	695884.81	13057059.91	735.84	448	30X
130	695884.99	13057049.92	736.82	448	30I
330	695885.79	13057054.84	733.41	56	Slurry Wall30

31	695816.87	13057059.16	736.13	448	31X
131	695815.77	13057052.43	736.83	448	31I
331	695816.57	13057055.23	733.78	56	Slurry Wall31
32	695738.82	13057058.44	736.53	448	32X
132	695738.55	13057052.43	737.59	448	32I
232	695738.50	13057050.81	737.81	448	32IP
332	695739.09	13057055.35	733.99	56	Slurry Wall32
33	695674.21	13057061.68	736.35	448	33X
133	695673.74	13057053.93	737.41	448	33I
333	695674.06	13057056.75	734.00	56	Slurry Wall33
34	695608.38	13057059.29	737.15	448	34X
134	695609.46	13057049.34	738.21	448	34I
334	695608.68	13057054.95	734.52	56	Slurry Wall34
35	695541.79	13057060.37	737.71	448	35X
135	695542.26	13057051.46	738.41	448	35I
335	695542.59	13057053.74	735.36	56	Slurry Wall35
36	695477.24	13057054.87	737.80	448	36X
136	695477.12	13057048.74	737.83	448	36I
236	695476.87	13057046.93	735.30	448	36IP
336	695476.54	13057051.82	734.94	56	Slurry Wall36
37	695456.61	13057018.88	738.74	448	37X
137	695466.49	13057018.54	739.17	448	37I
337	695461.74	13057019.41	735.88	56	Slurry Wall37
38	695458.04	13056885.14	734.71	448	38X
138	695464.52	13056884.32	737.41	448	38I
238	695466.87	13056884.03	737.49	448	38IP
338	695461.75	13056885.72	734.82	56	Slurry Wall38
39	695455.36	13056815.97	736.77	448	39X
139	695465.36	13056816.47	736.82	448	39I
339	695460.14	13056816.02	733.88	56	Slurry Wall39
40	695458.20	13056726.99	735.79	448	40X
140	695464.27	13056726.83	735.78	448	40I
240	695466.67	13056726.65	735.67	448	40IP
340	695461.71	13056727.00	732.74	56	Slurry Wall40
41	695457.11	13056654.90	734.56	448	41X
141	695466.88	13056656.24	735.06	448	41I

341	695462.16	13056656.09	731.95	56	Slurry Wall41
42	695454.99	13056630.51	733.91	448	42X
142	695469.17	13056627.90	735.20	448	42I
342	695462.33	13056630.50	731.52	56	Slurry Wall42

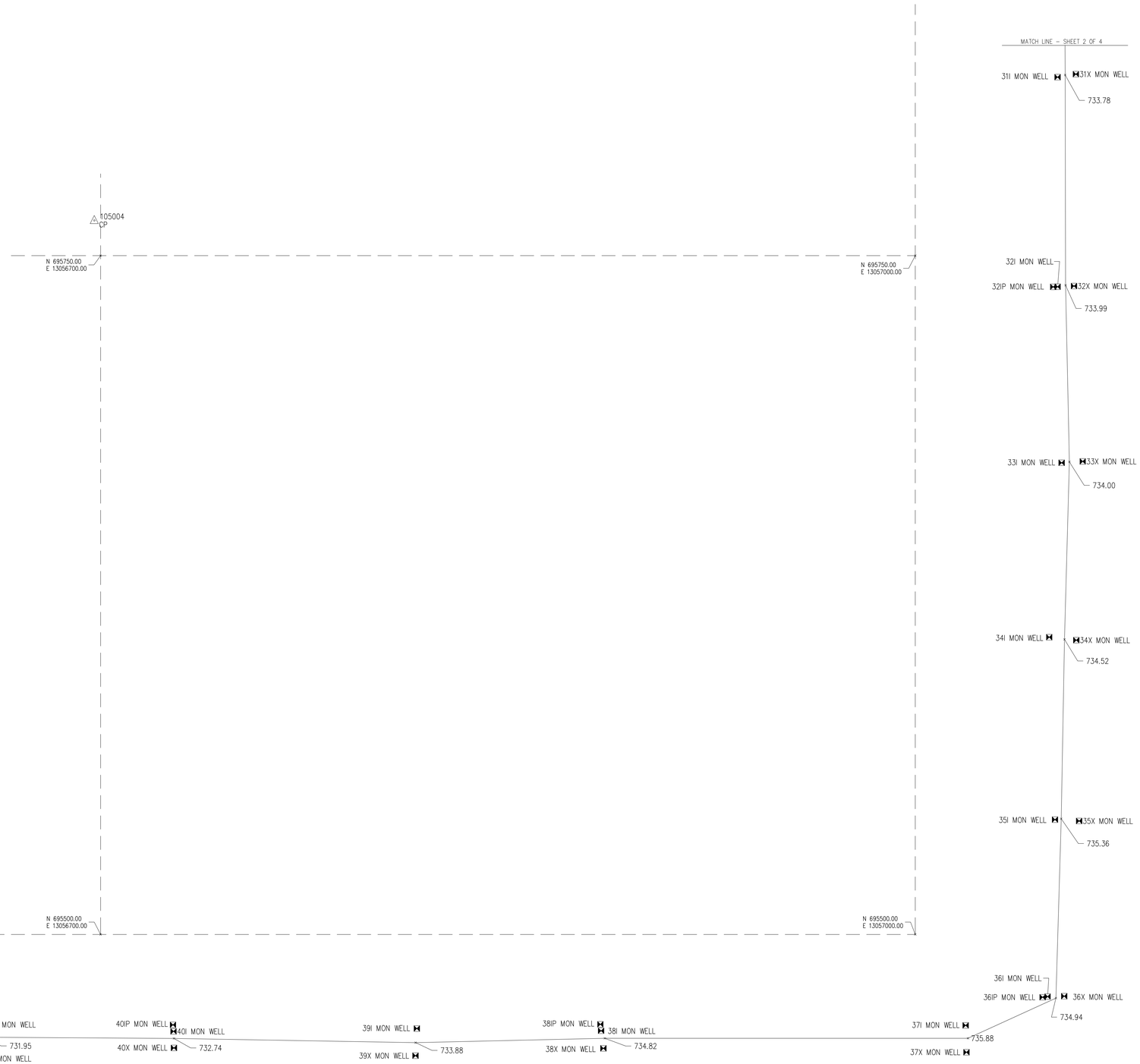
Coordinates and elevations based on provided
CP 105005 and CP 105004

LEGEND:

- #I MON WELL = PIEZOMETER INTERNAL
- #IP MON WELL = PIEZOMETER FURTHER INTERNAL
- #X MON WELL = PIEZOMETER EXTERNAL
- ###.## = SLURRY WALL LOCATION/GROUND ELEV.
- = EXISTING SLURRY WALL
- = GRID LINE

0 20 40

1 inch = 20' ft.



NOTES:

- HORIZONTAL DATUM NAD83/CORS2011, MCS SOUTH ZONE 2113, INTERNATIONAL FEET
- VERTICAL DATUM NAVD88
- HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT
  CP 105002 - N: 696892.665, E: 13057099.930, Elev: 736.91, Desc: 5/8" Iron Rod w/cap
  CP 105004 - N: 695762.947, E: 13056697.640, Elev: 744.53, Desc: 5/8" Iron Rod w/cap
  CP 105005 - N: 696213.038, E: 13056900.740, Elev: 736.11, Desc: 5/8" Iron Rod w/cap

I , JOHN H. RAUSER, PS., HEREBY CERTIFY THAT ALL WORK PERFORMED ON THIS PROJECT COMPLIES WITH THE ACCURACY REQUIREMENTS AND WITH APPLICABLE FEDERAL AND STATE LAWS, CODES, ORDINANCES, RULES AND REGULATIONS.

STATE OF MICHIGAN
JOHN H. RAUSER
PROFESSIONAL SURVEYOR
No. 39096
LICENSED PROFESSIONAL SURVEYOR

November 8, 2019
Date:

PLAN DATE: NOVEMBER 8, 2019
PROJECT MGR: JR
REVIEWER: JR
SCALE: 1" = 20'

ROWE PROFESSIONAL SERVICES COMPANY
127 S. Main Street
Mt. Pleasant, MI 48858
O: (989) 772-2138
F: (989) 773-7757
www.rowepsc.com

PREPARED FOR
VELSICOL CHEMICAL CORPORATION
CH2M HILL, INC. / JACOBS
UPGRADIENT SLURRY WALL INVESTIGATION
CITY OF ST. LOUIS, GRATIOT COUNTY, MICHIGAN

REV:

SHT# 1 OF 4

JOB No: 19M0093

PLOTTED: 11/8/2019 3:22 PM
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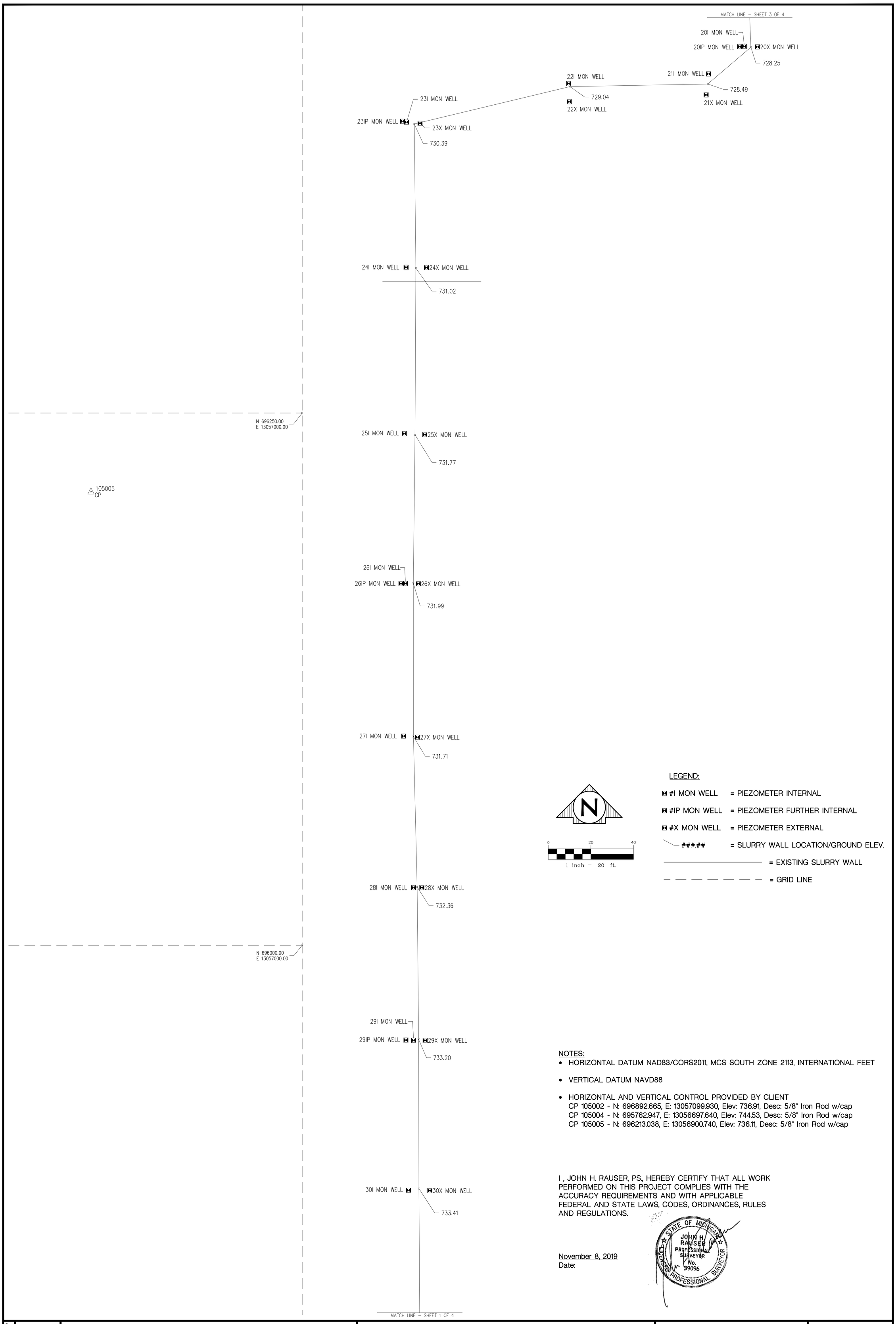

NOTES:

- HORIZONTAL DATUM NAD83/CORS2011, MCS SOUTH ZONE 2113, INTERNATIONAL FEET
- VERTICAL DATUM NAVD88
- HORIZONTAL AND VERTICAL CONTROL PROVIDED BY CLIENT
  CP 105002 - N: 696892.665, E: 13057099.930, Elev: 736.91, Desc: 5/8" Iron Rod w/cap
  CP 105004 - N: 695762.947, E: 13056697.640, Elev: 744.53, Desc: 5/8" Iron Rod w/cap
  CP 105005 - N: 696213.038, E: 13056900.740, Elev: 736.11, Desc: 5/8" Iron Rod w/cap

I , JOHN H. RAUSER, PS., HEREBY CERTIFY THAT ALL WORK PERFORMED ON THIS PROJECT COMPLIES WITH THE ACCURACY REQUIREMENTS AND WITH APPLICABLE FEDERAL AND STATE LAWS, CODES, ORDINANCES, RULES AND REGULATIONS.

STATE OF MICHIGAN
JOHN H. RAUSER
PROFESSIONAL SURVEYOR
No. 39096
LICENSED PROFESSIONAL SURVEYOR

November 8, 2019
Date:

JOB No: 19M0093
SHT# 2 OF 4
REV:

PREPARED FOR

VELISCOLE CHEMICAL CORPORATION
CH2MHILL, INC. / JACOBS

UPGRADIENT SLURRY WALL INVESTIGATION
CITY OF ST. LOUIS, GRATIOT COUNTY, MICHIGAN

ROWE PROFESSIONAL SERVICES COMPANY
127 S. Main Street
Mt. Pleasant, MI 48858
O: (989) 772-2138
F: (989) 773-7757
www.rowepsc.com

PLAN DATE: NOVEMBER 8, 2019
PROJECT MGR: JR
REVIEWER: JR
SCALE: 1"=20'

PLOTTED: 11/8/2019 3:23 PM
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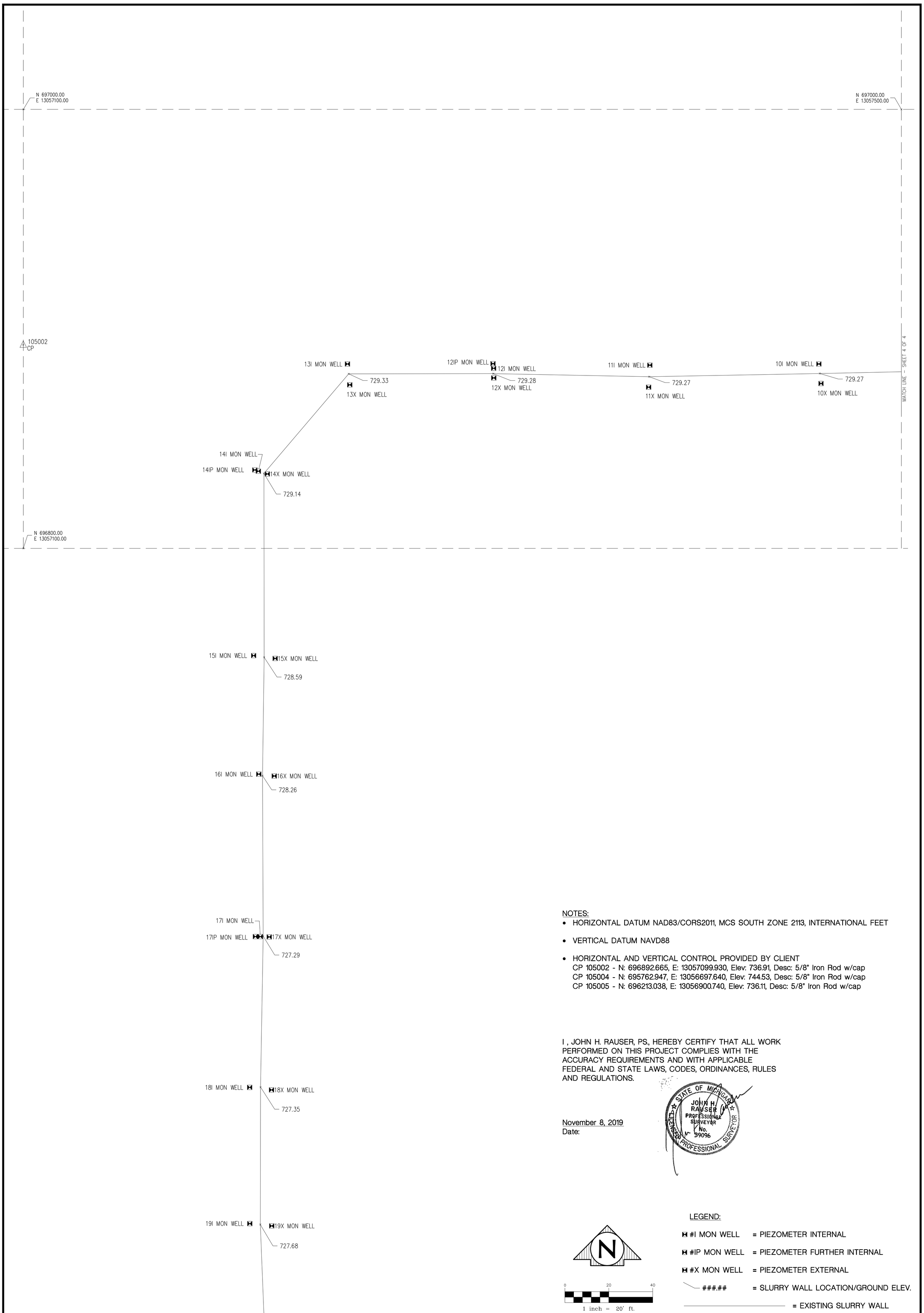

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STATE OF MICHIGAN
JOHN H. RAUSER
PROFESSIONAL SURVEYOR
No. 39096
LICENSED PROFESSIONAL SURVEYOR

November 8, 2019
Date:

N

0 20 40
1 inch = 20' ft.

LEGEND:

- #I MON WELL = PIEZOMETER INTERNAL
- #IP MON WELL = PIEZOMETER FURTHER INTERNAL
- #X MON WELL = PIEZOMETER EXTERNAL
- ###.## = SLURRY WALL LOCATION/GROUND ELEV.
- = EXISTING SLURRY WALL
- = GRID LINE

REV:
SHT# 3 OF 4
JOB No: 19M0093

PREPARED FOR
VELISCOLE CHEMICAL CORPORATION
CH2MHILL, INC. / JACOBS
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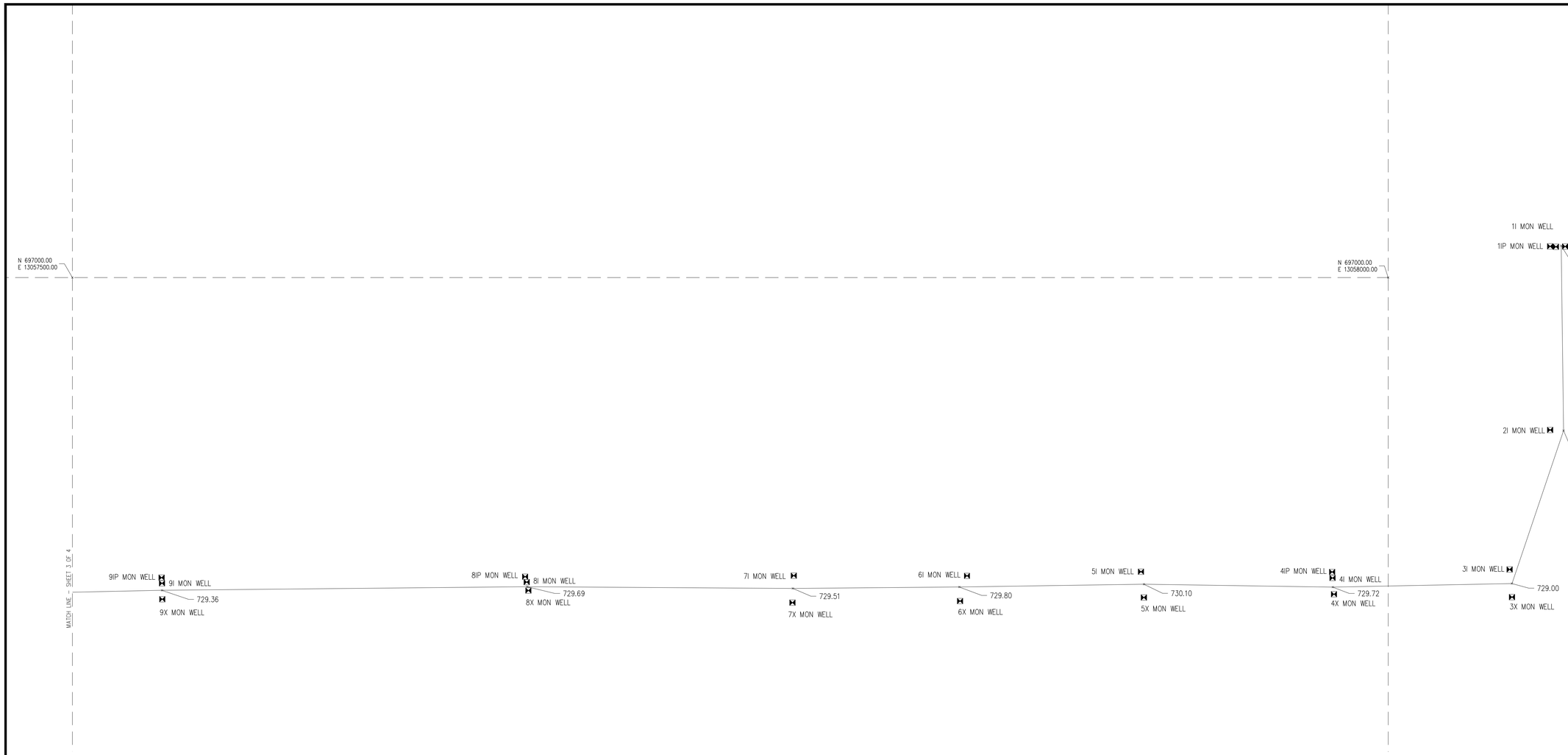
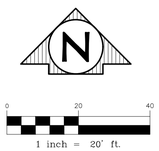
PROJECT MGR: JR
REVIEWER: JR
SCALE: 1"=20'





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November 8, 2019
Date:

PLAN DATE: NOVEMBER 8, 2019
PROJECT MGR: JR
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SCALE: 1" = 20'

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PLOTTED: 11/8/2019 3:23 PM

REV:

SHT# 4 OF 4

JOB No: 19M0093

Appendix D
Hydraulic Conductivity Testing Report

Materials Testing Consultants
www.mtc-test.com • 800.968.8378

PROJECT NO.: 191480
DATE: 9-26-2019
SHEET: 1 OF 1

AASHTO R18

PROJECT Velsicol
CLIENT Jacobs CH2M
CONTRACTOR
ENGINEER/ARCHITECT

MEASUREMENT OF HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIALS USING A FLEXIBLE WALL PERMEAMETER ASTM D 5084

MTC SAMPLE NO.: 155014 TEST DATE: 9/26/2019
SAMPLE LOCATION: ST-CPZ-09-7.5/9.5 SAMPLE CONDITION: Undisturbed
SAMPLE DESCRIPTION: Gray Clay
TYPE OF SAMPLE: Shelby Tube

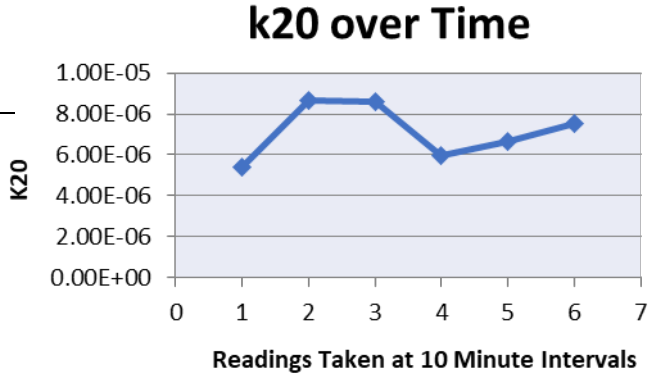
SAMPLE DIMENSIONS - INITIAL
DIAMETER (IN): 2.872 HEIGHT (IN): 3.104 AREA (SQ IN): 6.476
DRY UNIT WEIGHT (PCF): 126.7 WATER CONTENT (%): 8.2

TYPE OF PERMEANT: De-Aired Water
MAXIMUM BACK PRESSURE USED (PSI): 57.5 psi
MAXIMUM EFFECTIVE CONSOLIDATION STRESS: 2.5 psi
MINIMUM EFFECTIVE CONSOLIDATION STRESS: 0.5 psi
RANGE OF HYDRAULIC GRADIENT: 2.081 – 4.773

SAMPLE DIMENSIONS - FINAL
DIAMETER (IN): 2.849 HEIGHT (IN): 3.117 AREA (SQ IN): 6.376
DRY UNIT WEIGHT (PCF): 127.5 WATER CONTENT (%): 10.9 SATURATION: 100% *

AVERAGE HYDRAULIC CONDUCTIVITY (CM/SEC): 7.49×10^{-6}

REMARKS: *Assumed Specific Gravity – 2.63



REPORT BY: **REVIEWED BY:** Tim Lautenbach

Materials Testing Consultants
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PROJECT NO.: 191480
DATE: 9-26-2019
SHEET: 1 OF 1

AASHTO R18

PROJECT Velsicol
CLIENT Jacobs CH2M
CONTRACTOR
ENGINEER/ARCHITECT

MEASUREMENT OF HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIALS USING A FLEXIBLE WALL PERMEAMETER ASTM D 5084

MTC SAMPLE NO.: 155015 TEST DATE: 9/17/2019
SAMPLE LOCATION: ST-CPZ-04-9/11 SAMPLE CONDITION: Undisturbed
SAMPLE DESCRIPTION: Gray Clay
TYPE OF SAMPLE: Shelby Tube

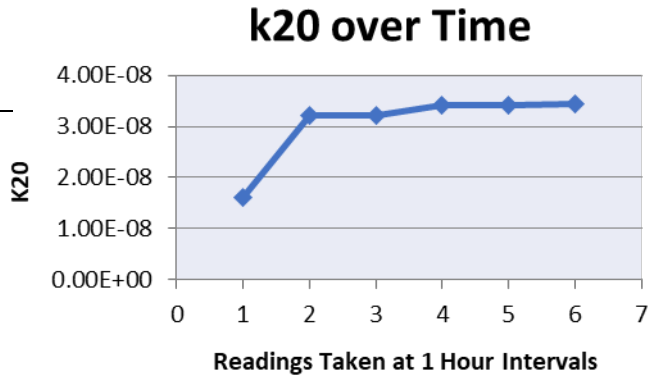
SAMPLE DIMENSIONS - INITIAL
DIAMETER (IN): 2.854 HEIGHT (IN): 2.923 AREA (SQ IN): 6.395
DRY UNIT WEIGHT (PCF): 126.8 WATER CONTENT (%): 10.1

TYPE OF PERMEANT: De-Aired Water
MAXIMUM BACK PRESSURE USED (PSI): 57.0 psi
MAXIMUM EFFECTIVE CONSOLIDATION STRESS: 3.0 psi
MINIMUM EFFECTIVE CONSOLIDATION STRESS: 1.0 psi
RANGE OF HYDRAULIC GRADIENT: 9.836 – 10.044

SAMPLE DIMENSIONS - FINAL
DIAMETER (IN): 2.878 HEIGHT (IN): 2.969 AREA (SQ IN): 6.504
DRY UNIT WEIGHT (PCF): 118.3 WATER CONTENT (%): 14.2 SATURATION: 100% *

AVERAGE HYDRAULIC CONDUCTIVITY (CM/SEC): 3.23×10^{-8}

REMARKS: *Assumed Specific Gravity – 2.60



REPORT BY: **REVIEWED BY:** Tim Lautenbach

Materials Testing Consultants
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PROJECT NO.: 191480
DATE: 9-26-2019
SHEET: 1 OF 1

AASHTO R18

PROJECT Velsicol
CLIENT Jacobs CH2M
CONTRACTOR
ENGINEER/ARCHITECT

MEASUREMENT OF HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIALS USING A FLEXIBLE WALL PERMEAMETER ASTM D 5084

MTC SAMPLE NO.: 155016 TEST DATE: 9/25/2019
SAMPLE LOCATION: ST-CPZ-17-6/8 SAMPLE CONDITION: Undisturbed
SAMPLE DESCRIPTION: Gray Clay
TYPE OF SAMPLE: Shelby Tube

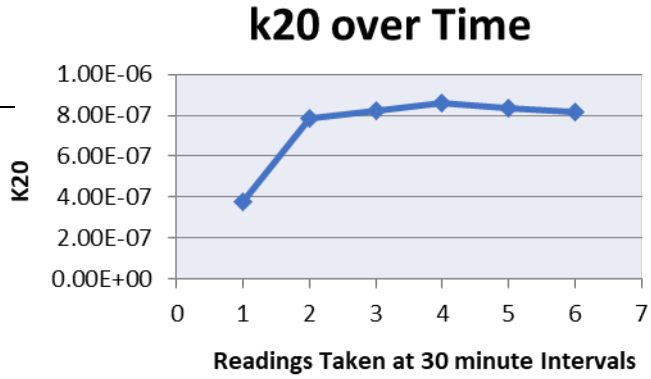
SAMPLE DIMENSIONS - INITIAL
DIAMETER (IN): 2.897 HEIGHT (IN): 3.025 AREA (SQ IN): 6.592
DRY UNIT WEIGHT (PCF): 117.6 WATER CONTENT (%): 16.6

TYPE OF PERMEANT: De-Aired Water
MAXIMUM BACK PRESSURE USED (PSI): 57.0 psi
MAXIMUM EFFECTIVE CONSOLIDATION STRESS: 3.0 psi
MINIMUM EFFECTIVE CONSOLIDATION STRESS: 1.0 psi
RANGE OF HYDRAULIC GRADIENT: 7.783 – 10.115

SAMPLE DIMENSIONS - FINAL
DIAMETER (IN): 2.885 HEIGHT (IN): 3.036 AREA (SQ IN): 6.537
DRY UNIT WEIGHT (PCF): 116.9 WATER CONTENT (%): 15.9 SATURATION: 100% *

AVERAGE HYDRAULIC CONDUCTIVITY (CM/SEC): 8.23×10^{-7}

REMARKS: *Assumed Specific Gravity – 2.66



REPORT BY: **REVIEWED BY:** Tim Lautenbach

Materials Testing Consultants
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PROJECT NO.: 191480
DATE: 9-26-2019
SHEET: 1 OF 1

AASHTO R18

PROJECT Velsicol
CLIENT Jacobs CH2M
CONTRACTOR
ENGINEER/ARCHITECT

MEASUREMENT OF HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIALS USING A FLEXIBLE WALL PERMEAMETER ASTM D 5084

MTC SAMPLE NO.: 155017 TEST DATE: 9/13/2019
SAMPLE LOCATION: ST-CPZ-26-6/8 SAMPLE CONDITION: Undisturbed
SAMPLE DESCRIPTION: Gray Clay
TYPE OF SAMPLE: Shelby Tube

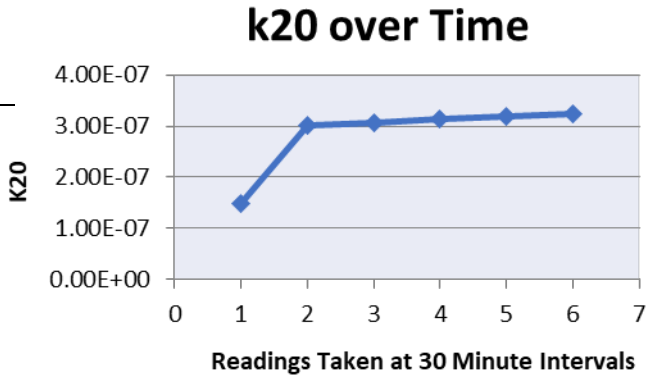
SAMPLE DIMENSIONS - INITIAL
DIAMETER (IN): 2.882 HEIGHT (IN): 2.861 AREA (SQ IN): 6.523
DRY UNIT WEIGHT (PCF): 116.1 WATER CONTENT (%): 17.3

TYPE OF PERMEANT: De-Aired Water
MAXIMUM BACK PRESSURE USED (PSI): 57.0 psi
MAXIMUM EFFECTIVE CONSOLIDATION STRESS: 3.0 psi
MINIMUM EFFECTIVE CONSOLIDATION STRESS: 1.0 psi
RANGE OF HYDRAULIC GRADIENT: 8.456 – 9.391

SAMPLE DIMENSIONS - FINAL
DIAMETER (IN): 2.853 HEIGHT (IN): 2.858 AREA (SQ IN): 6.391
DRY UNIT WEIGHT (PCF): 116.9 WATER CONTENT (%): 16.8 SATURATION: 100% *

AVERAGE HYDRAULIC CONDUCTIVITY (CM/SEC): 3.13×10^{-7}

REMARKS: *Assumed Specific Gravity – 2.73



REPORT BY: **REVIEWED BY:** Tim Lautenbach

Materials Testing Consultants
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PROJECT NO.: 191480
DATE: 9-26-2019
SHEET: 1 OF 1

AASHTO R18

PROJECT Velsicol
CLIENT Jacobs CH2M
CONTRACTOR
ENGINEER/ARCHITECT

MEASUREMENT OF HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIALS USING A FLEXIBLE WALL PERMEAMETER ASTM D 5084

MTC SAMPLE NO.: 155018 TEST DATE: 9/23/2019
SAMPLE LOCATION: ST-CPZ-38-8/10 SAMPLE CONDITION: Undisturbed
SAMPLE DESCRIPTION: Gray Clay
TYPE OF SAMPLE: Shelby Tube

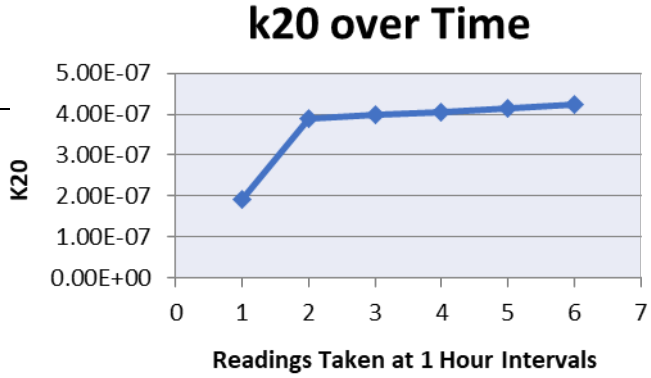
SAMPLE DIMENSIONS - INITIAL
DIAMETER (IN): 2.852 HEIGHT (IN): 3.052 AREA (SQ IN): 6.387
DRY UNIT WEIGHT (PCF): 114.1 WATER CONTENT (%): 17.2

TYPE OF PERMEANT: De-Aired Water
MAXIMUM BACK PRESSURE USED (PSI): 57.0 psi
MAXIMUM EFFECTIVE CONSOLIDATION STRESS: 3.0 psi
MINIMUM EFFECTIVE CONSOLIDATION STRESS: 1.0 psi
RANGE OF HYDRAULIC GRADIENT: 9.581 – 10.856

SAMPLE DIMENSIONS - FINAL
DIAMETER (IN): 2.871 HEIGHT (IN): 3.025 AREA (SQ IN): 6.475
DRY UNIT WEIGHT (PCF): 111.7 WATER CONTENT (%): 17.6 SATURATION: 100% *

AVERAGE HYDRAULIC CONDUCTIVITY (CM/SEC): 4.07×10^{-7}

REMARKS: *Assumed Specific Gravity – 2.62



REPORT BY: **REVIEWED BY:** Tim Lautenbach

Appendix E
Dye-Tracer Study Laboratory Reports

Crawford Hydrology Lab *

Western Kentucky University
Bowling Green, KY 42101
(270) 745-9224
E-mail: Crawford.Hydrology@wku.edu

* *Hydrogeologists, Geologists, Environmental Scientists*

* *Karst Groundwater Investigations * Fluorescent Dye Analysis*

LABORATORY REPORT SHEET

FLUORIMETRIC ANALYSIS RESULTS

Velsicol-Former Michigan Chemical Company

Analysis requested by:

Stephen Chumney-CH2M/Jacobs

D&C RED 28

Color Index:
Phloxine B

Dye Receptor:
Activated Charcoal

Analysis by:
Spectrofluorophotometer

						CHARCOAL RECEPTORS			
						D&C RED 28 PQL in Eluent: 0.010 ppb PQL in Water: 0.010 ppb λ in Eluent: 565.4nm λ in Water: 556.7 nm			
Lab ID	Event	Date Collected	Feature Name	TIME	Peakfit	Results	Conc in ppb	Peak Center (nm)	Comments
EL-01I-0	BG	10/21/19	CPZ-01I	1006		ND			
EL-01I-0	02	12/17/19	CPZ-01I	1006		ND			
EH-01I-D	03	01/02/20	CPZ-01I	1031		+++	5,131	565.2	DILUTED 1:100
EH-01I-D	04	01/15/20	CPZ-01I	1003		+++	11,130	565.4	DILUTED 1:10,000
EH-01I-D	05	01/29/20	CPZ-01I	1015		+++	3,646	565.2	DILUTED 1:1000
EH-01I-D	06	02/10/20	CPZ-01I	925		+++	15,146	565.2	DILUTED 1:1000
EL-01X-0	BG	10/21/19	CPZ-01X	1005		ND			
EL-01X-0	02	12/17/19	CPZ-01X	1005		ND			
EL-01X-0	03	01/02/20	CPZ-01X	1028		ND			
EL-01X-0	04	01/15/20	CPZ-01X	1009		ND			
EL-01X-0	05	01/29/20	CPZ-01X	1020		ND			
EL-01X-0	06	02/10/20	CPZ-01X	932		ND			
EL-04I-0	BG	10/21/19	CPZ-04I	1011		ND			
EL-04I-0	02	12/17/19	CPZ-04I	1011		ND			
EL-04I-0	03	01/02/20	CPZ-04I	1040		ND			
EL-04I-0	04	01/15/20	CPZ-04I	1016		ND			
EL-04I-0	05	01/29/20	CPZ-04I	1024		ND			
EL-04I-0	06	02/10/20	CPZ-04I	940		ND			
EL-04X-0	BG	10/21/19	CPZ-04X	1010		ND			
EL-04X-0	02	12/17/19	CPZ-04X	1010		B	0.012	560.0,POR	
EL-04X-0	03	01/02/20	CPZ-04X	1037		ND			
EL-04X-0	04	01/15/20	CPZ-04X	1022		ND			
EL-04X-0	05	01/29/20	CPZ-04X	1030		ND			
EL-04X-0	06	02/10/20	CPZ-04X	947		ND			
EH-08I-D	BG	10/21/19	CPZ-08I	1018		ND			
EH-08I-D	02	12/17/19	CPZ-08I	1018		+++	137,685	565.4	DILUTED 1:1000
EH-08I-D	03	01/02/20	CPZ-08I	1055		+++	1,001,330	565.2	DILUTED 1:10,000
EH-08I-D	04	01/15/20	CPZ-08I	1030		+++	428,280	565.4	DILUTED 1:10,000
EH-08I-D	05	01/29/20	CPZ-08I	1037		+++	745,920	565.2	DILUTED 1:10,000
EH-08I-D	06	02/10/20	CPZ-08I	952		+++	550,970	565.2	DILUTED 1:10,000
EL-08X-0	BG	10/21/19	CPZ-08X	1016		ND			
EL-08X-0	02	12/17/19	CPZ-08X	1016		ND			
EL-08X-0	03	01/02/20	CPZ-08X	1050		ND			
EL-08X-0	04	01/15/20	CPZ-08X	1030		ND			
EL-08X-0	05	01/29/20	CPZ-08X	1043		+?	0.857	565.0	
EL-08X-0	06	02/10/20	CPZ-08X	1000		ND			
EH-09I-0	BG	10/21/19	CPZ-09I	1027		ND			
EH-09I-0	02	12/17/19	CPZ-09I	1027		+++	51.313	565.2	
EH-09I-0	03	01/02/20	CPZ-09I	1100		+++	37.590	565.2	
EH-09I-0	04	01/15/20	CPZ-09I	1041		+++	36.143	565.2	
EH-09I-D	05	01/29/20	CPZ-09I	1054		+++	433.0	565.4	DILUTED 1:100
EH-09I-D	06	02/10/20	CPZ-09I	1020		+++	190.5	565.0	DILUTED 1:100
EL-09X-0	BG	10/21/19	CPZ-09X	1026		ND			
EL-09X-0	02	12/17/19	CPZ-09X	1026		ND			
EL-09X-0	03	01/02/20	CPZ-09X	1055		ND			
EL-09X-0	04	01/15/20	CPZ-09X	1050		ND			
EL-09X-0	05	01/29/20	CPZ-09X	1101		ND			
EL-09X-0	06	02/10/20	CPZ-09X	1027		ND			
EH-012I-D	BG	10/21/19	CPZ-12I	1033		ND			
EH-012I-D	02	12/17/19	CPZ-12I	1033		+++	11,229	565.4	DILUTED 1:1000
EH-012I-D	03	01/02/20	CPZ-12I	1104		+++	5,419	565.2	DILUTED 1:1000
EH-012I-D	04	01/15/20	CPZ-12I	1058		+++	1,223	565.2	DILUTED 1:1000
EH-012I-D	05	01/29/20	CPZ-12I	1107		+++	18,499	565.2	DILUTED 1:1000
EH-012I-D	06	02/10/20	CPZ-12I	1036		+++	7,327	565.0	DILUTED 1:1000
EL-012X-0	BG	10/21/19	CPZ-12X	1031		ND			
EL-012X-0	02	12/17/19	CPZ-12X	1031		ND			
EL-012X-0	03	01/02/20	CPZ-12X	1100		ND			
EL-012X-0	04	01/15/20	CPZ-12X	1107		ND			
EL-012X-0	05	01/29/20	CPZ-12X	1114		ND			
EL-012X-0	06	02/10/20	CPZ-12X	1042		ND			
EL-014I-0	BG	10/21/19	CPZ-14I	1035		ND			
EL-014I-0	02	12/17/19	CPZ-14I	1035		ND			

ND Below Quantitation Limit B Background NS No Sample + Positive ++ Very Positive +++ Extremely Positive

EL-014I-0	03	01/02/20	CPZ-14I	1111		ND		
EL-014I-0	04	01/15/20	CPZ-14I	1115		ND		
EL-014I-0	05	01/29/20	CPZ-14I	1121		ND		
EL-014I-0	06	02/10/20	CPZ-14I	1050		ND		
EL-014X-0	BG	10/21/19	CPZ-14X	1033		ND		
EL-014X-0	02	12/17/19	CPZ-14X	1033		ND		
EL-014X-0	03	01/02/20	CPZ-14X	1108		ND		
EL-014X-0	04	01/15/20	CPZ-14X	1121		+?	5.367	565.2
EL-014X-0	05	01/29/20	CPZ-14X	1127		ND		
EL-014X-0	06	02/10/20	CPZ-14X	1056		ND		
EL-017I-0	BG	10/21/19	CPZ-17I	1041		ND		
EL-017I-0	02	12/17/19	CPZ-17I	1041		ND		
EL-017I-0	03	01/02/20	CPZ-17I	1119		ND		
EL-017I-0	04	01/15/20	CPZ-17I	1129		ND		
EL-017I-0	05	01/29/20	CPZ-17I	1134		ND		
EL-017I-0	06	02/10/20	CPZ-17I	1101		ND		
EL-017X-0	BG	10/21/19	CPZ-17X	1040		ND		
EL-017X-0	02	12/17/19	CPZ-17X	1040		ND		
EL-017X-0	03	01/02/20	CPZ-17X	1113		ND		
EL-017X-0	04	01/15/20	CPZ-17X	1135		ND		
EL-017X-0	05	01/29/20	CPZ-17X	1140		ND		
EL-017X-0	06	02/10/20	CPZ-17X	1110		ND		
EL-020I-0	BG	10/21/19	CPZ-20I	1047		ND		
EL-020I-0	02	12/17/19	CPZ-20I	1047		ND		
EL-020I-0	03	01/02/20	CPZ-20I	1131		ND		
EL-020I-0	04	01/15/20	CPZ-20I	1145		B	0.027	564.0
EL-020I-0	05	01/29/20	CPZ-20I	1148		ND		
EL-020I-0	06	02/10/20	CPZ-20I	1117		ND		
EL-020X-0	BG	10/21/19	CPZ-20X	1045		ND		
EL-020X-0	02	12/17/19	CPZ-20X	1045		ND		
EL-020X-0	03	01/02/20	CPZ-20X	1128		ND		
EL-020X-0	04	01/15/20	CPZ-20X	1154		ND		
EL-020X-0	05	01/29/20	CPZ-20X	1153		ND		
EL-020X-0	06	02/10/20	CPZ-20X	1123		ND		
EL-023I-0	BG	10/21/19	CPZ-23I	1056		ND		
EL-023I-0	02	12/17/19	CPZ-23I	1056		ND		
EH-023I-D	03	01/02/20	CPZ-23I	1143		+++	78,335	565.2	DILUTED 1:1000
EH-023I-D	04	01/15/20	CPZ-23I	1202		+++	22,155	565.4	DILUTED 1:1000
EH-023I-D	05	01/29/20	CPZ-23I	1159		+++	4,954	565.2	DILUTED 1:1000
EH-023I-D	06	02/10/20	CPZ-23I	1129		+++	2,222	565.2	DILUTED 1:1000
EL-023X-0	BG	10/21/19	CPZ-23X	1054		ND		
EL-023X-0	02	12/17/19	CPZ-23X	1054		ND		
EL-023X-0	03	01/02/20	CPZ-23X	1137		ND		
EL-023X-0	04	01/15/20	CPZ-23X	1209		ND		
EL-023X-0	05	01/29/20	CPZ-23X	1208		ND		
EL-023X-0	06	02/10/20	CPZ-23X	1135		ND		
EH-026I-D	BG	10/21/19	CPZ-26I	1101		ND			DILUTED 1:1000
EH-026I-D	02	12/17/19	CPZ-26I	1101		+++	105,051	565.4	DILUTED 1:1000
EH-026I-D	03	01/02/20	CPZ-26I	1149		+++	459,900	565.2	DILUTED 1:10,000
EH-026I-D	04	01/15/20	CPZ-26I	1215		+++	35,270	565.4	DILUTED 1:10,000
EH-026I-D	05	01/29/20	CPZ-26I	1214		+++	117,700	565.2	DILUTED 1:10,000
EH-026I-D	06	02/10/20	CPZ-26I	1142		+++	1,904	565.4	DILUTED 1:1000
EL-026X-0	BG	10/21/19	CPZ-26X	1059		ND		
EL-026X-0	02	12/17/19	CPZ-26X	1059		+	0.198	563.4
EL-026X-0	03	01/02/20	CPZ-26X	1142		++	2.145	565.2
EL-026X-0	04	01/15/20	CPZ-26X	1223		ND		
EL-026X-0	05	01/29/20	CPZ-26X	1222		ND		
EL-026X-0	06	02/10/20	CPZ-26X	1150		ND		
EL-029I-0	BG	10/21/19	CPZ-29I	1109		ND		
EL-029I-0	02	12/17/19	CPZ-29I	1109		+?	0.388	565.0
EL-029I-0	03	01/02/20	CPZ-29I	1158		B	0.083	564.4
EL-029I-0	04	01/15/20	CPZ-29I	1230		B	0.015	563.0
EL-029I-0	05	01/29/20	CPZ-29I	1229		+?	0.108	564.4
EL-029I-0	06	02/10/20	CPZ-29I	1158		B	0.034	566.2
EL-029X-0	BG	10/21/19	CPZ-29X	1107		ND		
EL-029X-0	02	12/17/19	CPZ-29X	1107		B	0.060	563.4
EL-029X-0	03	01/02/20	CPZ-29X	1155		B	0.064	563.4
EL-029X-0	04	01/15/20	CPZ-29X	1235		ND		
EL-029X-0	05	01/29/20	CPZ-29X	1236		ND		
EL-029X-0	06	02/10/20	CPZ-29X	1206		ND		
EH-032I-D	BG	10/21/19	CPZ-32I	1115		ND			DILUTED 1:1000
EH-032I-D	02	12/17/19	CPZ-32I	1115		+++	65,408	565.4	DILUTED 1:1000
EH-032I-D	03	01/02/20	CPZ-32I	1210		+++	247,350	565.2	DILUTED 1:10,000
EH-032I-D	04	01/15/20	CPZ-32I	1244		+++	116,670	565.4	DILUTED 1:10,000
EH-032I-DD	05	01/29/20	CPZ-32I	1242		+++	69,060	565.2	DILUTED 1:10,000
EH-032I-D	06	02/10/20	CPZ-32I	1216		+++	88,320	565.2	DILUTED 1:10,000
EL-032X-0	BG	10/21/19	CPZ-32X	1114		ND		
EL-032X-0	02	12/17/19	CPZ-32X	1114		B	0.07	564.6
EL-032X-0	03	01/02/20	CPZ-32X	1205		+?	0.259	564.8
EL-032X-0	04	01/15/20	CPZ-32X	1251		B	0.027	562.6
EL-032X-0	05	01/29/20	CPZ-32X	1247		ND		
EL-032X-0	06	02/10/20	CPZ-32X	1223		ND		

ND Below Quantitation Limit B Background NS No Sample + Positive ++ Very Positive +++ Extremely Positive

EL-036I-0	BG	10/21/19	CPZ-36I	1123		ND			
EL-036I-0	02	12/17/19	CPZ-36I	1123		B	0.034	564.0	
EL-036I-0	03	01/02/20	CPZ-36I	1219		++	3.166	565.2	
EL-036I-D	04	01/15/20	CPZ-36I	1256		+++	1,299	565.4	DILUTED 1:1000
EL-036I-D	05	01/29/20	CPZ-36I	1254		+++	7,436	565.2	DILUTED 1:1000
EL-036I-D	06	02/10/20	CPZ-36I	1237		+++	20,634	565.0	DILUTED 1:1000
EL-036X-0	BG	10/21/19	CPZ-36X	1119		ND			
EL-036X-0	02	12/17/19	CPZ-36X	1119		B	0.084	565.2	
EL-036X-0	03	01/02/20	CPZ-36X	1213		ND			
EL-036X-0	04	01/15/20	CPZ-36X	1301		B	0.072	565.8	
EL-036X-0	05	01/29/20	CPZ-36X	1302		B	0.034	566.2	
EL-036X-0	06	02/10/20	CPZ-36X	1244		ND			
EL-038I-0	BG	10/21/19	CPZ-38I	1130		ND			
EL-038I-0	02	12/17/19	CPZ-38I	1130		ND			
EL-038I-0	03	01/02/20	CPZ-38I	1227		++	2.635	565.2	
EL-038I-0	04	01/15/20	CPZ-38I	1306		++	3.609	565.0	
EL-038I-0	05	01/29/20	CPZ-38I	1309		+	0.975	565.2	
EL-038I-0	06	02/10/20	CPZ-38I	1215		+	0.382	565.0	
EL-038X-0	BG	10/21/19	CPZ-38X	1128		ND			
EL-038X-0	02	12/17/19	CPZ-38X	1128		ND			
EL-038X-0	03	01/02/20	CPZ-38X	1222		ND			
EL-038X-0	04	01/15/20	CPZ-38X	1314		ND			
EL-038X-0	05	01/29/20	CPZ-38X	1314		ND			
EL-038X-0	06	02/10/20	CPZ-38X	1223		ND			
EL-040I-0	BG	10/21/19	CPZ-40I	1143		ND			
EL-040I-0	02	12/17/19	CPZ-40I	1143		ND			
EL-040I-0	03	01/02/20	CPZ-40I	1235		ND			
EL-040I-0	04	01/15/20	CPZ-40I	1319		ND			
EL-040I-0	05	01/29/20	CPZ-40I	1320		ND			
EL-040I-0	06	02/10/20	CPZ-40I	1232		B	0.050	562.2	
EL-040X-0	BG	10/21/19	CPZ-40X	1141		ND			
EL-040X-0	02	12/17/19	CPZ-40X	1141		B	0.056	564.4	
EL-040X-0	03	01/02/20	CPZ-40X	1230		B	0.012	563.4	
EL-040X-0	04	01/15/20	CPZ-40X	1329		B	0.033	564.6	
EL-040X-0	05	01/29/20	CPZ-40X	1326		ND			
EL-040X-0	06	02/10/20	CPZ-40X	1241		ND			

Approved by: L. Bledsoe **on** 2/18/20

Comments:

IB = Initial Background
B = Background (<10 times background or lowest detection limit)
POR = Peak Out of Range (>5nm, <10nm from dye peak center)
ND = No Detection
NPI=No Peak Indicated
EL - Eluent Low- High Sensitivity Scan
EH - Eluent High- Low Sensitivity Scan

+ = Positive (10 times background or lowest detection limit)
++ = Very positive (100 times background or lowest detection limit)
+++ = Extremely positive (1000 times background or lowest detection limit)
+? = Questionable Positive, needs two hits in a row to equal +
Q = Lab Duplicate
QA = Quality Assurance/Quality Contol Laboratory Dye Standards
PeakFit Utilized (Statistical Analysis Peakfitting Software)

Criteria for Interpreting Results of Synchronous Scanning

Interpretation of dye tracing data is not the same as interpreting the results of chemical analyses. Background levels of dye are often present above the quantitation limits of the fluorescent dyes used for tracing. Another reason for these background levels is the extremely low detection limits of fluorescent dyes. Crawford Hydrology Laboratory has developed a standard protocol to determine what constitutes background levels, what is positive, and what is negative (non-detect).

Background Samples

In order for background fluorescence to be recorded, it must meet the following conditions:

• The determined concentration for each dye must be greater than or equal to the practical quantitation limit for that dye.

• The shape of the curve from the synchronous scanning must be the characteristic symmetrical shape of each particular dye as determined from its laboratory standard.

• The recorded peak of the emission curve must be + / - 5 nm of a particular dye peak as determined from its laboratory standard. The only times exceptions may be made are:

- A water sample collected at the same location verifies the presence of the dye in question.
- Interference causing a shift in peak position is identified.

Post- Dye Injection Samples

Post-Dye Injection Samples must meet the following criteria for the determination of a positive trace:

• The determined concentration for each dye must be ten times greater than initial background concentrations or the practical quantitation limit for that dye. This means that for a dye with a quantitation limit of 0.01 parts per billion (ppb), no sample can be designated Positive (+) unless its concentration is greater than or equal to 0.100 ppb.

• The shape of the curve from the synchronous scanning must be the characteristic symmetrical shape of each particular dye as determined from its laboratory standard.

• The presence of dye at a particular location must not be attributable to any source other than the dye injected for the purpose of conducting the dye trace.

•The recorded peak of the emission curve must be + / - 5 nm of a particular dye peak as determined from its laboratory standard. The only times exceptions may be made are:

- •A water sample collected at the same location verifies the presence of the dye in question.
- •Interference causing a shift in peak position is identified.

•Two consecutive samples that meet the above criteria. The concentration of the dye eluted from the charcoal should display a rise and fall, similar to a dye breakthrough, over a period of time. Consequently, no location shall be called positive if there is only one occasion when the dye concentration met the above criteria. A minimum of two consecutive positives is needed in order to say that a particular location had a positive trace. If only one sample qualifies for a positive designation, then the location will either be designated as a potential positive, or the trace will be repeated.

