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

FINAL
BASIS OF DESIGN REPORT
Velsicol Chemical Corporation Superfund Site
PSA-1 and PSA-2 Excavations, Operable Unit 1
St. Louis, Michigan
Former Plant Site Remedial Design
WA No. 178-RDRD-0532/Contract No. EP-S5-06-01

January 2017

PREPARED FOR

U.S. Environmental Protection Agency

PREPARED BY

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Environmental Design International, Inc.
Teska Associates, Inc.

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Acronyms and Abbreviations

ANP	adjacent or nearby properties
ARAR	applicable or relevant and appropriate requirement
BMP	best management practices
BODR	basis of design report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CH2M	CH2M HILL, Inc.
cm/s	centimeters per second
COC	contaminant of concern
CRA	Conestoga-Rovers and Associates
C_{sat}	soil saturation concentration
CWIZ	Upper City Well Intake Zone
DBCP	1,2-dibromo-3-chloropropane
DDT	dichlorodiphenyl trichloroethane
DNAPL	dense nonaqueous phase liquid
DTM	digital terrain model
EPA	U.S. Environmental Protection Agency
FPS	former plant site
HBB	hexabromobenzene
MCC	Michigan Chemical Corporation
MCL	Michigan Compiled Laws
MDEQ	Michigan Department of Environmental Quality
µg/kg	micrograms per kilogram
MIOSHA	Michigan Occupation Safety and Health Act
NAPL	nonaqueous phase liquid
NREPA	Natural Resources and Environmental Protection Act
OU	operable unit
PBB	polybrominated biphenyl
POC	point of compliance
PSA	Potential Source Area
RA	remedial action
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act of 1976
RD	remedial design

RDI	remedial design investigation
RI	remedial investigation
ROD	Record of Decision
SESC	soil erosion and sedimentation control
site	Velsicol Chemical Corporation Superfund Site in St. Louis, Michigan
SVOC	semivolatile organic compound
TRIS	tris(2,3-dibromopropyl) phosphate
U.S.C.	United States Code
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
Weston	Weston Solutions, Inc.

SECTION 1

Introduction

The U.S. Environmental Protection Agency (EPA) contracted CH2M HILL, Inc. (CH2M) to prepare selected components of the remedial design (RD) for Operable Unit (OU) 1 of the Velsicol Chemical Corporation Superfund Site in St. Louis, Michigan (site). The remedy for OU1 is being implemented in accordance with the OU1 Record of Decision (ROD; EPA 2012). This RD is for a part of the overall site remedy as described in the ROD. This final basis of design report (BODR) is intended to guide the remedial action (RA) of Potential Source Area (PSA) 1 and PSA-2. As defined by the Record of Decision (ROD), soil contamination present in PSA-1 and PSA-2 will be removed through excavation and offsite disposal (EPA 2012). This document has been prepared in fulfillment of Work Assignment No. 178-RDRD-0532 under Contract No. EP-S5-06-01. The work will be completed in accordance with the revised work plan dated June 5, 2015, and the *Remedial Design/Remedial Action Handbook* (EPA 1995).

The final RD package will provide the engineering design approach, construction drawings (Appendix A), construction specifications (Appendix B), a construction cost estimate (AACE International Class 2 with an accuracy of plus 15 percent to minus 10 percent) (Appendix H), and general provisions necessary to implement PSA-1 and PSA-2 remedial activities. The RA phase will be performed under a separate work assignment.

1.1 Site Description

The site, National Superfund database identification number MID00722439, encompasses a 52-acre land parcel commonly referred to as the Former Plant Site (FPS) and includes the Adjacent or Nearby Properties (ANP). A chemical plant once occupied the FPS, which is located in a predominantly residential area. The Pine River flows along the western and northern boundary of the FPS into Mill Pond, where a hydroelectric dam is located (about 0.25-mile east of the FPS). The boundary of the 52-acre FPS is fenced, and access is controlled through a lockable main gate. Figure 1-1 shows the FPS location and the surrounding operable units.

The Velsicol Chemical Corporation/Pine River Superfund Site consists of three OUs, as follows:

- OU1—FPS and ANP
- OU2—Contaminated sediments in the Pine River downstream of the site to the St. Louis hydroelectric dam for which the RA has been completed
- OU3—An area of the Pine River downstream of the St. Louis hydroelectric dam

The Michigan Department of Environmental Quality (MDEQ) was the lead agency during the remedial investigation/feasibility study project phases, and EPA was the support agency. EPA is the lead agency for the RD and RA phases, and MDEQ is the support agency.

1.2 Site History

The FPS was used for industrial operations beginning in the mid-1800s until 1977. Historical operations at the site included a lumber mill, oil refinery, salt-processing plant, and chemical manufacturing plant. The FPS included numerous buildings that housed manufacturing, maintenance operations, administrative functions, and laboratories for product research and development. Storage facilities for raw and finished products, including warehouses and storage tanks constructed above- and belowground, were also integrated throughout the FPS. Historical documents identify several lagoons that are either known or presumed to be associated with waste-disposal practices.

In 1935, Michigan Chemical Corporation (MCC) purchased the property and operated a chemical-manufacturing business. In 1965, Velsicol Chemical Corporation gained a controlling interest in MCC. MCC manufactured a wide variety of products at the FPS from 1936 through 1977, including the following: various salts; magnesium oxide; rare earth chemicals; fire retardants, including polybrominated biphenyls (PBB); tris (2,3-dibromopropyl) phosphate (TRIS); and pesticides dichlorodiphenyl trichloroethane (DDT) and 1,2-dibromo-3-chloropropane (DBCP).

In 1977, production operations were terminated, and MCC initiated demolition and decommissioning of the facility in 1978. The aboveground site buildings were demolished, and some structures were buried onsite, including storage tanks and process piping. Building and tank foundations were not removed, and a significant amount of debris remains buried at the site.

1.3 Existing Site Conditions

1.3.1 Sitewide Geology

The sitewide geology was defined during the remedial investigation (RI) performed by Weston Solutions, Inc. (Weston) from 2002 through 2005. Sitewide, there are three naturally occurring unconsolidated deposits, consisting of a shallow unit, a till unit, and a lower unit. On the FPS, two manmade units are also present, including a clay cap and fill.

The clay cap was constructed as part of the 1982 Consent Judgement and varies from 2 feet to up to 10 feet in thickness. A sand layer is present directly above the clay cap, and a layer of topsoil is present above the sand layer. The thickness of the two layers has been observed to be up to 2.5 feet.

The shallow unit is composed of a variety of deposits consisting of fill, alluvium, and lacustrine deposits. Debris is also present within the shallow outwash unit (that is, concrete, metal, etc.) from the operation and demolition of the FPS. The thickness of the shallow outwash unit varies between 20 and 30 feet.

The till unit thickness ranges from 30 to 80 feet and is composed of sandy silt with variable amounts of sand, gravel, and cobbles. The thickness of sand and gravel seams within the till unit range from a few inches to several feet.

The lower unit extends from the base of the till unit to the top of bedrock (approximately 280 feet bgs) and consists of a series of saturated sands subdivided by the two aquitards. The lower unit is composed of the following:

- The Upper Lower Outwash, consists of the saturated sands immediately underlying the Till Unit. The Upper Lower Outwash has been observed to be up to 10 feet thick, but is typically about 2 to 4 feet thick. Immediately under the Upper Lower Outwash is a granular unit that is finer-grained and more gradational. This portion of the Lower Unit is referred to as the Lower Outwash.
- The Upper Aquitard is a cohesive unit of very stiff to hard gray to grayish brown clay or very stiff to hard gray silt approximately 10 to 30 feet thick.
- Upper City Well Intake Zone (CWIZ) consists of fine to coarse saturated sand, with gravel noted at some locations.
- The Lower Aquitard is a cohesive unit of very stiff to hard gray to grayish brown clay or very stiff to hard gray silt approximately 20 feet thick.
- Lower CWIZ consists of saturated fine to coarse sand with some fine gravel.

1.3.2 Geology of PSA-1

During the remedial design investigation (RDI) performed by CH2M in 2014, the geology within the PSA-1 and PSA-2 boundaries was further refined. The subsurface at PSA-1 consists of the following:

- **Clay cap—**The constructed clay cap consists of approximately 1 foot of topsoil, underlain by approximately 0.5 foot of fine to medium sand, followed by approximately 4 to 10 feet of hard silty clay to clayey silt. Boring results suggest that the cap is continuous across PSA-1. Varying amounts of debris (concrete, brick, glass, wood, and metal rebar) from the plant demolition were observed during the RDI within the lower portion of the cap and in the zone from 0 to 5 feet below the cap.
- **Interbedded sand, silt, and clay—**Underlying the cap are fine to medium sands with occasional coarse sands and interbedded silts and clays. Boring results from the RDI indicate that this lithology is generally continuous across PSA-1 and is present to depths ranging from approximately 10 to 25 feet bgs. Soil exhibiting staining and/or containing nonaqueous phase liquid (NAPL) was frequently encountered in this unit. Groundwater was typically encountered at depths ranging from approximately 10 to 20 feet bgs.
- **Glacial till—**Glacial till is present at depths ranging from approximately 13 to 25 feet bgs at PSA-1. The till consists primarily of hard silty clay to clayey silt with trace to little amounts of fine sand and trace amounts of gravel. Sand and silty sand seams are occasionally encountered within the till.

Also notable within PSA-1 is a slurry wall constructed around an area of the site previously used for fuel handling and storage ("oil-containment slurry wall"). Historical site documents indicate that fuel releases occurred within and adjacent to the PSA-1 boundary. The fuel release was allegedly contained by a slurry wall, which was constructed prior to the construction of the site containment slurry wall; however, construction details of the wall within PSA-1 are poorly documented. In general, the existing slurry wall within PSA-1 contains a mitten-shaped area of approximately 2 acres, of which approximately three-quarters of an acre overlaps the northeast portion of PSA-1. The presence of NAPL was confirmed both inside and outside the slurry wall during the RDI.

1.3.3 Geology of PSA-2

The subsurface at PSA-2 consists of the following:

- **Clay cap—**The constructed clay cap is consistent with that described for PSA-1. Boring results completed as part of the RDI suggest that the cap is continuous across PSA-2.
- **Interbedded sand, silt, and clay—**Underlying the cap are interbedded layers of reworked sand, silt, and clay. Boring results from the RDI indicate that this lithology is generally continuous across PSA-2 and is present to depths ranging from approximately 12 to 25 feet bgs. Some soils exhibiting staining are present in this unit; however, staining is less frequent than at PSA-1, and the presence of NAPL is significantly less.
- **Silt—**During the RDI, soft to firm silt with grey and black laminations was observed underlying the reworked sand, silt, and clay in the southwest portion of PSA-2. Boring results indicate that this lithology is continuous across the western portion of PSA-2, with thicknesses up to 9 feet in some areas. This lithology may be related to the dredge pond that historically occupied this area of the FPS.
- **Glacial till—**Glacial till is present at depths ranging from approximately 18 to 33 feet bgs at PSA-2. The till is consistent with that described for PSA-1.

1.3.4 Groundwater Flow

In the shallow unit, groundwater flow is influenced by the Pine River, the St. Louis dam, the ground surface elevation, and the presence of the site perimeter slurry wall (Weston 2006). The saturated

thickness of the shallow unit ranges from 0.5 foot to approximately 21.0 feet (Weston 2006). Generally, shallow unit groundwater flow below the FPS is towards the Pine River. As part of the RI completed by Weston, slug tests were performed on eight monitoring wells within the shallow unit. The hydraulic conductivity calculated from the slug test results averaged between 1.26 feet per day to 44.8 feet per day (4.46×10^{-4} centimeters per second [cm/s] to 1.58×10^{-2} cm/s). The geometric mean across the site was 7.31 feet per day (2.58×10^{-3} cm/s). Additional slug testing was performed by CH2M in 2015. The mean hydraulic conductivity values derived from the 2015 slug test data test range between 0.004 foot per day to 5.65 feet per day (1.3×10^{-6} cm/s to 1.99×10^{-3} cm/s). The field-measured values are consistent with published values for hydraulic conductivity of similar deposits (Weston 2006).

Groundwater flow in the lower unit is influenced by regional flow conditions, local geology, and municipal well usage (Weston 2006). In October 2015, the cities of St. Louis and Alma, Michigan, formed the Gratiot Area Water Authority, which began providing potable water to the St. Louis residents from the combined system, resulting in the cessation of operation of the City of St. Louis' municipal supply wells. Previous interpretations of lower-unit groundwater flow indicated that groundwater primarily flowed to the northeast in the northern portion of the FPS and southeast in the southern portion of the FPS towards the City of St. Louis municipal water supply wells. Provisions are in place to monitor groundwater elevation changes following well shutdown, and initial data indicate that groundwater elevations in the lower unit have increased approximately 10 feet with groundwater flow in the lower unit to the east to southeast. Field measurements and observations will be integrated to revise groundwater flow directions, magnitude, and to update the site conceptual model as necessary.

1.3.5 Existing Site-Perimeter Slurry Wall and Clay Cap

As part of the 1982 Consent Judgment with EPA and MDEQ, a 2-foot-thick, low-permeability slurry wall was installed around the FPS. In addition, a clay cap was constructed over the entire FPS. The construction was completed in 1984.

The thickness of the clay cap ranges between 2 and 10 feet and extends over the entire 52-acre parcel. The cap is composed of clay with a permeability of 1×10^{-7} cm/s or less. The purpose of the clay cap is to minimize the infiltration of precipitation to the water table and enhance surface runoff.

The slurry wall runs along the entire perimeter of the FPS, over 7,200 linear feet in length. Per the Consent Judgment Technical Appendix, the slurry wall was required to be a minimum of 24 inches thick (nominal), achieve a permeability of 1×10^{-7} cm/s or less, and was to be keyed in a minimum of 36 inches (nominal) into the underlying till layer.

The existing containment system (cap and slurry wall) was evaluated in the RI/feasibility study completed by MDEQ. That evaluation confirmed the presence and extent of the cap through the completion of RI soil borings and geotechnical sampling. The slurry wall was evaluated through the completion of paired piezometer installation and water level measurements, geotechnical soil borings, slurry wall sample collection for hydraulic conductivity testing, and completion of a dye tracer study. The RI concluded that the cap and slurry wall did not meet the referenced construction specifications at all locations evaluated, but that the slurry wall was constructed sufficient to influence shallow unit groundwater flow patterns. A full evaluation clay cap and slurry wall among other features of the site (such as the till unit) is presented in the *Remedial Investigation Report for Operable Unit One, Velsicol Chemical Corporation Superfund Site-St. Louis, Gratiot County, Michigan* (Weston 2006).

1.3.6 Existing Oil-containment slurry Wall

In addition to the perimeter slurry wall that is part of the containment system, an oil-containment slurry wall exists within part of the PSA-1 boundary. The oil-containment slurry wall encompasses an area approximately 2 acres in size and resembles the shape of a mitten. This slurry wall is anticipated to be encountered during excavation of PSA-1.

1.3.7 Former Dredge Pond

A dredge pond was formerly located in the southwestern portion of the FPS and includes a portion of PSA-2 (and PSA-3, which will be the subject of a future RA). Operations of the former dredge pond are largely unknown; however, historical photographs and plant records suggest that the pond was approximately 5 acres in size and was used to hold dredged sediments. The former dredge pond was not lined, and it was suspected that contents from the pond were migrating back into the Pine River (Weston 2011). Therefore, the former dredge pond was filled. The date of this occurrence is unknown.

1.3.8 Existing Groundwater Elevation Control Tile

A non-operational groundwater elevation control tile, installed by Conestoga-Rovers and Associates (CRA), is present along the perimeter of the FPS, adjacent to the Pine River. Not much is known about the historical operations of the groundwater elevation control tile. As shown on the CRA Securement of Plant Site as-built drawings, the groundwater elevation control tile is separated into a north system and a south system at manhole sumps 6A and 6B (CRA 1984). Collectively, the groundwater elevation control tile consists of approximately 8,210 linear feet of 4-inch and 6-inch perforated clay pipe, 9 manholes, 7 manhole sumps, and 13 granular sumps.

The groundwater elevation control tile was operated from June 1994 through the end of 1996 (Memphis Environmental Center, Inc. [MEC] 1997). Water was pumped from the groundwater elevation control tile at Manhole 9 and disposed offsite (MEC 1997). Through the end of 1996, at total of 4,030,000 gallons of water was removed from the FPS during three separate pumping events (MEC 1997).

The approximate location and layout of the groundwater elevation control tile is shown in the drawings.

1.4 Nature and Extent of Contamination

Findings from the RI and RDI indicate that volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) are present in shallow unit soils below PSA-1 and PSA-2 (CH2M 2015a) at concentrations exceeding remediation goals. Specifically, the contaminants of concern (COCs) for each PSA are as follows:

- PSA-1: chlorobenzene and xylenes
- PSA-2: chlorobenzene and TRIS

In addition, based on observations during the RI and RDI, NAPL is present in both PSAs.

1.5 Selected Remedy and Remedial Action Objectives

A ROD was issued on June 22, 2012, that defined the selected remedy for OU1. This BODR describes the final RD for the PSA-1 and PSA-2 RA that is established in the 2012 ROD. The RA for PSA-1 and PSA-2 includes excavation and offsite disposal of source material soils exceeding remediation goals and backfilling and restoring the excavated areas. Future RDs will be developed for OU1 to address the ROD requirements that are not relevant to the PSA-1 and PSA-2 excavations.

Remedial action objectives (RAOs) are goals that are specific to media or OUs for protecting human health and the environment. The PSA-1 and PSA-2 excavations will be performed to achieve RAOs for COCs on the FPS in accordance with the 2012 ROD. RAOs applicable to the PSA-1 and PSA-2 RA are summarized in the following sections. Future RAs for OU1 will achieve the additional RAOs described in the ROD that are not achieved as part of the PSA-1 and PSA-2 RA.

- At the FPS, prevent ingestion, inhalation, and direct contact of site-related COCs in soil to human and ecological receptors.

- Prevent the migration of site-related COCs from unsaturated and saturated subsurface media to the groundwater or surface water beyond the point of compliance (POC), as defined in the 2012 ROD.
- Reduce the ability of dense nonaqueous phase liquid (DNAPL) to adversely impact the aquifer by reducing DNAPL mass and mobility.
- Eliminate offsite migration of DNAPL to prevent the contamination of the surface water and recontamination of sediments of the Pine River.

The selected remedy in the 2012 ROD includes excavation of vadose-zone soil in PSA-1 and PSA-2 exceeding the remediation standards, which are based on MDEQ Part 201 soil saturation concentration screening levels (C_{sat}), with subsequent offsite disposal. The remediation standards for the COCs in PSA-1 and PSA-2 are as follows:

- PSA-1: chlorobenzene (260,000 micrograms per kilogram [µg/kg]) and xylenes (150,000 µg/kg)
- PSA-2: chlorobenzene (260,000 µg/kg) and TRIS (27,000 µg/kg)

During the RDI, NAPL-contaminated soil was identified below the groundwater table. After compilation of the RDI findings and in consultation with EPA, the vertical extent of the excavation was extended below the vadose zone to include NAPL-contaminated soil present below the groundwater table (CH2M 2015c).

Excavated soil, with the exception of the existing uncontaminated clay cap material and overlaying sand layer and topsoil, will be disposed of offsite. The excavation of soils exceeding remediation standards listed above and NAPL-contaminated soil will achieve the RAOs listed above.

SECTION 2

Basis of Design

Section 2 summarizes the technical parameters upon which the RD is based.

2.1 Design Data Sources

Several investigations have been completed at the FPS. Results from the investigations are summarized in the following documents:

- *Source Migration Investigation Report, Velsicol Chemical/Pine River Site, OU1, St. Louis, Michigan* (CH2M 2005)
- *Remedial Investigation Report for Operable Unit One, Velsicol Chemical Corporation Superfund Site, St. Louis, Gratiot County, Michigan* (Weston 2006)
- *Remedial Investigation Addendum Report for Operable Unit One, Velsicol Chemical Corporation Superfund Site, St. Louis, Gratiot County, Michigan* (Weston 2009)
- *Feasibility Study Operable Unit One, Velsicol Chemical Corporation Superfund Site, St. Louis, Gratiot County, Michigan* (Weston 2011)
- *Record of Decision, Velsicol Chemical Corporation/Pine River Superfund Site Former Plant Site—Operable Unit 1, St. Louis, Michigan* (EPA 2012)
- *Final Geophysical Survey and Test Pit Results for Velsicol Chemical/Pine River Superfund Site, St. Louis, Michigan* (CH2M 2015b)
- *Final Data Evaluation Report, Velsicol Former Plant Site Remedial Design Investigation Potential Source Area 1 and Potential Source Area 2, St. Louis, Michigan* (CH2M 2015a).

For detailed investigation and sampling information, refer to the *Remedial Investigation Report for Operable Unit One* (Weston 2006) and *Final Data Evaluation Report—Velsicol Former Plant Site Remedial Design Investigation, Potential Source Area 1 and Potential Source Area 2* (CH2M 2015a).

2.2 Soil Characterization

The soil analytical data and NAPL observations from the RDI were used to define the lateral and vertical extent of the soil that exceeded the remediation standards (Michigan Part 201 C_{sat} screening levels) or contained NAPL. Overall, findings from the RDI indicate that the presence of NAPL, particularly in PSA-1, is more widespread than initially reported during the RI. Pertinent RDI observations applied in the evaluation of contaminant extent in each area are summarized in the following subsections.

2.2.1 PSA-1

Chlorobenzene was detected in 56 of the 64 soil borings installed in PSA-1 during the RDI, with concentrations ranging from 8.8 to 1,500,000 µg/kg. Two locations exceeded the Michigan Part 201 C_{sat} value of 260,000 µg/kg.

Xylenes were detected in 57 of the 64 soil boring locations within PSA-1. Concentrations ranged from 37 to 330,000 µg/kg. Two locations exceeded the Michigan Part 201 xylenes C_{sat} value of 150,000 µg/kg.

The presence of NAPL was confirmed in 29 of 64 soil borings at PSA-1. In general, NAPL was observed at depths ranging from 6 to 22 feet bgs. NAPL was identified below the groundwater table in 17 soil boring locations.

2.2.2 PSA-2

Chlorobenzene was detected in 60 of the 61 soil boring locations installed at PSA-2 during the RDI, with concentrations ranging from 8.8 to 620,000 µg/kg. One location exceeded the Michigan Part 201 chlorobenzene C_{sat} value of 260,000 µg/kg.

TRIS was detected in 21 of the 61 soil boring locations, with concentrations ranging from 960 to 1,400,000 µg/kg. One location exceeded the Michigan Part 201 C_{sat} value of 27,000 µg/kg.

The presence of NAPL was confirmed in 6 of 61 soil borings at PSA-2. NAPL was identified below the groundwater table in four soil boring locations.

For more details on RDI sample results and NAPL identification, refer to the *Final Data Evaluation Report—Velsicol Former Plant Site Remedial Design Investigation, Potential Source Area 1 and Potential Source Area 2* (CH2M 2015a).

2.2.3 Delineation of Remediation Extents

Analytical results from samples collected by Weston in 2004–2005 during the RI and by CH2M in 2014 during the RDI were used to delineate the target excavation areas for each PSA in accordance with the RAOs defined by the ROD. Specific criteria applied for delineation (lateral and vertical extents) of the target excavation areas include the following:

- Soil borings where remediation standards were exceeded:
  - PSA-1: chlorobenzene (260,000 µg/kg) and xylenes (150,000 µg/kg)
  - PSA-2: chlorobenzene (260,000 µg/kg) and TRIS (27,000 µg/kg)
- Soil borings where remediation standards were exceeded and NAPL was present based on visual observation and/or a positive NAPL test kit result(s)
- Soil borings where NAPL was present based on visual observation and/or a positive NAPL test-kit result(s)

The target excavation area was determined by encompassing all soil borings that exceeded the remediation standards and/or had the presence of NAPL during the RI and RDI, to the extent possible. Consideration was taken to avoid excavating large areas where the remediation standards were not exceeded and NAPL presence was not observed. Therefore, multiple excavation area boundaries were established in each PSA.

The depth of impacted soil to be removed was determined using the soil descriptions, groundwater elevations, and NAPL observations recorded in the soil boring logs from the Weston 2004–2005 and CH2M 2014 investigations. In general, the excavation depth will be to the top of the groundwater table, as stipulated by the ROD. However, where NAPL was identified below the groundwater table, either from visual observations or positive NAPL test-kit results, excavation will be vertically extended to reach the top of the glacial till unit.

Data used to determine excavation limits and depth are provided in the *Remedial Investigation Report for Operable Unit One* (Weston 2006) and *Final Data Evaluation Report—Velsicol Former Plant Site Remedial Design Investigation, Potential Source Area 1 and Potential Source Area 2* (CH2M 2015a).

SECTION 3

Project Delivery Strategy

Section 3 presents the project delivery strategy for the PSA-1 and PSA-2 excavations for OU1 of the Velsicol Chemical Corporation Superfund Site. The RA consists of excavating soil from the target excavation areas. The primary components of the design and remediation are summarized in the following subsections. Key project delivery strategies relative to a specific component are also noted in the following subsections.

3.1 Final Design

The conceptual strategies and supporting technical details have been developed, reviewed, and accepted by project stakeholders during the preliminary design phase (CH2M 2015d). This BODR includes the final design activities. The conceptual strategies and ideas developed during the preliminary design have been expanded into a set of final design documents consisting of the following:

- Final BODR
- Construction Specifications
- Project Drawings
- Cost Estimate
- Subcontract Award Documents
- Constructability Review
- Revised Project Delivery Strategy

Detailed design drawings and specifications have been prepared for most of the selected components. The subcontractor will be required to present a detailed work plan to CH2M describing how the work will be executed.

3.2 Remedial Action

The procurement strategy for implementing the RA includes planning, subcontractor prequalification, issuance of a Request for Proposals, evaluation of the proposals, submittal of the Request for Consent, contract award, and subcontract management. Project changes made after the final design can be addressed in amendments to Requests for Proposal.

To provide prospective subcontractors with sufficient time to review the existing data and develop their proposals, CH2M recommends that the solicitation process begin following approval of the final design document. Any changes made to the final design will be addressed in amendments to the solicitations.

3.3 Subcontract Procurement

CH2M proposes a subcontracting approach to competitively solicit proposals that will:

1. Provide a clear interface between subcontracts for effective implementation.
2. Provide the ability to better manage subcontractor procurement.

Procurement of subcontractors for PSA-1 and PSA-2 excavation will be completed prior to the beginning of construction. Subcontractors for future RA activities will be competitively procured independently from PSA-1 and PSA-2 excavation activities.

Subcontracts will be competitively bid among qualified businesses that are able to meet the technical, safety, and schedule requirements. Potential bidders from various lists and other sources, including CH2M's supplier database, will be prequalified.

The bidders will propose means and methods based on the solicitation documents, which will include instructions to bidders, project specifications, drawings, proposed subcontract agreement (including EPA Remedial Action Contract 2 flow-down provisions), and other forms for bidders to complete. Specifications and drawings are included as a part of this design. Bidding instructions and subcontract terms will be prepared for the solicitation.

The subcontract documents will be prepared based on the understanding that EPA is the owner of the project, and CH2M is the construction contractor. Table 3-1 summarizes the anticipated subcontracts. One subcontractor will be solicited for the PSA-1 and PSA-2 excavation activities and may elect to solicit third-party subcontractor(s) to complete select components of the work. Although the PSA-1 and PSA-2 excavation subcontractor may choose to subcontract parts of the project to lower-tier subcontractors, the term “subcontractor” in this document refers to the PSA-1 and PSA-2 excavation activities subcontractor. The estimates of the subcontract value are discussed in Section 9. Final drawings and specifications accompanying this report are provided in Appendix A and Appendix B, respectively.

Table 3-1. Subcontracts for Remedial Action
Velsicol Chemical Corporation Superfund Site PSA-1 and PSA-2 Excavations, Operable Unit 1

	Subcontracts
1	Drilling Subcontractor – preconstruction confirmation and waste characterization sampling
2	PSA-1 and PSA-2 Excavation Subcontractor – excavation, dewatering, excavation support wall, backfill, site restoration, transportation and disposal of excavated material, and topographic surveys
3	Laboratory Subcontractor—soil samples and liquid samples

SECTION 4

Final Design Approach, Assumptions, and Parameters

Section 4 presents the technical details and assumptions of the final RD activities. The implementation of the remedial activities will consist of several components, including general activities for the project, as well as activities that will occur on a task-specific basis. Although some of the components will occur concurrently, the general sequencing of the primary components will be as follows:

- Preconstruction activities, including confirmation and waste characterization sampling
- Mobilization and site preparation, including demolition of existing groundwater elevation control tile in work areas and monitoring well abandonment
- PSA-1 and PSA-2 excavations, including the following:
  - Monitoring well abandonment
  - Construction of an excavation support wall prior to excavating PSA-1
  - Excavation
  - Dewatering
  - Water collection
  - Air monitoring
  - Surveying
  - Transportation and disposal
  - Backfill and compaction
  - Site restoration
- Demobilization

4.1 Design Criteria and Assumptions

In addition to the RAOs described in Section 1.6, the following design criteria and assumptions were used to complete the RD:

- All excavated soil and liquid and material removed from within the oil-containment slurry wall and groundwater elevation control tile for offsite disposal will be nonhazardous. This assumption is based on analytical results for the IDW soil drums that were generated and disposed of as part of the 2014 RDI and the six waste characterization samples that were collected in PSA-1 and PSA-2 in 2015. The 2015 waste characterization samples included three samples collected in each PSA at the locations with the highest COC concentrations, strongest odors, and/or positive indications of NAPL. Waste characterization samples will be collected during the preconstruction confirmation sampling, prior to excavation, to confirm that material removed from the excavations is nonhazardous.
- No active underground utilities will be encountered in either PSA during the utility locate. Currently, there are no known active underground utilities onsite.
- The only buried pipes and debris within PSA-1 and PSA-2 are associated with the CRA-installed groundwater elevation control tile described in Section 1.3.8.
- A portion of the CRA-installed groundwater elevation control tile described in Section 1.3.8 that is within the removal areas of PSA-1 and/or PSA-2 will be abandoned in-place or removed, including the following:

  - Three manholes (MH-1, MH-2, and MH-3), assumed to be 3 feet in diameter and 19 feet deep.
  - Approximately 600 linear feet of 6-inch perforated clay pipe
  - Approximately 400 linear feet of 4-inch perforated clay pipe
- The groundwater elevation control tile will be crushed and disposed offsite with the excavated soil and is assumed to be nonhazardous.
- Displaced water from the manholes will be disposed offsite as nonhazardous waste. The water from the groundwater elevation control tile will be sampled and characterized during preconstruction confirmation sampling.
- Use of the existing north gate will be avoided, to minimize heavy truck traffic through the ANP. The south gate off of M-46/Washington Avenue will be used for this work.
- Temporary site roads will be constructed, as needed, in the south area of the site to support excavations and will be constructed either from gravel or an advanced composite mat system.
- The target excavation areas are defined on the drawings that support this document. Although additional preconstruction confirmation sampling will be performed prior to excavation, for this RD, it is assumed that the target excavation areas, and therefore the removal areas, will not be expanded.
- The target excavation areas defined in this RD are based on analytical sample results and qualitative field screening observations of NAPL occurrence recorded during the RDI.
- Up to five monitoring wells will be abandoned prior to excavation.
- The existing topsoil, sand layer, and clay cap materials are uncontaminated and can be reused. It is also assumed that no additional materials will need to be brought onsite to reconstruct these layers.
  - Topsoil and sand layer thicknesses following removal action completion were assumed based on the existing soil cap detail and field observations during subsequent RAs. The thickness ranges are summarized in the soil cap detail in the drawings.
  - The clay cap thickness was assumed based on field observations during the RDI. The bottom elevation of the clay cap was identified using the RDI soil boring logs. This information was input into MicroStation InRoads to create a digital terrain model (DTM) of the PSAs to calculate volumes.
- The existing soil conditions will allow for installation of excavation support walls along the east and south boundaries of the PSA-1 excavation. It is also assumed that the data collected during the geotechnical investigation performed in fall 2016 will be sufficient for the subcontractor to design the excavation support walls.
  - For this design, it is assumed that the excavation support wall is constructed using steel sheetpile. The actual construction material and methods will be proposed by the subcontractor.
  - The excavation support walls will be installed inside the boundary of the site-perimeter slurry wall. The location of the site-perimeter slurry wall is assumed to be as shown on the drawings that support this RD and is assumed to be 24 inches thick as described in historical documents.
- Part of the existing oil-containment slurry wall will be removed during PSA-1 excavation activities. The integrity of this structure is unknown. Material within the oil-containment slurry wall that exceeds the remediation standards will be removed as part of the RA. Based on analytical results during the RDI and subsequent waste characterization sampling in this area, it is assumed that this material is nonhazardous.

- A 2:1 slope will be sufficient for the majority of the removal area. This is based on material identified during the RDI. The drawings and excavation approach described in the later subsections illustrate a 2:1 slope. It is assumed that the maximum slope required for excavation activities will be 3:1. Excavation and disposal volumes were based on a 3:1 slope as a conservative estimate.
- The material outside of the target excavation area that will be removed for sloping is assumed to be uncontaminated and is suitable for use as backfill.
- Excavation below the groundwater table was based on NAPL observations during the RDI. It is assumed that no additional NAPL will be encountered outside of the areas identified in this RD.
  - Where NAPL was identified below the groundwater table, excavation will occur until the NAPL-contaminated material has been removed, or to a maximum depth down to the top of the glacial till unit. The maximum depth below ground surface to the glacial till unit is 25 feet in PSA-1 and 30 feet in the areas of PSA-2 requiring excavation.
- Excavated soils will be direct loaded for immediate offsite disposal based on the analytical results from the preconstruction waste characterization sampling to be performed within the excavation area.
  - A weight conversion factor of 1.8 tons per cubic yard was used to estimate tons of soil for offsite disposal based on volume calculations.
  - If excavated materials do not fulfill requirements of the paint filter test, then wet soil will be managed in loadout piles until the time it can be directly removed.
  - Wet soil management can be implemented using the loadout pile strategy as defined by this RD.
- Approximately 22,000 gallons of water per day will need to be managed during excavation of PSA-1. Approximately 1,200 gallons of water per day will need to be managed during excavation of PSA-2. Groundwater seepage was calculated based on the hydraulic conductivity geometric mean determined during the RI and typical seasonal precipitation in St. Louis, Michigan.
- A satisfactory stand of grass will be established within 12 weeks of planting.

4.2 Preconstruction Activities

Preconstruction work includes preparation of site plans, permit-equivalents, review and approval of subcontractor submittals, identification and approval of uncontaminated borrow sources and disposal facilities, and coordination with the City of St. Louis. The work will be conducted prior to subcontractor mobilization.

4.2.1 Preconstruction Confirmation Sampling

Prior to starting work activities, preconstruction confirmation soil sampling will be conducted to finalize the lateral extent of the excavations so that backfilling operations can occur concurrently with excavation activities. This will minimize the length of time that the excavation is open, and will therefore improve worker and site safety and minimize nuisance odors.

Soil confirmation samples will be collected along the target excavation area boundaries at each PSA and analyzed for the COCs specific to each PSA. If confirmation samples exceed the remediation standards specific to each PSA (that is, 260,000 µg/kg chlorobenzene, and/or 150,000 µg/kg xylenes in PSA-1 and 260,000 µg/kg chlorobenzene, and/or 27,000 µg/kg TRIS in PSA-2), then the target excavation areas will be expanded to encompass the impacted material, based on the completion of additional confirmation soil borings. Additionally, soil confirmation samples will be inspected for visual indications of NAPL. The lateral

or vertical extent of soil to be excavated in PSA-1 and PSA-2 will also be expanded as needed if visual NAPL is encountered during confirmation sample collection.

The sampling will also include collection of soil and liquid samples to assist in waste characterization of the soils and water to be disposed of offsite so that excavated soil can be direct loaded (or placed in loadout piles pending paint filter test results) and hauled immediately to an appropriate disposal facility.

Preconstruction confirmation soil sampling and waste characterization sampling will be performed in accordance with a confirmation sampling plan and quality assurance project plan, which will both be developed as part of the RA.

4.2.2 Site-Specific Plans and Preconstruction Submittals

Pre-mobilization activities will include verification of compliance with the substantive requirements of applicable regulations and development of applicable preconstruction submittals, including site-specific plans and samples of materials as required in the specifications and identified in the construction quality assurance plan (Appendix C).

As part of the RA activities, draft versions of the following plans will be provided to the subcontractor to revise with information specific to its approach during the PSA-1 and PSA-2 excavations and submit to CH2M for approval: site-specific health and safety plan, project schedule, work plan, transportation and disposal plan, including onsite waste management, excavation plan, water control plan, shoring plan, movement monitoring plan, air monitoring plan, subcontractor quality control plan, and soil erosion and sedimentation control (SESC) plan. The health and safety plan will outline procedures to be followed so that the work is completed safely and with no adverse health effects to workers or the community. The transportation and disposal plan will guide the onsite management and offsite transportation and disposal of wastes and fill materials, and stockpiling of construction debris generated during the site work. The air monitoring plan will describe the air monitoring activities and compliance targets. The SESC plan will incorporate the use of best management practices (BMPs) for earth-disturbing activities associated with the work and procedures to control soil erosion and potential spills, and will follow the substantive requirements of Michigan's Permit-by-Rule for construction activities (State of Michigan 1994).

4.2.3 Borrow Source, Staging Area, and Disposal Source Identification

Suppliers of fill materials will be identified as part of the preconstruction activities. Samples of fill materials will be collected and submitted to the laboratory subcontractor for testing to verify that the material meets specifications and is appropriate for use. Specifically, the fill materials will be tested by a qualified laboratory for target compound list VOCs (including DBCP), SVOCs [including TRIS], target analyte list metals, pesticides and herbicides (including PBB, DDT, and hexabromobenzene [HBB]), total cyanide, target compound list acid fraction compounds, target compound list base neutral compounds, and particle-size distribution analyses. Borrow sources will be required to meet MDEQ Part 201 generic residential soil cleanup criteria and project specifications (Specification Sections 31 23 23 Fill and Backfill and 32 91 13B Soil Preparation) prior to use onsite. Supplemental borrow samples will be collected during construction activities to verify continued compliance of the material with project specifications.

Borrow source materials can be staged at appropriate locations at the Velsicol FPS property, as shown in Drawing C-4. The FPS is secured with fencing and has adequate space for stockpiling soils and storing equipment and temporary field trailers. Erosion control measures as described in the SESC plan will be placed as required and as shown in Drawings C-2 and C-3. The staging areas will be constructed and maintained by the subcontractor.

4.2.4 Coordination with City of St. Louis and Michigan Department of Transportation

A preconstruction meeting will be held before construction begins that will include the contractor (CH2M), the primary subcontractor, the City of St. Louis, MDEQ, and EPA. Discussion topics will include transportation routes, construction activities near City-owned utilities, EPA exempt permits, required licenses, allowable work hours, use of City water, street closings, City debris pickup, soil erosion control, and special requirements and considerations.

4.3 Mobilization and Site Preparation

Mobilization includes that of the contractor (CH2M), subcontractor, and any lower-tiered subcontractors. Mobilization will consist of the following, as needed:

- Utility locates
- Site surveying
- Installing erosion and sediment controls
- Constructing or establishing temporary facilities such as field trailers, material storage facilities, and sanitary facilities
- Delivering and assembling equipment
- Temporary road construction
- Groundwater elevation control tile abandonment
- Site security and coordination

Equipment to be used by the subcontractor is expected to be transported by road. The subcontractor will provide and maintain required temporary facilities for the duration of the project, along with a field trailer(s), if desired by the subcontractor and in accordance with the specifications.

4.3.1 Utility Locates

The subcontractor will be required to contact Michigan's one-call utility-location system (MISS DIG) and will also use a third-party utility-locating service to identify utilities within any areas of intrusive subsurface activities outside the boundary of the FPS or within 50 feet of the boundary of the FPS, including any areas requiring silt fencing. A third-party utility locate will be conducted to mark underground utilities within the boundaries of PSA-1 and PSA-2. There are no known active underground utilities onsite. The only known active utilities are shown in Drawing C-1. However, if underground utilities are identified during the third-party locate, the work will be conducted in a manner to avoid damaging the marked utilities.

4.3.2 Site Surveying

Surveying will be conducted during the RA to identify the horizontal extents of excavation and for calculating removal volumes. Horizontal and vertical control points for the survey will be established or recovered for the site and are shown in the drawings. The datum to be used at the site are as follows:

- Horizontal Datum: Michigan State Plane South, North American Vertical Datum of 1983, International Feet
- Vertical Datum: North American Vertical Datum of 1929

The vertical accuracy will be Third Order (0.05 √m) as outlined in the Federal Geographic Data Committee Geospatial Positioning Accuracy Standards, Part 4: Standards for Architecture, Engineering, Constructions (A/E/C) and Facility Management.

4.3.3 Erosion and Sediment Control and Construction Stormwater Management

Erosion and sediment control measures will be implemented on the project site as outlined in the drawings and SESC plan. The erosion and sediment control measures will be consistent with the requirements of Part 91 (Soil Erosion and Sedimentation Control) of the Natural Resources and Environmental Protection Act (NREPA) 1994 P.A. 451, as amended (Michigan Compiled Laws [MCL] 324.9101 - 324.9123a and Michigan Administrative Rules, R323.1701 - 1714). Erosion control measures to be implemented may include silt fencing, inlet protection, and appropriate BMPs at the construction site entrance and exit. BMPs will include administrative controls (for example, planning- and scheduling-related BMPs), and BMPs aligned with RA implementation, including good housekeeping practices, stormwater management, and sediment erosion control measures. Stormwater runoff will be controlled by maintaining erosion control measures such as silt fence on the riverside of intrusive subsurface activities. Contaminated materials will be stored on a bermed liner and covered, if storage is required.

Inspections will be performed during construction activities and afterwards for as long as necessary based on the SESC plan and compliance with Michigan's Permit-by-Rule for construction activities (State of Michigan 1994). Damaged or insufficient erosion and sediment control measures will be promptly replaced or repaired. Erosion and sediment control measures will be removed after all onsite work has been completed and heavy equipment has been moved offsite.

4.3.4 Temporary Facilities and Laydown Areas

The subcontractor will provide temporary sanitary facilities for all site workers during the work (including subcontractor personnel and lower-tiered subcontractors). If desired, the subcontractor will provide a field office trailer and temporary power for subcontractor personnel and lower-tiered subcontractors. The subcontractor may also choose to construct material and equipment laydown areas on the FPS as necessary to facilitate equipment assembly, maintenance, and storage.

4.3.5 Equipment and Assembly

Mobilization of equipment will be completed on a schedule approved by CH2M. Mobilization of equipment will not occur sooner than 30 days before the construction start date.

4.3.6 Temporary Road Construction

Temporary roadways will be constructed as required to support excavation activities. The roadways will be used to support truck traffic to haul materials to and from the PSAs to the site entrance. For the purposes of this design, it is assumed that roadways to the north area of the site will not be required because truck traffic will be accessing the site through the south site entrance off of M-46/Washington Avenue to avoid heavy truck traffic through the residential neighborhood.

It is assumed that the temporary roadways will be constructed by stripping the topsoil, compacting the existing material below the topsoil, placing an aggregate confinement geogrid over the existing material, and then placing a 6-inch aggregate base course of #4 limestone (or approved equivalent) and a 6-inch aggregate surface course of 21AA limestone. In some locations, the temporary roads may be constructed using an advanced composite mat system that can be easily installed and removed.

4.3.7 Demolition of Existing Groundwater Elevation Control Tile

According to the CRA as-builts, the groundwater elevation control tile is installed at a lower elevation than the anticipated bottom of excavation at PSA-1 and PSA-2. However, due to the potential inaccuracy

of the as-builts, the uncertainty of the finished excavation depths, and the close proximity of the groundwater elevation control tile to the anticipated bottom of the excavations, the groundwater elevation control tile will be abandoned in-place prior to construction activities. Approximately 600 linear feet of 6-inch perforated clay pipe and 400 linear feet of 4-inch perforated clay pipe will be abandoned. Three manholes will also be abandoned. Abandonment activities include dewatering and low-strength flowable fill installation in the portion of the groundwater elevation control system scheduled for abandonment. The low-strength flowable fill will be set prior to excavating material below the clay cap to avoid potential leakage into the excavations. Water collected during dewatering activities will be transported offsite for disposal/treatment. The water will be sampled and characterized during preconstruction confirmation sampling.

4.3.8 Site Security and Coordination

The Velsicol FPS will be used for storage of equipment, stockpiled uncontaminated materials, and temporary field offices. The FPS is fenced, and the subcontractor can elect to subcontract security to monitor site equipment and the staging area during nonworking hours. The subcontractor will maintain control over its work areas during working hours at the site. CH2M and EPA will not be held responsible for theft or damage to subcontractor equipment, materials, facilities, or field offices.

Other activities may be occurring at the FPS during the PSA-1 and PSA-2 excavations. Such activities could include soil and groundwater sampling and collection and offsite disposal of groundwater and NAPL. Allowances will be made by the subcontractor to minimize interference with other planned work at the FPS during PSA-1 and PSA-2 excavation activities.

4.4 Excavation of PSA-1 and PSA-2

The descriptions of the final PSA-1 and PSA-2 excavation RD are provided in the following subsections.

4.4.1 Description of Work

The RAO for PSA-1 and PSA-2 is to remove vadose-zone soil exceeding the remediation standards in PSA-1 and PSA-2. The PSA-1 and PSA-2 excavation activities are summarized in the following subsections and will be performed by the subcontractor to complete the RA to meet the RAO for these areas.

4.4.2 Excavation Approach

4.4.2.1 Target Excavation Areas

The target excavation area limits for PSA-1 and PSA-2 are shown in Drawings C-4 and C-5, respectively. The horizontal limits were developed using analytical results from the RI and RDI. The limits include areas where soils exceed the remediation standards above the water table and areas where NAPL-impacted soils were identified below the water table. The preconstruction confirmation sampling effort (described in Section 4.2.1) will finalize the lateral and vertical extent of the excavation in each area.

The target excavation area for PSA-1 consists of one large, irregularly shaped area located in the southeast area of the site (approximately 2.5 acres in size) and one small, discontinuous rectangular-shaped area (approximately 0.05 acre).

The target excavation area for PSA-2 consists of seven discontinuous rectangular-shaped areas, ranging from 0.05 acre to 0.10 acre.

4.4.2.2 Monitoring Well Abandonment

Up to five monitoring wells will require abandonment as part of the PSA-1 and PSA-2 excavation activities. Monitoring well abandonment will be performed by the preconstruction sampling drilling subcontractor. Detailed information on the wells to be abandoned, including northing, easting, ground

elevation, top of casing elevation, total depth from top of casing, top of screen elevation, and bottom of screen elevation is summarized in Table 4-1. Wells that are set shallower than the bottom of the excavations will be abandoned by over-drilling and removal of the well screen and riser. For the monitoring well set deeper than the bottom of excavation, the well will be abandoned prior to excavation activities by setting temporary telescoping isolation casings such that the currently installed 8-inch and 10-inch isolation casings and the 2-inch monitoring well can be removed. Well abandonment procedures will comply with applicable State of Michigan requirements (Part 127, Act 368 PA, R 325, State of Michigan 1978) and be performed by a driller licensed in the State of Michigan.

Table 4-1. Monitoring Wells to be Abandoned or Removed
Velsicol Chemical Corporation Superfund Site PSA-1 and PSA-2 Excavations, Operable Unit 1

Well ID	Removal Area	Northing	Easting	Ground Elevation (ft amsl)	Top of Casing Elevation (ft amsl)	Well Depth (ft below TOC)	Top of Screen Elevation (ft amsl)	Bottom of Screen Elevation (ft amsl)	Well Setting
MPZ-25	PSA-2	696125.11	13056757	738.8	742.01	20.97	726.04	721.04	Shallower than excavation
GWM-2	PSA-1	695882.67	13056904	738.56	741.74	23.65	734.74	718.09	Shallower than excavation
WMW-43D	PSA-1	695806.07	13056966	738.68	741.87	72.2	674.7	669.7	Deeper than excavation
MPZ-23	PSA-1	695624.37	13056845	740.4	744.3	20	729.3	724.3	Shallower than excavation
MPZ-22	PSA-1	695632.00	13056977	736.7	740.04	15.81	729.23	724.23	Shallower than excavation

ft amsl = feet above mean sea level

Monitoring wells CMW-15S, CMW-15I, and CMW-15D are within the limits of the clay cap removal area. However, they will remain in-place without abandonment. Excavation activities will occur to the extent possible around these monitoring wells without impacting their integrity.

4.4.2.3 Topsoil, Sand Layer, and Clay Cap Removal

The existing topsoil and sand layer will be removed and stockpiled on the FPS for reuse. To the extent possible, the topsoil and sand layer will be stockpiled separately to minimize the amount of new material imported to the site. The existing clay cap will be removed to within 1 foot of the impacted soils at both PSA-1 and PSA-2 to the extent shown in Drawings C-4 and C-5. For this design, it is assumed that removal will be performed with a scraper, bulldozer, or with a combination of excavators and off-road dump trucks. The clay cap material will be stockpiled separately on the FPS for reuse after the impacted material has been removed and the excavated areas have been backfilled. The stockpiles will be in a location that does not impact other site activities. Erosion control BMPs will be employed around the stockpiles to minimize erosion.

The existing topsoil, sand layer, and clay cap material will not be sampled prior to excavation; these materials are assumed to be uncontaminated. After the clay cap is removed, a post-clay cap removal survey will be performed to determine the elevations of the bottom of the clay cap (minus 1 foot) for backfill elevation confirmation.

The volume of the topsoil and sand layer material removal from each PSA was estimated using the ground surface elevations surveyed in 2015 in conjunction with the existing soil cap details and field observations during subsequent RAs. The volume of the clay cap removal for each PSA was estimated

using the ground surface elevations surveyed in 2015 in conjunction with the soil cap detail and soil boring logs completed during the RDI to determine the elevations for the bottom of the clay cap. This data was used to create a DTM of the topsoil, sand layer, and clay cap in MicroStation InRoads, which was then used to calculate material volumes.

The volume of topsoil to be removed from PSA-1 is estimated to be 6,600 cubic yards, and from PSA-2 is estimated to be 6,600 cubic yards. The volume of sand layer material estimated to be removed from PSA-1 is 6,500 cubic yards, and from PSA-2 is 6,400 cubic yards. The volume of clay cap removal for PSA-1 and PSA-2 is 21,400 and 21,100 cubic yards, respectively. It is assumed that the estimated removal quantities will be available for reuse for reinstallation of the clay cap, sand layer, and topsoil.

4.4.2.4 General Removal and Backfill Approach

The removal and backfill approach described in this section were assumed for the basis of this design. During subcontractor procurement and the RA, alternative approaches submitted by the subcontractor will be reviewed by CH2M and considered for implementation.

PSA-1

PSA-1 is a single area of contaminated soil with a smaller area of soil contamination located approximately 50 feet north. The larger area is directly adjacent to the east property line of the FPS, and soil removal to the property line is necessary based on observed distribution of subsurface contaminants. Soil to be removed is composed of sands and silts that become saturated with increasing depth. Limited geotechnical information is available for this area of the site. Given material types observed during the RDI, sloughing and slope stability during excavation are likely to affect removal operations.

To protect the properties east of the removal area from sloughing into the excavation, an excavation support wall will be installed along the eastern boundary of the removal area, west of the existing site perimeter slurry wall, as shown in Drawing C-4. Similarly, since the extent of the PSA-1 removal area approaches the southern boundary of the FPS, an excavation support wall will also be installed parallel to M-46/Washington Avenue on the north side of the existing site perimeter slurry wall, as shown in Drawing C-4. The installation of an excavation support wall will allow for excavation adjacent to the FPS property line without affecting the adjacent properties and M-46/Washington Avenue.

Prior to installation of the construction support wall, CH2M will conduct a meeting with the subcontractor and adjacent property owners along the west side of Watson Street, between Washington Avenue and Center Avenue. During the meeting, CH2M and the subcontractor will discuss the construction schedule and noise expectations during installation of the excavation support wall and excavation of PSA-1, and will document existing conditions of the property, including the exterior and interior home foundation, garages, sheds, porches, and decks, if present. A Preconstruction Structural Home Inspection form will be completed and signed by the contractor, subcontractor, and property owner, indicating that all parties are in agreement of the preconstruction conditions.

CH2M and the subcontractor will also notify property owners along the east side of Watson Street, between Washington Avenue and Center Avenue of the excavation support wall installation and excavation activities, although subsurface impacts are not expected at these properties. CH2M and the subcontractor will provide the property owners along the east side of Watson Street with engineering support explaining why subsurface impacts are not expected for their properties. The property owners will be informed of the construction schedule and noise expectations.

Geotechnical monitoring, including movement and settlement monitoring, will also be performed prior to and during excavation support wall installation, excavation activities while the excavation support wall is in-place, and during excavation support wall removal.

Once the excavation support wall is installed, the existing topsoil, sand layer, and clay cap will be excavated to the removal area limits shown in Drawing C-4. One foot of the clay cap will be left in place over the proposed removal area to minimize odors over the area until excavation of contaminated material occurs in the area. The limits shown in Drawing C-4 are based on the original footprint of soil contamination identified (that is, the target excavation areas) and include a 2:1 slope from the target excavation areas, plus a setback of 30 feet from the top of the excavation. The excavation setback was established to reduce the weight exerted on the top of the slope, and to reduce the potential for material sloughing. If sloughing should occur, lateral boundaries of cap removal will be expanded to provide sufficient setback to prevent sloughing of the cap materials into the excavation. The setback is intended to reduce RA excavation and disposal costs by limiting the volume of extra, uncontaminated material, which may slough into the area and minimize the volume of imported uncontaminated fill to replace material that sloughed into the excavation.

Excavation of contaminated soil within PSA-1 will be performed using an excavator. Excavation depths are based on removing contaminated material that exceeds the remediation standards in the vadose-zone soils, and areas where NAPL is visually observed below the water table. In general, soil will be removed until groundwater is encountered or to the top of the glacial till unit. Observations obtained during the RDI suggest that the vertical extent of the PSA-1 excavation will extend a depth of approximately 15 feet bgs, which corresponds to the static water table in this area of the site. However, as noted previously and within the RDI, the observation of NAPL below the water table may require localized areas where excavation depths approach 25 feet. In areas where excavation beyond the water table is deemed necessary, groundwater will be managed as described in subsequent sections of this document.

This design assumes that excavation of the target area will advance from west to east. Once the excavation is within 50 feet of the east property line, it is assumed that the excavation will advance from south to north, until excavation of the target area is complete. Outer edges of the excavation will be maintained at a 2:1 slope to minimize sloughing and provide a safe work area. Equipment movement along and around the edges of the excavation will be minimized. Depending on the material encountered, excavation edges may be modified to a 3:1 slope to maintain the sidewalls from sloughing. The drawings for this design show a 2:1 slope, and material quantities for this design assume a 3:1 slope for conservative estimates. As necessary, an odor-control measures, such as a foam, will be applied over the exposed surfaces of the excavation to minimize nuisance odors.

A visual barrier, such as high-visibility construction fencing, will be placed around the removal area to prevent accidental entry into the work area by other onsite personnel. Signage will also be posted at the site entrance(s) during excavation activities with contact information for CH2M in case of questions or concerns.

Overall, implementation of the RA will be sequenced to allow direct loading of contaminated materials to lined trucks for immediate offsite transport and disposal or into lined containers that will be loaded onto trucks prior to offsite disposal. Odor-control foam may be applied to excavated soil in loaded trucks to minimize odor in transit. All excavated material that leaves the site by truck will be securely covered. In areas where saturated soil must be removed, water content must be controlled and managed to permit material transport offsite.

If excavated materials do not fulfill requirements of the paint filter test, wet soil will be managed in loadout piles within the footprint of PSA-1 in an area that still requires excavation and any leachate or runoff will be directed into an excavation. As excavation nears completion and loadout piles can no longer be managed within the impacted footprint of PSA-1, saturated soil will be placed on plastic sheeting, and leachate will be collected, managed, and disposed of in accordance with procedures established in the waste management plan. A pozzolanic agent may be used to facilitate drying and stabilizing the loadout pile(s).

The volume of the contaminated soil to be removed from PSA-1 was estimated from soil boring logs completed during the RDI. The elevations of the bottom of the clay cap, groundwater table, and top of silty clay layer (assumed to be end of boring if silty clay layer was not logged) were tabulated for each soil boring. The data were used to create a DTM of the PSAs in MicroStation InRoads, which was then used to calculate excavation volumes. The volume of impacted soil removal for PSA-1 is approximately 39,500 cubic yards (71,100 tons) if a 3:1 slope is required to maintain the excavation. Actual excavation volumes for soil above the groundwater table will be determined during the RA by survey and soil volumes below the groundwater table will be estimated based on an assumed conversion factor (cubic yards to tons) of 1.8 and an assumed water content of 16 to 19 percent. The subcontractor will perform percent moisture testing a minimum of four times per day whenever material is excavated from below the groundwater table to determine the water content of material taken offsite. Material excavated at or below the water table will be stockpiled/drained back into the excavation prior to loadout to reduce the weight of the soil being shipped offsite for disposal. Uncontaminated materials, including sand that is removed to access contaminated intervals or for slope stability, will be used for backfill.

Backfilling will lag behind the excavation, but backfilling and excavation will occur concurrently. This design assumes that backfilling will proceed from west to east, and will begin after the excavation has advanced to the extent that uncontaminated backfill and soil within the removal area do not co-mingle. A 10-foot-minimum gap will be left between the toe of backfill and toe of excavation. Backfilling in this manner will help stabilize the excavation, and prevent further sloughing. In areas where backfilling occurs below the groundwater table, a self-compacting material, such as a 3/8-inch to 3/4-inch well-graded gravel will be used so compaction by mechanical means is not needed. General backfill material will be placed above the water table in 18-inch lifts, maximum, and compacted to 90 percent of the standard proctor maximum density (ASTM International D698) to the base elevation of the existing clay cap, in accordance with the post-cap removal survey performed.

Wet decontamination shall be performed on the decontamination pad at the staging area prior to use of equipment for backfill activities, unless separate (dedicated) equipment is used for excavation and backfill. Decontamination water will be managed as described in Section 4.4.2.6.

Once backfilling is complete, the stockpiled clay from the original cap will be used to reconstruct the clay cap in this area. The clay will be placed in 18-inch maximum lifts and compacted to 95 percent of the standard proctor (ASTM International D698). Grading will be performed to allow for surface water runoff and to match the existing grade. The sand layer will be replaced on top of the clay cap, followed by topsoil. The existing stockpiled sand layer material and topsoil will be used to reconstruct these layers to the extent possible. After the topsoil is placed, the area will be vegetated with a seed mix as described in Section 4.5. The final restored grade should be within 0.10 foot of the original grade.

After excavation and backfill is complete, the excavation support walls along the east and south property boundaries will be removed, decontaminated, and taken offsite. A post-construction meeting will be held with CH2M, the subcontractor, and property owners along the west side of Watson Street, between Washington Avenue and Center Avenue to inspect and document the post-construction conditions of the exterior and interior home foundation, garages, sheds, porches, and decks, if present. After the inspection is complete, CH2M, the subcontractor, and property owner will sign off on a Post-Construction – Structural Home Inspection Form, indicating that all parties are in agreement about post-construction conditions. CH2M and the subcontractor will also inform the property owners on the east side of Watson Street, between Washington Avenue and Center Avenue, of the excavation support wall removal.

PSA-2

PSA-2 consists of seven discontinuous rectangular-shaped areas, ranging between approximately 2,000 and 5,000 square feet. Subsurface conditions in PSA-2 are similar to materials present in PSA-1. Therefore, the excavation and 2:1 sideslope strategies established (and previously described) to

minimize material sloughing will also be applied in PSA-2. However, since the removal area is not adjacent to property lines or transportation corridors, excavation support walls are not necessary in PSA-2.

As previously assumed, the existing topsoil, sand layer, and clay cap will be excavated to the removal area limits as illustrated in Drawing C-5. One foot of the clay cap will be left in-place over the proposed removal area to minimize odors while excavation of soil exceeding remediation standards is removed. The limits shown are based on the original footprint of the target excavation areas with a 2:1 slope in the excavation of this area and a setback of 30 feet from the top of the excavations. The excavation setback was established to minimize the potential sloughing of cap material into the work area as previously described.

This design assumes that excavation of contaminated soil in PSA-2 will also be performed using an excavator. Excavation depths are based on removal of unsaturated soil that exceeds the remediation standards. Like PSA-1, NAPL-contaminated soil encountered below the water table will also be removed during remediation of PSA-2. This will generally result in an excavation to 19 feet bgs, but may locally extend to a depth of 30 feet bgs. In areas where excavation beyond the water table is deemed necessary, groundwater will be managed as described in subsequent sections of this document.

Excavation of each of the subareas will be performed separately from each other, as practical. Excavation will be performed maintaining a 2:1 slope on the outer edges, to minimize sloughing and provide a safe work area. Equipment movement along and around the edges of the excavation will be minimized. Depending on the material encountered, the excavation side slope may be modified to 3:1 to maintain the sidewalls from sloughing. The drawings for this design show a 2:1 slope, and material quantities for this design assume a 3:1 slope for conservative estimates. As necessary, an odor-control foam will be sprayed over the exposed surfaces of the excavation to minimize nuisance odors.

A visual barrier, such as high-visibility construction fencing, will be placed around the removal area to prevent accidental entry into the work area by other onsite personnel. Signage will also be posted at the site entrance(s) during excavation activities with contact information for CH2M in case of questions or concerns.

Excavation within PSA-2 will be sequenced to allow direct loading of contaminated materials to lined trucks for immediate offsite transport and disposal or into lined containers that will be loaded onto trucks prior to offsite disposal. If necessary, odor-control measures, such as a foam, will be applied to excavated soil in loaded trucks to minimize odor in transit. All excavated material that leaves the site by truck will be securely covered. In areas where saturated soil must be removed, water content must be controlled and managed to permit material transport offsite. If excavated materials do not fulfill requirements of the paint filter test, wet soil will be managed in loadout piles within the footprint of PSA-2 in an area that still requires excavation and any leachate or runoff will be contained or directed into an excavation. If necessary, a pozzolanic agent may be used to facilitate drying and stabilizing the loadout pile(s).

The volume of the impacted soil removal for PSA-2 was estimated using the soil boring logs completed during the RDI. The elevations of the bottom of the clay cap, groundwater table, and top of glacial till unit (assumed to be end of boring if silty clay layer was not logged) were tabulated for each soil boring. The data were used to create a DTM of the PSAs in MicroStation InRoads, which was then used to calculate excavation volumes. The volume of impacted soil removal for PSA-2 is approximately 11,700 cubic yards (21,000 tons) if a 3:1 slope is required to maintain the excavation. Actual excavation volumes for soil above the groundwater table will be determined during the RA by survey and soil volumes below the groundwater table will be estimated based on an assumed conversion factor (cubic yards to tons) of 1.8 and an assumed water content of 16 to 19 percent. The subcontractor will perform percent moisture testing a minimum of four times per day whenever material is excavated from below the groundwater table to determine the water content of material taken offsite. Material excavated at

or below the water table will be stockpiled/drained back into the excavation prior to loadout to reduce the weight of the soil being shipped offsite for disposal. Uncontaminated materials, including sand that is removed to access contaminated intervals or for slope stability, will be stockpiled at the FPS and used for backfill.

This design assumes that backfilling will be performed at the completion of each excavation. In areas where backfilling occurs below the groundwater table, a self-compacting material, such as a 3/8-inch to 3/4-inch well-graded gravel will be used so that compaction by mechanical means is not needed. General backfill material will be placed above the water table in 18-inch lifts, maximum, and compacted to 90 percent of the standard proctor maximum density (ASTM International D698) to the base elevation of the existing clay cap, in accordance with the post-cap removal survey performed.

Wet decontamination shall be performed on the decontamination pad at the staging area prior to use of equipment for backfill activities unless separate (dedicated) equipment is used for excavation and backfill. Decontamination water will be managed as described in Section 4.4.2.6.

Once backfilling is complete, the stockpiled clay from the original cap will be used to reconstruct the clay cap in this area. The clay will be placed in 18-inch lifts, maximum and compacted to 95 percent of the standard proctor (ASTM International D698). Grading will be performed to allow for surface water runoff and to match existing grade. The sand layer will be replaced on top of the clay cap, followed by topsoil. The existing stockpiled sand layer material and topsoil will be used to reconstruct these layers to the extent possible. After the topsoil is placed, the area will be vegetated with a seed mix as described in Section 4.5. The final restored grade should be within 0.10 foot of the original grade.

4.4.2.5 Excavation Support Wall Installation and Removal

An excavation support wall will be installed along the east and south boundaries of the large PSA-1 removal area. The east excavation support wall will be installed to protect the properties east of the removal area from sloughing into the excavation. The south excavation support wall will be installed to protect the integrity of M-46/Washington Avenue.

Because the proposed excavation will be conducted adjacent to private residential and commercial land along the west side of North Watson Street, this design includes a reasonable and proactive construction observation program to minimize potential claims from these landowners. The observation program consists of the following:

1. A visual recorded preconstruction survey of nearby structures.
2. Installation of settlement markers along the property lines adjacent to anticipated excavation support systems.
3. Installation of piezometers along the property line to monitor and quantify changes in the groundwater table.
4. Periodic monitoring of the settlement markers and piezometers over the course of construction.

If the subcontractor selects a shoring system that incurs considerable vibration during installation (such as sheet piling), the subcontractor will be responsible to supplement the specified monitoring.

Based on the knowledge of the subsurface conditions at the site (with the assumption of better or similar conditions on private land) and the proximity, age, and appearance of the existing residential and commercial structures, the design assumes the proposed construction will have minor, if any, material impact to existing properties along the west side of North Watson Street and is assumed to have no effect to properties on the east side of North Watson Street. The proposed observation program will provide documentation to mitigate exposure to claims from adjacent landowners.

The excavation support walls will be removed after backfill in PSA-1 is complete. The design of the excavation support walls will be completed by the subcontractor and certified by a Michigan-licensed

Professional Engineer, including the length, depth, and materials of construction. CH2M will provide available geotechnical data to the subcontractor to aid in the design. A geotechnical investigation was completed in fall 2016, as part of Work Assignment No. 201. The geotechnical borings are included in Appendix D. The subcontractor's design will be submitted to CH2M for review prior to construction.

4.4.2.6 Accumulated Water

Because portions of the excavations in PSA-1 and PSA-2 will extend below the groundwater table, it is expected that groundwater will continually seep into the excavation. Additionally, precipitation that falls within the area of the excavation will be managed. The estimated volume of water to be managed during excavation is approximately 22,000 gallons per day (roughly 15 gallons per minute) for PSA-1 and approximately 1,200 gallons per day for PSA-2 (approximately 0.8 gallon per minute). Volume estimates are presented in Appendix E, and include daily groundwater seepage and typical seasonal precipitation events. A biodegradable, water-based surfactant may be used to address odors coming from the groundwater (similar to the use for the soils), and also to help manage any NAPL present in the water and prevent it from smearing and adsorbing onto other materials in the excavation (such as the glacial till unit).

During excavation, accumulated water will be channeled to a sump area and pumped to holding tanks staged at the FPS. A tanker truck will then haul the water offsite for treatment/disposal, similar to the operations for the existing groundwater collection system.

4.4.2.7 Encountering NAPL

In the event that NAPL is encountered, it will be pumped with the groundwater into a 20,000-gallon frac tank. Following gravity separation in the temporary frac tank, accumulated NAPL will be skimmed and transferred to a 55-gallon drum and analyzed for disposal. NAPL-stained soil will be segregated from non-stained soil and characterized for offsite disposal. Details for sampling and offsite disposal of NAPL will be outlined in the transportation and disposal plan.

4.4.2.8 Waste Characterization of Soil for Disposal

Soil sampling to support characterization for waste disposal was performed in August 2015. Additional soil waste characterization sampling will be completed by CH2M as part of the RA, during the preconstruction confirmation sampling. Supplemental sampling is intended to provide secondary confirmation of the nonhazardous waste profile established by August 2015 samples. Soil samples will be collected below the clay cap and submitted for analysis. The results will be reviewed and characterized by CH2M's environmental manager. Details, including sample collection frequency, will be outlined in the confirmation sampling plan, which will be developed by CH2M as part of the RA activities. Assuming the supplemental waste characterization samples indicate the soil is nonhazardous, soil will be live-loaded during excavation activities and taken offsite for disposal.

As stated in Section 4.1, the abandoned groundwater elevation control tile will be crushed and disposed offsite with the soil. Based on the available soil and groundwater data for PSA-1 and PSA-2, this design assumes the groundwater elevation control tile will be nonhazardous.

Should supplemental characterization indicate that excavated soil is hazardous, material will be live-loaded and disposed at an appropriate, EPA Offsite Rule-approved, commercial Resource Conservation and Recovery Act of 1976 (RCRA) Subtitle C facility. Regardless of final classification, waste profiles will be reviewed by CH2M's environmental manager and/or waste coordinator prior to signature by EPA and submittal to the landfill. Offsite disposal of excavated soil will be coordinated and arranged upon receipt of waste profile approval.

4.4.2.9 Waste Characterization of Water for Disposal

Liquid waste characterization sampling will also be conducted by CH2M as part of the RA, during the soil waste characterization sampling. For the purposes of this design, it is assumed that all liquid waste produced during PSA excavation will also be nonhazardous. Waste characterization sampling will be conducted during the RA, as necessary, to support establishment of waste profiles with an approved offsite nonhazardous disposal facility. The sampling frequency and analyses will be outlined in the confirmation sampling plan. Should supplemental characterization indicate that recovered liquid is hazardous, material will be transferred from storage and disposed at an appropriate, EPA Offsite Rule-approved, commercial RCRA Subtitle C facility. Regardless of final classification, waste profiles will be reviewed by the contractor's environmental manager and/or waste coordinator prior to signature by EPA and submittal to the landfill. Offsite disposal of liquid waste will be coordinated and arranged upon receipt of waste profile approval.

4.4.2.10 Transportation and Disposal of Excavated Soil

Excavated soils, groundwater elevation control tile materials, and NAPL (if encountered) will be transported to an approved disposal facility. The subcontractor will subcontract directly with the disposal facility. Transportation firms and disposal facilities will be approved by EPA and CH2M.

Prior to leaving the excavation area, exterior surfaces of loaded trucks will undergo dry decontamination measures to remove loose soil. As previously described, truck or container contents may be sprayed with odor-control foam and covered prior to leaving the site. Manifests for excavated soil will be prepared prior to leaving the site. Transporters and disposal facilities will be required to provide proof of EPA approval under the CERCLA Offsite Rule, set forth in the National Contingency Plan, 40 *Code of Federal Regulations* 300.440. Waste disposal manifests will be prepared and signed by trained contractor personnel on behalf of EPA prior to leaving the site.

The cost of transportation will be paid based on the haul truck weights taken onsite or at the landfill (TONS), with the exception of the existing topsoil, sand layer, and clay cap material, which will be used for backfill. Excavation volumes have been estimated as part of this RD; however, actual excavation volumes will be determined during the RA.

Dust abatement will be performed during loadout and transportation operations as necessary to prevent emission of visible fugitive dust beyond the property boundary.

4.4.2.11 Surveying

Existing topography elevations were collected in fall 2015. This information has been incorporated into the drawings and will be provided to the subcontractor for final grade elevation data.

Surveys will be conducted during the RA as follows:

- Pre-excavation survey
- Post-excavation survey after removal of existing topsoil
- Post-excavation survey after removal of existing sand layer
- Post-excavation survey after removal of existing clay cap
- Post-excavation survey after removal of impacted material
- Post-backfilling survey after placement of general backfill to confirm bottom of clay cap elevation
  - Within 0.50 foot of original grade
- Post-backfilling survey after placement of clay cap material to confirm top of clay cap elevation/bottom of sand layer elevation

  - Within 0.10 foot of original grade
- Post-backfilling survey after placement of sand layer to confirm top of sand layer elevation/bottom of topsoil elevation
  - Within 0.10 foot of original grade
- Post-backfilling survey after placement of topsoil to confirm pre-seeding placement grade
  - Within 0.10 foot of original grade

Horizontal and vertical control monuments for the survey will be established or recovered for the site. The vertical accuracy will be Third Order (0.05 √m) as outlined in the Federal Geographic Data Committee Geospatial Positioning Accuracy Standards, Part 4: Standards for Architecture, Engineering, Constructions (A/E/C) and Facility Management.

4.5 Site Restoration

Site restoration work includes seeding, watering, and restoring damage to existing site roads to preconstruction condition or better. The final graded areas of the excavations will be hydro-seeded. A seed mix native to the local area will be used, subject to acceptance by CH2M. The seed mix will contain species appropriate to the hydrologic regime anticipated for the planting site and will be certified weed-free and free from any state-listed noxious, non-native, or non-native invasive species.

Hydroseeding will occur during the growing season, which is defined as the period during which soil temperatures reach 50 degrees Fahrenheit or greater in the spring with a limited possibility of frost, and greater than 45 degrees Fahrenheit in the fall, typically May 1 through October 16.

The subcontractor will maintain all areas that will be seeded and planted from 12 weeks beyond demobilization with adequate, viable establishment greater than 80 percent with no bare spots larger than 3 square feet. Maintenance is defined as the actions necessary to establish healthy, viable habitats in accordance with the specifications. This includes erosion repairs, irrigation, weed and invasive species control, inspections, and other actions necessary during the establishment or maintenance period of this project.

Establishment will be measured a minimum of 1 time during the year the seeding is completed and 1 time during the subsequent growing season prior to the end of the 12-week maintenance period. The subcontractor also will be responsible for maintaining the seeded areas and plantings in accordance with the specifications.

4.6 Demobilization

Demobilization will include removal of temporary facilities such as field trailer, utilities, material storage facilities, equipment decontamination facilities, and erosion and sediment control features. In addition, all waste materials will be properly disposed of prior to demobilization. Until site restoration and demobilization are completed, erosion and sediment control features must comply with the SESC plan. Wet decontamination shall be performed on all trucks and equipment that hauled or handled contaminated soils prior to final demobilization.

4.7 Green Remediation

Green remediation is a valuable consideration to help reduce the environmental burden of the remedy and reduce costs. CH2M's experience has proven that there is a strong correlation between reducing the footprint of a project and reducing the costs of the project. CH2M has technology-specific sustainability BMPs and footprint, life-cycle assessment, and cost/benefit analysis tools to identify the best

sustainable remediation attributes that could provide the greatest cost reductions. CH2M has found that the following topics have the best outcomes for cost-saving, sustainable remedies:

- Materials
- Residual Solid and Liquid Management
- Site Preparation/Land Management
- Surface and Stormwater
- Vehicle and Equipment

Based on the scope of work for this final design, CH2M has identified seven EPA BMP documents that are potentially applicable to this work. From these BMP documents, CH2M identified approximately 50 green remediation BMPs that will potentially be implemented as part of the RA (Appendix F). Recommended BMPs will provide environmental benefit and cost savings to the project.

4.8 Post-Construction Documentation

CH2M will prepare an RA completion report and an ambient air monitoring report. The RA completion report will document the work completed by CH2M and its subcontractors using a report format used for other similar residential superfund sites and in accordance with *Close Out Procedures for National Priorities List Sites, OSWER Directive 9320.2-22* (EPA 2011).

SECTION 5

Environmental Management

Section 5 identifies the regulatory requirements for the RA.

5.1 Compliance with Applicable or Relevant and Appropriate Requirements

This project is being performed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) ROD for OU1 (EPA 2012). Under CERCLA, a requirement under environmental laws may be either applicable or relevant and appropriate to an RA, but not both. *Applicable requirements* are cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, RA, location, or other circumstances found at a CERCLA site. *Relevant and appropriate requirements* are cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not applicable to a hazardous substance, pollutant, contaminant, RA, location, or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site, and are well-suited to the particular site. Determination of "relevant and appropriate" relies on professional judgment, considering environmental and technical factors at the site. Once a requirement is determined to be relevant and appropriate, it must be complied with as if it were applicable.

Under CERCLA 121(e), onsite RAs (that is, activities within OU1) do not need to comply with the administrative requirements of applicable or relevant and appropriate requirements (ARARs) (environmental laws and regulations). Substantive requirements, however, must be met.

Only state standards that are more stringent than federal requirements may be applicable or relevant and appropriate. The statutes and regulations listed in Table 4-1 contain requirements from the ROD (EPA 2012) that are deemed to be ARARs for the PSA-1 and PSA-2 RA, and describe how the design will comply with those requirements as documented in the ROD.

EPA recognizes the following three types of ARARs:

- Chemical-specific ARARs: Health- or risk-based numeric values or methodologies that establish the acceptable amount or concentration of a chemical that may be found in or discharged to the ambient environment.
- Location-specific ARARs: Requirements that relate to the geographical position of the site. Examples of location-specific ARARs include state and federal laws and regulations that apply to the protection of wetlands, construction in floodplains, and protection of endangered species in streams or rivers.
- Action-specific ARARs: Technology- or activity-based requirements or limitations on actions involving the management of regulated materials, including contaminated media, hazardous substances, and hazardous and nonhazardous wastes.

Other federal and state advisories, criteria, or guidance may, as appropriate, be considered in formulation of the RA selected in the ROD. Other information to be considered generally falls within the following three categories: (1) health effects information with a high degree of credibility, (2) technical information on how to perform or evaluate site investigations or response actions, and (3) policy.

Table 5-1 is organized by the two types of ARARs: action-specific and location-specific, and distinguish federal ARARs from state ARARs. Chemical-specific ARARs relating to cleanup levels were used in developing the RAOs and in selecting the remedies set forth in the ROD; therefore, they are not described here. Clean-up standards were established in ROD and were based on MDEQ Part 201 C_{sat} screening levels. ARARs relating to the discharge of contaminants are included in the action-specific tables. The ROD contains multiple phases of remediation, with different target areas and objectives. Therefore, of the action-specific and location-specific ARARs described in the ROD, only those that have substantive requirements and align with the PSA-1 and PSA-2 excavation activities are included in Table 5-1. When federal regulations are implemented by the state, only the state regulations are included here. Table 5-2 describes other key regulatory requirements that must be fully complied with, both substantively and administratively. For example, full substantive and administrative compliance with the Occupational Safety and Health Administration and Michigan Department of Transportation regulations is required, as described in the specifications.

Table 5-1. Applicable or Relevant and Appropriate Requirements
Velsicol Chemical Corporation Superfund Site PSA-1 and PSA-2 Excavations, Operable Unit 1

Requirement	Requirement Synopsis	Action to be Taken to Attain Compliance
Action-specific ARARs		
Clean Air Act (42 United States Code [U.S.C.] 7401 et seq.)		
Air Pollution Control Rules (Mich. Admin. Code R 336.1301, 336.1371, and 336.1372(2), (3) and (5))	Emission Limitations and Prohibitions—Particulate Matter. Provisions that apply to the following as sources of fugitive dust: (2) open storage piles of bulk materials, including clay, sand, and gravel (3) transport of bulk materials, including clay, sand, and gravel (5) roads and lots located within industrial, commercial, and government-owned facilities	Implement fugitive emission controls as indicated in rule. Anticipated dust-control measures will include covering the piles when not working, wetting the piles with water, covering trucks during transport, and cleaning the wheels and body of the truck after loading. To control odor that may be objectionable, the design requires application of an odor-suppression foam. The opacity of a visible emission will be determined by a qualified observer and shall be certified in accordance with, and using the procedures specified in EPA Method 9 or an alternative method approved by the department.
RCRA (42 U.S.C. 6901 et seq.)		
Hazardous Waste Management Rules – Part 3, Generators of Hazardous Waste (Mich. Admin. Code R 299.9302)	Requirement for hazardous waste determination.	The design will specify that wastes be properly characterized and managed.
Hazardous Waste Management Rules – Part 3, Generators of Hazardous Waste (Mich. Admin. Code R 299.9305 and 9305)	Hazardous waste pre-transport and accumulation requirements.	Wastes generated during the PSA-1 and PSA-2 excavation activities of the OU1 remedy are not anticipated to be hazardous. If determined to be hazardous, such waste will be packaged, labeled, and marked and managed onsite as indicated in the rule. Note that if found to be hazardous, excavated soil, NAPL/oil, or the material in the control tiles may be subject to full substantive and administrative requirements of the Land Disposal Restrictions (R 299.9620), as disposal would occur offsite.

Table 5-1. Applicable or Relevant and Appropriate Requirements

Velsicol Chemical Corporation Superfund Site PSA-1 and PSA-2 Excavations, Operable Unit 1

Requirement	Requirement Synopsis	Action to be Taken to Attain Compliance
Transportation Standards and Recordkeeping (Mich. Admin. Code R. 299.9608 – 9609)	Requirements for using a manifest system to track the type and quantity of hazardous waste shipped from a facility.	The manifest system originates onsite (uniform nonhazardous waste or uniform hazardous waste manifest) and will be used to track the waste from its onsite origin through its offsite disposal. The design requires full substantive and administrative compliance for all offsite activities, including transportation and recordkeeping.
Michigan NREPA: Natural Resources and Environmental Protection Act		
Part 91 (Soil Erosion and Sedimentation Control) of the NREPA, 1994 P.A. 451 as amended (MCL 324.9101 – 324.9123a), Michigan Admin Code Part 17, Erosion and Sediment Control (R323.1702, 1703, 1709, 1710 and Part 31 of the NREPA (Water Resources Protection), Rule 2190, (R 323.2190 – National Permit for Storm Water Discharge from Construction Activity)	Prevents uncontrolled erosion and sedimentation in lakes, streams, and rivers from earth-changing activities. Requires soil erosion control and sedimentation controls for soil disturbance of 1 or more acres or that is within 500 feet of the water's edge of a lake or stream.	The area of disturbance is greater than 5 acres. Substantive requirements of the rule will be met through implementation of the SESC plan, which will incorporate appropriate BMPs, erosion and sediment control measures, inspections and other substantive requirements of the Michigan National Pollutant Discharge Elimination System Construction Stormwater Permit-by-Rule.
Part 121 (Liquid Industrial Waste) of the NREPA, 1994 P.A. 451 as amended (MCL 324.12103)	Requires liquid industrial waste generators to properly characterize the waste and to use haulers that are licensed and bonded.	The RA will generate liquid waste requiring management in accordance with this rule. Wastes will be characterized, and labeled, and transporters will be in accordance with Part 121. The offsite transportation and disposal of liquid waste is not an ARAR; rather, full compliance with Part 121 and R324.12101-324.12117 is required and will be adhered to. The design will comply with the requirements of sampling, characterization, storage and disposal.

Table 5-1. Applicable or Relevant and Appropriate Requirements

Velsicol Chemical Corporation Superfund Site PSA-1 and PSA-2 Excavations, Operable Unit 1

Requirement	Requirement Synopsis	Action to be Taken to Attain Compliance
General provisions for Part 201. Environmental Remediation of the NREPA, 1994 P.A. 451, As amended. (Mich. Admin. Code R. 299.5101 – 5105, 5701 – 5727)	Definitions and cleanup criteria for Part 201 that include methodology for determining cleanup standards for environmental media at contaminated sites.	Confirmation soil sampling will be performed as required in the ROD, as part of RA to confirm that cleanup standards are being met.
Location-specific ARARs		
Endangered Species Act (16 U.S.C. 1531)	Establishes requirements to protect species threatened by extinction and habitats critical to their survival.	Informal concurrence was obtained from the U.S. Fish and Wildlife Service (USFWS) and MDEQ in 2013 and 2014 regarding threatened and endangered species, the potential presence of their habitat at the site, and remedial work on an adjacent OU, which involved limited tree cutting. Both agencies concurred that limited tree removal require no further action although minimizing cutting from April 1 to October 15 was advised, if possible. No trees will be cut during implementation of the site preparation activities, and no action is required for this phase of work.
Part 365 (Endangered Species Protection) of the NREPA. 1994 P.A. 451 as amended (MCL 324.36501 – 324.36507)	Contains listing of the fish, wildlife, and plant species that have been determined to be endangered or threatened; prohibits taking of listed species.	Informal concurrence was obtained from USFWS and MDEQ in 2013 and 2014 regarding threatened and endangered species, the potential presence of their habitat at the site, and remedial work on an adjacent OU, which involved limited tree cutting. Both agencies concurred that limited tree removal would require no further action, although minimizing cutting from April 1 to October 15 was advised, if possible. No trees will be cut during implementation of the site preparation. Therefore, no action is required as part of the site preparation design.
Migratory Bird Treaty Act (16 U.S.C. 703)	Makes it unlawful to take, kill, or possess any migratory bird or any part, nest, or eggs of any such bird with appropriate authorization.	Trees, shrubs, structures, and equipment at the site may be used by protected migratory birds (e.g., American Robin) during the nesting season. Site preparation activities will require clearing of vegetation or relocation of structures that have the potential to support migratory bird nests. Disturbance to migratory birds and nests containing hatchlings or eggs will be minimized where possible and mitigated by clearing vegetation or structures prior to the nesting season, rescheduling work if possible to avoid disturbing nests, limiting removal to only those shrubs or structures absolutely necessary to support the work, or removing nests as they are being built, before they are inhabited. While CERCLA onsite actions are exempt from environmental permits (per CERCLA Section 121(e)(1)), EPA will seek concurrence with USFWS on the mitigation measures. If needed, a USFWS Special Purpose-Miscellaneous permit application-equivalent for will submitted as a means to obtain formal documentation within the USFWS process.

Table 5-2. Other Key Regulatory Requirements

Velsicol Chemical Corporation Superfund Site - PSA-1 and PSA-2 Excavations, Operable Unit 1

Requirement	Requirement Synopsis	Action to be Taken to Attain Compliance
Transportation Standards and Recordkeeping (Mich. Admin. Code R 299.9608-9609)	Requirements for using a manifest system to track the type and quantity of hazardous waste received by or shipped from a facility. The rules may apply and will be adhered to if the RA generates waste that can be classified as hazardous.	Applicable. A manifest system will be used for transport of contaminated soil and debris. The requirements will be identified in the transportation and disposal plan.
Part 121 (Liquid Industrial Waste) of NREPA 1994 P.A. 451, as amended (MCL 324.12101-12118)	Provides for the control of wastes with free liquids, including manifest requirements and storage and transport.	Applicable. Decontamination activities will generate liquid wastes requiring management in accordance with this rule. Wastes will be containerized, characterized, stored, manifested, and transported for disposal in accordance with Part 121.
Part 127 (Water Supply and Sewer Systems) of the Michigan Public Health Code, 1978 P.A. 368 (MCL 333.12701 – 333.12771)	Regulates construction of private drinking water wells, monitoring wells, test wells (mineral wells), dewatering wells, and sewer system.	The site preparation activities require the abandonment of monitoring wells. The design will specify that well drillers be certified by the state in accordance with these rules.
Groundwater Quality Control Rules, Part I. Well Construction Code (Mich. Admin. Code R. 325.1601 – 1781)	Establishes regulations for well construction, pump installation, and well abandonment, including dewatering wells.	Requirements may be applicable for remedies involving groundwater remediation systems.
Part 115 (Solid Waste Management) of the NREPA, 1994 P.A. 451 as amended (MCL 324.11501 – 324.11550)	Addresses solid waste management, as promulgated in the administrative rules of the Michigan Solid Waste Management Regulations.	The site preparation will produce nonhazardous solid waste. The design will specify that nonhazardous solid waste be disposed in a Type II Landfill.
Occupational Safety and Health Standards (29 CFR Part 1910, Subpart Z – Toxic and Hazardous Substances)	RA will require specific training and monitoring based on contaminant concentrations and risk.	The project specifications will require that remediation workers comply, during implementation of the remedy.
Safety and Health Regulations for Construction (29 CFR Part 1926)	Establishes construction standards.	Standards will be applicable during the construction of remedial alternatives.
Michigan Occupation Safety and Health Act (MIOSHA), 1974 P.A. 154 (MCL 408.1001 – 408.1094)	Statute that dictates and regulates working conditions and the duties of employers and employees as to places and conditions of employment. Establishes rules for safety standards in the workplace.	Onsite RAs have the potential to expose workers to contaminants. Construction, excavation, and other site actions may present potential health hazards to workers. Human labor could construct remedial systems and provide long-term maintenance on the systems. Such activities are governed by worker safety and health standards under this act, and MIOSHA standards and safety standards must be followed for all site actions and activities.

Table 5-2. Other Key Regulatory Requirements
Velsicol Chemical Corporation Superfund Site - PSA-1 and PSA-2 Excavations, Operable Unit 1

Requirement	Requirement Synopsis	Action to be Taken to Attain Compliance
MIOSHA Construction Safety Standards (Part 1-91) and Occupational Health Standards for Construction (Parts 303-681)	These regulations set forth safety standards for construction and construction-related activities. Standards adopted include those for excavations, trenching and shoring, ladders, demolition, personal protective equipment, electrical, etc.	The design will specify compliance with these standards for work that is triggered by these regulations.
Michigan Vehicle Code, 1949 P.A. 300, Michigan Compiled Laws Annotated (MCLA) – Section 257.722	Rules governing the reduction of the maximum axle loads during the period of March, April, and May (i.e., frost laws).	These rules would be applicable; RA may require heavy loads of equipment or media to be moved on roads affected by these rules.

5.2 Minimizing Public and Environmental Impacts

Environmental and public health and welfare impacts will be minimized through the following methods:

- Site access control
- Limitation of working hours
- Dust control
- Stormwater management
- Air monitoring
- Odor control during excavation
- Transportation and disposal of contaminated materials offsite
- Compliance with permits/codes

5.2.1 Site Access Control

Access control to the site during construction is necessary to prevent exposure of trespassers to contaminated soil and open excavations. In addition to the existing site perimeter fence and posted CERCLA signage, access will be controlled by installing construction fencing around work areas to prevent workers involved in other activities on the FPS from entering the excavations. The site entrance gates will be locked when the site is vacant.

5.2.2 Limitation of Working Hours

Typical working hours for construction activities will be 8:00 AM to 5:00 PM, Monday through Friday. Approval must be obtained for alternate work hours during the week or for work on the weekend.

5.2.3 Dust Control

During construction, dust abatement will be performed, as required and as described in the air monitoring plan, based on ambient measurements and health and safety standards. The dust monitoring results will determine if dust abatement is required due to weather or an absence of precipitation. Construction activities may include a work stoppage until dust abatement measures are implemented, typically water application. Due to the close proximity of some construction activities to public roads (M-46/Washington Avenue), street cleaning will be performed by the subcontractor as directed by CH2M during construction activities. Street cleaning is assumed to use equipment that will

capture debris after sweeping, using either mechanical methods or vacuum, to minimize fugitive dust emissions.

5.2.4 Construction Stormwater Management

Procedures will be implemented during construction activities to prevent or reduce pollutants in stormwater discharges, consistent with substantive requirements of Part 91 (Soil Erosion and Sedimentation Control) of NREPA 1994 P.A. 451, as amended. As a matter of coordination, Gratiot County and City of St. Louis requirements will also be considered. Erosion control features will be described in a SESC plan designed to reduce stormwater pollution potential at the site. The following erosion and sediment control measures will be identified in the plan:

- Silt fence
- Inlet protection
- Temporary covers for materials staged or stockpiled on site
- Application of best management practices for construction entrances and exits
- Inspections and maintenance procedures

Spill and release accident scenarios could occur and involve rinsates from decontamination activities or contaminated soil. Also, the potential exists for spills of vehicle fuel and hydraulic oils. A SESC plan will address the following activities:

- Fuel and oil storage requirements
- Preplanning for spill control
- Spill and fire control materials and equipment
- Spill control measures
- Drum, container, and tank handling and moving procedures

The plan will also provide instructions to respond to and mitigate releases on the project site.

5.2.5 Air Monitoring

The potential for dust generation during excavation activities and presence of VOCs within PSA-1 and PSA-2 will require air monitoring. The monitoring program will be developed to verify that contaminants are not migrating offsite in dust particles and that protection of health for site workers and ANP residents is maintained. The program will also aim to support effective deployment of countermeasures for nuisance odor control. Perimeter, work area, and breathing zone air monitoring will be conducted during the remedial activities.

Real-time air monitoring for particulate matter will be conducted continuously at the FPS near the work area while excavation is being performed, in accordance with an approved air monitoring plan. The air monitoring equipment will be placed at locations to verify effectiveness of engineering controls in minimizing dust generation that may potentially leave the exclusion zone. Dust monitors will be placed upwind and downwind of excavation activities, and near the excavation activities to determine the impact of the construction activities on air quality.

Real-time air monitoring for non-specific VOCs will be conducted around the perimeter of the work area. This monitoring will be conducted using a multi-gas meter (VOCs, LEL, and oxygen) equipped with a chlorine sensor and an 11.7-elctron-volt lamp. Based on the VOC concentrations measured during the RDI, personal air sampling is not required. However, VOCs will be monitored initially and intermittently throughout the work day in the breathing zone using a multi-gas meter. If the multi-gas meter readings indicate that VOC concentrations are above the action level to be described in the Air Monitoring Plan, then personal air sampling will be performed and analyzed.

All air monitoring activities will be conducted in accordance with an air monitoring plan, which will be developed and approved as part of the RA.

5.2.6 Odor Control During Excavation

Observations during the RDI suggest that excavation operations within PSA-1 and PSA-2 may produce objectionable odor. Breathing zone and perimeter air monitoring was performed during the RDI and indicated that VOC concentrations near the breathing zone and perimeter were below the action level and did not pose a threat to field worker safety. However, nuisance odor was still noted during subsurface drilling activities.

Field implementation will be sequenced to minimize the potential for odor generation; however, active mitigation of nuisance odor during excavation may be necessary to support RA completion.
If objectionable odor is encountered during soil removal, as described in the air monitoring plan, an odor-control foam will be applied to open excavation areas. Odor-suppressing foam relies on multiple layers of entrained air bubbles to create a film barrier that encapsulates odor causing materials and dust. Surface encapsulating foams are appropriate for use during active excavation and overnight odor control by forming a physical barrier between the atmosphere and contamination source. There are numerous formulations for odor control; however, most are based on mixtures of aqueous anionic surfactants, which are the primary components of soap. Odor control foams will offer the following advantages:

- Nonhazardous—safe for human health and the environment
- Non-reactive—effective on any source of contamination
- Non-hardening—foam is 96 percent air by volume and will not add significant mass to waste volume
- Controls odors and VOCs immediately upon application
- Adheres to near vertical slopes
- Has little to no odor itself; however, scents can be added for extra measure in masking residual odors not contained under foam blanket

5.2.7 Transportation and Disposal of Contaminated Materials Offsite

A transportation and disposal plan, including a sitewide waste management plan, will describe the management, transport, and disposal of contaminated materials to the approved disposal facility, and importing materials from approved borrow sources. Transportation firms and disposal facilities will be approved prior to offsite disposal. Disposal facilities will be required to provide proof of EPA approval under the CERCLA Offsite Rule, set forth in the National Contingency Plan, 40 *Code of Federal Regulations* 300.440. Excavated materials (contaminated or non-contaminated) destined for disposal may be sprayed with odor control foam, then covered or enclosed before transporting offsite. Waste manifests will be prepared and signed on behalf of EPA by qualified contractor personnel prior to leaving the site. The waste characterization requirements will be determined by the approved disposal facility. The sitewide transportation and disposal and waste management plans will be submitted prior to mobilization. These plans will address the following:

- Identification of waste streams
- Decontamination procedures
- Waste characterization and profiling
- Waste and container management, storage, labeling, and marking
- Waste transportation practices
- Manifests/haul tickets and other shipping documentation
- Qualified contractor personnel who can sign the waste manifests on behalf of EPA
- Waste disposal
- Spill response and reporting

- Dust abatement
- Traffic control, including road closure permits or protective measures
- Records and reporting

SECTION 6

Construction Schedule

A final construction schedule is provided in Appendix G. The schedule is conceptual and assumes a mobilization date in April 2018. It is anticipated that RA construction activities will take 1 year from mobilization to demobilization, assuming no interruption in construction activities, and an additional 12-week maintenance period for site restoration.

SECTION 7

Engineer's Estimate of Construction Cost

The engineer's estimate of construction costs for the final RD activities, as described in this report, is estimated at [redacted] (Class 2 with an accuracy of plus 15 percent to minus 10 percent) based on the results of the assumptions presented in this BODR. Appendix H contains the cost estimate, which details the costs to perform the work as described in this *Final Basis of Design Report, Velsicol Chemical Corporation Superfund Site, PSA-1 and PSA-2 Excavations, Operable Unit 1, St. Louis, Michigan*.

Cost savings that were implemented as part of the final PSA-1 and PSA-2 excavation design include reusing the existing topsoil, sand layer material, clay cap material, and the non-impacted layback material for backfill to the extent possible. Also, by excavating the clay cap material an additional 30 feet from the excavation limits of the impacted material, the weight on the slope of the excavation is reduced; therefore, reducing sloughing of uncontaminated material into the excavation that would need to be hauled offsite for disposal. In addition, local CH2M construction management and field technician staff that can potentially provide construction management services during construction activities will be used to the extent possible.

The engineer's estimate of construction costs has been prepared for guidance in project evaluation and implementation from the information available at the time that the cost estimate was prepared. The final costs of the project will depend on actual labor and material costs, competitive market conditions, actual site conditions, implementation schedule, and other variable factors. As a result, the final project costs will vary from the cost estimates presented herein. Because of these factors, project feasibility and funding needs must be carefully reviewed before specific financial decisions are made or project budgets are established to help ensure project evaluation and adequate funding.

SECTION 8

Bidability and Constructability Review

CH2M senior construction project management staff reviewed the BODR, drawings, and specifications with an emphasis on bidability and constructability. In addition, this BODR, drawings, and specifications were reviewed by the project review team, and comments were incorporated, as appropriate. The review did not identify significant concerns at this level of design.

SECTION 9

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Figure

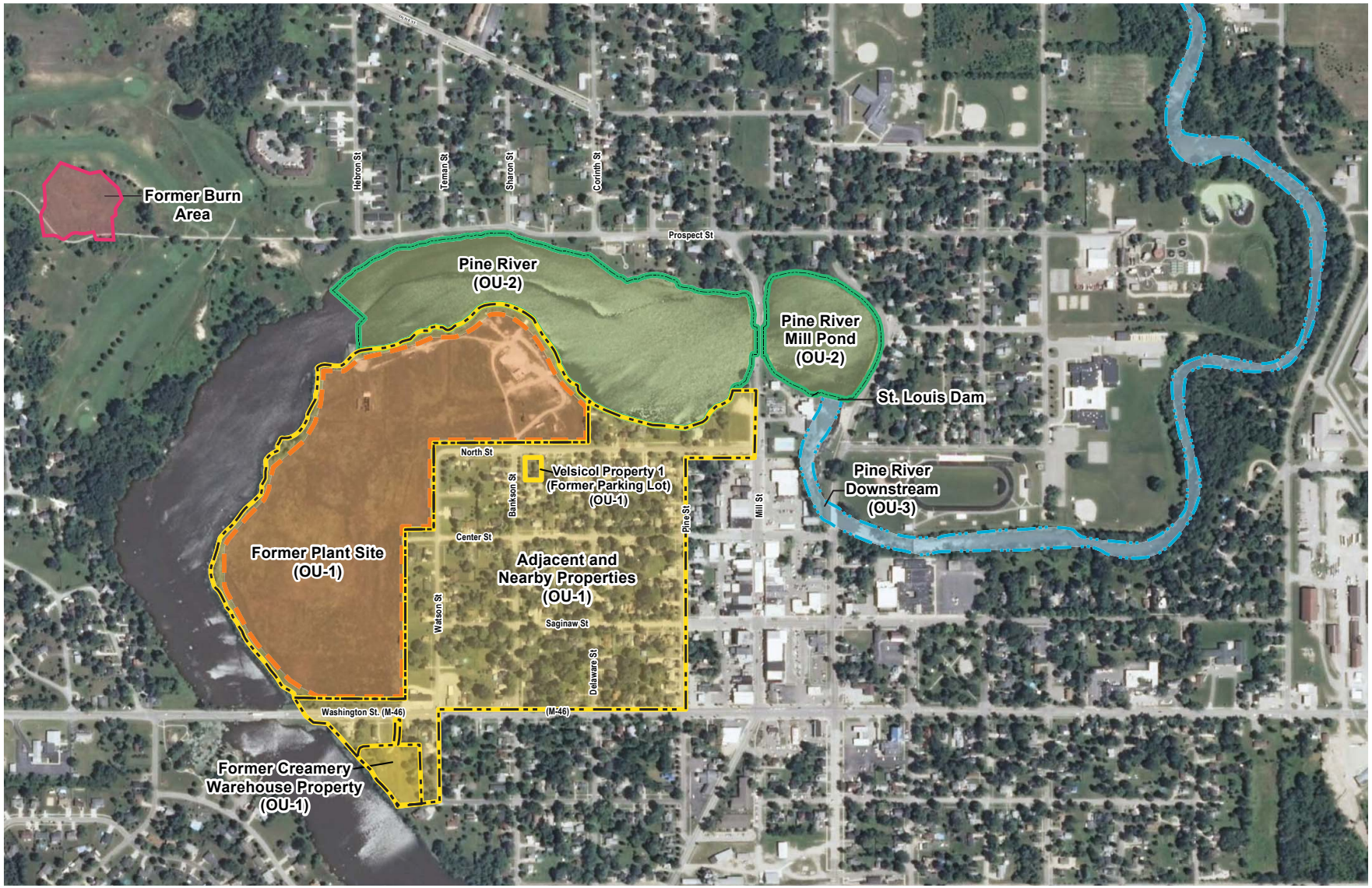
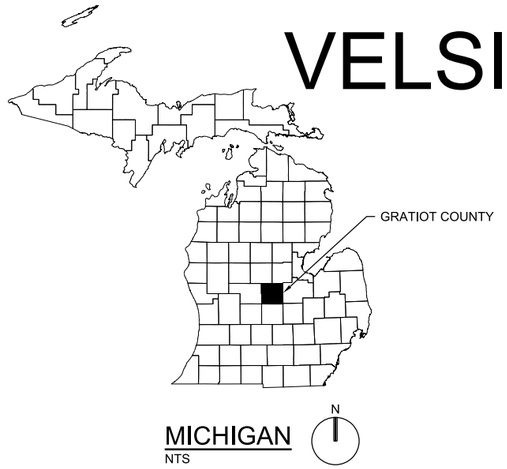


Figure 1-1
Study Areas and Operable Units
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

Appendix A
Final Drawings

PSA-1 AND PSA- 2 EXCAVATIONS
OPERABLE UNIT 1
VELSICOL CHEMICAL CORPORATION

EPA SUPERFUND SITE
ST. LOUIS, MICHIGAN



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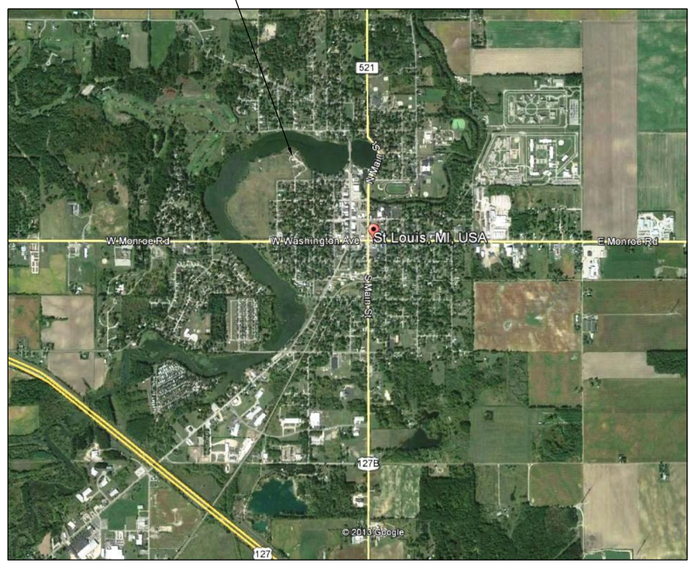
PROJECT LOCATION



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VICINITY MAP

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ST. LOUIS, MICHIGAN
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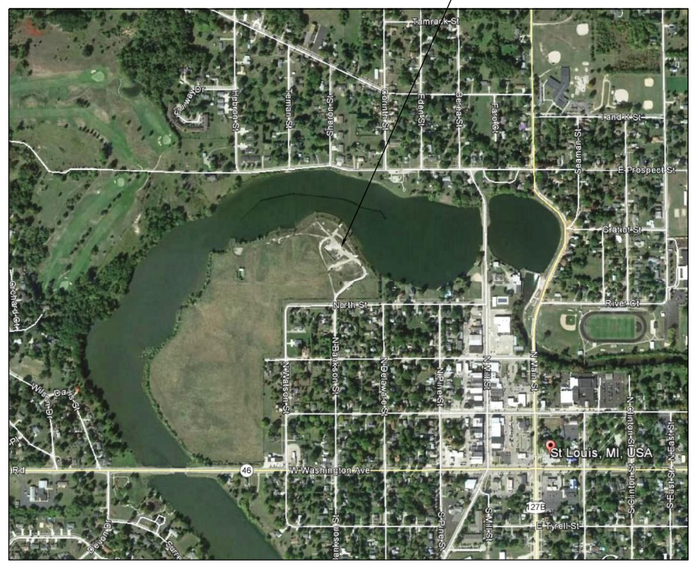

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LOCATION MAP

STATE OF MICHIGAN
JASON D COLE
ENGINEER
No. 6201063070
LICENSED PROFESSIONAL ENGINEER

NO.	DATE	DSGN	DR	CHK	APVD	BY	APVD
		RL VAUGHAN	NA LINDHOLM	WM ANDRAE			J COLE

REVISION

PSA-1 AND PSA-2 EXCAVATIONS
OPERABLE UNIT 1
VELSICOL CHEMICAL CORPORATION
EPA SUPERFUND SITE
ST. LOUIS, MICHIGAN

ch2m

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TITLE SHEET, VICINITY / LOCATION MAPS, AND INDEX TO DRAWINGS

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FINAL DESIGN

ABBREVIATIONS

@	AT
ABDN	ABANDONED
ADDL	ADDITIONAL
ADJ	ADJACENT
AHR	ANCHOR
AL	ALUMINUM
ALTN	ALTERNATE
APPROX	APPROXIMATE
APVD	APPROVED
ARCH	ARCHITECTURAL
ARV	AIR RELEASE VALVE
ASSY	ASSEMBLY
AVG	AVERAGE
BETW	BETWEEN
BF	BOTTOM FACE
BGS	BELOW GROUND SURFACE
BLDG	BUILDING
BOT	BOTTOM
BRG	BEARING
BV	BUTTERFLY VALVE
C TO C	CENTER TO CENTER
CARV	COMBINATION AIR RELEASE VALVE
CHEM	CHEMICAL
CHK	CHECKED
CI	CAST IRON
CJ	CONSTRUCTION JOINT
CKT	CIRCUIT
CL	CENTER LINE
CLR	CLEAR
CMP	CORRUGATED METAL PIPE
CO	CLEANOUT
CONC	CONCRETE
CONN	CONNECT / CONNECTION
CONST	CONSTRUCTION
CONT	CONTINUED
COR	CORNER
CP	CONCRETE PIPE
CTR	CENTER
CU FT	CUBIC FEET
CU YD	CUBIC YARDS
DBL	DOUBLE
DECON	DECONTAMINATION
DEG / °	DEGREE
DEMO	DEMOLISH / DEMOLITION
DET	DETAIL
DIA	DIAMETER
DIAG	DIAGONAL
DIM	DIMENSION
DIP	DUCTILE IRON PIPE
DIR	DIRECTION
DISCH	DISCHARGE
DN	DOWN
DP	DISTRIBUTION PANEL
DSGN	DESIGNED
DWG	DRAWING
E	EAST
EA	EACH
EF	EACH FACE
EL	ELEVATION
ELB	ELBOW
ELEC	ELECTRICAL
EQL	EQUAL
EQL SP	EQUALLY SPACED
EQPT	EQUIPMENT
EW	EACH WAY
EXST	EXISTING
EXT	EXTERNAL OR EXTERIOR
FACIL	FACILITY
FC	FIELD CLOSURE
FDN	FOUNDATION
F.EXT	FIRE EXTINGUISHER
FED	FEDERAL
FLEX	FLEXIBLE
FLGD	FLANGED
FLR	FLOOR
FNSH	FINISH
FT	FOOT / FEET
G	GAS
GAC	GRANULAR ACTIVATED CARBON
GAL	GALLON
GPD	GALLONS PER DAY
GV	GATE VALVE
GVL	GRAVEL
GW	GROUNDWATER
H OR HGT	HEIGHT
HDPE	HIGH DENSITY POLYETHYLINE
HORIZ	HORIZONTAL
HPT	HIGH POINT ELEVATION
HR	HOUR
HWL	HIGH WATER LEVEL
ID	INSIDE DIAMETER OR IDENTIFICATION
IE	INVERT ELEVATION
IN	INCHES
INSTL	INSTALL
INVT	INVERT
JT	JOINT
LB	POUND(S)
LF	LINEAR FEET
LG	LONG
LLDPE	LINEAR LOW DENSITY POLYETHYLENE
LONG	LONGITUDINAL
MATL	MATERIAL
MAX	MAXIMUM
MDOT	MICHIGAN DEPARTMENT OF TRANSPORTATION
MECH	MECHANICAL
MFR	MANUFACTURER
MGD	MILLION GALLONS PER DAY
MG/L	MILLIGRAMS PER LITER
MH	MANHOLE
MIN	MINIMUM
MISC	MISCELLANEOUS
MJ	MECHANICAL JOINT
MLC	MINI LOAD CENTER
MM	MILLIMETER
MON	MONUMENT
MTL	METAL
MTRG	METERING
N	NORTH
N.C.	NORMALLY CLOSED
NIC	NOT IN CONTRACT
N.O.	NORMALLY OPEN
NO.	NUMBER
NOM	NOMINAL
NORM	NORMAL
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
OF	OUTSIDE FACE
OPNG	OPENING
OPP	OPPOSITE
PC	POINT OF CURVATURE
PERM	PERMANENT
PF	PROFILE
PI	POINT OF INTERSECTION
PL	PROPERTY LINE
POC	POINT ON CURVE
POT	POINT ON TANGENT
PR	PAIR
PROJ	PROJECT
PROP	PROPERTY
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PT	POINT OF TANGENCY
PVC	POINT OF VERTICAL CURVATURE OR POLYVINYL CHLORIDE
PVI	POINT OF VERTICAL INTERSECTION
PVMT	PAVEMENT
PVT	POINT OF VERTICAL TANGENCY
QDRNT	QUADRANT
QTY	QUANTITY
QUAL	QUALITY
R	RISER
RAD	RADIUS
RC	REINFORCED CONCRETE
RCP	REINFORCED CONCRETE PIPE
RECP	ROLLED EROSION CONTROL PRODUCT
REINF	REINFORCE
RELOC	RELOCATED
REQD	REQUIRED
RMV	REMOVE
RR	RAILROAD
R&R	REMOVE AND REPLACE
R/W	RIGHT-OF-WAY
S	SOUTH
SCHED	SCHEDULE
SD	STORM DRAIN
SDR	STANDARD DIMENSION RATIO
SECT	SECTION
SF	SQUARE FEET
SH	SHEET
SIM	SIMILAR
SPECD	SPECIFIED
SPECS	SPECIFICATIONS
SPG	SPACING
SQ	SQUARE
ST	STREET
STA	STATION
STD	STANDARD
STL	STEEL
STOR	STORAGE
STR	STRAIGHT
STRUCT	STRUCTURE
SWD	SURFACE WATER DITCH
SYMM	SYMMETRICAL
TAN	TANGENT LENGTH
T&B	TOP AND BOTTOM
TC	TOP OF CONCRETE
THK	THICK
T.O.	TOP OF
TPD	TONS PER DAY
TRANSV	TRANSVERSE
TW	TOP OF WALL
TYP	TYPICAL
UON	UNLESS OTHERWISE NOTED
V	VALVE
VB	VALVE BOX
VERT	VERTICAL
W	WEST OR WATER
W/	WITH
WL	WATER LINE
WS	WATER SURFACE
YR	YEAR

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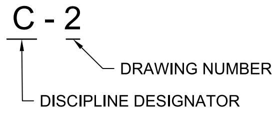

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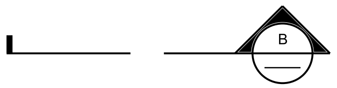

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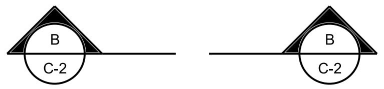

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2. THE TERM STANDARD DETAIL, OR A FORM OF IT, IS SYNONYMOUS WITH DESIGN DETAIL AND REFERS TO THE DESIGN DETAILS FOUND IN THIS SET OF SUBCONTRACT DOCUMENTS.
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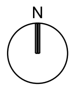

NORTH ARROW

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JASON D COLE
ENGINEER
No. 6201063070

NO.	DATE	REVISION	BY	APVD

DSGN RL VAUGHAN
DR NA LINDHOLM
CHK WM ANDRAE
APVD J COLE

PSA-1 AND PSA-2 EXCAVATIONS
OPERABLE UNIT 1
VELSICOL CHEMICAL CORPORATION
EPA SUPERFUND SITE
ST. LOUIS, MICHIGAN

ch2m

GENERAL
ABBREVIATIONS AND
DESIGNATIONS LEGENDS

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2. EXISTING TOPOGRAPHY, STRUCTURES, AND SITE FEATURES ARE SHOWN SCREENED AND/OR LIGHT-LINED. NEW FINISH GRADE, STRUCTURES, AND SITE FEATURES ARE SHOWN HEAVY-LINED.
3. CRA GROUND WATER ELEVATION CONTROL TILE MANHOLE, MANHOLE SUMPS, GRANULAR SUMPS, AND PIPING LOCATIONS ARE ALL APPROXIMATE. LOCATIONS ARE BASED ON SECUREMENT OF PLANT SITE, ST. LOUIS, MICHIGAN AS BUILTS (CRA 1984).
4. HORIZONTAL DATUM: MICHIGAN STATE PLANE SOUTH 2133, NAD83, INTERNATIONAL FEET.
5. VERTICAL DATUM: NAVD88, GEOID12A
6. SUBCONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTING AND MAINTAINING EROSION CONTROL DEVICES DURING CONSTRUCTION. EROSION CONTROL DEVICE (3125-165) IS THE MINIMUM REQUIRED.
7. SUBCONTRACTOR SHALL TAKE MEASURES TO POSITIVELY PRECLUDE EROSION MATERIALS FROM LEAVING THE SITE.
8. A TWO FOOT THICK SOIL CAP IS PRESENT SITE WIDE.
9. 100 YEAR FLOODPLAIN LIMITS WERE OBTAINED FROM THE FEMA NATIONAL FLOOD INSURANCE PROGRAM MAP (NO. 26057C0061C), PANEL 61 OF 500, GRATIOT COUNTY, MI, OCTOBER 18, 2011.

FIELD OFFICE NOTES:

1. SUBCONTRACTOR TO PROVIDE FIELD OFFICE TRAILER AND TEMPORARY POWER FOR OWN USE.
2. PROVIDE SANITARY FACILITIES INCLUDING HAND WASHING STATION IN COMPLIANCE WITH STATE AND LOCAL HEALTH AUTHORITIES.

CIVIL LEGEND

EXISTING	THIS SUBCONTRACT	
× 757.7	⊗ 758.5	SPOT ELEVATION
745	745	CONTOUR LINE
	3:1	EMBANKMENT AND SLOPE
		DRAINAGEWAY OR DITCH
CB OR CB	CB OR CB	CATCH BASIN OR INLET
		TRENCH DRAIN
	OR	SIGN
MH	D OR S	MANHOLE
E	E	ELECTRICAL MANHOLE
H	H	ELECTRIC HANDHOLE
J	J	ELECTRIC JUNCTION BOX
		POST OR GUARD POST
		GUY ANCHOR
		FIRE HYDRANT
		GATE VALVE
		AIR RELIEF VALVE
		UTILITY POLE
		LIGHT POLE
BM	BM	BENCH MARK
	B-1	BORING LOCATION AND NUMBER
		SURVEY CONTROL POINT OR POINT OF INTERSECTION
		BRUSH/TREE LINE
		TREE
		PROPERTY LINE
		CENTER LINE, BUILDING, ROAD, ETC.
		STAGING OR WORK AREA LIMITS
		AREA TO BE EXCAVATED
		AREA TO BE FILLED
OR OR		DEMOLITION
OR	OR	STRUCTURE, BUILDING OR FACILITY
		GRAVEL SURFACING
		ASPHALT CONCRETE PAVEMENT
		CURB
		CURB AND GUTTER
		SINGLE SWING GATE
		DOUBLE SWING GATE
		SLIDING GATE
		CHAIN LINK FENCE
		CULVERT
SD	SD	STORM SEWER
SS	SS	SANITARY SEWER
G	G	NATURAL GAS
E	E	ABOVE GROUND ELECTRIC
E	E	UNDERGROUND ELECTRIC
W	W	UNDERGROUND WATER
C	C	ABOVE GROUND COMMUNICATION / INTERNET

EROSION CONTROL LEGEND

COVER PRACTICES	SYMBOL
TEMPORARY SEEDING	TS
MULCHING AND MATTING	MU
CLEAR PLASTIC COVERING	CPC
BUFFER ZONES	BZ
PERMANENT SEEDING AND PLANTING	PS
CONSTRUCTION ENTRANCE	
INTERCEPTOR DIKE	ID
INTERCEPTOR SWALE	IS
CHECK DAMS	
OUTLET PROTECTION / RIPRAP	
FILTER FENCE	
STRAW BALE BARRIER (BIOFILTER)	
SEDIMENT TRAP (OR SUMP)	
SEDIMENT POND OR BASIN	

GENERAL NOTE:

1. THIS IS A STANDARD LEGEND SHEET. THEREFORE, NOT ALL OF THE INFORMATION SHOWN MAY BE USED ON THIS PROJECT.

STATE OF MICHIGAN
JASON D COLE
ENGINEER
No. 6201063070
LICENSED PROFESSIONAL ENGINEER

NO.	DSGN	DATE	BY	REVISION	CHK	APVD
	DR	RL VAUGHAN		NA LINDHOLM	WM ANDRAE	J COLE

PSA-1 AND PSA-2 EXCAVATIONS
OPERABLE UNIT 1
VELSICOL CHEMICAL CORPORATION
EPA SUPERFUND SITE
ST. LOUIS, MICHIGAN

GENERAL

GENERAL SITE NOTES AND CIVIL LEGEND

NO SCALE	
VERIFY SCALE	
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"	
DATE	JANUARY 2017
PROJ	478783
DWG	G-3
SHEET	3 of 14

FINAL DESIGN

VELSICOL CHEMICAL CORPORATION
SUPERFUND SITE

APPROXIMATE LOCATION
EXISTING CONTAINMENT
SLURRY WALL

POTENTIAL SOURCE
AREA 2 TARGET
EXCAVATION AREAS

POTENTIAL SOURCE
AREA 2 TARGET
EXCAVATION AREAS

CP-105005
N=696213.0380
E=13056900.7400
Z=736.114

SITE WIDE SOIL CAP
1

CRA-INSTALLED GROUNDWATER
ELEVATION CONTROL TILE
(NOT IN USE)

APPROXIMATE LOCATION
OF CULVERT

SITE ACCESS ROAD

CITY STOCKPILE AREA

PROPERTY BOUNDARY

POTENTIAL SOURCE AREA 1
TARGET EXCAVATION AREAS

CP-105004
N=695762.9470
E=13056697.6400
Z=744.531

EXISTING OIL
CONTAINMENT
SLURRY WALL

CRA-INSTALLED GROUNDWATER
ELEVATION CONTROL TILE
(NOT IN USE)

FORMER DREDGE POND

100-YEAR
FLOODPLAIN BOUNDARY

SITE ACCESS ROAD

PINE RIVER
FLOW

EXISTING MONITORING
WELL LOCATION (TYP)

SITE ACCESS ROAD

8 FEET HIGH PROPERTY FENCE

SOUTH SITE ACCESS GATE

POTABLE WATER
FROM FIRE HYDRANT
AVAILABLE FOR USE
BY SUBCONTRACTOR

6-INCH WATER MAIN

WASHINGTON AVENUE (M-46)

CMW14D
CMW14I
CMW14S
MPZ-26
CATW2D
WMW-44D
WMW-44S
WMW-44I
WPZ-05X
WPZ-05S
WPZ-05IP
WPZ-05I
GMW-07D
CMW13I
GMW-04D
CMW17D
CMW17I
CMW17S
CMW15D
CMW15S
CMW15I
MPZ-25
WMW-33D
CATW1D
GMW-15D
MW-23I
WMW-23S
CW19-IP
CW19-EP
GMW-03
GMW-02
WPZ-16I
WPZ-16IP
WPZ-16S
WPZ-16X
CMW12D
CMW12I
CMW12S
MPZ-24
WMW-43D
MPZ-23
MPZ-22
WMW-45I
GMW-01B
WPZ-04IP
WPZ-04I
WMW-18S
WPZ-04S
WPZ-04X1
WMW-18D
WSW-12P
WPZ-04X2
GMW-01C
GMW-01A
GMW-01D
WPZ-03I
WPZ-03X

N
0 50 100 150
1"= 50'

PINE RIVER

A B 150' 90'

NORTH ST.

SITE
ACCESS GATE

LEGEND

46" +/- CAP

28" +/- CAP

NOTE:
INFORMATION REGARDING EXISTING SOIL CAP OBTAINED FROM AS BUILT DRAWINGS OF THE SECUREMENT OF PLANT SITE: ST. LOUIS, MICHIGAN: PREPARED BY CONESTOGA-ROVERS & ASSOCIATES LIMITED FOR VELSICOL CHEMICAL CORPORATION DATED OCTOBER 1984. HISTORIC FIELD OBSERVATIONS INDICATE ACTUAL SOIL CAP THICKNESS EXHIBITS HIGH SPATIAL VARIABILITY WHICH RANGES FROM 2 TO 10 FEET ACROSS THE SITE.

DIRECT FIELD MEASUREMENTS DEMONSTRATE THE ACTUAL THICKNESSES OF TOPSOIL, CLAY AND SAND LAYERS VARY CONSIDERABLY FROM AS-BUILT DOCUMENTATION. SOIL CAP DETAIL DEPICTED REFLECTS THE BEST AVAILABLE INFORMATION OBTAINED DURING SITE INVESTIGATION, BUT MAY NOT REFLECT ACTUAL THICKNESSES IN PSA-1 AND PSA-2.

N. WATSON ST.

200'

80'

WASHINGTON AVE. (M-46)

PLAN

N

CLAY WITH >18% GRAIN SIZE
SMALLER THAN 0.005 MILLIMETERS

THICKNESS
OF CLAY CAP
VARIES

3% MIN

SEED AND MULCH

6"-12" TOPSOIL

4"-18" SAND
BLANKET

18" +/- CLAY
CAP

~18"

~18"

IMPORTED FILL

20' TRANSITION

CLAY WITH <18% GRAIN SIZE
SMALLER THAN 0.005 MILLIMETERS

SECTION A

CLAY WITH >18% GRAIN SIZE
SMALLER THAN 0.005 MILLIMETERS

THICKNESS
OF CLAY CAP
VARIES

3% MIN

SEED AND MULCH

6"-12" TOPSOIL

4"-18" SAND
BLANKET

18" +/- CLAY
CAP

~18"

~18"

IMPORTED FILL

50' TRANSITION

CLAY WITH <18% GRAIN SIZE
SMALLER THAN 0.005 MILLIMETERS

SECTION B

1 SOIL CAP DETAIL
NTS

STATE OF MICHIGAN
JASON D
COLE
ENGINEER
No.
6201063070
LICENSED PROFESSIONAL ENGINEER

NO.	DATE	DSGN
	REVISION	BY CHK APVD
		J COLE

PSA-1 AND PSA-2 EXCAVATIONS
OPERABLE UNIT 1
VELSICOL CHEMICAL CORPORATION
EPA SUPERFUND SITE
ST. LOUIS, MICHIGAN

ch2m

CIVIL

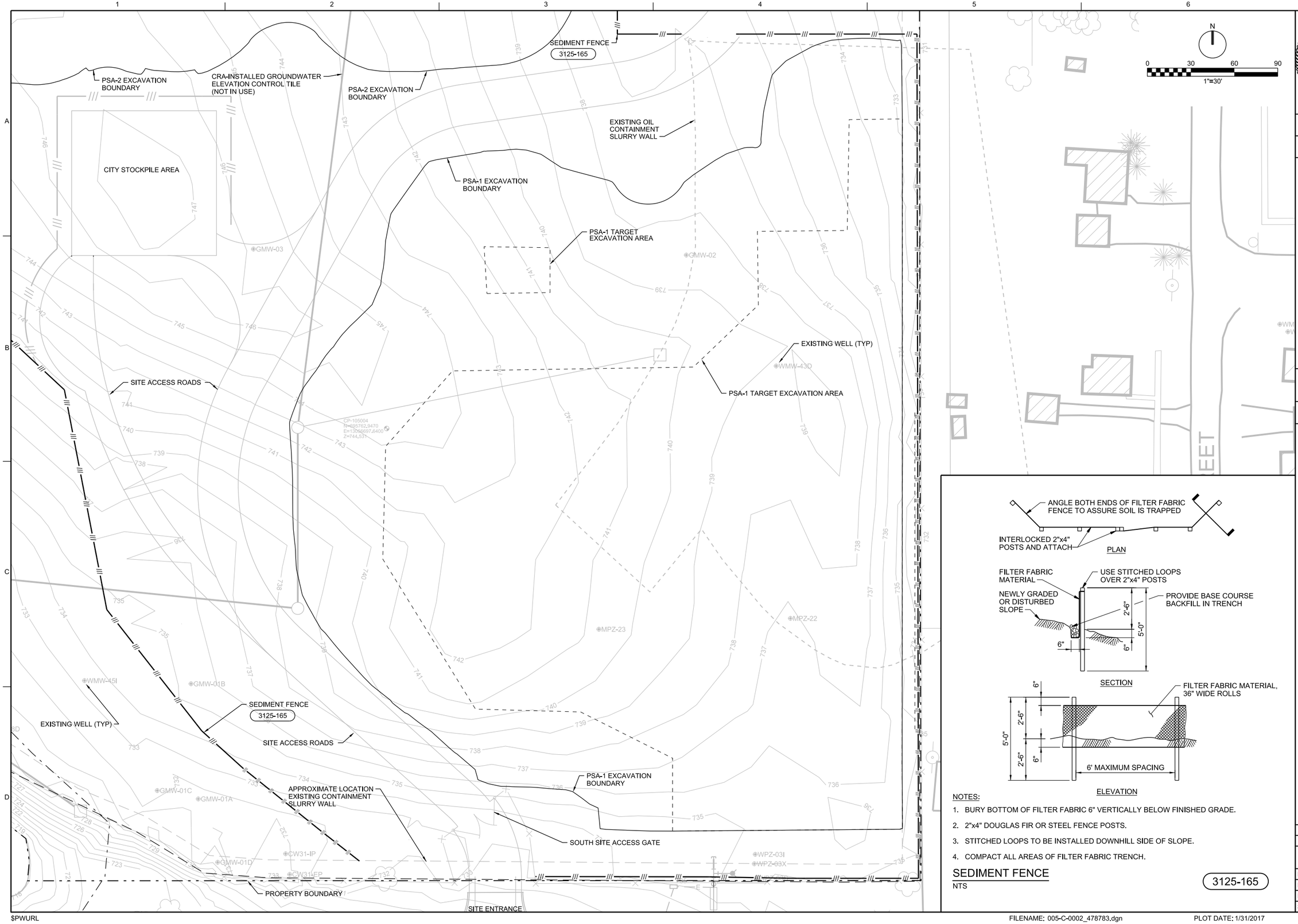
EXISTING CONDITIONS PLAN

1"=50'
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT 1" ADJUST SCALE ACCORDINGLY
DATE JANUARY 2017
PROJ 478783
DWG C-1
SHEET 4 of 14

FINAL DESIGN

$PWURL

FILENAME: 005-C-0001_478783.dgn PLOT DATE: 1/30/2017 PLOT TIME: 2:56:34 PM



NOTES:

1. BURY BOTTOM OF FILTER FABRIC 6" VERTICALLY BELOW FINISHED GRADE.
2. 2"x4" DOUGLAS FIR OR STEEL FENCE POSTS.
3. STITCHED LOOPS TO BE INSTALLED DOWNHILL SIDE OF SLOPE.
4. COMPACT ALL AREAS OF FILTER FABRIC TRENCH.

SEDIMENT FENCE

NTS

3125-165

STATE OF MICHIGAN
JASON D COLE
ENGINEER
No. 6201063070
LICENSED PROFESSIONAL ENGINEER

NO.	DATE	DSGN	DR	CHK	APVD	BY	REVISION
		RL VAUGHAN	NA LINDHOLM	WM ANDRAE		J COLE	

PSA-1 AND PSA-2 EXCAVATIONS
OPERABLE UNIT 1
VELSICOL CHEMICAL CORPORATION
EPA SUPERFUND SITE
ST. LOUIS, MICHIGAN

ch2m

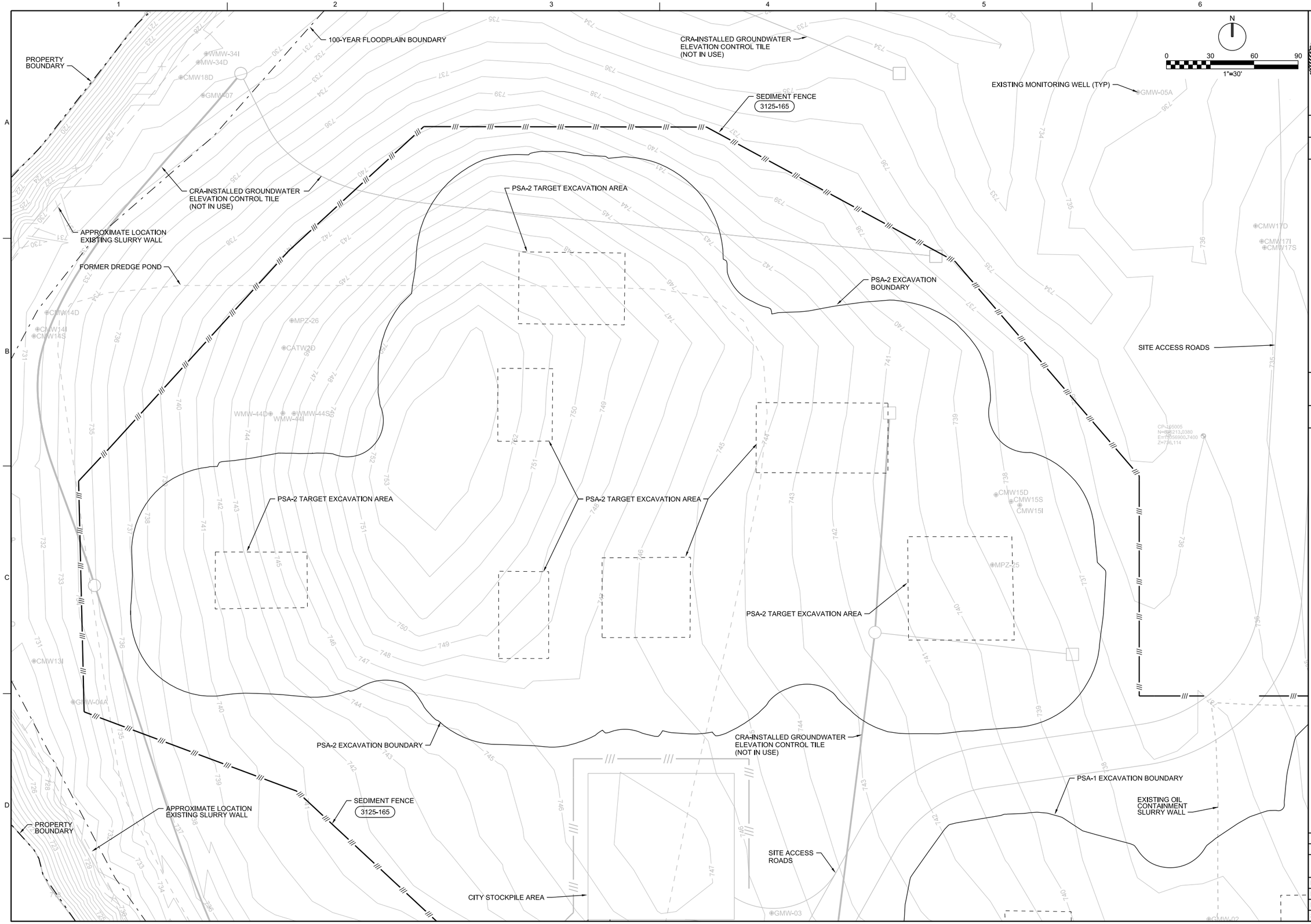
CIVIL

PSA -1 EROSION CONTROL PLAN

1"=30'
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JANUARY 2017
PROJ	478783
DWG	C-2
SHEET	5 of 14

FINAL DESIGN



STATE OF MICHIGAN
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No. 6201063070
LICENSED PROFESSIONAL ENGINEER

NO.	DATE	DSGN	DR	CHK	APVD	BY
		RL VAUGHAN	NA LINDHOLM	WM ANDRAE	APVD	J COLE

REVISION

PSA-1 AND PSA-2 EXCAVATIONS
OPERABLE UNIT 1
VELSICOL CHEMICAL CORPORATION
EPA SUPERFUND SITE
ST. LOUIS, MICHIGAN

ch2m.

CIVIL

PSA -2 EROSION CONTROL PLAN

1"=30'

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JANUARY 2017
PROJ	478783
DWG	C-3
SHEET	6 of 14

FINAL DESIGN

SHEET KEYNOTES

1. AT TIME THESE DRAWINGS WERE ISSUED, THIS FEATURE WAS NOT EXISTING, THIS FEATURE IS PLANNED TO BE INSTALLED PRIOR TO EXCAVATION OF PSA-1 AND PSA-1.

100-YEAR FLOODPLAIN BOUNDARY

EXISTING UTILITY LINE PER NAPL/DBCP AREA 1 IN-SITU THERMAL TREATMENT DRAWINGS (1)

SITE ACCESS ROADS

EXISTING UTILITY POLE

EXISTING ELECTRICAL SERVICE-FIELD VERIFY LOCATION

CRA-INSTALLED GROUNDWATER ELEVATION CONTROL TILE (NOT IN USE)

EXISTING 1.5" POTABLE WATER SERVICE-FIELD VERIFY LOCATION

EXISTING UTILITY LINE PER NAPL/DBCP AREA 1 IN-SITU THERMAL TREATMENT DRAWINGS (1)

PROPERTY BOUNDARY

APPROXIMATE LOCATION OF EXISTING GAS LINES FIELD VERIFY

PROPOSED TRAILER AND PARKING AREA

VELSICOL CHEMICAL CORPORATION SUPERFUND SITE

POTENTIAL SOURCE AREA 2 TARGET EXCAVATION AREA

MONITORING WELLS TO REMAIN IN-PLACE

ABANDON MONITORING WELL

CRA-INSTALLED GROUNDWATER ELEVATION CONTROL TILE (NOT IN USE)

ABANDON PORTION OF EXISTING GROUNDWATER ELEVATION CONTROL TILE

POTENTIAL SOURCE AREA 1 TARGET EXCAVATION AREAS

APPROXIMATE LOCATION OF CULVERT

PROPOSED STOCKPILE AND DECON AREA

100-YEAR FLOODPLAIN BOUNDARY

ABANDON MONITORING WELLS

SOUTH SITE ACCESS GATE

SITE ACCESS ROADS

NORTH WATSON STREET

NORTH BANKSON STREET

NORTH DELAWARE STREET

NORTH STREET

WEST CENTER STREET

WEST SAGINAW STREET

WASHINGTON AVENUE (M-46)

BANKSON STREET

DELAWARE STREET

Monitoring Wells to be Abandoned

Well ID	Northing	Easting	Ground Elevation (ft amsl)	Top of Casing Elevation (ft amsl)	Well Depth (ft below TOC)	Top of Screen Elevation (ft amsl)	Bottom of Screen Elevation (ft amsl)
MPZ-25	696125.11	13056757	738.8	742.01	20.97	726.04	721.04
GWM-2	695882.67	13056904	738.56	741.74	23.65	734.74	718.09
WMW-43D	695806.07	13056966	738.68	741.87	72.2	674.7	669.7
MPZ-23	695624.37	13056845	740.4	744.3	20	729.3	724.3
MPZ-22	695632	13056977	736.7	740.04	15.81	729.23	724.23

N

0 100 200 300

1"=100'

STATE OF MICHIGAN
JASON D COLE
ENGINEER
No. 6201063070
LICENSED PROFESSIONAL ENGINEER

NO.	DATE	DSGN	DR	CHK	APVD	BY
		RL VAUGHAN	NA LINDHOLM	WM ANDRAE	APVD	J COLE

REVISION

PSA-1 AND PSA-2 EXCAVATIONS
OPERABLE UNIT 1
VELSICOL CHEMICAL CORPORATION
EPA SUPERFUND SITE
ST. LOUIS, MICHIGAN

ch2m

CIVIL

SITE IMPROVEMENTS AND DEMOLITION PLAN

1"=100'

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JANUARY 2017
PROJ	478783
DWG	C-4
SHEET	7 of 14

FINAL DESIGN

$PWURL

FILENAME: 005-C-0004_478783.dgn

PLOT DATE: 2017\01\31

PLOT TIME: 7:07:10 AM

SITE ACCESS ROADS

EXCAVATION SUPPORT WALL

CRA-INSTALLED GROUNDWATER ELEVATION CONTROL TILE (NOT IN USE)

PSA-2 EXCAVATION SEE DWG C-6

CITY STOCKPILE AREA

EXISTING OIL CONTAINMENT SLURRY WALL

PSA- TARGET EXCAVATION AREA

LIMITS OF GRADING TOPSOIL AND SAND REMOVAL

2 TO 1 SLOPE (TYPICAL)

SITE ACCESS ROADS

EXISTING WELL (TYP)

2 TO 1 SLOPE (TYPICAL)

PSA-1 TARGET EXCAVATION AREA

PSA-1 EXCAVATION LIMITS

PSA-1 REMOVAL AREA

LIMITS OF EXISTING CLAY CAP REMOVAL, 30 FOOT OFFSET FROM EXCAVATION LIMITS

30'

2 TO 1 SLOPE (TYPICAL)

EXISTING WELL (TYP)

SITE ACCESS ROAD

SOUTH SITE ACCESS GATE

APPROXIMATE LOCATION EXISTING CONTAINMENT SLURRY WALL

EXCAVATION SUPPORT WALL

PROPERTY BOUNDARY

SITE ENTRANCE

6-INCH WATER MAIN

NORTH WATSON STREET

N

0 30 60 90

1"=30'

STATE OF MICHIGAN
JASON D COLE
ENGINEER
No. 6201063070
LICENSED PROFESSIONAL ENGINEER

NO.	DATE	DR	REVISION	CHK	APVD	BY	APVD
DSGN	RL VAUGHAN		NA LINDHOLM		WM ANDRAE		J COLE

PSA-1 AND PSA-2 EXCAVATIONS
OPERABLE UNIT 1
VELSICOL CHEMICAL CORPORATION
EPA SUPERFUND SITE
ST. LOUIS, MICHIGAN

ch2m

CIVIL

PSA -1 EXCAVATION PLAN

1"=30'
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JANUARY 2017
PROJ	478783
DWG	C-5
SHEET	8 of 14

FINAL DESIGN

$PWURL

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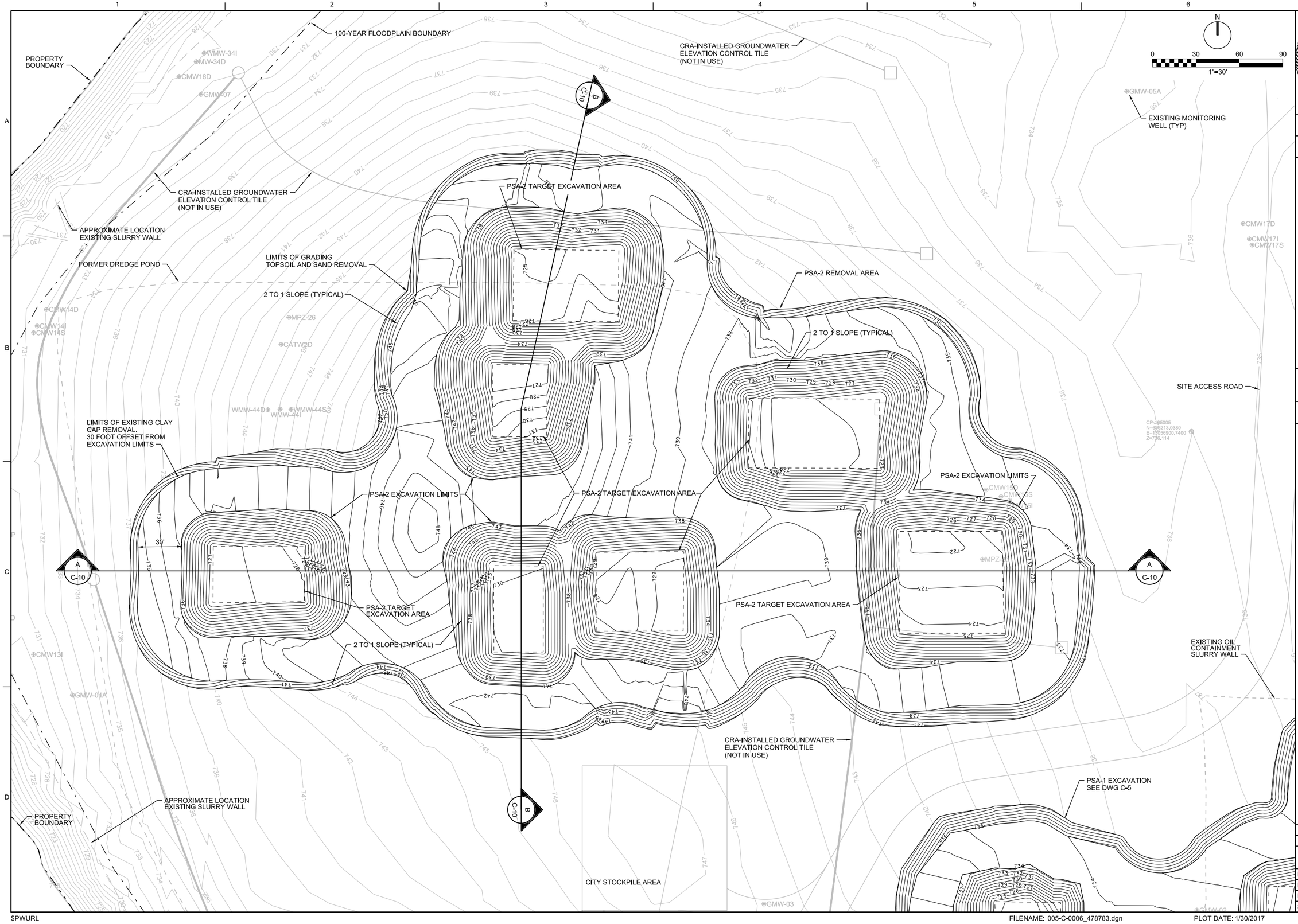


STATE OF MICHIGAN
JASON D COLE
ENGINEER
No. 6201063070
LICENSED PROFESSIONAL ENGINEER

NO.	DATE	DR	REVISION	CHK	APVD	BY	APVD
DSGN	RL VAUGHAN		NA LINDHOLM		WM ANDRAE		J COLE

PSA-1 AND PSA-2 EXCAVATIONS
OPERABLE UNIT 1
VELSICOL CHEMICAL CORPORATION
EPA SUPERFUND SITE
ST. LOUIS, MICHIGAN

ch2m

CIVIL

PSA -2 EXCAVATION PLAN

1"=30'
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JANUARY 2017
PROJ	478783
DWG	C-6
SHEET	9 of 14

FINAL DESIGN

SITE ACCESS ROADS

EXCAVATION SUPPORT WALL

PSA-2 EXCAVATION RESTORATION AREA SEE DWG C-8

RESORATION AREA 1

BACKFILL 1 / C-11

CITY STOCKPILE AREA

GMW-03

GMW-02

LIMITS OF GRADING TOPSOIL AND SAND REMOVAL

WMW-43D

SITE ACCESS ROADS

CP-105004
N=695762.9429
E=1305692.6800
Z=744.53

WMW-45I

GMW-01B

SITE ACCESS ROAD

EXISTING WELL (TYP)

RESTORE AREAS DISTURBED DURING CONSTRUCTION 2

EXISTING WELL (TYP)

GMW-01C

GMW-01A

SOUTH SITE ACCESS GATE

APPROXIMATE LOCATION EXISTING CONTAINMENT SLURRY WALL

GMW-01D

CW31-IP

CW31-EP

PROPERTY BOUNDARY

SSD-01

BACKFILL 2 / C-11

EXCAVATION SUPPORT WALL

WPZ-03I

WPZ-03X

WPZ-03S

SITE ENTRANCE

6-INCH WATER MAIN

MPZ-23

MPZ-22

NORTH WATS

LEGEND

RESORATION AREA 1

N

0 30 60 90

1"=30'

TOPSOIL (WITHIN 0.10 FT OF EXISTING GRADE)

SEED AND MULCH

SAND LAYER (WITHIN 0.10 FT OF EXISTING GRADE)

CLAY CAP (WITHIN 0.10 FT OF EXISTING GRADE)

GENERAL BACKFILL (WITHIN 0.50 FT OF EXISTING GRADE)

1 EXCAVATION RESTORATION

NTS

℄ ALIGNMENT

14'* 14' *

6" 21 AA SURFACE COURSE

12" #4 LIMESTONE BASE COURSE OR APPROVED EQUIVALENT

PGL CROWN POINT

2.0% 2.0%

6" 6"

1:3 1:3 1:3

EX GROUND

EMBANKMENT

PREPARED SUBGRADE

GEOGRID

EX GROUND

2 TWO-LANE GRAVEL HAUL ROAD

NTS

STATE OF MICHIGAN
JASON D COLE
ENGINEER
No. 6201063070
LICENSED PROFESSIONAL ENGINEER

NO.	DATE	DR	REVISION	CHK	APVD	BY	APVD
DSGN	RL VAUGHAN		NA LINDHOLM		WM ANDRAE		J COLE

PSA-1 AND PSA-2 EXCAVATIONS
OPERABLE UNIT 1
VELSICOL CHEMICAL CORPORATION
EPA SUPERFUND SITE
ST. LOUIS, MICHIGAN

ch2m.

CIVIL

PSA -1 RESTORATION PLAN

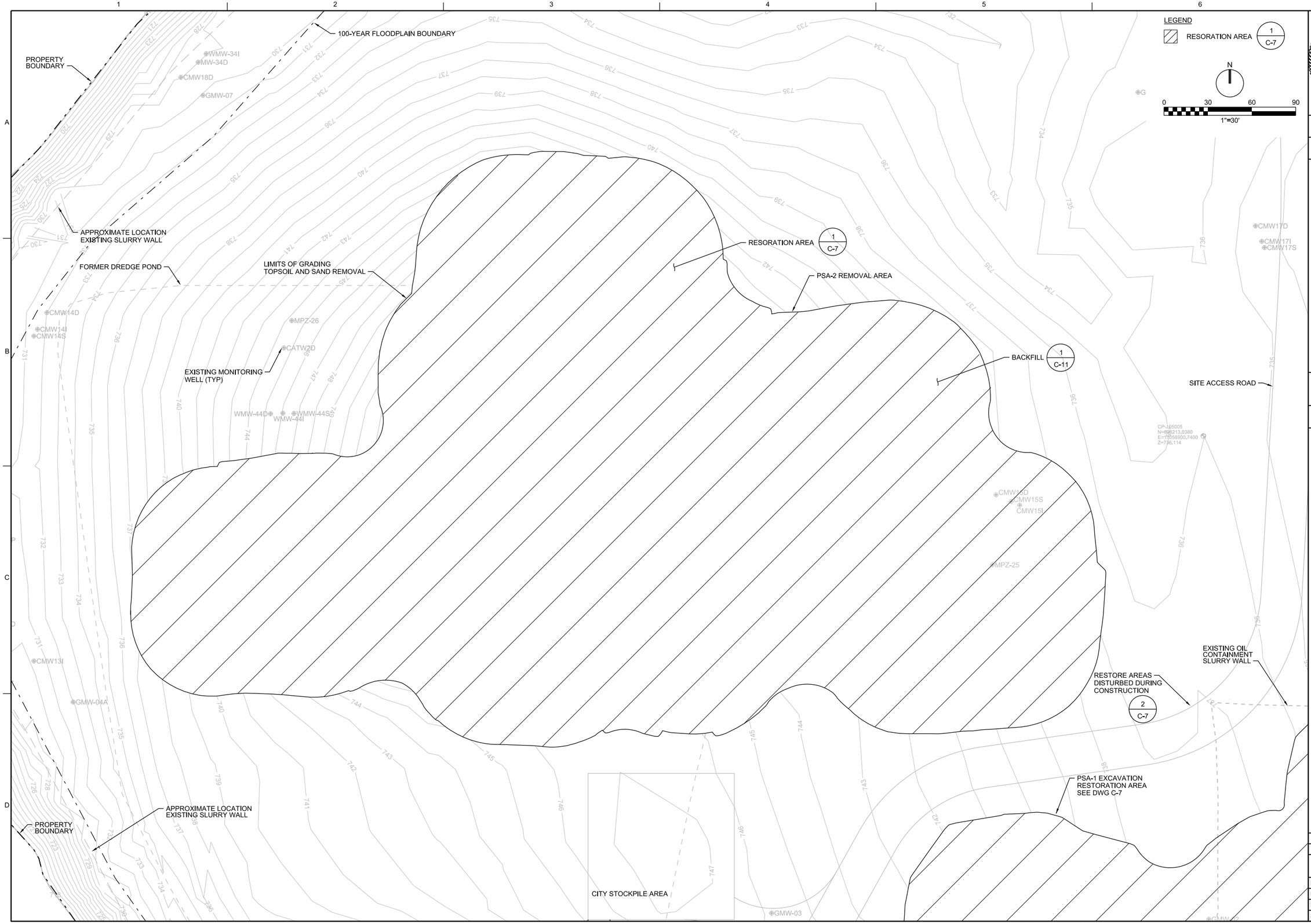
1"=30'

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JANUARY 2017
PROJ	478783
DWG	C-7
SHEET	10 of 14

FINAL DESIGN



STATE OF MICHIGAN
JASON D COLE
ENGINEER
No. 6201063070
LICENSED PROFESSIONAL ENGINEER

NO.	DATE	DSGN	DR	CHK	APVD	BY	REVISION
		RL VAUGHAN	NA LINDHOLM	WM ANDRAE	APVD	J COLE	

PSA-1 AND PSA-2 EXCAVATIONS
OPERABLE UNIT 1
VELSICOL CHEMICAL CORPORATION
EPA SUPERFUND SITE
ST. LOUIS, MICHIGAN

CIVIL

PSA -2 RESTORATION PLAN

1"=30'
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

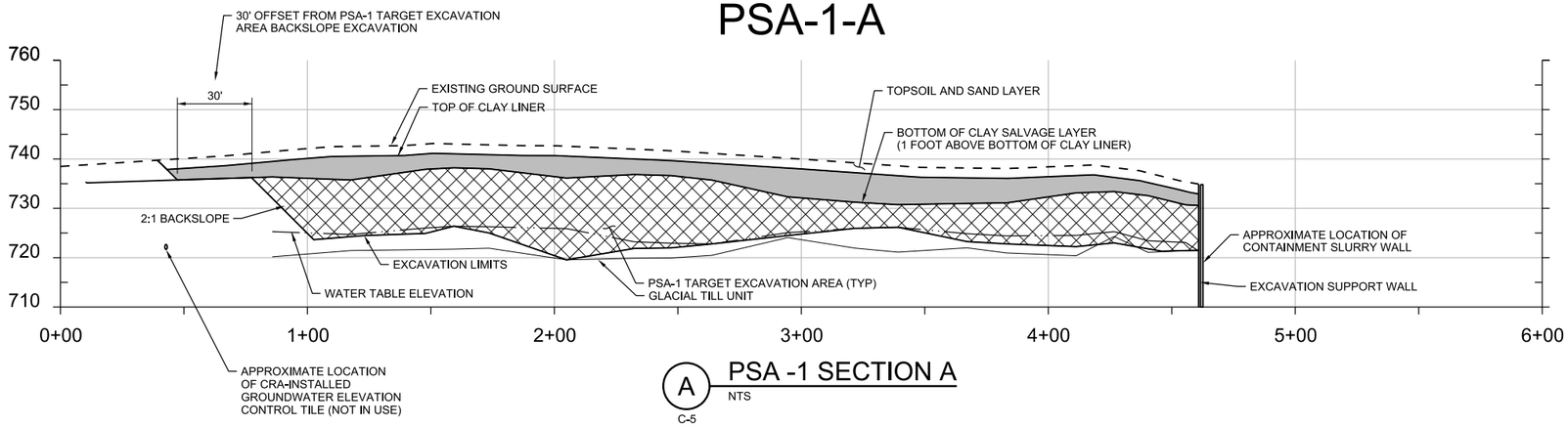
DATE	JANUARY 2017
PROJ	478783
DWG	C-8
SHEET	11 of 14

FINAL DESIGN

GENERAL NOTES

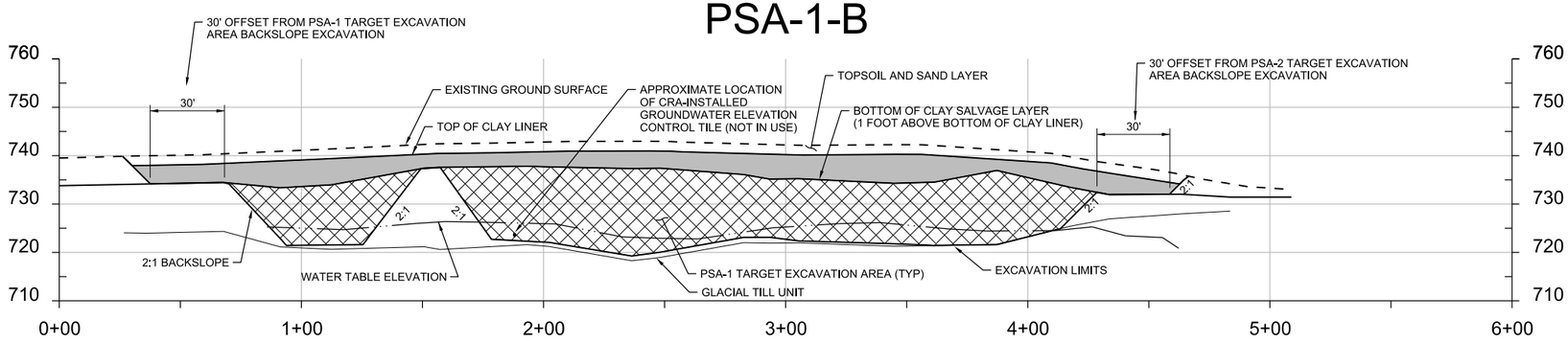
1. INFORMATION REGARDING EXISTING SOIL CAP OBTAINED FROM AS BUILT DRAWINGS OF THE SECUREMENT OF PLANT SITE; ST. LOUIS, MICHIGAN; PREPARED BY CONESTOGA-ROVERS & ASSOCIATES LIMITED FOR VELSICOL CHEMICAL CORPORATION DATED OCTOBER 1984. HISTORIC FIELD OBSERVATIONS INDICATE ACTUAL SOIL CAP THICKNESS EXHIBITS HIGH SPATIAL VARIABILITY WHICH RANGES FROM 2 TO 10 FEET ACROSS THE SITE.
2. DIRECT FIELD MEASUREMENTS DEMONSTRATE THE ACTUAL THICKNESSES OF TOPSOIL, CLAY AND SAND LAYERS VARY CONSIDERABLY FROM AS-BUILT DOCUMENTATION. SOIL CAP DETAIL DEPICTED REFLECTS THE BEST AVAILABLE INFORMATION OBTAINED DURING SITE INVESTIGATION, BUT MAY NOT REFLECT ACTUAL THICKNESSES IN PSA-1 AND PSA-2.

PSA-1-A



A PSA -1 SECTION A
NTS
C-5

PSA-1-B



B PSA -1 SECTION B
NTS
C-5

STATE OF MICHIGAN
JASON D COLE
ENGINEER
No. 6201063070
LICENSED PROFESSIONAL ENGINEER

NO.	DATE	DSGN	REVISION	CHK	APVD	BY	APVD
	RL VAUGHAN	DR	NA LINDHOLM		WM ANDRAE		J COLE

PSA-1 AND PSA-2 EXCAVATIONS
OPERABLE UNIT 1
VELSICOL CHEMICAL CORPORATION
EPA SUPERFUND SITE
ST. LOUIS, MICHIGAN

CIVIL

PSA - 1 CROSS SECTIONS

NO SCALE
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

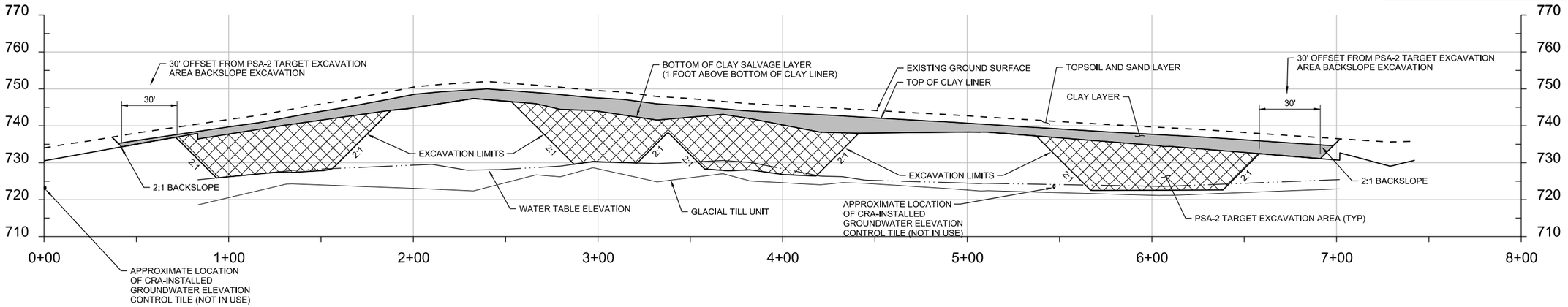
DATE	JANUARY 2017
PROJ	478783
DWG	C-9
SHEET	12 of 14

FINAL DESIGN

GENERAL NOTES

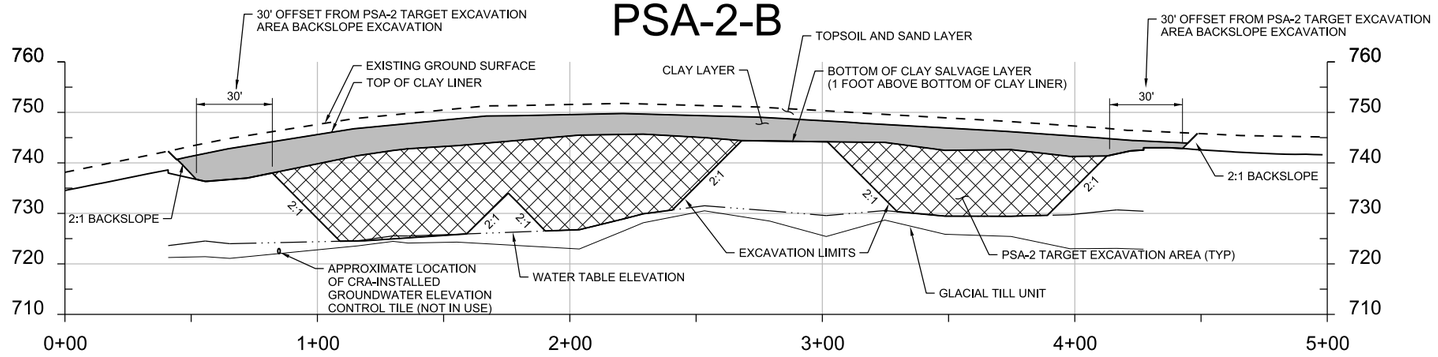
1. INFORMATION REGARDING EXISTING SOIL CAP OBTAINED FROM AS BUILT DRAWINGS OF THE SECUREMENT OF PLANT SITE; ST. LOUIS, MICHIGAN; PREPARED BY CONESTOGA-ROVERS & ASSOCIATES LIMITED FOR VELSICOL CHEMICAL CORPORATION DATED OCTOBER 1984. HISTORIC FIELD OBSERVATIONS INDICATE ACTUAL SOIL CAP THICKNESS EXHIBITS HIGH SPATIAL VARIABILITY WHICH RANGES FROM 2 TO 10 FEET ACROSS THE SITE.
2. DIRECT FIELD MEASUREMENTS DEMONSTRATE THE ACTUAL THICKNESSES OF TOPSOIL, CLAY AND SAND LAYERS VARY CONSIDERABLY FROM AS-BUILT DOCUMENTATION. SOIL CAP DETAIL DEPICTED REFLECTS THE BEST AVAILABLE INFORMATION OBTAINED DURING SITE INVESTIGATION, BUT MAY NOT REFLECT ACTUAL THICKNESSES IN PSA-1 AND PSA-2.

PSA-2-A



A PSA -2 SECTION A
NTS
C-6

PSA-2-B



B PSA -2 SECTION B
NTS
C-6

STATE OF MICHIGAN
LICENSED PROFESSIONAL ENGINEER
JASON D COLE
ENGINEER
No. 6201063070

NO.	DATE	REVISION	BY	APVD
DSGN	RL VAUGHAN	NA LINDHOLM	DR	CHK
		WM ANDRAE		APVD
		J COLE		APVD

PSA-1 AND PSA-2 EXCAVATIONS
OPERABLE UNIT 1
VELSICOL CHEMICAL CORPORATION
EPA SUPERFUND SITE
ST. LOUIS, MICHIGAN

ch2m:

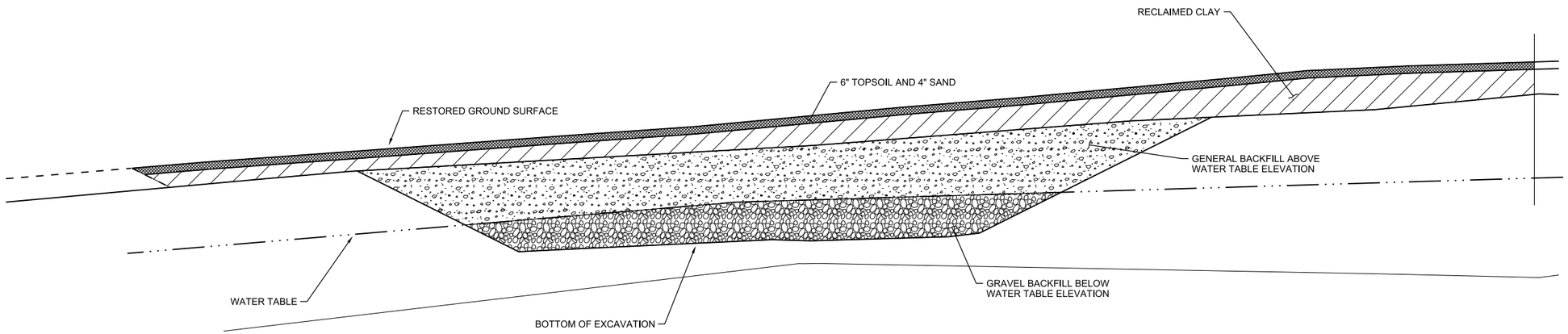
CIVIL

PSA - 2 CROSS SECTIONS

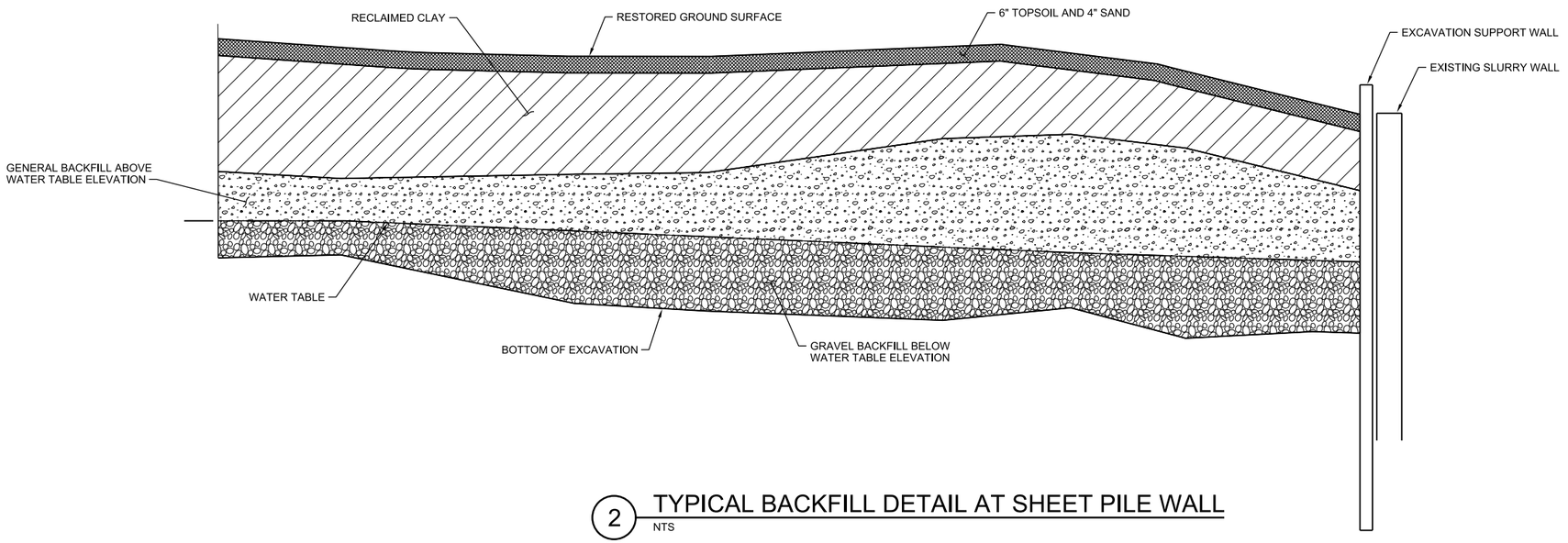
NO SCALE
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JANUARY 2017
PROJ	478783
DWG	C-10
SHEET	13 of 14

FINAL DESIGN



1 TYPICAL BACKFILL DETAIL
NTS
C-6



2 TYPICAL BACKFILL DETAIL AT SHEET PILE WALL
NTS
C-6

STATE OF MICHIGAN
JASON D COLE
ENGINEER
No. 6201063070
LICENSED PROFESSIONAL ENGINEER

NO.	DATE	DR	CHK	APVD	BY	REVISION
DSGN	RL VAUGHAN	NA LINDHOLM	WM ANDRAE	APVD	J COLE	

PSA-1 AND PSA-2 EXCAVATIONS
OPERABLE UNIT 1
VELSICOL CHEMICAL CORPORATION
EPA SUPERFUND SITE
ST. LOUIS, MICHIGAN

CIVIL

DETAILS

FINAL DESIGN

NO SCALE
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JANUARY 2017
PROJ	478783
DWG	C-11
SHEET	14 of 14

Appendix B
Final Specifications

Environmental Protection Agency

St. Louis, Michigan

BIDDING REQUIREMENTS
AND
CONTRACT DOCUMENTS

For the construction of the

Velsicol Chemical Corporation Superfund Site
PSA-1 and PSA-2 Excavations
Operable Unit 1

WA No. 178-RDRD-0532/Contract No. EP-S5-06-01

****

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CH2M HILL

Brighton, Michigan

January, 2017

Project No. 478783

TABLE OF CONTENTS

END OF SECTION

SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 DEFINITIONS

A. Owner: U.S. Environmental Protection Agency, Region 5 (USEPA).

B. Contractor: The construction management firm that the USEPA has contracted with to complete the remedial action.

C. CERCLA: Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), also known as “Superfund”. CERCLA is the regulatory driver for this scope of remediation work.

D. Subcontractor: The successful bidder of the solicitation. The Subcontractor will be contracted to the Contractor and is responsible for completing the Work described in these Specifications and as shown on the Drawings.

E. Drilling Subcontractor: Responsible for drilling to aid in the collection of preconstruction soil confirmation samples to define the target excavation areas for PSA-1 and PSA-2 and to aid in the collection of waste characterization samples. Preconstruction confirmation samples will be collected by the Contractor. The Drilling Subcontractor is also responsible for monitoring well abandonment prior to the start of excavation activities. The Drilling Subcontractor will be subcontracted to the Contractor.

F. Successful Bidder: The Bidder selected for Subcontract award prior to award of Subcontract.

G. Lower-Tier Subcontractor: A subcontractor retained by the Subcontractor.

H. Laboratory Subcontractor: Responsible for analysis of waste characterization samples and confirmation samples and geotechnical analyses. Samples will be collected and sent to the Laboratory Subcontractor by the Contractor. The Laboratory Subcontractor will be subcontracted to the Contractor. If needed, the Laboratory Subcontractor may retain a Lower-Tier Laboratory Subcontractor for some of the analyses.

I. Project Area:

1. Excavation Project Areas PSA-1 and PSA-2 on the former plant site (FPS), as shown on the Drawings. The Excavation Project Areas PSA-1

and PSA-2 are based on the *Final Data Evaluation Report – Velsicol Former Plant Site Remediation Design Investigation, Potential Source Area 1 and Potential Source Area 2, St. Louis, Michigan,* CH2M, 2015. (Attachment 1).

2. Offloading and support area.
3. Temporary Facilities staging area.

J. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

K. When “furnish,” “install,” “perform,” or “provide” is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Subcontractor, “provide” is implied.

L. Work: Excavation and restoration activities described herein which the Subcontractor and/or Contractor will perform.

1.02 PERFORMANCE REQUIREMENTS

A. The activities for satisfying the performance requirements for this project are summarized as follows:

1. Management of all Lower Tier Subcontractors and vendor activities onsite during the execution of this Work.
2. Coordination with other Lower-tier Subcontractors.
3. Mobilization, including transportation of equipment, materials, and personnel to the site and assembly of equipment.
4. Site preparation, including preparation of storage and staging area(s), installing temporary facilities and controls as identified in Section 01 50 00, Temporary Facilities and Controls, utility clearances, installation of erosion and sediment controls as identified in Section 01 57 13, Temporary Erosion and Sediment Control, and documentation of existing property conditions.
5. Construct and maintain temporary site roads.
6. Drilling activities to support preconstruction confirmation sampling and waste characterization (to be performed by Drilling Subcontractor).
7. Collection of preconstruction confirmation samples to confirm extents of impacted material (to be performed by Others).
8. Coordination with the Contractor to develop excavation plans.
9. Performing air monitoring at the work and staging areas during all active operations.
10. Prior to excavation, removal and abandonment of up to 5 monitoring wells (to be performed by Others).

11. Prior to excavation, dewatering and abandonment of existing groundwater elevation control tile, including three manholes, approximately 600 LF of 6-inch perforated clay pipe and 400 LF of 4-inch perforated clay pipe.
12. Prior to excavation of PSA-1, installation of excavation support walls along the east and south boundaries of the target excavation area, as shown in the Drawings.
13. Performing geotechnical monitoring during installation of the excavation support walls.
14. PSA-1: Excavation of approximately 13,000 cubic yards (CY) of topsoil and sand bedding, approximately 21,400 CY of clay cap material and approximately 39,500 cubic yards (CY) of impacted soil from within PSA-1 excavation boundaries, as specified in Section 31 23 16, Excavation.
15. PSA-2: Excavation of approximately 13,000 cubic yards (CY) of topsoil and sand bedding, approximately 21,100 CY of clay cap material and approximately 11,700 cubic yards (CY) of impacted soil from within PSA-2 excavation boundaries, as specified in Section 31 23 16, Excavation.
16. Dewater approximately 22,000 gallons of water per day from PSA-1 and approximately 1,200 gallons of water per day from PSA-2 excavations, as indicated in Section 31 23 19.01, Dewatering.
17. Transportation of excavated impacted soil and groundwater from the PSA-1 and PSA-2 areas by a licensed transporter to a licensed disposal facility as specified in Section 31 23 16, Excavation.
18. Backfill of excavated area as specified in Section 31 23 23, Fill and Backfill and Section 32 91 13, Soil Preparation.
19. Conducting pre-excavation, post-excavation, and post-backfilling surveys.
20. Restoration of excavated surfaces and Work areas.
21. During work, implement, manage and control for storm water to prevent the offsite discharge of pollutants, air monitoring and noise controls.
22. Specific Tasks Not Mentioned: Specific tasks not mentioned or completely detailed in this SOW that are necessary or normally required as part of the Work described shall be performed by the Subcontractor as incidental Work without extra costs to Contractor, as if fully detailed. The expense for such Work shall be included in the applicable lump sum and unit prices for the Work described.

1.03 ENVIRONMENTAL CONTAMINANTS

A. Volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs).

B. Specifically, the contaminants of concern (COC) for each PSA are as follows:

1. PSA-1: chlorobenzene and xylenes.
2. PSA-2: chlorobenzene and tris (2,3 dibromopropyl) phosphate (TRIS).

1.04 QUALIFICATIONS

A. The Subcontractor shall be licensed, insured, and bonded to operate in the state of Michigan and shall comply with all applicable federal, state, county, and local laws and regulations. In the event of conflict, the most stringent of these regulations shall apply.

1.05 PROJECT PERMITS

A. CERCLA projects are generally exempt from requirements to obtain environmental permits for on-site work under CERCLA 121(e); however, compliance with all substantive requirements is required.

B. Coverage under the Michigan National Pollutant Discharge Elimination System Construction Stormwater Permit-by-Rule (Mich. Admin. Code R 323-2190) is not required. However, Project shall be conducted as indicated in Section 01 57 13, Temporary Erosion and Sediment Control and as indicated in the Basis of Design document.

C. Non-environmental permits and permits related to off-site activities must be obtained, and both administrative and substantive requirements apply to off-site activities.

1.06 SUBMITTALS PRIOR TO AWARD

A. Prior to contract award, the Subcontractor will be required to submit a certificate of insurance naming USEPA, City of St. Louis and Contractor as additional insured and waivers of subrogation against USEPA and Contractor, in accordance with the Subcontract. All certificates of insurance, as well as bonds, shall be either executed by or countersigned by a licensed resident agent of the surety or insurance company having its place of business in the State of Michigan. Further, the said surety or insurance company shall be duly licensed and qualified to do business in the State of Michigan.

B. Prior to contract award, the Subcontractor will be required to submit the following:

1. Completed certification of compliant drug policy.
2. Subcontractor’s site-specific health and safety plan and Activity Hazard Analysis (AHA) worksheets.

3. Proof of training and medical monitoring programs.
4. Safety data sheets (SDSs).
5. Copies of Subcontractors' and business licenses as required by state and local statutes.
6. Completed Waste Subcontractor Qualification Form.
7. Transporter's valid U.S. DOT Number.
8. Transporter's valid EPA ID# (for hazardous waste transport).
9. Transporter's Certificate of Insurance.
10. For waste disposal facilities, written evidence of USEPA approval under Offsite Rule of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (40 CFR 300.440); and a summary of violations (formal and informal) and how they were resolved in the last 5 years.
11. Table describing potential borrow sources and a site drawing identifying the location(s) of borrow areas, and of any samples with respect to the specific borrow area at the borrow source.

C. A schedule for completing the work should be submitted as part of the bid proposal.

1.07 SUBMITTALS AFTER AWARD

A. The selected Subcontractor shall provide the following before the commencement of any Work onsite:

1. Current hazardous waste site training and medical surveillance documentation for all field personnel, as necessary.
2. Progress Schedule updates in accordance with Subcontract Agreement.
3. Completed AHA Forms.
4. Project Schedule and schedule narrative of Subcontractor's approach in performing the Work. The narrative will identify equipment, labor resources, crews and subcontracts. The narrative will also discuss project coordination.
5. Subcontractor Quality Control Plan.
6. Work Plan. The Work Plan narrative will identify equipment, labor resources, crews and lower-tier subcontracts. The narrative will also discuss project coordination, storage and staging area plans, haul routes, and detail the means and methods to complete the work.
7. Soil Erosion and Sedimentation Control Plan (SESC Plan).
8. Air Monitoring Plan.
9. Noise Control Plan.
10. Excavation Plan, as required in Section 31 23 16, Excavation.
11. Water Control Plan, as required in Section 31 23 19.01, Dewatering.
12. Shoring Plan.

13. Movement Monitoring Plan.
14. Transportation and Disposal Plan including:
    a. Pre-disposal: The Subcontractor will prepare all disposal paperwork, including waste profile forms, supporting analytical results, applicable pre-printed manifests, labels, State and EPA Land Disposal Restriction (LDR) notification/certification forms (for hazardous waste), and any other document required for transportation or disposal. This information will be submitted to the Contractor for review and subsequent provision to USEPA. The Generator of this waste is USEPA Region 5. Upon satisfactory completion of all documentation by the Subcontractor the waste profile will be signed by USEPA. All waste manifests will be signed on site by Contractor on behalf of USEPA. Once the waste profile is signed, the Contractor will provide the signed profile back to the Subcontractor for submittal to the disposal facility.

B. Provide the following submittals during execution of the Work:

1. Daily reports (Subcontractor production report, Subcontractor quality control report, AHAs, and soil excavation/transportation log, waste disposal log for soil and liquid waste, weight tickets) during the field operations period. Daily reports shall be submitted no later than 12:00 noon on the day following the work reported.
2. Summary of remedial actions completed each day, including any deviations from the specified SOW.
3. Weekly updated schedule of values showing cumulative amounts for the billing period and cumulative project to date are to be submitted no later than 9:00 A.M. on Tuesday for each week in which work is completed for the project.
4. Progress schedule and narrative report.
5. As-built redline drawings of all excavation areas with lateral and vertical limits of excavation. Beginning and ending elevation of excavation areas confirmed and documented using survey. Changes shall reflect modifications to the excavation extents, depths, fill encountered during excavation, or other similar factors that alter the lateral or vertical excavation extents. As-built redlines shall be submitted to Contractor after excavation of each layer of material (i.e. topsoil, sand, clay cap, and impacted material) identifying limits of excavation, and after backfill of each layer identifying limits of backfill.
6. A table documenting information on wastes managed, including quantities generated at each location and disposition of wastes.
7. Disposal: As required in Section 31 23 16, Excavation.

8. Fully completed manifests or delivery tickets for all waste streams documenting ultimate disposal, as necessary.
    a. Manifesting: A manifest for each load of waste will be created before leaving the site. At a minimum, the manifest form will include the following information:
        1) Generator information, including name, address, contact, and phone number, and EPA ID number.
        2) Transporter information, including name and EPA ID number.
        3) Designated facility information, including name, address, phone number, and EPA ID number.
        4) Site name, including street and mailing address.
        5) DOT proper shipping name.
        6) Type and number of container.
        7) Quantity of waste (volumetric estimate).
        8) Task order or job number.
        9) Profile number.
        10) 24-hour emergency phone number.
    b. Post-disposal: The Subcontractor will provide fully executed manifests (with transporter and facility signatures), weight tickets, and Certificates of Disposal/Destruction (CD) as applicable. Originals shall be sent directly to the Contractor via a means of traceable mail such as Federal Express or UPS or hand-delivered with a signature receipt. Original facility-signed manifests will not be attached to invoices. All original hazardous waste manifests must be returned to the Contractor within 25 calendar days.

C. Action and informational submittals required by the technical specification.

1.08 APPLICABLE REGULATIONS

A. General: Work shall comply with all Federal, State and local regulations, and with the latest edition of applicable sections of the following regulations, standards, and codes:

1. American National Standards Institute (ANSI).
2. American Society for Testing and Materials (ASTM).
3. Building Code of America.
4. National Electric Code (NEC).
5. National Electrical Manufacturer’s Association (NEMA) Code.
6. National Fire Protection Association (NFPA) Standards.
7. Occupational Safety and Health Act.
8. Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120.

9. Underwriter's Laboratory (UL).
10. St. Louis Code of Ordinances.
11. Michigan Department of Transportation (MDOT).
12. Michigan Department of Environmental Quality (MDEQ).
13. United States Environmental Protection Agency (USEPA).
14. Other applicable state and local codes and regulations.

B. Regulatory Framework:

1. This Work is part of the USEPA's Superfund Program and is governed by CERCLA. CERCLA projects are generally exempt from requirements to obtain environmental permits for on-site work under CERCLA 121(e); however, compliance with all substantive requirements is required. Non-environmental permits and permits related to off-site activities must be obtained, and both administrative and substantive requirements apply to off-site activities.
2. A SESC Plan will be required for this Work. The Subcontractor will be required to prepare the SESC Plan for approval and implement erosion control measures as best management practices for controlling erosion, regardless of other requirements.
3. The actions described in this SOW are not likely to result in any atmospheric discharges that would require either notification or permitting under the Clean Air Act (CAA). Under the CAA, temporary sources are not considered stationary sources and therefore are not regulated by the provision set forth in the act; however, any emission or escape into the open air can be declared a public nuisance. To avoid the nuisance rule, best management practices (i.e., periodic wetting of the area) shall be implemented by the Subcontractor during the completion of the soil excavation activities.

1.09 HEALTH AND SAFETY

A. A copy of Contractor's health and safety plan (HASP) can be supplied for reference. The Subcontractor shall provide its own health and safety procedures for the performance of its activities. The primary chemicals of concern for this project are summarized in Section 1.03 and are contained within the soil that will be excavated during this project. The Subcontractor is responsible for the health and safety of its own personnel and any of its Lower-Tier Subcontractors' personnel at the project site, and shall provide, for all its own personnel and any of its Lower-Tier Subcontractors' personnel, all health and safety equipment required to comply with the Subcontractor's Safety Procedures and that are necessary to complete the Work.

B. Failure to comply with the appropriate health and safety procedures outlined in the Contractor HASP and the Subcontractor's safety procedures, as determined by Contractor's representative, shall be considered grounds for a Stop Work Order. The Subcontractor shall remedy failure of compliance, as directed and approved by Contractor, before resuming Work. The Subcontractor will not be paid for the time occurring after notice of Stop Work Order and before resuming Work and may be responsible for Contractor costs during the downtime.

C. Responsibilities:

1. The Subcontractors are responsible for the health and safety of their employees. Each company shall designate one site employee as the "Designated Safety Coordinator" (DSC) who shall interface with the Contractor Site Safety and Health Specialist (SSHS) in matters of site safety.
2. The Health and Safety Program has three objectives: 1) to protect personnel onsite, 2) to comply with applicable (federal, state, and local) health and safety regulations and 3) minimize health and safety liabilities.
3. All employees shall follow, as a minimum, the requirements of OSHA 29 CFR 1910 and 29 CFR 1926.

D. Minimum Requirements :

1. Personal Protective Equipment:
    a. General Requirements:
        1) Responsibilities (29 CFR 1910.132):
            a) Employees must use all personal protective equipment (PPE) that maintains their exposure within acceptable limits as defined in the HASP.
            b) Employers shall ensure that employees receive training in and have knowledge of the use and maintenance of all PPE that is required to maintain their exposure within acceptable limits.
        2) Employees shall be physically able and medically determined qualified to use the PPE and safety equipment that may be required in their job duties.
        3) PPE and safety equipment shall be tested, inspected, and maintained in serviceable and sanitary condition.
            a) Defective equipment shall not be used.
            b) Records of any tests or inspection shall be available for inspection by Contractor.

4) For hazardous waste operations, Subcontractors shall abide by 29 CFR 1910.120, Appendix B.

b. Minimum Requirements for Appropriate Personal Protective Equipment: As described in the Contractor's Health and Safety Plan.

c. Minimum Requirements for Site Safety:

1) Safety color code for marking physical hazards (29 CFR 1910.144) shall include the following:

a) Caution tape shall be at a minimum of 3 inches wide, yellow, and the words "CAUTION" spelled out legibly in black.

b) Safety cans or other portable containers of flammable liquids shall be in compliance.

2) All signs and tags shall be in compliance with 29 CFR 1910.145.

3) Fencing will be required around excavations (29 CFR 1926.501).

2. Outline for the Site-specific Health and Safety Plan:

a. Activity Hazard Analysis:

1) All definable features of Work will be addressed with an activity hazard analysis (AHA) prior to beginning each activity. This chart looks at principal steps of the operation, potential safety/health hazards for each step, and recommended controls for each hazard. In addition, a listing of equipment to be used onsite, inspection requirements, and training requirements for operation of equipment shall be included.

2) Analyses will define the activities being performed, identify the sequences of Work, the specific hazards anticipated, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level.

3) Work will not begin until the hazard analysis for each Work activity has been reviewed and accepted by Contractor.

b. Training requirements are as follows (29 CFR 1910.120.(e)):

1) 40-hour hazardous waste training.

2) 8-hour hazardous waste refresher training within the last 12 months.

3) Site-specific training including names of personnel and alternates responsible for site safety and health; safety, health, and other hazards identified in the AHA; use of PPE; Work practices to minimize risks from hazards; medical surveillance requirements and recognition of symptoms and signs which might indicate overexposure to hazards; and decontamination procedures.

4) Surveyors: 24-hour hazardous waste training plus 8-hour hazardous waste refresher training within the last 12 months.

c. Personal Protective Equipment: A specific list of PPE to be used by Subcontractor employees for each site task and operation plus the assigned level of protection and criteria for upgrading or downgrading a task shall be included.

d. Medical Surveillance:
   1) As a minimum, list the requirements for annual and any site-specific physical requirements for contaminants of concern on the site.
   2) Provide name, route map, and contact number for emergency medical services available in case of a suspected exposure or emergency.
   3) 5-panel drug testing shall be completed for all subcontractor and lower-tier subcontractor onsite employees within 30 days prior to arrival onsite.

e. Site Control: Implement appropriate site controls to isolate areas with hazardous substances or physical hazards before Work begins. Establish Work zones, use of the “buddy” system, site communications including emergency signals, and identification of standard operating procedures.

f. Decontamination:
   1) Written procedures will be developed and implemented before and during site activities based upon actual site conditions. Decontamination for hand tools, light equipment and personnel will be described in the Subcontractor’s AHAs. Decontamination for heavy equipment and trucks will be described in the Subcontractor’s Work Plan.
   2) All trucks or other equipment entering the exclusion zones must be decontaminated prior to exiting the exclusion zones. This includes, but is not limited to, trucks transporting contaminated soil from excavation areas to the waste stabilization area (if needed), trucks transporting contaminated soil from the excavation areas to the landfill(s), and trucks transporting liquids for offsite treatment/disposal. The Subcontractor is responsible for conducting all truck decontamination and management of decontamination wastes.
   3) All equipment leaving the site shall be decontaminated and decontamination wastes shall be managed, contained and disposed of by the Subcontractor in a manner approved by the Contractor in the appropriate plans.

g. Spill Control:
   1) Onsite spills: Requirements for spill containment procedures are described in the Contractor's Health and Safety Plan; these shall be followed when developing the Subcontractor's procedures.
   2) Offsite spills: Describe procedures for containment of offsite spills in detail in the Transportation and Disposal Plan; a general description of these procedures shall be described in the Subcontractor's Health and Safety Plan.
   3) All personnel leaving the exclusion area will perform the required decontamination. The Subcontractor DSC will observe these operations and ensure proper decontamination procedures are being followed. These procedures shall be followed every time personnel leave the site.
   4) PPE will be cleaned or disposed of in a method specified in the Subcontractor's HASP.

h. Emergency response plan shall include the following:
   1) Pre-emergency planning including designation of personnel roles, responsibilities, emergency recognition, safe places of refuge or gathering, evacuation routes, emergency decontamination procedures, alerting procedure, and availability of first aid and medical treatment.
   2) Site emergency equipment including first aid kits, 15-minute eyewash, 20-pound fire extinguishers, bloodborne pathogen kit, emergency map, designated emergency vehicle, and listing of trained first aid and CPR personnel.
   3) Procedures for reporting incidents, emergency communications, and testing of the site emergency notification system.
   4) Post-emergency evaluation, an evaluation looking at how resources came into play, response of outside sources, and steps to improve the process.

i. Confined Space Entry, if Required by Site Activities: This includes the specific procedure following 29 CFR 1910.146, including training, site isolation, permit procedures, air monitoring, and emergency rescue.

j. Spill Containment Program:
   1) Written spill containment program that is targeted at the quantities and types of material brought to the site by the Subcontractor or as a result of stockpiling or tankage of site materials.
   2) Spill control materials in adequate quantities to control solid or liquid spills.

3) Drums or containers for recovery of spilled material or rapidly available local resources to provide these materials.

k. Activity Hazard Analyses:
   1) The Subcontractor shall prepare AHAs to review the hazards posed and required hazard control procedures for each day's planned activities.
   2) During the daily safety meeting, the Subcontractor's supervisor shall brief their Work crew on the AHA, which shall include the day's planned tasks, tools, equipment, and materials that will be used, along with hazards posed and required hazard control procedures for each day's planned activities.

3. References:
   a. CH2M Health and Safety Program Plan.
   b. OSHA 29 CFR 1910, General Industry Standards.
   c. OSHA 29 CFR 1926, Construction Industry Standards.

1.10 SUBCONTRACT TIME

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Subcontract.

B. Substantial Completion:

1. Substantial Completion shall occur when preliminary punch list Work has been completed and the Post-Construction Meeting is conducted with the Contractor and USEPA.
2. The Work is to be performed in 2 construction seasons. Project Substantial Completion shall occur when remediation and restoration is complete for both PSAs, and maintenance, watering and punch list work is complete.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Schedule of Values: Submit on Subcontractor's standard form.
2. Schedule of Estimated Progress Payments:
   a. Submit with initially acceptable Schedule of Values.
   b. Submit adjustments thereto with Application for Payment.
3. Application for Payment.
4. Final Application for Payment.

1.02 SCHEDULE OF VALUES

A. On a weekly basis, the Subcontractor shall provide an updated Schedule of Values (SOV) as described in Section 01 11 00, Summary of Work.

B. The Schedule of Values shall be reviewed weekly during each weekly progress meeting with the Contractor. Based on the weekly review, the SOV shall be revised, if needed.

C. Upon request of Contractor, provide documentation to support the accuracy of the Schedule of Values.

D. The Schedule of Values shall correspond to each definable feature of work (DFOW), as outlined in Section 01 45 16.13, Subcontractor Quality Control.

E. Unit Price Work: Reflect unit price quantity and price breakdown from conformed Bid Form.

F. Lump Sum Work:

1. List bonds and insurance premiums, mobilization, demobilization, preliminary and detailed progress schedule preparation, equipment testing, facility startup, and contract closeout separately.
2. Break down by Division 02 through 33 with appropriate subdivision of each Specification.

G. An unbalanced or front-end loaded schedule will not be acceptable.

H. Summation of the complete Schedule of Values representing all the Work shall equal the Subcontract Price.

1.03 SCHEDULE OF ESTIMATED PROGRESS PAYMENTS

A. Show estimated payment requests throughout Subcontract Times aggregating initial Subcontract Price.

B. Base estimated progress payments on initially acceptable progress schedule. Adjust to reflect subsequent adjustments in progress schedule and Subcontract Price as reflected by modifications to the Subcontract Documents.

1.04 APPLICATION FOR PAYMENT

A. Transmittal Summary Form: Attach one Summary Form with each detailed Application for Payment for each schedule and include Request for Payment of Materials and Equipment on Hand as applicable. Execute certification by authorized officer of Subcontractor.

B. Use detailed Application for Payment Form provided by Contractor.

C. Provide separate form for each schedule as applicable.

D. Include accepted Schedule of Values for each schedule or portion of lump sum Work and the unit price breakdown for the Work to be paid on a unit priced basis.

E. Include separate line item for each Change Order and Work Change Directive executed prior to date of submission. Provide further breakdown of such as requested by Contractor.

F. Preparation:

1. Round values to nearest dollar.
2. Submit Application for Payment, including a Transmittal Summary Form and detailed Application for Payment Form(s) for each schedule as applicable, a listing of materials on hand for each schedule as applicable, and such supporting data as may be requested by Contractor.

1.05 MEASUREMENT—GENERAL

A. Weighing, measuring, and metering devices used to measure quantity of materials for Work shall be suitable for purpose intended and conform to tolerances and specifications as specified in National Institute of Standards and Technology, Handbook 44.

B. Whenever pay quantities of material are determined by weight, material shall be weighed on scales furnished by Subcontractor and certified accurate by state agency responsible. Weight or load slip shall be obtained from weigher using properly certified scales and delivered to Contractor at point of delivery of material.

C. Vehicles used to haul material being paid for by weight shall be weighed empty daily and at such additional times as required by Contractor. Each vehicle shall bear a plainly legible identification mark.

D. Materials that are specified for measurement by the cubic yard measured in the vehicle shall be hauled in vehicles of such type and size that actual contents may be readily and accurately determined. Unless all vehicles are of uniform capacity, each vehicle must bear a plainly legible identification mark indicating its water level capacity. Vehicles shall be loaded to at least their water level capacity. Loads hauled in vehicles not meeting above requirements or loads of a quantity less than the capacity of the vehicle, measured after being leveled off as above provided, will be subject to rejection, and no compensation will be allowed for such material.

E. Quantities Based on Profile Elevations: Existing ground profiles shown on Drawings were taken from a topographic map drawn with contour intervals of 2 feet with supplementary spot elevations to nearest half foot.

F. Excavation quantities for the existing topsoil, sand layer, clay cap, and impacted material above the groundwater table will be based on ground profiles shown and post-excavation surveys for each layer. Field surveys will be made by Subcontractor to confirm accuracy of elevations shown in Drawings and determine quantities for payment.

G. Variations of 1 foot or less will be ignored, and profiles shown on Drawings will be used for determining quantities.

H. Excavation quantities for impacted material below the groundwater table will be based on weight tickets of material transported from the site for offsite disposal, an assumed conversion factor of 1.8 tons per cubic yard, and an assumed water content of 16-19 percent.

1. The Subcontractor will perform percent moisture testing a minimum of 4 times per day each day impacted material is removed from below the groundwater table. The Subcontractor will submit the results to the Contractor with the volume calculations.
2. The Subcontractor is responsible for stabilizing/dewatering the impacted material to pass dryness criteria (e.g., paint filter test) set forth by the selected disposal facilities.

I. Quantities for soil disposal will be based on weight tickets of material transported from the site for offsite disposal.

J. Units of measure shown on Bid Form shall be as follows, unless specified otherwise.

Item	Method of Measurement
AC	Acre—Field Measure by Subcontractor
CY	Cubic Yard—Field Measure by Subcontractor by survey within limits specified or shown
CY-VM	Cubic Yard—Measured in Vehicle by Volume
EA	Each—Field Count by Subcontractor
GAL	Gallon—Field Measure by Subcontractor
HR	Hour
LB	Pound(s)—Weight Measure by Scale
LF	Linear Foot—Field Measure by Subcontractor
SF	Square Foot – Field Measure by Subcontractor
SY	Square Yard
TON	Ton—Weight Measure by Scale (2,000 pounds)

1.06 PAYMENT

A. General:

1. Progress payments will be made in accordance with the subcontract documents.
2. The date for Subcontractor's submission of monthly Application for Payment shall be established at the Preconstruction Conference.

B. Payment for all Lump Sum Work covers all Work specified or shown within the limits or specification sections as shown in Table 1 – Lump Sum Price Items, attached as a supplement to this Section.

C. Payment for Unit Price Items covers all the labor, materials and services necessary to furnish and install the items shown in Table 2 – Unit Price Items, attached as a supplement to this section.

1.07 PAYMENT FOR WORK COMPLETED

A. Payment for work completed will be made only after the Contractor has reviewed the payment application and confirms that the work has been completed satisfactorily according to the specifications and in accordance with the 3-phase quality control process, as discussed in the Subcontractor's Quality Control Plan.

1.08 NONPAYMENT FOR REJECTED OR UNUSED PRODUCTS

A. Payment will not be made for following:

1. Loading, hauling, and disposing of rejected material.
2. Quantities of material wasted or disposed of in manner not called for under Subcontract Documents.
3. Rejected loads of material, including material rejected after it has been placed by reason of failure of Subcontractor to conform to provisions of Subcontract Documents.
4. Material not unloaded from transporting vehicle.
5. Defective Work not accepted by Contractor.
6. Material remaining on hand after completion of Work.
7. Unauthorized overexcavation without written approval from Contractor.

1.09 PARTIAL PAYMENT FOR STORED MATERIALS AND EQUIPMENT

A. Partial Payment: No partial payments will be made for materials and equipment delivered or stored. Payment will be made only for materials incorporated in Work.

1.10 SUPPLEMENTS

A. The supplements listed below, following "End of Section", are part of this specification.

1. Subcontractor Application for Payment and Partial Release of Lien.
2. Table 1 – Lump Sum Price Items.
3. Table 2 – Unit Price Items.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SUBCONTRACTOR APPLICATION FOR PAYMENT & PARTIAL RELEASE OF LIEN

CH2M HILL Constructors, Inc Attn: CCI AP PO Box 241329 Denver, CO 80224	CCI Subcontract No.:	
	CCI Project No.:	
	Site Location:	
Subcontractor:	Invoice No.:	
	Invoice Date:	
	Period:	To:
		From:

Present Contract Status as Follows:

1	**Original Subcontract Amount**	**$**
2	Net Change by Change Orders through CO No. ___	$
3	**Total Subcontract Amount to Date (Line 1 + Line 2)**	**$**
4	Total Complete & Stored to Date	$
5	Less Previous PERIOD Applications for Payment (Line 5 + Line 6 from previous Pay Applications)	$
6	**This PERIOD Application (Line 4 – Line 5)**	$
7	Less Retainage this PERIOD at 10%	NA
8	Net Payment Due this PERIOD (Line 6 – Line 7)	$
9	Total Retainage including this Application (10% of Line 4)	NA

CERTIFICATION AND LIEN WAIVER:

I certify that all items and amounts shown above are correct, that all work has been performed and materials supplied in full accordance with the terms and conditions of this subcontract, and that, to the extent not previously furnished, a signed (Conditional) Waiver of Lien is attached for each Subcontractor or Supplier who performed work or furnished items for the Project.

I also certify that payment has been made to all labor through the last pay period and to all Suppliers, and lower tier subcontractors (except retainage) used in connection with performance of the subcontract through the last pay period,

The foregoing instrument was acknowledged before me this _____ by _____

_____

By_____.
Notary Public

BY:_____
(authorized signature)
Printed Name_____
Title_____

My commission expires: _____

TABLE 1
Lump Sum Items

Item	Description
Performance/Payment Bonds and Taxes	Includes the cost for required performance and payment bonds and taxes as required in General Terms & Conditions.
Insurance	Includes the cost for insurance as required in General Terms & Conditions.
Onsite Preconstruction Meeting	Includes all necessary labor and expenses for all of the Subcontractor's personnel to attend an onsite preconstruction meeting with Contractor to introduce project staff and review the project scope and schedule.
Premobilization Submittals	Includes, but is not limited to: signed confidentiality statements, health, safety and training certifications, certification of negative drug testing for field personnel, completed Health and Safety Questionnaire for lower-tiered subcontractors, and the following plans: Sediment and Erosion Control Plan, Site Preparation Plan, Land Survey/Construction Layout, Corporate Health and Safety Plan, Site Specific Health and Safety Plan including Activity Hazard Analyses (AHAs), Quality Control Plan, Air Monitoring Plan, and Transportation and Disposal Plan. Other plans required for the work can be found in the specifications.
Mobilization and Temporary Facilities	Includes all necessary labor, expenses, and material to mobilize staff and equipment to the site, and all personal labor and expenses associated with travel for inter-shift travel to/from the site. Costs also includes labor, equipment, and materials necessary to obtain all permits, mobilize personnel and equipment to the site, perform utility clearances, and to assemble and set up equipment, construct staging areas, install sediment and erosion control (per BODR), office trailer, sanitary facilities, temporary power, and site security. Not to exceed 7.5 percent of total bid.
Site Surveys	Includes all necessary labor, expenses and material to mobilize surveyor and equipment to site and conduct initial site survey, post-excavation surveys (after removal of existing topsoil, after removal of existing sand layer, after removal of existing clay cap, and after removal of impacted material), and post backfill surveys (after placement of general backfill to bottom of clay cap elevation, after placement of clay cap material to bottom of sand layer elevation, after placement of sand layer to bottom of topsoil elevation, and after placement of topsoil to pre-seeding grade). Costs also includes labor, equipment, and materials necessary to obtain all permits and licenses, mobilize personnel and equipment to the site, and to assemble and set up equipment.

TABLE 1
Lump Sum Items

Item	Description
Abandon CRA-Installed Groundwater Elevation Control Tile	Includes all necessary labor, equipment, and materials to dewater the existing manholes and pipelines into a frac tank, install flowable fill in manholes and piping as shown on the Drawings, and install sheet piling for abandonment as shown on the Drawings. This item also includes transportation and offsite disposal of water removed from groundwater elevation control tile. Includes all fees necessary to dispose of material offsite.
Install Excavation Support Wall	Includes all necessary labor, materials, and equipment to design, install, and maintain the excavation support wall for PSA-1. Costs should include pre-installation meetings with property owners adjacent to the excavation support wall, including documentation of existing conditions and movement/settlement monitoring.
Remove Excavation Support Wall	Includes all necessary labor, materials, and equipment to remove the excavation support wall for PSA-1. Costs should include removal and offsite disposal. If material is salvaged, credit should be applied to this item.
Performance of Debris Sweep	Not to exceed 7.5 percent of total bid.
Demobilization	Includes all necessary labor, equipment, and materials necessary to demobilize personnel and equipment from the site, including assembly and breakdown of equipment, sediment and erosion control, office trailer, sanitary facilities, and temporary power; Also includes decontamination of all equipment, testing, reporting, remove all debris and rubbish related to construction activities. This item also includes preparation and submittal of all required waivers and record drawings as required in General Terms & Conditions.

TABLE 2
Unit Price Items

Item	Description	Unit of Measure
Excavation	Includes all required labor, equipment, and material necessary to complete the excavation work.	CY
Transportation and Material – General Backfill	Includes all material and transportation costs to source and haul borrow source material to the FPS. This item also includes the required laboratory testing for the imported material.	CY
Transportation and Material – Gravel	Includes all material and transportation costs to source and haul borrow source material to the FPS. This item also includes the required laboratory testing for the imported material.	CY
Backfill	Includes all required labor and equipment necessary to place material for all excavation backfill. This item also includes the required field testing for all backfill materials.	CY
Site Restoration – Roads (if required)	Includes all necessary labor, materials, and equipment to restore permanent site roads to original condition, as detailed in the Drawings.	SF
Site Restoration – Seeding	Includes all necessary labor, materials, and equipment to remove the temporary haul roads, lay down areas; filling and grading excavation areas to final design elevations, and reseeding with a grass mixture which shall be managed per the specifications.	SF
Site Restoration – Maintenance Period	This item includes all labor, materials, and equipment required during the maintenance period.	DAY
Transportation and Disposal of Soil	Includes all required labor, equipment, and material necessary to manage and transport excavated soil and other encountered solid debris offsite. Includes all fees necessary to dispose of material offsite.	TON

TABLE 2
Unit Price Items

Item	Description	Unit of Measure
Dewatering and Transportation and Disposal of Water	Includes all required labor, equipment, and material necessary to manage and containerize water accumulated in excavations and during decontamination activities. This item also includes all required labor, equipment and materials necessary to transport water accumulated during excavation activities and decontamination water at an approved facility. Includes all fees necessary to dispose of material offsite.	GAL
Hourly Standby Time	Includes all necessary labor, material, and equipment costs for operation shutdown with less than a 12-hr advance notification from Contractor. Applicable for the first 24-hrs following the notification from Contractor. Standby time does not cover downtime as a result of Subcontractor's actions that would prevent continued operations, including, but not limited to, Subcontractor equipment failure or not meeting other subcontract requirements nor force-majeure.	HR
Daily Standby Time	Includes all necessary labor, material, and equipment costs for operation shutdown as directed by Contractor following a 12-hr advanced notice. Standby time does not cover downtime as a result of Subcontractor's actions that would prevent continued operations, including, but not limited to, Subcontractor equipment failure or not meeting other subcontract requirements nor force-majeure.	DAY

SECTION 01 31 13
PROJECT COORDINATION

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational:

1. Statement of Qualification (SOQ) for land surveyor.
2. Utility locate tickets:
   a. Documentation of completed utility locates for both MISS DIG and 3rd party (if Applicable).
   b. Submit one copy, within 2 days prior to beginning excavation activities.
3. Photographs:
   a. Digital Images: Each image is to have a minimum file size of 1.4 Mb (1,400 Kb) so viewed resolution is high quality. The production of larger file sizes with higher resolution is encouraged.
   b. Copies of videos and photographs taken by Subcontractor.

B. Action:

1. Sketch showing Existing Conditions: Submit electronic files in Microstation V8i SELECT series 2 or other compatible format within three (3) days after the Initial Preconstruction Meeting.
2. Survey Documentation:
   a. Survey No. 1–Pre-Excavation Survey: Submit electronic files and coordinates with elevations and estimated excavation volume
   b. Survey No. 2 through 5–Post-Excavation Surveys: Submit electronic files and coordinates with elevations and calculated excavation volumes for each layer of material removed.
   c. Survey No. 6 through 9–Post-Backfill Surveys: Submit electronic files and coordinates with post-backfill grades and calculated backfill volumes for each layer of backfill material placed.

1.02 RELATED WORK AT SITE

A. General:

1. Other work that is either directly or indirectly related to scheduled performance of the Work under these Subcontract Documents, listed henceforth, is anticipated to be performed at Site by others.

2. Coordinate the Work of these Subcontract Documents with work of others as specified in General Conditions.
3. Subcontractor shall make the southern and central portions of the existing process pad available to others every Thursday between 7:00 a.m. and 1:00 p.m.
4. Include sequencing constraints specified herein as a part of Progress Schedule.

1.03 UTILITY NOTIFICATION AND COORDINATION

A. The Subcontractor will coordinate utility clearance through the local one-call system (MISS DIG). The Subcontractor shall verify that utilities have been identified and marked prior to beginning excavation and protect the utilities (if any) from damage during construction.

B. The Subcontractor shall notify applicable utilities prior to commencing Work and if damage occurs, or if conflicts or emergencies arise during Work.

1. Electricity Company:
   a. Contact Person: Mike Parsons.
   b. Telephone: 989-681-3351.
2. Telephone/Internet Company: Charter Communications.
   a. Telephone: 877-906-9121.
3. Water Department:
   a. Contact Person: Steve Mepham.
   b. Telephone: 989-681-3567.
4. Gas Department: Consumers Energy.
   a. Contact Person: Dan Jones
   b. Telephone: 989-791-5903.

C. Third Party Utility Locator:

1. The Subcontractor shall provide a third-party utility locate subcontractor to perform an independent utility locate search that will help define the location of existing utilities in the work area. The Subcontractor shall investigate areas where subsurface work will be performed. The utility locating task will include the following:
   a. Verify the presence or absence of underground utilities in the proposed work areas shown on the design drawings. Previous utility locate may be used but must be confirmed by completing a new utility locate.
   b. Methods used to locate underground utilities and anomalies shall include ground penetrating radar and electromagnetic/magnetometer.

c. Underground utilities will be marked as appropriate for each utility (e.g., electrical, gas or water). Utilities shall be clearly marked with spray paint and flags capable of withstanding inclement weather and normal abuse in accordance with American Public Works Association (APWA) uniform color codes.
d. All utilities in the area will be delineated and clearly marked.

2. The results of the locate effort shall be submitted to Contractor.

1.04 ADJACENT FACILITIES AND PROPERTIES

A. Examination:

1. After Effective Date of the Agreement and before Work at Site is started, Subcontractor, Contractor and affected nearby property owners and utility owners (if applicable) shall make a thorough examination of pre-existing conditions including existing buildings, structures, and other improvements in vicinity of Work, as applicable, which could be damaged by construction operations.
2. Prior to installation of the excavation support wall and start of excavation activities, meetings will be conducted with the adjacent property owners along Watson Street. Schedule and noise expectations will be discussed during the meetings.
3. The Contractor and Subcontractor will inspect the properties along the west side of Watson Street, between Washington Avenue and Center Avenue. The Contractor will obtain property owner-signed access agreements and verify property ownership prior to the inspections.
   a. During the inspection the Contractor and Subcontractor will take video records and/or photographs of the exterior and interior home foundation and other permanent structures such as garages, sheds, porches, and decks, showing their condition prior to installation of the excavation support wall and start of excavation activities.
   b. The Contractor will record notes, concerns, and understandings discussed with the Property Owner on the Pre-Construction – Structural Home Inspection Form.
   c. After the inspection is complete, the Pre-Construction – Structural Home Inspection Form will be signed by the Contractor, Subcontractor, and Property Owner, indicating all parties are in agreement of preconstruction conditions.

4. The Contractor and Subcontractor will notify the Property Owners on the east side of Watson Street, between Washington Avenue and Center Avenue, of the excavation support wall installation and start of excavation activities.
    a. Inspections of these properties is not required, unless deemed necessary by the Subcontractor. During the meeting, the Contractor and Subcontractor will inform the Property Owners of the excavation support wall installation and excavation activities and provide engineering support explaining why subsurface impacts are not expected for their properties.
5. Periodic reexamination shall be jointly performed to include, but not limited to, cracks in nearby structures, settlement, leakage, and similar conditions.
6. After removal of the excavation support wall, the Contractor and Subcontractor will do a post-construction inspection of the properties along the west side of Watson Street, between Washington Avenue and Center Avenue. The Property Owner will also be in attendance.
    a. During the inspection the Contractor and Subcontractor will take video records and/or photographs of the exterior and interior home foundation and other permanent structures such as garages, sheds, porches, and decks, showing their condition after removal of the excavation support wall.
    b. The Contractor will record notes, concerns, and understandings discussed with the Property Owner on the Post-Construction – Structural Home Inspection Form.
    c. After the inspection is complete, the Post-Construction – Structural Home Inspection Form will be signed by the Contractor, Subcontractor, and Property Owner, indicating all parties are in agreement of post-construction conditions.
7. The Contractor and Subcontractor will notify the Property Owners on the east side of Watson Street, between Washington Avenue and Center Avenue, of the excavation support wall removal.

B. Documentation:

1. Record and submit documentation of observations made on examination inspections in accordance with Article Construction Photographs.
2. Upon receipt, Contractor will review, sign, and return one record copy of documentation to Subcontractor to be kept on file in field office.
3. Such documentation shall be used as indisputable evidence in ascertaining whether and to what extent damage occurred as a result of Subcontractor’s operations, and is for the protection of adjacent property owners, Contractor, and Owner.

1.05 CONSTRUCTION PHOTOGRAPHS

A. General:

1. Photographically document all phases of the Project including pre-construction, construction progress, and post-construction.
2. Contractor shall have right to select subject matter and vantage point from which photographs are to be taken.
3. Digital Images: No post-session electronic editing of images is allowed. Stored image shall be actual image as captured without cropping or other edits.

B. Preconstruction and Post-Construction:

1. After Effective Date of the Agreement and before Work at Site is started, and again upon issuance of Substantial Completion, take photographs of Site and property adjacent to perimeter of Site.
2. Particular emphasis shall be directed to structures both inside and outside the Site.
3. Format: Digital, Digital, minimum resolution of 1,832 by 3,264 pixels and 24 bit, millions of color.

C. Construction Progress Photos:

1. Photographically demonstrate progress of construction, showing every aspect of Site and adjacent properties as well as interior and exterior of new or impacted structures.
2. Weekly: Take 48 photographs using digital, minimum resolution of 1,832 by 3,264 pixels and 24 bit, millions of color.

D. Documentation:

1. Digital Images:
   a. Electronic image shall have date taken embedded into image.
   b. Archive using a commercially available photo management system that provides listing of photographs including date and keyword description.
   c. Label file folders or database records with Project and Owner’s name, and month and year images were produced.

1.06 REFERENCE POINTS AND SURVEYS

A. All survey work shall be completed under the direct supervision of a Professional Land Surveyor licensed and in good standing with the State of Michigan.

B. Location and elevation of known bench marks are shown on the Drawings.

C. Subcontractor's Responsibilities:

1. Complete survey work in accordance with Exhibit 1 of this specification.
2. Establish bench marks convenient to Work and at least every 500 feet on pipelines and roads.
3. Establish horizontal reference points or coordinate system with bench marks and reference points for Subcontractor's use as necessary to lay out Work.
4. Provide additional survey and layout required to layout the Work.
5. Check and establish exact location of existing facilities prior to construction of new facilities and any connections thereto.
6. In event of discrepancy in data provided by Contractor, request clarification before proceeding with Work.
7. Retain professional land surveyor or civil engineer registered in state of Project who shall perform or supervise engineering surveying necessary for additional construction staking and layout.
8. Maintain complete accurate log of survey Work as it progresses as a Record Document.
9. On request of Contractor, submit documentation.
10. Provide competent employee(s), tools, stakes, and other equipment and materials as Contractor may require to:
    a. Establish control points, lines, and easement boundaries.
    b. Check layout, survey, and measurement Work performed by others.
11. Measure quantities for payment purposes.
12. Establish clearing limits, set toe of fill and top of cut stakes, and set bench marks convenient for use as necessary to establish basic layout of the Work.
13. Provide cut data sheets to the Subcontractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SALVAGE OF MATERIALS

A. Materials to be salvaged include:

1. Existing topsoil, to the extent possible, as determined by the Contractor.
2. Existing sand layer, to the extent possible, as determined by the Contractor.

3. Existing clay cap material, to the extent possible, as determined by the Contractor.

3.02 CUTTING, FITTING, AND PATCHING

A. Cut, fit, adjust, or patch Work and work of others, including excavation and backfill as required, to make Work complete.

B. Restore existing work, Underground Facilities, and surfaces that are to remain in completed Work as specified and as shown on Drawings.

C. Remove specimens of installed Work for testing when requested by Contractor.

3.03 SUPPLEMENTS

A. The supplements listed below, following “End of Section”, are part of this specification.

1. Form: Pre-Construction – Structural Home Inspection.
2. Form: Post-Construction – Structural Home Inspection.
3. Exhibit 1 - Standard Survey Scope of Work.

END OF SECTION

Property Owner(s):_____

Address:_____ Email:_____

Date of Inspection:_____ Time of Inspection:_____

Foundation Material: ☐ Concrete Blocks ☐ Concrete Poured Walls ☐ Michigan Basement

Additional Information:

_____

_____

_____

Foundation Type: ☐ Full Basement ☐ Crawl Space ☐ Concrete Slab

Additional Information:

_____

_____

_____

1. Does the property owner have any knowledge of water/dampness on walls in the basement?

   ☐Yes ☐No

Location_____ Description_____

Location_____ Description_____

Location_____ Description_____

2. Does the property owner have any knowledge of existing exterior home foundation issues?

   ☐Yes ☐No

Location_____ Description_____

Location_____ Description_____

Location_____ Description_____

3. Does the property owner have any knowledge of existing interior home foundation issues?

☐Yes ☐No

Location_____ Description_____

Location_____ Description_____

Location_____ Description_____

4. Does the property owner have any knowledge of existing shed/garage/porch/patio foundation issues?

☐Yes ☐No

Location_____ Description_____

Location_____ Description_____

Location_____ Description_____

Inspection Procedures

Examine the interior and exterior of building(s)/other structure(s) for evidence of distress, deterioration and weather tightness (siding and windows) that may indicate conditions affecting the overall structural integrity and stability of the building(s)/other structure(s). Photos and videos will be used to document existing conditions.

Inspection Findings:

Signatures below represent agreement between the three parties on the existing condition of the home as described in this document.

Property Owner Signature	Print Name	Date
Subcontractor Representative Signature	Print Name	Date
CH2M HILL Representative Signature	Print Name	Date

Property Owner(s):_____

Address:_____ Email:_____

Date of Inspection:_____ Time of Inspection:_____

1. Has the property owner observed new evidence of dampness on walls or water in basement/crawl space?

☐Yes ☐No

Location_____ Description_____

Location_____ Description_____

Location_____ Description_____

2. Has the property owner observed newly formed cracks in the exterior home foundation?

☐Yes ☐No

Location_____ Description_____

Location_____ Description_____

Location_____ Description_____

3. Has the property owner observed newly formed cracks in the interior home foundation?

☐Yes ☐No

Location_____ Description_____

Location_____ Description_____

Location_____ Description_____

4. Has the property owner observed newly formed cracks in shed/garage/porch/patio foundations?

☐Yes ☐No

Location_____ Description_____

Location_____ Description_____

Location_____ Description_____

Inspection Procedures

Examine the interior and exterior of building(s)/other structure(s) for evidence of distress, deterioration and weather tightness (siding and windows) that may indicate conditions affecting the overall structural integrity and stability of the building(s)/other structure(s). Photos and videos will be used to document post-construction conditions.

Inspection Findings:

Signatures below represent agreement between the three parties on the post-construction condition of the home as described in this document.

Property Owner Signature	Print Name	Date
Subcontractor Representative Signature	Print Name	Date
CH2M HILL Representative Signature	Print Name	Date

1Standard Survey Specification

1.1.1 General

- All work shall be performed by or under the direction of a currently registered Michigan Licensed Land Surveyor who is licensed and in good standing with the State of Michigan licensing agency (surveyor).
- All documents submitted shall bear the surveyor's stamped, dated, and signed seal and a certification that all work was completed under the Surveyor's supervision and that all information contained in the delivered documents are true and accurately shown.
- The surveyor is responsible for obtaining all permits and access permissions required for this work, shall take all reasonable precautions to prevent damage to public and private property, and shall restore the properties to the condition existing prior to the surveyor's entry.
- The surveyor shall take all reasonable precautions to prevent damage to public and private property, and shall restore the site to the condition existing prior to the surveyor's entry.
- All work shall be completed under the direction of the surveyor. All work shall be conducted using equipment, personnel, and procedures that will ensure compliance with the accuracy standards as defined herein. It is the responsibility of the supervising land surveyor to ensure that all work under this agreement complies with all federal, state, and local regulations. All documents submitted shall bear the surveyor's seal, signature, and a certificate that all work was done under the surveyor's supervision and that all information contained in the document is true and is accurately shown.
- The surveyor is responsible for quality assurance for the survey work performed on this project, which shall include but is not limited to fieldwork checks, equipment calibration, office calculations, drawings, and a final peer review. Obtain and report survey check shots to document quality assurance/quality control (QA/QC) measures and to document horizontal and vertical survey accuracies. Post-processing reports shall be provided where the global positioning system (GPS) is used. The surveyor shall provide documentation of QA and QC completed upon request and at the time of the surveyor's report final deliverable.
- All data and deliverables prepared for this survey are the property of the Owner and CH2M HILL, Inc. (CH2M). The surveyor also understands and agrees that the Owner and CH2M may reproduce the drawings and use all or part of the information provided on the drawings. This includes any reports prepared in connection with the investigative work for this site without incurring obligation for additional compensation to the surveyor. The original drawings, copies of field notes, and any required survey reports shall be and shall remain the property of the Owner and CH2M. All required documents and copies of field notes shall be submitted to CH2M upon completion of the work or upon request.
- Daily information shall be recorded in hard copy field notebook format, and any data collector information shall also be provided to CH2M. Electronic field notes alone are not acceptable. In addition, QA/QC checks and other measurement information shall be included in the field notes. The field notes shall include the following: the date, names of the crew, weather conditions, barometric pressure, and all collected survey data information. The field notes shall contain enough sketches and other information to clearly show the work performed, including control monuments used and set. The field notes shall be complete enough for retracement of the surveys by others.

- Where practical, traverses and level loops shall include and verify two different permanent control monuments. Where not practical, they shall be closed to the starting point control monument, and the closure error recorded. If the error is above the standards outlined above, then the surveyor shall re-run the horizontal and/or vertical traverses until the errors are reduced to within the acceptable range.
- All surveyed features shall be incorporated into the base mapping. A CH2M field representative will be onsite to confirm the exact survey area.

1.1.2 Specifications of Work

- The surveyor shall perform and provide data as for the following surveys, at a minimum:
  - Pre-excavation survey
  - Post-excavation survey after removal of existing topsoil
  - Post-excavation survey after removal of existing sand layer
  - Post-excavation survey after removal of existing clay cap
  - Post-excavation survey after removal of impacted material
  - Post-backfilling survey after placement of general backfill to confirm bottom of clay cap elevation
    - Within 0.50 foot of original grade
  - Post-backfilling survey after placement of clay cap material to confirm top of clay cap elevation/bottom of sand layer elevation
    - Within 0.10 foot of original grade
  - Post-backfilling survey after placement of sand layer to confirm top of sand layer elevation/bottom of topsoil elevation
    - Within 0.10 foot of original grade
  - Post-backfilling survey after placement of topsoil to confirm pre-seeding placement grade
    - Within 0.10 foot of original grade
- The objective for this task is the delivery of 1”=20-feet scale, one-half foot contour interval accuracy planimetric and topographic mapping to the accuracies specified in this document for “Other Field Surveys” and to deliver a one-half-foot contour interval accuracy DTM file to be used for volume calculations.
- Accuracy of Control: The surveyor shall recover or establish horizontal and vertical control monuments for the site. The horizontal accuracy of the control shall be Third Order Class I, (1:10,000) or better, and the vertical accuracy shall be Third Order, (0.05√m) as outlined in the Federal Geographic Data Committee (FGDC) Geospatial Positioning Accuracy Standards, Part 4: Standards for Architecture, Engineering, Constructions (A/E/C) and Facility Management.

  Prior to using GPS survey methods to establish onsite control, the surveyor shall describe their planned method and provide the CH2M project manager with their determination of the horizontal and vertical accuracy they can achieve based on their planned GPS methodology and baseline lengths and how they plan to document achievement of the attained accuracy. **GPS cannot be used until the accuracy determination is provided by the surveyor and is approved by the project manager.**
- If GPS is allowed for establishing onsite horizontal control, then the surveyor shall also perform and document direct field measurement checks between the monuments established using GPS.
- If GPS is allowed for establishing vertical control, then the surveyor shall also perform and document direct differential level loop closure checks between the monuments established using GPS.

- Accuracy of all Other Field Surveys: Other than the control surveys, field survey mapping shall comply with FGDC Geospatial Positioning Accuracy Standards, Part 4: Standards for A/E/C, and facility management with relative accuracy tolerances of ±0.25 foot for the horizontal and ±0.07 foot for the vertical on all hard surfaces (including compacted ground surfaces) and ±0.10 foot for the vertical on soft or natural ground surfaces.
- The surveyor shall provide coordinates of all points X, Y, and Z to the nearest 0.01 foot, except ground control coordinates shall be reported to three decimal places.
- Daily information shall be recorded in hard copy field book format and copies provided to CH2M. All data collector information shall also be provided to CH2M. Field notes shall include sketches to show the location of control points and other information to allow for review and retracement of the survey. Electronic field notes alone are not acceptable. They shall also include the following: the date, names of the crew, weather conditions, and all collected survey data information.
- Where practical, all differential level and horizontal traverses shall be closed to a second benchmark or control monument and the errors recorded. If the errors are above the standards outlined above, then the survey shall re-run the horizontal and vertical traverses until the errors are eliminated within the acceptable range.
- The surveyor shall research, recover, and confirm the existing past project horizontal and vertical control networks found on or near the properties. The surveyor shall confirm that the horizontal and vertical coordinate system and datum(s) specified herein (including adjustments) are consistent with the coordinate system and datum(s) currently in use on the properties. If the surveyor determines that the past systems are different than those specified herein, then the surveyor shall explain the differences and shall work with the project manager to decide which systems to use for the work identified in this document. Unless otherwise agreed to in writing, the horizontal coordinate system and horizontal and vertical datum(s) shall be as follows:
  - The project horizontal coordinate system and datum shall be the Michigan State Plane Coordinates System, South Zone, North American Datum of 1983 (NAD83) most current adjustment.
  - The project vertical datum shall be the North American Vertical Datum of 1988, most current adjustment.
- The unit of measure shall be the International Foot.

1.1.3 Standards and Delivery Formats

Survey Accuracy Standard –
FGDC Geospatial Positioning Accuracy Standards, Part 4: Standards for A/E/C, and Facility Management.

Map Accuracy Standard –
ASPRS (Map) Accuracy Standards – Class 1 for the required map scale and contour interval, except the X, Y, and Z positions for all surveyed points shown in the mapping shall comply with the survey accuracy standards cited in this scope of work.

CAD Standard –
National CAD Standards (NCS), as published for the National Institute of Building Sciences.

Geographic Information System (GIS) Standard –
Spatial Data Standards for Facilities, Infrastructure and Environment (SDSFIE), version 2.6.

GIS Format –
GIS deliverables shall be provided in either ESRI's shape file (.shp) or geodatabase (.gdb) format, along with an accompanying map document (.mxd) in ArcMap Version 10.2 or newer. All shape files and/or geodatabases must adhere to the **Spatial Data Standards for Facilities, Infrastructure and Environment (SDSFIE), version 2.6**. **At a minimum, the naming convention of SDSFIE must be followed and relevant attribute information populated.** Should the subcontractor be unable to provide the information in the SDSFIE format, the subcontractor shall provide to CH2M information to define the GIS format proposed for use and obtain acceptance from the CH2M project manager prior to use.

CAD Format –
CAD deliverables shall be provided in a native current version of MicroStation or AutoCAD electronic format. All electronic drawing symbology must conform to the CAD Standards identified above**.**

Minimum Content of the Map/Drawing Deliverables –

Construction staking Record Map: Scale to be proposed by the surveyor for approval by CH2M.

As-Built Survey Base Mapping: For plotting at 1 inch = 20 feet horizontal scale.

Minimum Content Requirements		
Title block	North arrow	Scale (Bar) and contour interval
Date of survey	Legend with symbols and abbreviations	Coordinate system and datum – horizontal and vertical
Grid Ticks – A minimum of four labeled grid ticks	Grid Values – Coordinate system values for the grid ticks	All survey control monuments found and set
Subcontractors Certificate – Which certifies that all work complies with the accuracy requirements and with federal, state, laws, codes, ordinances, rules, and regulations.	Subcontractors (Surveyor's) stamped, dated, and signed seal	

Coordinate Listing of Surveyed Points –
A Microsoft Excel spreadsheet file containing ALL **survey shots/points** shall be provided in the following format:

- Point number/name, northing, easting, elevation, field code, and point description.
- Control point northings and eastings and elevations shall be reported to 3 decimal places.
- The northing, easting, and elevation for all points, other than control points, shall be reported to 2 decimal places.
- All field-collected data shall have unique point numbers/names assigned and point numbers/names shall not be re-used in subsequent field surveys for the project.

1.1.4 Detailed Scope of Services by Task

Control Surveys
If existing horizontal control monuments are not recovered very near the properties, then two inter-visible pair (three semi-permanent) control monuments shall be set (e.g., 30-inch or longer, #5 rebar or larger, or equivalent, driven to refusal and appropriately capped and marked). These monuments shall be set at ground level and shall achieve the accuracies stated herein.

If existing vertical monuments are not recovered very near the properties, then two pairs of semi-permanent vertical benchmark control monuments (three benchmarks) shall be set. These monuments can be the same points as the horizontal control monuments if there are no existing features or structures available that would provide more stability for vertical control monuments (e.g., bridge headwalls, building foundation, sidewalks, curbs, etc. where a chiseled square could be generated).

Construction activities will be performed within the survey/mapping area; therefore, the horizontal and vertical control monuments shall be set nearby but outside of the survey area in an area that will be undisturbed by construction activities.

When control is established, regardless of the techniques used (e.g., GPS or conventional Total Station survey) the surveyor shall conduct direct conventional field measurements to confirm the accuracy of the new control points and shall report the results. The surveyor shall base all surveys, horizontal and vertical, on the survey control monuments recovered or established as the project control monuments.

Control Surveys shall include the following:

1. Recovered or established NAD83 State Plane Coordinate System horizontal control monuments.
2. Recovered or established Project North American Vertical Datum of 1988 benchmark monuments.
3. Data sheets, descriptions, to-reach descriptions, photographs, and coordinate listings of all found and set control monuments.
4. All other information described in the scope of work regarding the control shall be included as part of the surveyor's report and/or base mapping deliverables.

Surveyor's Report
Surveyor's Report shall include the following:

1. A survey report shall be prepared and delivered addressing all survey fieldwork and aerial mapping performed. The survey report shall include the following:
    a. Copies of all field notes, manual, and electronic.
    b. Documentation of the horizontal coordinate system and horizontal and vertical datum(s) and adjustments.
    c. The control monuments recovered and set, and those used as the basis for the surveys.
    d. The surveyor's report shall describe the equipment and methodology used to perform the work and shall also describe the results of the survey and accuracies attained.
    e. Documentation of the QC procedures and checks performed and their results.
    f. The report shall contain a coordinate point listing for all points field surveyed provided in both paper and Microsoft Excel electronic format.
    g. The report shall be stamped, dated, and signed by the surveyor who shall certify that the work was completed in compliance with the specifications and that the deliverables meet or exceed (are better than) the specified accuracy requirements.
    h. The surveyor's report shall be delivered in hard copy, in pdf format, and in Microsoft Word format. It shall be delivered in draft in Word format for review and comment by CH2M. A final version, addressing all comments, shall also be delivered.

2. A record map containing all points surveyed. The map shall include the minimum content requirements listed in the table in the Minimum Content of Map/Drawing Deliverables section of this document. This deliverable shall be delivered in ESRI ArcMap GIS format, including an .mxd map document in ArcMap10.2.1 or higher and associated shape files or a personal geodatabase. If the surveyor does not have ESRI GIS capabilities, then the CAD deliverables shall be delivered in a manner that can be easily converted to GIS. The ease of conversion to GIS shall be demonstrated as part of the delivery.

SECTION 01 31 19
PROJECT MEETINGS

PART 1 GENERAL

1.01 GENERAL

A. Subcontractor shall participate in specified project meetings as required herein. The meetings include, but are not limited to, the following:

1. Pre-construction conference.
2. Scheduling meetings.
3. Pre-construction meetings.
4. Preparatory phase meetings.
5. Pre- and Post-construction meetings with adjacent property owners.
6. Post-construction meetings.
7. Daily tailgate meetings.
8. Weekly progress meetings.
9. Final post-construction meeting.
10. Other meetings that may be determined necessary during the construction period.

B. Contractor shall schedule physical arrangements for meetings throughout progress of the Work, prepare meeting agenda with regular participant input and distribute with written notice of each meeting, preside at meetings, record minutes to include significant proceedings and decisions, and reproduce and distribute copies of minutes within 2 days after each meeting to participants and parties affected by meeting decisions.

1.02 PRECONSTRUCTION CONFERENCE

A. Subcontractor shall attend a one-time mandatory preconstruction conference, which will be held in St. Louis, Michigan, prior to mobilization. The exact date and time will be determined at the time of Subcontract Award. Subcontractor shall be prepared to discuss the following subjects, as a minimum:

1. Required schedules.
2. Status of Bonds and insurance.
3. Sequencing of critical path work items.
4. Progress payment procedures.
5. Project changes and clarification procedures.
6. Use of Site, access, office and storage areas, security and temporary facilities.

7. Major product delivery and priorities.
8. Activity Hazard Analyses.
9. Subcontractor Air Monitoring Plan.
10. Subcontractor Noise Control Plan.
11. Subcontractor Excavation Plan.
12. Subcontractor Water Control Plan.
13. Subcontractor Shoring Plan and Movement Monitoring Plan.
14. Subcontractor Transportation and Disposal Plan.
15. Status of permits, license or required approvals.
16. Status of Required submittals.
17. Maintaining required records.
18. Subcontractor's safety plan and representative.
19. Subcontractor Key Personnel Information and Points of Contact for 24-hours per day, 7 days a week.
20. Subcontractor Quality Control Plan.

B. Attendees will include:

1. Contractor's representatives.
2. Owner's representatives.
3. Subcontractor's office representative.
4. Subcontractor's project manager
5. Subcontractor's resident superintendent.
6. Subcontractor's quality control representative.
7. Lower-tiered Subcontractors' representatives and/or Suppliers whom Subcontractor may desire or Contractor may request to attend.
8. Others as appropriate.

1.03 PRELIMINARY SCHEDULES REVIEW MEETING

A. As set forth in General Conditions and Section 01 32 00, Construction Progress Documentation.

1.04 PREPARATORY PHASE MEETINGS

A. Preparatory Phase meetings shall be held to review each definable feature of work (DFOW), as outlined in Section 01 45 16.13, Subcontractor Quality Control.

1.05 PRE- AND POST-CONSTRUCTION MEETINGS WITH ADJACENT PROPERTY OWNERS

A. Prior to installation of the excavation support wall and start of excavation activities, meetings will be conducted with the adjacent property owners along Watson Street, as specified in Section 01 31 13, Project Coordination.

B. After removal of the excavation support wall, the Contractor and Subcontractor will do a post-construction meeting with the adjacent property owners along Watson Street, as specified in Section 01 31 13, Project Coordination.

1.06 DAILY TAILGATE MEETINGS

A. Daily tailgate meetings shall be conducted every workday morning at 7 a.m. Eastern time (or earlier) with Contractor prior to starting Work for the day. Generally, attendees for this meeting will include all Subcontractor and lower-tier Subcontractor personnel who will be working that day. Documentation of the meeting shall be provided to Contractor by 10 a.m. that same day.

B. Daily tailgate meetings shall discuss the following subjects, as a minimum:

1. The work planned for the day.
2. Changes in work assignment.
3. Health and safety issues.
4. Quality issues.
5. Review problems encountered the previous day.
6. Review and sign the AHA prior to beginning any Work onsite.

1.07 WEEKLY PROGRESS MEETINGS

A. Contractor will schedule regular progress meetings at the site, conducted weekly to review construction progress, safety performance since the previous meetings, progress schedule, sample collection and submissions schedule, contract modifications, Quality Control meetings and other matters that require discussion and resolution.

B. Submittals required for each weekly progress meeting will include, at a minimum:

1. Updated progress schedule.
2. Updated schedule of values.

C. Attendees will include:

1. Owner’s representative(s), as appropriate.
2. Contractor’s representative(s).
3. Subcontractor’s representative(s).
4. Lower-tiered Subcontractors’ representative(s) and Suppliers, as appropriate.
5. Others as appropriate.

1.08 QUALITY CONTROL MEETINGS

A. In accordance with Section 01 45 16.13, Subcontractor Quality Control.

B. Scheduled by Contractor on regular basis and as necessary to review test and inspection reports, and other matters relating to quality control of the Work and work of other Subcontractors.

C. Attendees will include:

1. Subcontractor.
2. Subcontractor's designated quality control representative.
3. Lower-tiered Subcontractors and Suppliers, as necessary.
4. Owner's and Contractor's quality control representatives.

1.09 POSTCONSTRUCTION MEETINGS

A. Preliminary Post-Construction meetings will be conducted following completion of restoration to review acceptability of completed Work and to develop punch list items as required. During the meeting a copy of the edited survey notes and construction drawings will be reviewed. Contractor will coordinate and lead the meetings with the Owner and Subcontractor in attendance at the site.

B. A final Post-Construction meeting will be conducted one week after the preliminary post-construction meeting. Subcontractor shall attend a mandatory final post-construction meeting for the project, which will be scheduled after completion of all field activities but prior to Subcontractor demobilization. The purpose of this final inspection/meeting is to close out any punch list items, discuss schedule for demobilization, and discuss delivery of all required deliverables.

1.10 OTHER MEETINGS

A. In accordance with Subcontract Documents and as may be required by Owner and Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.01 SUBMITTALS

A. A Preliminary Progress Schedule shall be submitted with the Subcontractor's proposal and an updated one during the pre-construction conference.

B. Overall Progress Schedule: Submit adjusted schedule with each Monthly Application for Payment in accordance with the General Term and Conditions, and at such other times as necessary to reflect:

1. Progress of Work to within 2 working days prior to submission;
2. Changes in Work scope and activities modified since submission;
3. Delays in Submittals or resubmittals, deliveries, or Work;
4. Adjusted or modified sequences of Work;
5. Other identifiable changes; and
6. Revised projections of progress and completion.

C. Weekly Progress Schedule: Submit adjusted schedule weekly at weekly progress meeting to reflect:

1. Progress of Work to within 2 working days prior to submission;
2. Changes in Work scope and activities modified since submission;
3. Delays in Submittals or resubmittals, deliveries, or Work;
4. Adjusted or modified sequences of Work;
5. Other identifiable changes; and
6. Revised projections of progress and completion.

D. For each progress schedule submission,

1. Subcontractor's certification that Progress Schedule submission is actual schedule being utilized for execution of the Work.
2. Three legible paper copies and one electronic copy shall be provided in specified application format.
3. Disk file compatible with Microsoft Office Project 13 unless otherwise approved by Contractor.
4. Narrative Progress Report: Same number of copies as specified for Progress Schedule.
5. Prior to final payment, submit a final Updated Progress Schedule.

1.02 SCHEDULE COORDINATION

A. The Contractor will develop and maintain a master Progress Schedule utilizing Progress Schedules prepared by the Subcontractor as submitted to the Contractor under this section.

B. The construction schedule will be reviewed during the weekly progress meetings.

1.03 PRELIMINARY PROGRESS SCHEDULE

A. The schedule shall show major Work activities, beginning with Notice to Proceed. The major Work activities will include project coordination, mobilization, and all major activities outlined in Summary of Work through Final Completion.

B. Show activities including, but not limited to the following:

1. Notice to Proceed.
2. Permits.
3. Preconstruction Conference.
4. Project Mobilization Activities.
5. Submittals, with review time. Contractor may use Schedule of Submittals specified in Section 01 33 00, Submittal Procedures.
6. Early procurement activities for long lead equipment and materials.
7. Initial Site work.
8. Earthwork.
9. Specified Work sequences and construction constraints.
10. Contract Milestone and Completion Dates.
11. Post-construction Meetings.
12. Project Close-out Summary.
13. Demobilization Summary.

C. The Preliminary Progress Schedule shall show Work approach, sequences and constraints. This schedule data will be used by the Subcontractor in preparation of the Detailed Progress Schedule.

D. Format: In accordance with Article Progress Schedule—Bar Chart.

1.04 DETAILED PROGRESS SCHEDULE

A. Prior to the Pre-construction Conference, submit Detailed Progress Schedule with each corresponding definable feature of work (DFOW) beginning with Notice to Proceed and continuing through Final Completion.

B. Show the duration and sequences of activities required for complete performance of the Work reflecting means and methods chosen by Subcontractor.

C. When accepted by Contractor, Detailed Progress Schedule will replace Preliminary Progress Schedule and become Baseline Schedule. Subsequent revisions will be considered as Updated Progress Schedules, and shall provide progress/actual dates to baseline start and baseline finish dates.

D. Format: In accordance with Article Progress Schedule—Bar Chart.

E. Update weekly to reflect actual progress and occurrences to date, including weather delays.

1.05 PROGRESS SCHEDULE—BAR CHART

A. General: Comprehensive bar chart schedule, generally as outlined in Associated General Contractors of America (AGC) 580, “Construction Project Planning and Scheduling Guidelines.” If a conflict occurs between the AGC publication and this Specification, this Specification shall govern.

B. Format:

1. Color print on 11-inch by 17-inch sheet size.
2. Title Block: Show name of Project, Owner, date submitted, revision or update number, and the name of the scheduler. Updated schedules shall indicate data date.
3. Identify horizontally across top of schedule the time frame by year, month, and day.
4. Identify each activity with a unique number and a brief description of the Work associated with that activity.
5. Indicate the critical path.
6. Show, at a minimum, the controlling relationships between activities.
7. Plot activities on a time-scaled basis, with the length of each activity proportional to the current estimate of the duration.
8. Plot activities on an early start basis unless otherwise requested by Contractor.
9. Provide a legend to describe standard and special symbols used.
10. Schedule shall show accepted baseline start and finish dates, and actual start and finish dates.

C. Contents:

1. Schedule shall begin with the date of Notice to Proceed and conclude with the date of Final Completion.
2. Identify Work calendar basis using days as a unit of measure.

3. Show complete interdependence and sequence of construction and Project-related activities reasonably required to complete the Work.
4. Identify the Work of separate stages and other logically grouped activities, and clearly identify critical path of activities.
5. Reflect sequences of the Work, restraints, delivery windows, review times, Subcontract Times and Project Milestones set forth in the Agreement and this section.
6. Include as applicable, at a minimum:
    a. Obtaining permits, submittals for early product procurement, and long lead time items.
    b. Mobilization and other preliminary activities.
    c. Pre-construction and Post-construction meetings.
    d. Specified Work sequences, constraints, and Milestones, including Substantial Completion date(s) Subcontract Work.
    e. Excavation support wall installation.
    f. Groundwater elevation control tile abandonment.
    g. Excavation of each PSA.
    h. Backfill for each PSA.
    i. Restoration of each PSA.
    j. Maintenance periods.
    k. Maintenance.
    l. Project closeout and cleanup.
    m. Demobilization.

D. Network Graphical Display:

1. Color print on 11x17 paper.
2. Title Block: Show name of Project, Owner, date submitted, revision or update number, and the name of the scheduler. Updated schedules shall indicate data date.
3. Identify horizontally across top of schedule the time frame by year, month, and day.
4. Identify each activity with a unique number and a brief description of the Work associated with that activity.
5. Indicate the critical path.
6. Show, at a minimum, the controlling relationships between activities.
7. Plot activities on a time-scaled basis, with the length of each activity proportional to the current estimate of the duration.
8. Plot activities on an early start basis unless otherwise requested by Contractor.
9. Provide a legend to describe standard and special symbols used.

E. Schedule Report:

1. On 8-1/2-inch by 11-inch white paper, unless otherwise approved.

2. List information for each activity in tabular format, including at a minimum:
    a. Activity Identification Number.
    b. Activity Description.
    c. Original Duration.
    d. Remaining Duration.
    e. Early Start Date (Actual start on Updated Progress Schedules).
    f. Early Finish Date (Actual finish on Updated Progress Schedules).
    g. Late Start Date.
    h. Late Finish Date.
    i. Total Float.
3. Sort reports, in ascending order, as listed below: Activity number sequence with predecessor and successor activity.

1.06 PROGRESS OF THE WORK

A. Updated Progress Schedule shall reflect:

1. Progress of Work to within 2 working days prior to submission.
2. Approved changes in Work scope and activities modified since submission.
3. Delays in Submittals or resubmittals, deliveries, or Work.
4. Adjusted or modified sequences of Work.
5. Other identifiable changes.
6. Revised projections of progress and completion.
7. Report of changed logic.

B. If Subcontractor fails to complete activity by its latest scheduled completion date and this failure may extend Subcontract Times (or Milestones), Subcontractor shall, within 3 days of such failure, submit a written statement as to how Subcontractor intends to correct nonperformance and return to the acceptable current progress schedule. Actions by Subcontractor to complete Work within Subcontract Times (or Milestones) will not be justification for adjustment to Subcontract Price or Subcontract Times.

C. Contractor may order Subcontractor to increase, equipment, labor force or working hours if Subcontractor fails to:

1. Complete a critical scheduled activity by its latest Milestone completion date.
2. Satisfactorily execute Work as necessary to prevent delay to the overall completion of the project without any additional compensation to the Subcontractor.

1.07 OVERALL PROGRESS SCHEDULE

A. Notice to Proceed will be issued only after the Overall Progress Schedule has been reviewed as acceptable by Contractor in accordance with Section 01 33 00, Submittal Procedures. Contractor will review the initial submittal and subsequent resubmittals of the Overall Progress Schedule within 7 calendar days of receipt.

B. Schedule(s) shall reflect Work logic sequences, restraints, delivery windows, review times, Subcontract Times, and Milestones set forth in the Agreement and shall begin with the date of Notice to Proceed and conclude with the date of Final Completion.

C. The schedule requirement herein is the minimum required.

D. Subcontractor may prepare a more sophisticated schedule if such will aid Subcontractor in execution and timely completion of Work.

E. Float time is a Project resource available to both parties to meet contract Milestones and Subcontract Times.

F. Use of float suppression techniques such as preferential sequencing or logic, special lead/lag logic restraints, and extended activity times are prohibited, and use of float time disclosed or implied by use of alternate float-suppression techniques shall be shared to proportionate benefit of the Contractor and Subcontractor.

G. Pursuant to above float-sharing requirement, no time extensions will be granted nor delay damages paid until a delay occurs which (i) impacts Project’s critical path, (ii) consumes available float or contingency time, and (iii) extends Work beyond contract completion date.

H. If Subcontractor provides an accepted schedule with an early completion date, Contractor reserves the right to reduce Subcontract Times to match the early completion date by issuing a deductive Change Order at no change in Subcontract Price.

1.08 NARRATIVE PROGRESS REPORT

A. Format:

1. Organize same as Progress Schedule.
2. Identify, on a cover letter, reporting period, date submitted, and name of author of report.

B. Contents:

1. Number of days worked over the period, work force on hand, construction equipment on hand (including utility vehicles such as pickup trucks, maintenance vehicles, stake trucks).
2. General progress of Work, including a listing of activities started and completed over the reporting period, mobilization/demobilization of subcontractors, and major milestones achieved.
3. Subcontractor's plan for management of Site (e.g., lay down and staging areas, construction traffic), utilization of construction equipment, buildup of trade labor, and identification of potential Subcontract changes.
4. Identification of new activities and sequences as a result of executed Subcontract changes.
5. Documentation of weather conditions over the reporting period, and any resulting impacts to the work.
6. Description of actual or potential delays, including related causes, and the steps taken or anticipated to mitigate their impact.
7. Changes to activity logic.
8. Changes to the critical path.
9. Identification of, and accompanying reason for, any activities added or deleted since the last report.
10. Steps taken to recover the schedule from Subcontractor-caused delays.

1.09 SCHEDULE ACCEPTANCE

A. Contractor's acceptance will demonstrate agreement that:

1. Proposed schedule is accepted with respect to:
   a. Contract Times, including Final Completion and all intermediate Milestones are within the specified times.
   b. Specified Work sequences and constraints are shown as specified.
   c. Specified Owner-furnished Equipment or Material arrival dates, or range of dates, are included.
   d. Access restrictions are accurately reflected**.**
   e. Startup and testing times are as specified.
   f. Submittal review times are as specified.
   g. Startup testing duration is as specified and timing is acceptable.
2. In all other respects, Contractor's acceptance of Subcontractor's schedule indicates that, in Contractor's judgement, schedule represents reasonable plan for constructing Project in accordance with the Contract Documents. Contractor's review will not make any change in Contract requirements. Lack of comment on any aspect of schedule that is not in accordance with the Contract Documents will not thereby indicate acceptance of that change, unless Subcontractor has explicitly called the

nonconformance to Contractor's attention in submittal. Schedule remains Subcontractor's responsibility and Subcontractor retains responsibility for performing all activities, for activity durations, and for activity sequences required to construct Project in accordance with the Contract Documents.

B. Unacceptable Preliminary Progress Schedule:

1. Make requested corrections; resubmit within 5 days.
2. Until acceptable to Contractor as Baseline Progress Schedule, continue review and revision process, during which time Subcontractor shall update schedule on a monthly basis to reflect actual progress and occurrences to date.

C. Unacceptable Detailed Progress Schedule:

1. Make requested corrections; resubmit within 5 days.
2. Until acceptable to Contractor as Baseline Progress Schedule, continue review and revision process.

D. Narrative Report: All changes to activity duration and sequences, including addition or deletion of activities subsequent to Contractor's acceptance of Baseline Progress Schedule, shall be delineated in Narrative Report current with proposed Updated Progress Schedule.

1.10 CLAIMS FOR ADJUSTMENT OF SUBCONTRACT TIMES

A. Where Contractor has not yet rendered formal decision on Subcontractor's claim for adjustment of Subcontract Times, and parties are unable to agree as to amount of adjustment to be reflected in progress schedule, Subcontractor shall reflect that amount of time adjustment in progress schedule as Contractor may accept as appropriate for the interim. It is understood and agreed that such interim acceptance by Contractor will not be binding and will be made only for purpose of continuing to schedule Work, until such time as formal decision as to an adjustment, if any, of the Subcontract Times acceptable to Contractor has been rendered. Subcontractor shall revise progress schedule prepared thereafter in accordance with Contractor's formal decision.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 DEFINITIONS

A. Action Submittal: Written and graphic information submitted by Subcontractor that requires Contractor's approval.

B. Informational Submittal: Information submitted by Subcontractor that requires Contractor's review and determination that submitted information is in accordance with the Conditions of the Contract.

1.02 PROCEDURES

A. Direct submittals, except samples, in electronic format to Contractor at SharePoint website to be supplied by Contractor. If SharePoint website is down or not reachable, the Subcontractor shall notify the Contractor via email.

B. Direct sample submittals to the Contractor at the following, unless specified otherwise.

CH2M
41850 West 11 Mile Road,
Suite 101
Novi, MI 48375
Attn: Scott Pratt

C. Electronic Submittals: Submittals shall, unless otherwise specified, be made in electronic format.

1. Each submittal shall be an electronic file in Adobe Acrobat Portable Document Format (PDF). Use the latest version available at time of execution of the Agreement.
2. Electronic files that contain more than 10 pages in PDF format shall contain internal bookmarking from an index page to major sections of the document.
3. PDF files shall be set to open "Bookmarks and Page" view.
4. Add general information to each PDF file, including title, subject, author, and keywords.
5. PDF files shall be set up to print legibly at 8.5-inch by 11-inch or 11-inch by 17-inch No other paper sizes will be accepted.

6. Submit new electronic files for each resubmittal.
7. Include a copy of the Transmittal of Submittal form, with each electronic file.
8. Provide Contractor with authorization to reproduce and distribute each file as many times as necessary for Project documentation.

A. Transmittal of Submittal:

1. Subcontractor shall:
   a. Review each submittal and check for compliance with Subcontract Documents.
   b. Subcontractor is responsible for thorough review of Lower-tier Subcontractor submittals, prior to submittal to Contractor for final review and approval.
   c. Stamp each submittal with uniform approval stamp before submitting to Contractor.
      1) Stamp to include Project name, submittal number, Specification number, Subcontractor's reviewer name, date of Subcontractor's approval, and statement certifying submittal has been reviewed, checked, and approved for compliance with Subcontract Documents.
      2) Contractor will not review submittals that do not bear Subcontractor's approval stamp certifying the submittal has been checked and approved for compliance with Subcontract Documents and will return them without action.
2. Complete, sign, and transmit with each submittal package, one Transmittal of Subcontractor's Submittal form attached at end of this section.
3. Identify each submittal with the following:
   a. Numbering and Tracking System:
      1) Sequentially number each submittal.
      2) Resubmission of submittal shall have original number with sequential alphabetic suffix.
   b. Specification section and paragraph to which submittal applies.
   c. Project title and Contractor's project number.
   d. Date of transmittal.
   e. Names of Contractor, Subcontractor or Supplier, and manufacturer as appropriate.
4. Identify and describe each deviation or variation from Contract Documents.
5. All action and information submittals will be submitted electronically on a SharePoint site. SharePoint site address will be provided by Contractor.

B. Format:

1. Do not base Shop Drawings on reproductions of Subcontract Documents.
2. Package submittal information by individual Specification section. Do not combine different Specification sections together in submittal package, unless otherwise directed in Specification.
3. Present in a clear and thorough manner and in sufficient detail to show kind, size, arrangement, and function of components, materials, and devices, and compliance with Subcontract Documents.
4. Index with labeled tab dividers in orderly manner.

C. Timeliness: Schedule and submit in accordance Schedule of Submittals, and requirements of individual Specification sections.

D. Processing Time:

1. Time for review shall commence on Contractor's receipt of submittal.
2. Contractor will act upon Subcontractor's submittal and transmit response to Subcontractor not later than 10 work days after receipt, unless otherwise specified.
3. Resubmittals will be subject to same review time.
4. No adjustment of Contract Times or Price will be allowed as a result of delays in progress of Work caused by rejection and subsequent resubmittals.

E. Resubmittals: Clearly identify each correction or change made.

F. Incomplete Submittals:

1. Contractor will return entire submittal for Subcontractor's revision if preliminary review deems it incomplete.
2. When any of the following are missing, submittal will be deemed incomplete:
    a. Subcontractor's review stamp; completed and signed.
    b. Transmittal of Subcontractor's Submittal; completed and signed.
    c. Insufficient number of copies.

G. Submittals not required by Subcontract Documents:

1. Will not be reviewed and will be returned stamped "Not Subject to Review."
2. Contractor will keep one copy and return submittal to Subcontractor.

1.03 ACTION SUBMITTALS

A. Prepare and submit Action Submittals required by individual Specification sections.

B. Shop Drawings:

1. Copies: 1 hardcopy unless requested otherwise by the Contractor, and one reproducible electronic copy on CD, except copyrighted documents.
2. Identify and Indicate:
    a. Applicable Contract Drawing and Detail number, products, units and assemblies, and system or equipment identification or tag numbers.
    b. Equipment and Component Title: Identical to title shown on the Drawings.
    c. Critical field dimensions and relationships to other critical features of Work. Note dimensions established by field measurement.
    d. Project-specific information drawn accurately to scale.
3. Manufacturer's standard schematic drawings and diagrams as follows:
    a. Modify to delete information that is not applicable to the Work.
    b. Supplement standard information to provide information specifically applicable to the Work.
4. Product Data: Provide as specified in individual Specifications.
5. Foreign Manufacturers: When proposed, include following additional information:
    a. Names and addresses of at least two companies that maintain technical service representatives close to Project.
    b. Complete list of spare parts and accessories for each piece of equipment.

C. Samples:

1. Copies: Two, unless otherwise specified in individual Specifications.
2. Preparation: Mount, display, or package Samples in manner specified to facilitate review of quality. Attach label on unexposed side that includes the following:
    a. Manufacturer name.
    b. Model number.
    c. Material.
    d. Sample source.
3. Manufacturer's Color Chart: Units or sections of units showing full range of colors, textures, and patterns available.

4. Full-size Samples:
   a. Size as indicated in individual Specification section.
   b. Prepared from same materials to be used for the Work.
   c. Cured and finished in manner specified.
   d. Physically identical with product proposed for use.

D. Action Submittal Dispositions: Contractor will review, submittals and respond as appropriate:

1. Approved:
   a. Subcontractor may incorporate product(s) or implement Work covered by submittal.
   b. Distribution:
      1) One copy retained by Contractor.
      2) One copy furnished to Contractor's onsite Representative.
      3) Remaining copies returned to Subcontractor appropriately annotated.
2. Approved as Noted:
   a. Subcontractor may incorporate product(s) or implement Work covered by submittal, in accordance with Contractor's notations.
   b. Distribution:
      1) One copy retained by Contractor.
      2) One copy furnished to Contractor's onsite Representative.
      3) Remaining copies returned to Subcontractor appropriately annotated.
3. Partial Approval, Resubmit as Noted:
   a. Make corrections or obtain missing portions, and resubmit.
   b. Except for portions indicated, Subcontractor may begin to incorporate product(s) or implement Work covered by submittal, in accordance with Contractor's notations.
   c. Distribution:
      1) One copy retained by Contractor.
      2) One copy furnished to Contractor's onsite Representative.
      3) Remaining copies returned to Subcontractor appropriately annotated.
4. Revise and Resubmit:
   a. Subcontractor may not incorporate product(s) or implement Work covered by submittal.
   b. Distribution:
      1) One copy retained by Contractor.
      2) One copy furnished to Contractor's onsite Representative.
      3) Remaining copies returned to Subcontractor appropriately annotated.

1.04 INFORMATIONAL SUBMITTALS

A. General:

1. Copies: Submit three copies, unless otherwise indicated in individual specification section or directed otherwise by Contractor.
2. Refer to individual Specification sections for specific submittal requirements.
3. Contractor will review each submittal. If submittal meets conditions of the Contract, Contractor will forward copy to appropriate parties. If Contractor determines submittal does not meet conditions of the Contract and is therefore considered unacceptable, Contractor will retain a copy of the submittal and return remaining copy with review comments to Subcontractor, and require that submittal be corrected and resubmitted.

B. Certificates:

1. General:
   a. Provide notarized statement that includes signature of entity responsible for preparing certification.
   b. Signed by officer or other individual authorized to sign documents on behalf of that entity.
2. Installer: Prepare written statements on manufacturer’s letterhead certifying installer complies with requirements as specified in individual Specification section.
3. Material Test: Prepared by qualified testing agency, on testing agency’s standard form, indicating and interpreting test results of material for compliance with requirements.
4. Certificates of Successful Testing or Inspection: Submit when testing or inspection is required by Laws and Regulations or governing agency or specified in individual Specification sections.

C. Construction Photographs: In accordance with Section 01 31 13, Project Coordination, and as may otherwise be required in Subcontract Documents.

D. Closeout Submittals: In accordance with Section 01 77 00, Closeout Procedures.

E. Subcontractor-design Data (related to temporary construction):

1. Written and graphic information.
2. List of assumptions.
3. List of performance and design criteria.

4. Summary of loads or load diagram, if applicable.
5. Calculations.
6. List of applicable codes and regulations.
7. Information requested in individual Specification section.

F. Manufacturer's Instructions: Written or published information that documents manufacturer's recommendations, guidelines, and procedures in accordance with individual Specification section.

G. Payment:

1. Application for Payment: In accordance with Section 01 29 00, Payment Procedures.
2. Schedule of Values: In accordance with Section 01 29 00, Payment Procedures.

H. Quality Control Documentation: As required in Section 01 45 16.13, Subcontractor Quality Control.

I. Schedules:

1. Schedule of Submittals: Prepare separately or in combination with Progress Schedule as specified in Section 01 32 00, Construction Progress Documentation.
   a. Show for each, at a minimum, the following:
      1) Specification section number.
      2) Identification by numbering and tracking system as specified under Paragraph Transmittal of Submittal.
      3) Estimated date of submission to Contractor, including reviewing and processing time.
   b. On a weekly basis, submit updated Schedule of Submittals to Contractor if changes have occurred or resubmittals are required.
2. Progress Schedules: In accordance with Section 01 32 00, Construction Progress Documentation.

J. Special Warranty: Supplier's written warranty as required in individual Specification sections.

K. Statement of Qualification: Evidence of qualification, certification, or registration as required in Subcontract Documents to verify qualifications of professional land surveyor, engineer, materials testing laboratory, specialty subcontractor, trade, specialist, consultant, installer, and other professionals.

L. Submittals Required by Laws, Regulations, and Governing Agencies:

1. Promptly submit notifications, reports, certifications, payrolls, and otherwise as may be required, directly to the applicable federal, state, or local governing agency or their representative.
2. Transmit to Contractor one copy of correspondence and transmittals (to include enclosures and attachments) between Subcontractor and governing agency.

M. Test, Evaluation, and Inspection Reports:

1. General: Shall contain signature of person responsible for test or report.
2. Factory:
    a. Identification of product and specification section, type of inspection or test with referenced standard or code.
    b. Date and time of test, Project title and number, and name and signature of authorized person.
    c. Date issued, testing laboratory name, address, and telephone number, and name and signature of laboratory inspector.
    d. Test results.
    e. If test or inspection deems material or equipment not in compliance with Subcontract Documents, identify corrective action necessary to bring into compliance.
    f. Provide interpretation of test results, when requested by Contractor.
    g. Other items as identified in individual specification sections.
3. Field:
    a. As a minimum, include the following:
        1) Project title and number.
        2) Date and time.
        3) Record of temperature and weather conditions.
        4) Identification of product and Specification section.
        5) Type and location of test, Sample, or inspection, including referenced standard or code.
        6) Date issued, testing laboratory name, address, and telephone number, and name and signature of laboratory inspector.
        7) If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.
        8) Provide interpretation of test results, when requested by Contractor.
        9) Other items as identified in individual Specification sections.

N. Training Data: In accordance with Section 01 11 00, Summary of Work.

1.05 SUPPLEMENTS

A. The supplements listed below, following “End of Section”, are part of this Specification.

1. Form: Transmittal of Subcontractor’s Submittal.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

TRANSMITTAL OF SUBCONTRACTOR'S SUBMITTAL

(ATTACH TO EACH SUBMITTAL)

DATE: _____

TO: _____ _____ _____ _____ _____ **FROM**: _____ Subcontractor _____ _____ _____	Submittal No.: _____ ☐ New Submittal ☐ Resubmittal Project: _____ Project No.: _____ Specification Section No.: _____ **(Cover only one section with each transmittal)** Schedule Date of Submittal: _____

SUBMITTAL TYPE:	☐ Shop Drawing	☐ Sample	☐ Informational
	☐ Deferred		

The following items are hereby submitted:

Number of Copies	Description of Item Submitted (Type, Size, Model Number, Etc.)	Spec. and Para. No.	Drawing or Brochure Number	Contains Variation to Subcontract	
				No	Yes

Subcontractor hereby certifies that (i) Subcontractor has complied with the requirements of Subcontract Documents in preparation, review, and submission of designated Submittal and (ii) the Submittal is complete and in accordance with the Subcontract Documents and requirements of laws and regulations and governing agencies.

By: _____

Subcontractor (Authorized Signature)

SECTION 01 42 13
ABBREVIATIONS AND ACRONYMS

PART 1 GENERAL

1.01 REFERENCE TO STANDARDS AND SPECIFICATIONS OF TECHNICAL SOCIETIES

A. Reference to standards and specifications of technical societies and reporting and resolving discrepancies associated therewith shall be as provided in Article 3 of the General Conditions, and as may otherwise be required herein and in the individual Specification sections.

B. Work specified by reference to published standard or specification of government agency, technical association, trade association, professional society or institute, testing agency, or other organization shall meet requirements or surpass minimum standards of quality for materials and workmanship established by designated standard or specification.

C. Where so specified, products or workmanship shall also meet or exceed additional prescriptive or performance requirements included within Subcontract Documents to establish a higher or more stringent standard of quality than required by referenced standard.

D. Where two or more standards are specified to establish quality, product and workmanship shall meet or exceed requirements of most stringent.

E. Where both a standard and a brand name are specified for a product in Subcontract Documents, proprietary product named shall meet or exceed requirements of specified reference standard.

F. Copies of standards and specifications of technical societies:

1. Copies of applicable referenced standards have not been bound in these Subcontract Documents.
2. Where copies of standards are needed by Subcontractor, obtain a copy or copies directly from publication source and maintain in an orderly manner at the Site as Work Site records, available to Subcontractor’s personnel, lower-tiered Subcontractors, Owner, and Contractor.

1.02 ABBREVIATIONS

A. Abbreviations for trade organizations and government agencies: Following is a list of construction industry organizations and government agencies to which references may be made in the Contract Documents, with abbreviations used.

1.	AA	Aluminum Association
2.	AABC	Associated Air Balance Council
3.	AAMA	American Architectural Manufacturers Association
4.	AASHTO	American Association of State Highway and Transportation Officials
5.	ABMA	American Bearing Manufacturers' Association
6.	ACI	American Concrete Institute
7.	AEIC	Association of Edison Illuminating Companies
8.	AGA	American Gas Association
9.	AGMA	American Gear Manufacturers' Association
10.	AHRI	Air-Conditioning, Heating, and Refrigeration Institute
11.	AI	Asphalt Institute
12.	AISC	American Institute of Steel Construction
13.	AISI	American Iron and Steel Institute
14.	AITC	American Institute of Timber Construction
15.	ALS	American Lumber Standards
16.	AMCA	Air Movement and Control Association
17.	ANSI	American National Standards Institute
18.	APA	APA – The Engineered Wood Association
19.	API	American Petroleum Institute
20.	APWA	American Public Works Association
21.	ASA	Acoustical Society of America
22.	ASABE	American Society of Agricultural and Biological Engineers
23.	ASCE	American Society of Civil Engineers
24.	ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
25.	ASME	American Society of Mechanical Engineers
26.	ASNT	American Society for Nondestructive Testing
27.	ASSE	American Society of Sanitary Engineering
28.	ASTM	ASTM International
29.	AWI	Architectural Woodwork Institute
30.	AWPA	American Wood Preservers' Association
31.	AWPI	American Wood Preservers' Institute
32.	AWS	American Welding Society

33.	AWWA	American Water Works Association
34.	BHMA	Builders Hardware Manufacturers' Association
35.	CBM	Certified Ballast Manufacturer
36.	CDA	Copper Development Association
37.	CGA	Compressed Gas Association
38.	CISPI	Cast Iron Soil Pipe Institute
39.	CMAA	Crane Manufacturers' Association of America
40.	CRSI	Concrete Reinforcing Steel Institute
41.	CS	Commercial Standard
42.	CSA	Canadian Standards Association
43.	CSI	Construction Specifications Institute
44.	DIN	Deutsches Institut für Normung e.V.
45.	DIPRA	Ductile Iron Pipe Research Association
46.	EIA	Electronic Industries Alliance
47.	EJCDC	Engineers Joint Contract Documents' Committee
48.	EPA	U.S. Environmental Protection Agency
49.	ETL	Electrical Test Laboratories
50.	FAA	Federal Aviation Administration
51.	FCC	Federal Communications Commission
52.	FDA	Food and Drug Administration
53.	FEMA	Federal Emergency Management Agency
54.	FIPS	Federal Information Processing Standards
55.	FM	FM Global
56.	Fed. Spec.	Federal Specifications (FAA Specifications)
57.	FS	Federal Specifications and Standards (Technical Specifications)
58.	GA	Gypsum Association
59.	GANA	Glass Association of North America
60.	HI	Hydraulic Institute
61.	HMI	Hoist Manufacturers' Institute
62.	IBC	International Building Code
63.	ICBO	International Conference of Building Officials
64.	ICC	International Code Council
65.	ICEA	Insulated Cable Engineers' Association
66.	IFC	International Fire Code
67.	IEEE	Institute of Electrical and Electronics Engineers, Inc.
68.	IESNA	Illuminating Engineering Society of North America
69.	IFI	Industrial Fasteners Institute
70.	IGMA	Insulating Glass Manufacturer's Alliance

71.	IMC	International Mechanical Code
72.	INDA	Association of the Nonwoven Fabrics Industry
73.	IPC	International Plumbing Code
74.	ISA	International Society of Automation
75.	ISO	International Organization for Standardization
76.	ITL	Independent Testing Laboratory
77.	JIC	Joint Industry Conferences of Hydraulic Manufacturers
78.	MDEQ	Michigan Department of Environmental Quality
79.	MIA	Marble Institute of America
80.	MIL	Military Specifications
81.	MMA	Monorail Manufacturers' Association
82.	MSS	Manufacturer's Standardization Society
83.	NAAMM	National Association of Architectural Metal Manufacturers
84.	NACE	NACE International
85.	NBGQA	National Building Granite Quarries Association
86.	NEBB	National Environmental Balancing Bureau
87.	NEC	National Electrical Code
88.	NECA	National Electrical Contractor's Association
89.	NEMA	National Electrical Manufacturers' Association
90.	NESC	National Electrical Safety Code
91.	NETA	InterNational Electrical Testing Association
92.	NFPA	National Fire Protection Association
93.	NHLA	National Hardwood Lumber Association
94.	NICET	National Institute for Certification in Engineering Technologies
95.	NIST	National Institute of Standards and Technology
96.	NRCA	National Roofing Contractors Association
97.	NRTL	Nationally Recognized Testing Laboratories
98.	NSF	NSF International
99.	NSPE	National Society of Professional Engineers
100.	NTMA	National Terrazzo and Mosaic Association
101.	NWWDA	National Wood Window and Door Association
102.	OSHA	Occupational Safety and Health Act (both Federal and State)
103.	PCI	Precast/Prestressed Concrete Institute
104.	PEI	Porcelain Enamel Institute
105.	PPI	Plastic Pipe Institute
106.	PS	Product Standards Section-U.S. Department of Commerce
107.	RMA	Rubber Manufacturers' Association

108.	RUS	Rural Utilities Service
109.	SAE	SAE International
110.	SDI	Steel Deck Institute
111.	SDI	Steel Door Institute
112.	SJI	Steel Joist Institute
113.	SMACNA	Sheet Metal and Air Conditioning Contractors National Association
114.	SPI	Society of the Plastics Industry
115.	SSPC	The Society for Protective Coatings
116.	STI/SPFA	Steel Tank Institute/Steel Plate Fabricators Association
117.	SWI	Steel Window Institute
118.	TEMA	Tubular Exchanger Manufacturers' Association
119.	TCA	Tile Council of North America
120.	TIA	Telecommunications Industry Association
121.	UBC	Uniform Building Code
122.	UFC	Uniform Fire Code
123.	UL	Underwriters Laboratories Inc.
124.	UMC	Uniform Mechanical Code
125.	USBR	U.S. Bureau of Reclamation

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 45 16.13
SUBCONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this Section:

1. ASTM International (ASTM):
   a. D3740-12a, Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
   b. E329-11c, Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

1.02 DEFINITIONS

A. Subcontractor Quality Control (SQC): The means by which Subcontractor ensures that the construction, to include that performed by subcontractors and suppliers, complies with the requirements of the Subcontract.

B. Preliminary Work: The work carried out on the job site before the start of the main construction activities but not actually part of the construction work. The Preliminary work sets up the base for the construction activities.

C. Definable Feature of Work (DFOW): A task that is separate and distinct from other tasks and has separate control requirements.

1.03 SUBMITTALS

A. Informational Submittals:

1. SQC Plan: Submit, not later than 10 business days after receipt of Notice to Proceed.
2. SQC Report: Submit daily, a signed electronic version within 24 hours.

1.04 CONTRACTOR'S QUALITY ASSURANCE

A. All Work is subject to Contractor's quality assurance inspection and testing at all locations and at all reasonable times before acceptance to ensure strict compliance with the terms of the Subcontract Documents.

B. Contractor's quality assurance inspections and tests are for the sole benefit of Contractor and do not:

1. Relieve Subcontractor of responsibility for providing adequate quality control measures;
2. Relieve Subcontractor of responsibility for damage to or loss of the material before acceptance;
3. Constitute or imply acceptance; or
4. Affect the continuing rights of Contractor after acceptance of the completed Work.

C. The presence or absence of a quality assurance inspector does not relieve Subcontractor from any Subcontract requirement.

D. Promptly furnish all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by Contractor.

E. Contractor may charge Subcontractor for any additional cost of inspection or test when Work is not ready at the time specified by Subcontractor for inspection or test, or when prior rejection makes re-inspection or retest necessary. Quality assurance inspections and tests will be performed in a manner that will not unnecessarily delay the Work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Maintain an adequate inspection system and perform such inspections as will ensure that the Work conforms to the Subcontract Documents.

B. Maintain complete inspection records and make them available at all times to Owner and Contractor.

C. The quality control system shall consist of plans, procedures, and organization necessary to produce an end product that complies with the Subcontract Documents. The system shall cover all excavation and restoration, operations, both onsite and offsite, including Work by lower-tier subcontractors, fabricators, suppliers and purchasing agents, and shall be keyed to the proposed construction sequence.

3.02 COORDINATION MEETING

A. After the Pre-construction Conference, but before start of construction, and prior to acceptance of the SQC Plan, schedule a meeting with Contractor to discuss the quality control system.

B. Develop a mutual understanding of the system details, including the forms for recording the SQC operations, control activities, testing, administration of the system for both onsite and offsite Work, and the interrelationship of Contractor's management and control with the Owner's Quality Assurance.

C. There may be occasions when subsequent conferences may be called by either party to reconfirm mutual understandings and/or address deficiencies in the SQC system or procedures that may require corrective action by Subcontractor.

3.03 QUALITY CONTROL ORGANIZATION

A. SQC System Manager:

1. Designate an individual within Subcontractor's organization who will be responsible for overall management of SQC and have the authority to act in SQC matters for the Subcontractor.
2. SQC System Manager may not perform other duties on the Project.
3. SQC System Manager shall be an experienced construction person, with a minimum of 3 years construction experience on similar type Work.
4. SQC System Manager shall report to the Subcontractor's project manager or someone higher in the organization. Project manager in this context shall mean the individual with responsibility for the overall quality and production management of the Project.
5. SQC System Manager shall be onsite during construction.
6. Identify an alternate for SQC System Manager to serve with full authority during the SQC System Manager's absence. The requirements for the alternate will be the same as for designated SQC System Manager.

B. SQC Staff:

1. Designate a SQC staff, available at the Site at all times during progress, with complete authority to take any action necessary to ensure compliance with the Subcontract. SQC staff members shall be subject to acceptance by Contractor.
2. SQC staff shall take direction from SQC System Manager in matters pertaining to QC.

3. SQC staff must be of sufficient size to ensure adequate QC coverage of Work phases, work shifts, and work crews involved in the construction. These personnel may perform other duties, but must be fully qualified by experience and technical training to perform their assigned QC responsibilities and must be allowed sufficient time to carry out these responsibilities.
4. The actual strength of the SQC staff may vary during any specific Work period to cover the needs of the Project. Add additional staff when necessary for a proper SQC organization.

C. Organizational Changes: Obtain Contractor's acceptance before replacing any member of the SQC personnel. Requests for changes shall include name, qualifications, duties, and responsibilities of the proposed replacement.

3.04 DEFINABLE FEATURES OF WORK (DFOW)

A. The DFOW are as follows:

1. Mobilization and Site Preparation.
2. Utility Locating.
3. Well and Groundwater Tile Abandonment.
4. Sampling/Testing (Borrow sources, air monitoring, compaction).
5. Surveying.
6. Installation and Removal of Excavation Support Walls.
7. Excavation.
8. Waste Management.
9. Backfill.
10. Site Restoration.
11. Demobilization.
12. Maintenance Period.

3.05 QUALITY CONTROL PHASING

A. SQC shall include three phases of control to be conducted by SQC System Manager for all definable features of Work, as follows:

1. Preparatory Phase:
   a. Notify Contractor at least 48 hours in advance of beginning any of the required action of the preparatory phase.
   b. The SQC System Manager shall schedule a meeting with the Contractor to be attended by the superintendent, other SQC personnel (as applicable), and the foreman responsible for the definable feature. The SQC System Manager shall instruct applicable SQC staff as to the acceptable level of workmanship required in order to meet Subcontract requirements.

c. Document the results of the preparatory phase meeting by separate minutes prepared by the SQC System Manager and attached to the QC report.
d. Perform prior to beginning Work on each definable feature of Work:
    1) Review applicable Subcontract Specifications.
    2) Review applicable Subcontract Drawings.
    3) Verify that all materials and/or equipment have been tested, submitted, and approved.
    4) Verify that provisions have been made to provide required control inspection and testing.
    5) Examine the Work area to verify that all required preliminary Work has been completed and is in compliance with the Subcontract.
    6) Perform a physical examination of required materials, equipment, and sample Work to verify that they are on hand, conform to approved Shop Drawing or submitted data, and are properly stored.
    7) Review the appropriate activity hazard analysis to verify safety requirements are met.
    8) Review procedures for constructing the Work, including repetitive deficiencies.
    9) Document construction tolerances and workmanship standards for that phase of the Work.
    10) Check to verify that the plan for the Work to be performed, if so required, has been accepted by Contractor.

2. Initial Phase:
    a. Accomplish at the beginning of a definable feature of Work:
        1) Notify Contractor at least 48 hours in advance of beginning the initial phase.
        2) Perform prior to beginning Work on each definable feature of Work:
            a) Review minutes of the preparatory meeting.
            b) Check preliminary Work to verify compliance with Subcontract requirements.
            c) Verify required control inspection and testing.
            d) Establish level of workmanship and verify that it meets minimum acceptable workmanship standards.
            e) Resolve all differences.
            f) Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

3) Separate minutes of this phase shall be prepared by the SQC System Manager and attached to the QC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.
4) The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3. Follow-up Phase:
   a. Perform daily checks to verify continuing compliance with Subcontract requirements, including control testing, until completion of the particular feature of Work.
   b. Daily checks shall be made a matter of record in the SQC documentation and shall document specific results of inspections for all features of Work for the day or shift.
   c. Conduct final follow-up checks and correct all deficiencies prior to the start of additional features of Work that will be affected by the deficient Work. Constructing upon or concealing nonconforming Work will not be allowed.
4. Additional Preparatory and Initial Phases: Additional preparatory and initial phases may be conducted on the same definable features of Work as determined by Contractor if the quality of ongoing Work is unacceptable; or if there are changes in the applicable QC staff or in the onsite production supervision or work crew; or if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3.06 SUBCONTRACTOR QUALITY CONTROL PLAN

A. General:

1. Plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used.
2. Construction will be permitted to begin only after acceptance of the SQC Plan or acceptance of an interim plan applicable to the particular feature of Work to be started.
3. Work outside of the features of Work included in an accepted interim plan will not be permitted to begin until acceptance of a SQC Plan or another interim plan containing the additional features of Work to be started.

B. Content:

1. Plan shall cover the intended SQC organization for the entire Subcontract and shall include the following, as a minimum:
   a. Organization: Description of the quality control organization, including a chart showing lines of authority and acknowledgment that the SQC staff will implement the three-phase control system (see Section 3.04 QC Phasing) for all aspects of the Work specified.
   b. SQC Staff: The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a QC function.
   c. Letters of Authority: A copy of a letter to the SQC System Manager signed by an authorized official of the firm, describing the responsibilities and delegating sufficient authorities to adequately perform the functions of the SQC System Manager, including authority to stop Work which is not in compliance with the Subcontract. The SQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities and responsibilities. Copies of these letters will also be furnished to Contractor.
   d. Submittals: Procedures for scheduling, reviewing, certifying, and managing submittals, including those of lower-tier subcontractors, offsite fabricators, suppliers and purchasing agents.
   e. Testing: Control, verification and acceptance testing procedures for each specific test are to include the test name, frequency, specification paragraph containing the test requirements, the personnel and laboratory responsible for each type of test, and an estimate of the number of tests required.
   f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests, including documentation.
   g. Procedures for tracking deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.
   h. Reporting procedures, including proposed reporting formats; include a copy of the SQC report form.

C. Acceptance of Plans: Acceptance of the Subcontractor's basic and addendum SQC plans is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. Contractor reserves the right to require Subcontractor to make changes in the SQC plan and operations including removal of personnel, as necessary, to obtain the quality specified.

D. Notification of Changes: After acceptance of the SQC plan, Subcontractor shall notify Contractor, in writing, a minimum of 3 calendar days prior to any proposed change. Proposed changes are subject to acceptance by Contractor.

3.07 SUBCONTRACTOR QUALITY CONTROL REPORT

A. Prepare a SQC report daily for each day on site. Account for all days throughout the life of the Subcontract. Reports shall be signed and dated by SQC System Manager. Include copies of test reports and copies of reports prepared by QC staff.

B. Maintain current records of quality control operations, activities, and tests performed, including the Work of lower-tiered subcontractors and suppliers.

C. Records shall be on an acceptable form and shall be a complete description of inspections, the results of inspections, daily activities, tests, and other items, including, but not limited to, the following:

1. Subcontractor/Lower-tier subcontractors and their areas of responsibility.
2. Operating equipment with hours worked, idle, or down for repair.
3. Work performed today, giving location, description, and by whom.
4. When a network schedule is used, identify each phase of Work performed each day by activity number.
5. Test and/or control activities performed with results and references to specifications/plan requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.
6. Material received with statement as to its acceptability and storage.
7. Identify submittals reviewed, with Subcontract reference, by whom, and action taken.
8. Offsite surveillance activities, including actions taken.
9. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
10. List instructions given/received and conflicts in Drawings and/or Specifications.
11. Subcontractor's verification statement.

12. Indicate a description of trades working on the Project; the number of personnel working; weather conditions encountered; and any delays encountered.
13. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in file work and workmanship comply with the Subcontract.

3.08 SUBMITTAL QUALITY CONTROL

A. Submittals shall be as specified in Section 01 33 00, Submittal Procedures. The SQC organization shall be responsible for certifying that all submittals are in compliance with the Subcontract requirements.

3.09 TESTING QUALITY CONTROL

A. Testing Procedure:

1. Perform tests specified or required to verify that control measures are adequate to provide a product which conforms to Subcontract requirements. Perform the following activities and record the following data:
   a. Verify testing procedures comply with contract requirements.
   b. Verify facilities and testing equipment are available and comply with testing standards.
   c. Check test instrument calibration data against certified standards.
   d. Verify recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
   e. Documentation:
      1) Record results of all tests taken, both passing and failing, on the SQC report for the date taken.
      2) Include specification paragraph reference, location where tests were taken, and the sequential control number identifying the test.
      3) Actual test reports may be submitted later, if approved by Contractor, with a reference to the test number and date taken.
      4) Provide directly to Contractor an information copy of tests performed by an offsite or commercial test facility. Test results shall be signed by an engineer registered in the state where the tests are performed as applicable.
      5) Failure to submit timely test reports, as stated, may result in nonpayment for related Work performed and disapproval of the test facility for this Subcontract.

B. Testing Laboratories: Laboratory facilities, including personnel and equipment, utilized for testing soils, concrete, or asphalt shall meet criteria detailed in D3740-12a and ASTM E329-11c, and be accredited by the American Association of Laboratory Accreditation (AALA), National Institute of Standards and Technology (NIST), National Voluntary Laboratory Accreditation Program (NVLAP), the American Association of State Highway and Transportation Officials (AASHTO), or other approved national accreditation authority. Personnel performing concrete testing shall be certified by the American Concrete Institute (ACI).

3.10 COMPLETION INSPECTION

A. SQC System Manager shall conduct an inspection of the Work at the completion of all Work or any milestone established by a completion time stated in the Subcontract.

B. Completion inspections need to be performed before equipment or subcontractors required for any element of the Work are demobilized.

C. Punch List:

1. SQC System Manager shall develop a punch list of items which do not conform to the Subcontract requirements.
2. Include punch list in the SQC report, indicating the estimated date by which the deficiencies will be corrected.
3. SQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected and so notify the Contractor.
4. These inspections and any deficiency corrections required will be accomplished within the time stated for completion of the entire Work or any particular increment thereof if the Project is divided into increments by separate completion dates.

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Nursery and Landscape Association (ANLA): American Standards for Nursery Stock.
2. Federal Emergency Management Agency (FEMA).
3. National Fire Prevention Association (NFPA): 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations.
4. Telecommunications Industry Association (TIA): 568-C, Commercial Building Telecommunications Cabling Standard.
5. U.S. Department of Agriculture (USDA): Urban Hydrology for Small Watersheds.
6. U.S. Weather Bureau: Rainfall-Frequency Atlas of the U.S. for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years.
7. OSHA 29 CFR 1910 and 1926.
8. U.S. Environmental Protection Agency:
   a. Resource Conservation and Recovery Act (RCRA).
      1) Title 40 of the Code of Federal Regulations, Part 261 (40 CFR 261), Subpart C Characteristics of Hazardous Waste.
      2) 40 CFR 263, Standards Applicable to Transporters of Hazardous Waste.
      3) 40 CFR 268, Land Disposal Restrictions.
   b. Toxic Substances Control Act (TSCA), 40 CFR 761.
   c. Oil Pollution Prevention, 40 CFR, Part 112.
9. U.S. Department of Transportation:
   a. 49 CFR 171, General Information, Regulations, and Definitions.
   b. 49 CFR 172, Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements.
   c. 49 CFR 173, Shippers - General Requirements for Shipments and Packaging.
   d. 49 CFR 178, Specifications for Packaging.
10. State of Michigan:
    a. Transportation Standards and Recordkeeping (Mich. Admin. Code R 299.9608-9609).

b. Solid Waste Management (Mich. Admin. Code R 299.4101 - 299.4922).
c. Part 121 of the Natural Resource and Environmental Protection Act (Liquid Industrial By-Products).

1.02 SUBMITTALS

A. Informational Submittals:

1. Copies of permits and approvals for construction as required by Laws and Regulations and governing agencies.
2. Temporary Utility Submittals: Electrical connections.
3. Site Specific Health and Safety Plan:
   a. The Subcontractor shall submit a Site Specific Health and Safety Plan (SHSP) to the Contractor. Full Notice to Proceed will be given by the Contractor only after the SHSP has been accepted as satisfactory by the Contractor.
   b. Onsite personnel shall present certifications of training (as applicable) prior to beginning onsite Work.
   c. The SHSP shall meet the requirements given in the General Terms and Conditions.
4. Copies of permits and approvals for construction as required by Laws and Regulations and governing agencies.
5. Temporary Construction Submittals:
   a. Subcontractor’s field office.
   b. Storage and staging area plans.
   c. Fencing and protective barrier locations and details.
   d. Plan for disposal of waste materials, maintenance of access roads, and intended haul routes.
6. Temporary Control Submittals:
   a. Noise Control Plan: Submit information to mitigate construction noise, including method of construction, operating procedures, equipment to be used, and acoustical treatments for compliance with local noise regulations and ordinances.
   b. Air Monitoring Plan: Submit information for the management of stockpiles and transport of bulk materials to minimize fugitive dust emissions and describe breathing zone air monitoring procedures.

c. Transportation and Disposal Plan will describe the sampling, onsite management, transportation, and disposal of wastes, including stockpiling of excavated soils and construction debris. Subcontractor shall revise the draft Transportation and Disposal Plan developed by the Contractor; revised plan shall include the following:
   1) Proposed offsite disposal location.
   2) Proposed transporters.
   3) Sequences of construction affecting use of roadways, time required and phasing of operations to limit traffic on the residential roads.
   4) The sequence of moving, handling and loading of trucks.
   5) Describe signage and protective measures for vehicular traffic on streets.
   6) Information for intended haul routes to and from the staging area and approved disposal facility. Routes to and from the site shall generally be shortest route available.
   7) Sampling and handling requirements for excavation water.
   8) Provisions for sampling and disposing of decontamination liquids and also disposal of used personal protective equipment.
   9) Plans for transporting and disposing of contaminated soil at the approved disposal facility and importing materials from approved borrow sources.
   10) Preparation of waste characterization profiles, proof of disposal facility approval under the CERCLA Offsite Rule, set forth in the National Contingency Plan, at 40 *Code of Federal Regulations* 300.440, and proof of disposal facility acceptance.
   11) Drum, container, and tank handling and moving procedures.
   12) Provisions for equipment decontamination.
   13) Manifesting and other shipping documentation requirements for transportation of contaminated soils.
   14) Identification of all waste streams.
   15) Waste and container management, storage, labeling, and marking.
   16) Spill response and reporting (for potential spills related to transportation of materials).
   17) Records and reporting.

7. Water supply source.

1.03 PROTECTION OF WORK AND PROPERTY

A. Comply with Contractor’s safety rules while onsite.

B. Keep Contractor informed of all near misses, incidents, onsite accidents, and related claims.

C. Use of Explosives: No blasting or use of explosives will be allowed onsite.

D. Where completion of the Work requires temporary or permanent removal or relocation of existing utility, coordinate all activities with owner of said utility and perform all work to their satisfaction.

1.04 PERMITS

A. Permits, Licenses, or Approvals: Obtain in accordance with the General Conditions and as otherwise may be provided in the Supplementary Conditions and retain onsite.

B. During the performance of the Work, Subcontractor is responsible for adapting its means, methods, techniques, sequences, and procedures of construction consistent with applicable permit requirements, and Laws and Regulations.

1.05 TEMPORARY CONTROLS

A. Subcontractor shall provide safety and environmental controls during remediation-related construction activities to protect the public, workers, and environment and ensure that all work is performed in a manner that meets the intent of federal, state, and local environmental regulations.

B. Soil Erosion and Sedimentation Control Plan as indicated in 01 57 13, Temporary Erosion and Sediment Control.

1.06 SAFETY

A. Subcontractor is responsible for all safety activities associated with the execution of the Work.

B. Keep Contractor informed of all near misses, incidents, onsite accidents, and related claims.

C. Subcontractor shall provide a fulltime onsite Health and Safety Manager with a minimum of 5 years of construction and safety experience for the entire time the Subcontractor is onsite.

D. All workers associated with any activity that may expose them to contaminated materials or the treatment of such must have proper OSHA-approved 40-hour health and safety training. If the Subcontractor guarantees that separate individuals will perform routine custodial services and will NOT be exposed to any potentially contaminated materials or disposable items associated with its treatment, such employees need not have this training after concurrence by Contractor.

1.07 VEHICULAR TRAFFIC

A. Traffic Routing Plan: Provide necessary access, and plans for signing, barricading, and striping to provide passages for pedestrians and vehicles.

B. Traffic Control: Subcontractor personnel shall adhere to traffic control in approved Transportation and Disposal Plan. Changes to traffic control shall be made only by written approval of appropriate public authority and the Contractor. Subcontractor shall secure approvals for necessary changes so as not to delay progress of the Work.

PART 2 PRODUCTS

2.01 SUBCONTRACTOR'S FIELD OFFICES

A. If needed, furnish field office and equipment for exclusive use of Subcontractor and its representatives.

B. Potable water will be available for use via an onsite fire hydrant; however, Subcontractor shall find materials and methods to use the potable water.

C. The Subcontractor shall provide portable toilets and hand wash units for use.

2.02 TEMPORARY STOCKPILE COVERING

A. Material shall be reinforced black plastic, 6 mil minimum, with an ultra-violet ray inhibitor or polyvinyl chloride (PVC) a minimum of 10 mils thick. When freezing conditions are expected, use PVC material.

2.03 HIGH-VISIBILITY FENCE

A. As specified in Section 01 57 13, Temporary Erosion and Sediment Control.

2.04 BARRICADES AND LIGHTS

A. As required to perform Work.

2.05 SIGNS AND EQUIPMENT

A. As specified in Section 3.03 E and/or recommended by Subcontractor and approved by the Contractor.

B. Delivered equipment will be inspected at the project site. Equipment that is not in good condition or which arrives with contents and/or contamination will be turned away with the costs borne by the Subcontractor at the sole discretion of Contractor.

2.06 SPILL RESPONSE AND CONTROL EQUIPMENT

A. Supply spill response equipment in areas where fuel and chemicals are stored or used, and where liquid wastes are stored.

B. Provide containment around fuels, chemical, and liquid wastes or their storage areas such that a release of these materials do not reach waters of the state, drainage way(s), streams, storm sewers, or sanitary sewers.

PART 3 EXECUTION

3.01 MOBILIZATION

A. This task will consist of mobilizing Subcontractor personnel, equipment, any lower-tier Subcontractors, and materials to the project site. The Subcontractor will be responsible for coordinating and making arrangements for storage and laydown areas for construction equipment.

B. The Subcontractor shall install erosion control measures according to best management practices and the Soil Erosion and Sedimentation Control Plan, and also prepare a vehicle decontamination area and a soil storage area that are designed to contain runoff from these activities.

1. Coordination and scheduling of mobilization activities will be discussed with Subcontractor in detail during the pre-construction meeting.

C. Mobilization shall include, but not be limited to, these principal items:

1. Obtaining required approvals and permits.
2. Mobilizing Subcontractor’s field office, if desired, and equipment required for operations onto Site.
3. Installing temporary construction power, wiring, and lighting facilities.
4. Providing onsite communication facilities if desired by Subcontractor.

5. Providing onsite sanitary facilities and potable water facilities as specified and as required by Laws and Regulations, and governing agencies.
6. Arranging for Subcontractor's storage yard.
7. Posting OSHA required notices and establishing safety programs and procedures.
8. Having Subcontractor's superintendent at the Site full time.

3.02 TEMPORARY UTILITIES

A. Power:

1. Electric power will be available at the Site. Subcontractor shall arrange for and bear costs for electrical hook-ups at the field office and staging areas, if desired.
2. Cost of electric power will be borne by Subcontractor.

B. Lighting: Provide temporary lighting to meet applicable safety requirements to allow erection, application, or installation of materials and equipment, and observation or inspection of the Work 24 hours per day.

C. Heating, Cooling, and Ventilating:

1. Provide as required to maintain adequate environmental conditions to facilitate progress of the Work, to meet specified minimum conditions for installation of materials, and to protect materials, equipment, and finishes from damage because of temperature or humidity. Costs for temporary heat shall be borne by Subcontractor.
2. Provide adequate forced air ventilation of enclosed areas to cure installed materials, to dispense humidity, and to prevent hazardous accumulations of dust, fumes, vapors, or gases.
3. Pay costs of installation, maintenance, operation, removal, and fuel consumed.
4. Provide portable unit heaters, complete with controls, oil- or gas-fired, and suitably vented to outside as required for protection of health and property.

D. Water:

1. Potable water is available from an onsite fire hydrant. Make arrangements for providing water required for construction purposes and for drinking by Subcontractor and lower-tier subcontractor personnel during construction. Subcontractor shall record water usage daily and submit usage to Contractor.

2. Hydrant Water:
   a. Is available from onsite hydrant. Secure written permission for connection and use from water department and meet requirements for use. Notify fire department before obtaining water from fire hydrants.
   b. Use only special hydrant-operating wrenches to open hydrants. Make certain hydrant valve is open full, since cracking valve causes damage to hydrant. Repair damaged hydrants and notify appropriate agency as quickly as possible.
   c. Include costs to connect and transport water to construction areas in Contract Price.
3. Cost of water obtained by hydrant(s) to be borne by Contractor.

E. Sanitary and Personnel Facilities will be provided and maintained by Subcontractor. Sanitary facilities will be anchored according to manufacturer instructions and located such that in the event of a release or spill, they will not drain to surface waters (e.g., storm drain inlets, ditches, streams, wetlands, floodplains, etc.).

F. Telephone Service: Subcontractor shall provide onsite telephone service for use during construction, and pay costs of installation and monthly bills during construction.

G. Fire Protection: Furnish and maintain on Site adequate firefighting equipment capable of extinguishing incipient fires. Comply with applicable parts of NFPA 241.

3.03 PROTECTION OF WORK AND PROPERTY

A. General:

1. Maintain in continuous service existing gas pipelines, underground power, telephone or communication cable, water mains, sewers, poles and overhead power, and other utilities encountered a long line of the Work and not designated for demolition or removal.
2. Where completion of the Work requires temporary or permanent removal or relocation of existing utility, coordinate activities with said utility and perform work to their satisfaction.
3. Keep fire hydrants and water control valves free from obstruction and available for use at all times.

4. In areas where Subcontractor's operations are adjacent to or near a utility, such as gas, telephone, electric power, water or sewer, and such operations may cause damage or inconvenience, suspend operations until arrangements necessary for protection have been made by Subcontractor.
5. Notify property owners and utility offices that may be affected by construction operation at least 2 days in advance by calling the Michigan utility one-call number (MISS DIG) or utility owner directly as appropriate and provide private utility locate to identify any utilities that may be present in the work area. Before exposing a utility, obtain utility owner's permission. Should service of utility be interrupted due to Subcontractor's operation, notify proper authority and Contractor immediately. Cooperate with said authority in restoring service as promptly as possible and bear costs incurred.
6. Remove existing utilities encountered within the footprint of the consolidation facility and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by Contractor.
7. Do not impair operation of existing sewer system. Prevent construction material, pavement, concrete, earth, volatile and corrosive wastes, and other debris from entering sewers, pump stations, or other sewer structures.
8. Maintain original Site drainage wherever possible.
9. Maintain integrity of existing site-wide soil cap and existing site roads. Repair at Subcontractor's cost if damaged. Notify Contractor at least two days prior to all intrusive activities. Obtain written permission prior to starting work.

B. Site Security:

1. Provide and maintain additional temporary security fences as necessary to protect the Work and Subcontractor-furnished products not yet installed.
2. The Owner and Contractor are not responsible for theft, damages or losses incurred during the performance of this Work.

C. Waterways: Keep ditches, culverts, and natural drainages continuously free of construction materials and debris.

D. Barricades and Lights: Provide as necessary to prevent unauthorized entry to construction areas and affected roads, streets, and alleyways, inside and outside of fenced area, and as required to ensure public safety and the safety of Subcontractor's employees, other employer's employees, and others who may be affected by the Work.

E. Dewatering: Refer to Section 31 23 19.01, Dewatering.

F. Archaeological Finds: Should finds of an archaeological or paleontological nature be made within the limits of the Site, immediately notify Owner and Contractor. Continue the Work in other areas without interruption.

G. Protected Species and Their Habitat:

1. Take precautions necessary and prudent to protect endangered and threatened flora and fauna, fauna habitat, and migratory birds (including active nests).
2. Notify Contractor of construction activities that might threaten protected species or their habitats, including threatened and endangered species and migratory birds.
3. Contractor will mark areas known as habitats of protected species prior to commencement of onsite activities.
4. Additional areas will be marked by Contractor as other habitats of protected species become known during construction.

3.04 TEMPORARY CONTROLS

A. Air Pollution Control:

1. Minimize air pollution from construction operations.
2. Burning of waste materials, rubbish, or other debris will not be permitted on or adjacent to Site.

B. Noise Control:

1. Provide controls if noise emanating from tools or equipment will exceed legal noise levels.
2. Standard hours for operation of construction equipment are Monday through Friday from 7 a.m. to 5 p.m. Weekend hours can be added from 9 a.m. to 6 p.m. if necessary work permits and approval from the Contractor have been obtained.
3. Noise Control Plan: Propose plan to mitigate construction noise and to comply with noise control ordinances, including method of construction, equipment to be used, and acoustical treatments.

C. Water Pollution Control:

1. Comply with Section 01 57 13, Temporary Erosion and Sediment Control.

2. Do not dispose of wastewater, stormwater, decontamination fluids, or volatile wastes in storm or sanitary drains. Disposal of wastes into streams or waterways is prohibited. Provide acceptable containers for collection and disposal of waste materials, debris, and rubbish.
3. Notify Contractor immediately of any spill, sheen, or release onto the ground or water.

D. Erosion, Sediment, and Flood Control: Design, install/implement and maintain erosion and sediment controls and other best management practices as specified in Section 01 57 13, Temporary Erosion and Sediment Control.

E. Dust Control:

1. The Subcontractor shall be responsible for controlling the dust and airborne dirt generated by construction activities. Water or other suppression means shall be used as needed to control dust.
2. All excavation activities shall be performed in a manner that limits blowing dust and tracking of mud onto site access roads. Dust control measures may include vacuuming, water spraying, and sweeping or other methods allowed under local regulations. The Subcontractor shall prepare an air monitoring plan that will address the management of stockpiles and transport of bulk materials.
3. Conduct operations of dumping stone or sand and of carrying stone or sand away in trucks to cause a minimum of dust. Give unpaved streets, roads, detours, or haul roads used in construction area a dust-preventive treatment or periodically water to prevent dust.
4. Limit drop height during soil loading and unloading.
5. Strictly adhere to applicable environmental regulations for dust prevention.

3.05 ACCESS ROADS AND LAYDOWN AREAS

A. Construct access roads within Project limits as shown on the Drawings. Utilize existing roads where shown.

B. Maintain drainage ways. Install and maintain culverts to allow water to flow beneath access roads. Provide corrosion-resistant culvert pipe of adequate strength to resist construction loads.

C. If needed, additional access roads and laydown areas will be constructed by stripping the existing topsoil layer proof-rolling the underlying material, grading to build the subgrade to roadway profile elevation, and placing geotextile fabric over the subgrade prior to aggregate base placement. The aggregate base will consist of 6 inches of sand, and the aggregate surface course will be 6 inches thick. All material will be placed in 6-inch lifts. The aggregate base layers will be compacted to 98 percent of the standard Proctor maximum density (ASTM International D698). In situ density testing will be performed using a nuclear density gauge or approved equivalent to demonstrate proper compaction.

D. Provide gravel, crushed rock, or other stabilization material to permit access by all motor vehicles at all times.

E. Maintain road grade and crown to eliminate potholes, rutting, and other irregularities that restrict access.

F. Provide good housekeeping practices at equipment laydown yards. Protect equipment and cover receptacles as necessary to prevent blowing trash.

G. Coordinate with Contractor detours and other operations affecting traffic and access. Provide at least 72 hours' notice to Engineer of operations that will alter access to Site.

H. Upon completion of construction, leave access roads and laydown areas in condition suitable for future use by Owner and Contractor. Replace damaged or broken culverts with new culvert pipe of same diameter and material.

3.06 PARKING AREAS

A. Control vehicular parking to preclude interference with public traffic or parking, access by emergency vehicles, Contractor's operations, other onsite operations, or construction operations.

B. Parking lot for personnel working on Project provided by Subcontractor.

3.07 VEHICULAR TRAFFIC

A. Comply with Laws and Regulations regarding closing or restricting use of public streets or highways. No public or private road shall be closed, except by written permission of proper authority. Ensure the least possible obstruction to traffic and normal commercial pursuits.

B. Conduct the Work to interfere as little as possible with public travel, whether vehicular or pedestrian.

C. Coordinate traffic routing with that of others working in same or adjacent areas.

D. When flaggers and guards are required by regulation or when deemed necessary for safety, furnish them with approved orange wearing apparel and other regulation traffic control devices. Flaggers shall have appropriate training as required by the Michigan Department of Transportation (MDOT).

3.08 SURFACE WATER CONTROL IN EXCAVATIONS

A. Install temporary liners in excavated areas overnight, where possible, to prevent stormwater from contacting soils in open excavations. Anchor the temporary liners with sandbags or approved equivalent spaced along the perimeter of or within the excavation to prevent the liner from becoming displaced. Stormwater contained on top of the liner will be discharged as clean stormwater in accordance with the approved Soil Erosion and Sedimentation Control plan.

B. Install highly efficient pumps as controls to quickly discharge water from the work area.

C. If an excavation is unable to be covered and standing water is present in the excavation when backfill must occur, and water cannot be allowed to infiltrate due to schedule or other constraints, Subcontractor shall remove, containerize and store water at staging area in accordance with the approved Waste Transportation and Disposal Plan. The Contractor will sample the water for disposal at an appropriate treatment facility. The treatment facility is subject to the approval of the Contractor and Owner.

D. Remove surface runoff controls when no longer needed.

E. Provide supplemental ditches and sumps only as necessary to collect water from rain events. Do not use ditches and sumps as primary means of water control.

3.09 SPILL PREVENTION, RESPONSE, AND REPORTING

A. Areas used to store fuel, chemicals and waste will be properly protected from vehicle traffic. If fuel is stored onsite, fuel tanks or containers (including fuel storage and waste storage) will be equipped with secondary containment. These tanks or containers will be inspected routinely for signs of leaks. Accumulated water must be inspected for signs of contamination (e.g., product sheen, discoloration and odor) before being discarded. Applicable fire protection codes and guidance will be adhered to.

B. The Subcontractor shall prepare a Spill Prevention Control and Countermeasures Plan that conforms to the requirements of 40 CFR Part 112, Oil Pollution Prevention, if the total on-site oil or oil product storage capacity is expected to meet or exceed 1,320 gallons at any time during the project. All containers with a capacity of 55 gallons or greater will be included in determining on-site capacity. This threshold does not include mobile refueling tanks if they do not remain onsite overnight.

C. Onsite vehicles and equipment will be refueled onsite at designated fueling areas, located on level ground and away from any surface water features including storm water inlets or ditches. Spill kits, drip pans, and absorbent spill cleanup materials will be available in the fueling area. These materials will be properly disposed of after use. No vehicle or equipment maintenance will be performed on the construction site.

D. Chemical products will be properly stored, transferred, and used. Original labels on chemical containers with the identity of the chemical and any hazard warnings, will be maintained.

E. Spill response equipment will be adequately stocked and maintained throughout the project. Spills and leaks will be cleaned up immediately and disposed of properly.

F. The Subcontractor is responsible for the disposal of waste and contaminated environmental media from a spill or release of Subcontractor-owned hazardous substances and petroleum products (diesel, hydraulic oil, etc.). Subcontractor shall immediately report all spills to Contractor. Unless otherwise directed by Contractor or Owner, Subcontractor shall make notification to external agencies for reportable spills of contractor-owned materials.

G. Good housekeeping procedures will be followed to reduce risks associated with construction materials and hazardous materials. These procedures include but are not limited to keeping materials in their original containers whenever possible, maintaining original labels and Safety Data Sheets, and using proper disposal methods for surplus materials.

3.10 CLEANING DURING CONSTRUCTION

A. Wet down exterior surfaces prior to sweeping to prevent blowing of dust and debris.

B. Pick up and dispose of trash s as necessary to prevent trash from blowing offsite.

C. Provide approved containers for collection and disposal of waste materials, debris, and rubbish. At least weekly, dispose of such waste materials, debris, and rubbish offsite or as necessary to prevent waste receptacles from overflowing.

3.11 DECONTAMINATION OF EQUIPMENT AND PERSONNEL

A. Field equipment that has come into contact with any potentially contaminated material shall be decontaminated using a dry method of cleaning. The equipment shall be visually inspected for signs of contamination, and the cleaning procedure shall be repeated until the equipment is visually clean. After dry decontamination, the Subcontractor shall perform wet decontamination on a decon pad at the staging area. All contaminated equipment shall be cleaned before leaving the site. All equipment decontamination shall be documented in the field logbooks.

B. Field equipment that has been used for excavation activities shall have dry decontamination performed prior to leaving a residential property and wet decontamination performed on the decon pad at the staging area prior to use for backfill activities if dedicated excavation and backfill equipment are not used.

3.12 DEMOBILIZATION

A. Upon completion of Work, Subcontractor shall demobilize from the Site. Demobilization includes:

1. Removal of all field equipment, temporary facilities, and other miscellaneous items (for example, barricades, caution tapes, and signs) resulting from or used during field operations, unless otherwise directed by the Contractor.
2. Proper offsite disposal of all wastes and general construction debris generated by construction activities.

B. Subcontractor shall complete closeout punchlist described in Section 01 77 00, Closeout Procedures.

END OF SECTION

SECTION 01 57 13
TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. This section covers Work to implement structural and nonstructural Best Management Practices (BMP) to control soil erosion by wind or water and keep eroded sediments and other construction-generated pollutants from moving off project sites. Requirements described in this specification and shown on the Drawings are part of the project Soil Erosion and Sediment Control Plan (SESC Plan) and are the minimum for all project construction sites and conditions. This specification covers all project activities, including material sources, disposal sites, and offsite mitigation areas unless specific project activities are excluded elsewhere in this specification or in other Contract Documents controlling the Work.

B. This section covers Work necessary for stabilization of soil to prevent erosion during construction and land disturbing activities. The minimum areas requiring soil erosion and sediment control measures are indicated on the Drawings. The Contractor reserves right to modify use, location, and quantities of soil erosion and sediment control measures based on activities of the Subcontractor.

C. The work shall include the furnishing of all labor, materials, tools, and equipment to perform the work and services necessary as herein specified. This includes the installation, maintenance, and final removal of all temporary soil erosion and sediment control measures.

1.02 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced.

1. ASTM International (ASTM):
    a. D638-10, Standard Test Method for Tensile Properties of Plastics.
    b. D3776/D3776M, Standard Test Methods for Mass Per Unit Area (Weight) of Fabric.
    c. D4355-07, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in Xenon Arc Type Apparatus.
    d. D4632-08, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

2. Federal Emergency Management Agency (FEMA).
3. U.S. Department of Agriculture: Urban Hydrology for Small Watersheds; Soil Conservation Service Contracting Technical Release No. 55, 1986.
4. U.S. Weather Bureau: Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years, Technical Paper No. 40, 1981.
5. Michigan Department of Environmental Quality. Part 91, Soil Erosion and Sedimentation Control, of the Natural Resources and Environmental Protection Act (NREPA).
6. Part 17 - Soil Erosion and Sedimentation Control (Mich. Admin. Code R 323.1702, 1703, 1709, 1710)
7. Part 21 National Permit for Storm Water Discharge from Construction Activity (Mich. Admin. Code R 323-2190).
8. *Michigan Nonpoint Source Best Management Practices Manual*, Michigan Department of Environmental Quality
9. *Soil Erosion and Sedimentation Control Guidebook*, Michigan Department of Technology, Management & Budget.

1.03 GENERAL

A. The Subcontractor shall revise the draft Soil Erosion and Sedimentation Control Plan developed by the Contractor. The Soil Erosion and Sedimentation Control Plan will be submitted to the Contractor and City of St. Louis for review and approval. The revised Soil Erosion and Sedimentation Control Plan shall be consistent with substantive requirements of Part 21 R 323.2190 (National Permit for Stormwater Discharge During Construction) of NREPA 1994 P.A. 451, as amended; Gratiot County requirements; *Michigan Nonpoint Source Best Management Practices Manual*; and the *Soil Erosion and Sedimentation Control Guidebook*. The revised plan shall at a minimum:

1. Describe the structural best management practices (BMPs) for earth disturbing activities and procedures to prevent the offsite discharge of pollutants. Erosion and sediment control BMPs will be installed, at a minimum, at the site perimeter, excavated areas, stockpiles of general backfill and excavated soils, staging and storage areas, inlets and drains, and construction site entrance and exit. BMPs, including by not limited to sediment retention measures (e.g., silt fence), vegetated buffer zones, stormwater diversions, will be designed, installed, and maintained in accordance with the *Michigan Nonpoint Source Best Management Practices Manual* and the *Soil Erosion and Sedimentation Control Guidebook* – see References.

2. Describe non-structural BMPs, including but not limited to housekeeping practices, dust control, spill prevention and response measures, fuel storage and use, and equipment and vehicle maintenance practices.
3. Describe stabilization BMPs.
4. Describe how water entering excavations and contained on top of liners will be discharged as clean stormwater and other stormwater management activities.
5. Describe inspection and maintenance procedures.

B. All activities shall conform to the substantive environmental requirements of the City of St. Louis, Gratiot County, the State of Michigan and Drawings. In the event of a conflict, the more stringent requirement shall apply.

C. Subcontractor shall install, inspect, and maintain and provide recordkeeping for temporary soil erosion and sediment control measures under the authorization of a Michigan DEQ-certified stormwater operator.

1.04 SYSTEM DESCRIPTION

A. Erosion and Sediment Control:

1. Provide, maintain, and operate temporary facilities to control erosion and prevent sediment releases, and to protect the Work and existing facilities from flooding during construction period.
2. Design erosion and sediment controls to handle peak runoff resulting from 25-year, 24-hour storm event based on *Michigan Nonpoint Source Best Management Practices Manual*, Michigan Department of Environmental Quality and *Soil Erosion and Sedimentation Control Guidebook*, Michigan Department of Technology, Management & Budget.
3. Size temporary stormwater conveyances based on procedures presented in *Michigan Nonpoint Source Best Management Practices Manual*, Michigan Department of Environmental Quality and *Soil Erosion and Sedimentation Control Guidebook*, Michigan Department of Technology, Management & Budget.

B. Soil erosion, stabilization, and sedimentation control consists of the following elements:

1. Maintenance of existing permanent or temporary storm drainage piping and channel systems, as necessary.
2. Construction and maintenance of permanent and temporary storm drainage piping and channel systems, as necessary.

3. Construction of temporary erosion and sediment controls such as silt fences and check dams.
4. Placement and maintenance of stabilization measures such as temporary seeding on areas disturbed by construction.

1.05 SUBMITTALS

A. Submittals shall be made in accordance with Section 01 33 00, Submittal Procedures.

B. Informational Submittals:

1. Soil Erosion and Sedimentation Control Plan and procedures.
   a. The Subcontractor will update or modify the Draft SESC Plan. Provide a schedule for SESC Plan implementation and incorporate it into Contractor's progress schedule. Obtain Contractor's approval of the SESC Plan and schedule before any Work begins.
   b. Modified SESC Plans shall meet all requirements of the applicable jurisdictions.
   c. The SESC Plan shall cover all areas that may be affected inside and outside the limits of the Project (including all Owner-provided sources, disposal sites, and haul roads, and all nearby land, streams, and other bodies of water).
   d. Allow at least 5 working days for Contractor to review any original or revised SESC Plan. Failure to approve all or part of any such Plan shall not make Owner liable to Contractor for any Work delays.
2. Initial schedule for installation of drainage, erosion, and sedimentation control measures.
3. Method for placement of soil stabilization seed and additives.

1.06 QUALITY ASSURANCE

A. Soil Erosion and Sediment Control Plan:

1. A draft SESC Plan is furnished as part of the Drawings and will be updated or revised by the Subcontractor.
2. For each phase of the scheduled work, indicate in the SESC Plan the proposed BMPs. Include all temporary slopes, constructed for staging or other reasons, which may not have been identified in the original Subcontract plans.
3. SESC Plan required elements:
   a. Narrative Site Description:
      1) Nature of construction activity planned for the Site.

2) Estimates of total site area and the areas of the Site expected to be disturbed.
3) Soil types found onsite and their erosion potential.
4) The types of fill materials to be used.
5) Timetable for sequence of major construction events.

b. Site Map:
1) All areas of development.
2) Drainage patterns.
3) Areas of soil disturbance, including pre-development and post-development elevation contours.
4) Areas used for storage of soils or wastes.
5) Areas where vegetative practices are to be implemented.
6) Location of structural erosion and sediment control BMPs.
7) Location of stabilization measures.
8) Location of all impervious structures and surfaces after project is completed.
9) Location of laydown area/equipment storage.
10) Springs, wetlands, and other surface waters located onsite and location of nearest receiving water(s).
11) Boundaries of the 100-year floodplain, if determined. Ordinary High Water line, if determined..
12) Location of detention ponds, storm drain inlets and ditches.

c. Required BMPs and Procedures for Erosion Prevention, Runoff Control, and Sediment Control:
1) Construction entrances and parking areas.
2) Unpaved site roads such as haul roads.
3) Hauling saturated soils from the Site.
4) Water washed from concrete trucks.
5) Erosion and sediment control BMPs , including detail on design, installation, and maintenance.
6) Clearing and grading practices to minimize area of exposed soil throughout life of the Project.
7) Schedule of phased clearing operations to limit soils to what can be stabilized.
8) Stabilization and vegetative buffers, including preservation of existing vegetation, seeding, mulching, and buffer strips.
9) Perimeter controls.
10) Additional controls for wet season work and temporary work suspensions.
11) Sensitive areas such as wetlands.
12) Equipment and waste storage areas.
13) Soil stockpile management.
14) Dust control.
15) Emergency materials stockpiled onsite.

4. SESC Plan update/revision and implementation schedules must be prepared by a competent individual. Furnish a signed copy of the SESC Plan with individual's name, title, state certifications, and employing firm if different than Subcontractor's firm.
5. Do not begin any Site activities that have potential to cause erosion or sediment movement until the SESC Plan and implementation schedules are approved by Contractor.
6. Keep a copy of the approved SESC Plan with updated changes onsite during all construction activities. During inactive periods longer than 7 calendar days, keep the SESC Plan onsite or provide a copy to Contractor to retain.
7. Continually update the SESC Plan and schedules as needed for unexpected storm or other events to ensure that sediment-laden water does not leave the construction site. Add approved changes to the SESC Plan no later than 24 hours after implementation.

B. Preventing erosion, and controlling runoff, sedimentation, and non-stormwater pollution, requires Subcontractor to perform temporary Work items including, but not limited to:

1. Providing ditches, berms, culverts, and other measures to control surface water.
2. Installing check dams, settling basins, energy dissipaters, and other measures, to control downstream flow and flow velocity.
3. Controlling underground water found during construction.
4. Covering or otherwise protecting slopes until permanent erosion control measures are working.

C. To the degree possible, coordinate this temporary Work with permanent drainage and erosion control work the Subcontract requires.

D. Contractor may require additional temporary control measures if it appears pollution or erosion may result from weather, nature of materials, or progress on the Work.

E. When natural elements rut or erode the slope, restore and repair damage with eroded material where possible, and remove and dispose of any remaining material found in ditches and culverts. When Contractor orders replacement with additional or other materials, unit Subcontract prices will cover quantities needed.

F. Install all structural BMPs including, but not limited to perimeter, construction entrance/exit, and sediment retention BMPs, prior to any ground disturbing activity. Do not expose more erodible earth than necessary during clearing, grubbing, excavation, borrow, or fill activities without written approval by Contractor. Contractor may increase or decrease the limits based on project conditions. Erodible earth is defined as any surface where soils, grindings, or other materials may be capable of being displaced and transported by rain, wind, or surface water runoff. Stabilize inactive areas of erodible earth, whether at final grade or not, using the BMP(s) identified in the SESC Plan. Phase clearing and grading to maximum extent practical to prevent exposed inactive areas from becoming a source of erosion.

G. Water Management:

1. Manage site water in accordance with the conditions of the waste discharge permit from a local permitting authority. If site water management is not subject to permit, manage as follows:
    a. Excavation water. When groundwater is encountered in an excavation and/or stormwater accumulates in an excavation, treat and discharge as follows:
        1) When excavation water conforms to Michigan Department of Environmental Quality (MDEQ) Water Quality Standards, it may bypass detention and treatment facilities and be routed directly to its normal discharge point at a rate and method that will not cause erosion.
        2) When turbidity of excavation is similar to turbidity of site runoff, water may be treated using same BMPs being used to treat the site runoff and then discharged at a rate that will not cause erosion.
        3) When excavation water turbidity is greater than turbidity of site runoff, treat water separately until turbidity is similar to or better than site runoff, and then it may be combined with site runoff and treated as described above.
        4) In no case can the discharge of excavation water cause an exceedance of MDEQ water quality standards in the receiving water.
    b. Process Water:
        1) Do not discharge high pH process water or wastewater (non-stormwater) that is generated onsite, including water generated during concrete grinding, rubblizing, washout, and hydrodemolition activities, to waters of Gratiot County, including wetlands. Water may be infiltrated upon approval of Contractor. Offsite disposal of concrete process water is subject to approval of Contractor.

2) Treat all water generated onsite from construction or washing activities that is more turbid than site runoff separately until turbidity is the same or less than site runoff, and then it may be combined with site runoff and treated as described above. Water may be infiltrated upon approval of Contractor.

c. Offsite Water: Prior to disruption of normal watercourse, intercept offsite stormwater and pipe it either through or around the Project Site. This water shall not be combined with onsite stormwater. Discharge offsite water at its preconstruction outfall point preventing an increase in erosion below the site. Submit proposed method for performing this Work for Contractor's approval.

H. Dispersion/Infiltration: Convey water only to dispersion or infiltration areas designated in the SESC Plan or to sites approved by Contractor. Water shall be conveyed to designated dispersion areas at a rate such that, when runoff leaves the area and enters waters of Gratiot County, turbidity standards are achieved. Convey water to designated infiltration areas at a rate that does not produce surface runoff.

I. Detention/Retention Pond Construction: Whether permanent or temporary, construct before beginning other grading and excavation Work in the area that drains into that pond. Install temporary conveyances concurrently with grading in accordance with the SESC Plan so that newly graded areas drain to the pond as they are exposed.

J. Pollution Control: Use BMPs to prevent or minimize stormwater exposure to pollutants from spills; vehicle and equipment fueling, maintenance, and storage; other cleaning and maintenance activities; and waste handling activities. These pollutants include fuel, hydraulic fluid, and other oils from vehicles and machinery, as well as debris, leftover paints, solvents, and glues from construction operations. Implement the following BMPs when applicable:

1. Written spill prevention and response procedures.
2. Employee training on spill prevention and proper disposal procedures.
3. Spill kits in all vehicles.
4. Regular maintenance schedule for vehicles and machinery.
5. Material delivery and storage controls.
6. Training and signage.
7. Covered storage areas for waste and supplies.

K. If Contractor orders the Work suspended, continue to prevent the discharge of pollutants from the construction site during the shutdown.

L. Nothing in this section shall relieve Subcontractor from complying with other Subcontract requirements.

PART 2 PRODUCTS

2.01 SILT FENCE

A. Geotextile: In accordance with *Michigan Nonpoint Source Best Management Practices Manual*, Michigan Department of Environmental Quality

B. Support Posts: In accordance with *Michigan Nonpoint Source Best Management Practices Manual*, Michigan Department of Environmental Quality and as recommended by manufacturer of geotextile.

C. Fasteners: Heavy-duty wire staples at least 1-inch long, tie wires, or hog rings, as recommended by manufacturer of geotextile.

2.02 CLEARING LIMIT FENCE

A. Fabric:

1. Ultraviolet stabilized polyethylene, polypropylene, or nylon filaments woven into uniform pattern, with distinct and measurable openings.
2. Minimum Physical Qualities:
   a. Tensile Yield: Average 2,000 pounds per 4-foot width; ASTM D638-10.
   b. Ultimate Tensile Yield: Average 2,900 pounds per 4-foot width; ASTM D638-10.
   c. Elongation at Break: Greater than 1,000 percent; ASTM D638-10.
   d. Chemical Resistance: Inert to most chemicals and acids.
3. Color: Yellow or orange.
4. Height: 3 feet.
5. Material Edges: Finished in order that filaments retain their relative positions under stress.

B. Posts: Conventional metal “T” or “U” posts.

2.03 STRAW MULCH

A. Clean salt hay or threshed straw of oats, wheat, barley, or rye; free from seed of noxious weeds.

2.04 EROSION CONTROL BLANKET (MATTING), BIODEGRADABLE

A. Temporary erosion control blanket shall be made of natural plant fibers. Supply independent test results meeting the following:

Properties	ASTM Test Method	Requirements
Protecting Slopes from Rainfall-Induced Erosion	D6459: Test in one soil type. Soil tested shall be sandy loam as defined by the NRCS Soil Texture Triangle.	Maximum C factor of 0.15 using Revised Universal Soil Loss Equation (RUSLE)
Dry Weight per Unit Area	D6475	0.36 lb/sq. yd. minimum
Performance in Protecting Earthen Channels from Stormwater-Induced Erosion	D6460: Test in one soil type. Soil tested shall be loam as defined by the NRCS Soil Texture Triangle.	1.0 lb/sq. ft. minimum
Seed Germination Enhancement	D7322	200 percent minimum
Netting, if present, shall be biodegradable with a life span not to exceed 1 year.		

B. For permanent erosion control blanket, see Section 31 32 00, Soil Stabilization.

2.05 FILTRATION SYSTEM

A. Sand: The sand filtration system shall be rapid or slow. Rapid sand filters achieve relatively high hydraulic flow rates, on the order of 2 gpm/sf to 20 gpm/sf, because they have automatic backwash systems to remove accumulated solids. Slow sand filters have very low hydraulic rates, on the order of 0.02 gpm/sf, because they do not have backwash systems.

B. Chemical: The chemical treatment system shall consist of a stormwater collection system (either temporary diversion or the permanent site drainage system), a storage pond (or portable trailer-mounted tanks), pumps, a chemical feed system, treatment cells, and interconnecting piping.

2.06 GEOTEXTILE

A. Geotextiles shall consist only of long chain polymeric fibers or yarns formed into a stable network such that the fibers or yarns retain their position relative to each other during handling, placement, and design service life. At least 95 percent by weight of the material shall be polyolefins or polyesters. The material shall be free from defects or tears. Geotextile shall also be free of any

treatment or coating which might adversely alter its hydraulic or physical properties after installation. Geotextile properties shall be as described in Table 1 through Table 3.

Table 1
Geotextile for Permanent Erosion Control

Geotextile Property	ASTM Test Method	Geotextile Property Requirements					
		Permanent Erosion Control				Ditch Lining	
		Moderate Survivability		High Survivability			
		Woven	Non-woven	Woven	Non-woven	Woven	Non-woven
AOS	D4751	See Table 2		See Table 2		U.S. No. 30 max.	
Water Permittivity	D4491	See Table 2		See Table 2		0.02 sec^{-1} min.	
Grab Tensile Strength, in machine and x-machine direction	D4632/ D4632M	250 lb min.	160 1b min.	315 lb min.	200 lb min.	250 lb min.	160 lb min.
Grab Failure Strain, in machine and x-machine direction	D4632/ D4632M	15% -50%	≥50%	15% -50%	≥50%	<50%	≥50%
Seam Breaking Strength	D4632/ D4632M	220 lb min.	140 lb min.	270 lb min.	180 lb min.	220 lb min.	140 lb min.
Puncture Resistance	D6241	495 lb min.	310 lb min.	620 lb min.	430 lb min.	495 lb min.	310 lb min.
Tear Strength, in machine and x-machine direction	D4533	80 lb min.	50 lb min.	112 lb min.	79 lb min.	80 lb min.	50 lb min.
Ultraviolet (UV) Radiation Stability	D4355	70% strength retained min., after 500 hours in xenon arc device					

Table 2
Filtration Properties for Geotextile for Permanent Erosion Control

Geotextile Property	ASTM Test Method	Geotextile Property Requirements		
		Class A	Class B	Class C
AOS	D4751	U.S. No. 40 max.	U.S. No. 60 max.	U.S. No. 70 max.
Water Permittivity	D4491	0.7 sec^{-1} min.	0.4 sec^{-1} min.	0.2 sec^{-1} min.

Table 3
Geotextile for Temporary Silt Fence

Geotextile Property	ASTM Test Method	Geotextile Property Requirements	
		Unsupported Between Posts	Supported Between Posts with Wire or Polymeric Mesh
AOS	D4751	U.S. No. 30 max. for silt wovens, U.S. No. 50 for all other geotextile types, U.S. No. 100 min.	
Water Permittivity	D4491	0.2 sec^{-1} min.	
Grab Tensile Strength, in machine and x-machine direction	D4632/ D4632M	180 lb min. in machine direction, 100 lb min. in x-machine direction	100 lb min.
Grab Failure Strain, in machine and x-machine direction	D4632/ D4632M	30% max. at 180 lb or more	
Ultraviolet (UV) Radiation Stability	D4355	70% strength retained min., after 500 hours in xenon arc device	

2.07 HIGH VISIBILITY FENCING

A. High Visibility Fence: UV stabilized, orange, high-density polyethylene or polypropylene mesh.

B. Height: 4 feet minimum.

C. Support Posts: Wood or steel with sufficient strength and durability to support the fence through the life of the Project.

2.08 INLET PROTECTION

A. As specified under Article Geotextile.

2.09 OUTLET PROTECTION

A. Size riprap or quarry spall to resist movement under design flows. Install at least 8 inches deep. Provide riprap or quarry spall material free of extraneous material.

2.10 PLASTIC COVERING

A. Clear plastic meeting requirements of ASTM D4397 for polyethylene sheeting having a minimum thickness of 6 mils.

2.11 POLYACRYLAMIDE (PAM)

A. Meet ANSI/NSF Standard 60 for drinking water treatment with an AMD content not to exceed 0.05 percent.

B. Anionic, linear, and not cross-linked.

C. Minimum average molecular weight greater than 5 mg/mole and minimum 30 percent charge density.

D. 80 percent active ingredients minimum with moisture content not exceeding 10 percent by weight.

E. Delivered in a dry granular or powder form.

2.12 SEEDING

A. See Section 32 92 00, Turf and Grasses.

2.13 STRAW

A. Straw:

1. Air dried condition free of noxious weeds, seeds, and other materials detrimental to plant life. Hay is not acceptable. Provide weed-free documentation:
   a. Certified Weed Free Straw using North American Weed Management Association (NAWMA) standards.
   b. Provide documentation that material is steam or heat treated to kill seeds.
   c. Provide U.S. or state’s Department of Agriculture laboratory test reports, dated within 90 days prior to date of application, showing there are no viable seeds in the straw.

B. Straw Mulch: Suitable for spreading with mulch blower equipment.

C. Posts for Straw Bales: 2-inch by 2-inch untreated wood or commercially manufactured metal posts.

2.14 TACKIFIERS

A. Biodegradable Hydraulically Applied Erosion Control Products (HECPs) in a dry condition, free of noxious weeds, seeds, chemical printing ink, germination inhibitors, herbicide residue, chlorine bleach, rock, metal, plastic, and other materials detrimental to plant life. Up to 5 percent by weight may be photodegradable material.

B. Suitable for spreading with a hydroseeder.

C. Furnish HECPs premixed by the manufacturer. Under no circumstances will field mixing of additives or components be acceptable.

D. Provide test results, dated within 3 years prior to the date of application, from an independent, accredited laboratory, as approved by Contractor, showing that the product meets the HECP requirements in Table 4.

Table 4
HECP Requirements

Properties	Test Method	Requirements
Acute Toxicity	EPA-821-R-02-012 Methods for Measuring Acute Toxicity of Effluents. Test leachate from recommended application rate receiving 2 inches of rainfall per hour using static test for No-Observed-Adverse-Effect-Concentration (NOEC).	Four replicates are required with no statistically significant reduction in survival in 100 percent leachate for a Daphnid at 48 hours and Oncorhynchus mykiss (rainbow trout) at 96 hours.
Solvents	EPA 8260B	Benzene: < 0.03 mg/kg Methylene chloride: < 0.02 mg/kg Naphthalene: < 5 mg/kg Tetrachloreoethylene: < 0.05 mg/kg Toluene: < 7 mg/kg Trichloroethylene: < 0.03 mg/kg Xylenes: < 9 mg/kg

Table 4
HECP Requirements

Properties	Test Method	Requirements
Heavy Metals	EPA 6020A Total Metals	Antimony: < 4 mg/kg Arsenic: < 6 mg/kg Barium: < 80 mg/kg Boron: < 100 mg/kg Cadmium: < 2 mg/kg Chromium: < 2 mg/kg Copper: < 5 mg/kg Lead: < 5 mg/kg Mercury: < 2 mg/kg Nickel: < 2 mg/kg Selenium: < 10 mg/kg Strontium: < 30 mg/kg Zinc: < 5 mg/kg
Water Holding Capacity	ASTM D7367	900 percent minimum
Organic Matter Content	ASTM D2974	90 percent minimum
Moisture Content	ASTM D2974	15 percent
Seed Germination Enhancement	ASTM D7322	Long-Term: 420 percent minimum Moderate-Term: 400 percent minimum Short-Term: 200 percent minimum

2.15 TIRE WHEEL WASH FACILITY

A. Specified by Subcontractor with approval of Contractor. Wheel wash facilities should have a non-erosive base, and a small grade change, 6 inches to 12 inches for a 10-foot-wide pond, to allow sediment to flow to low side of pond to help prevent re-suspension of sediment. A drainpipe with a 2-foot to 3-foot riser should be installed at low side of pond to allow for cleaning and refilling. Pond should be deep enough to hold 14 inches of water after displacement. Alternatively, pressure washing combined with an adequately-sized and adequately-surfaced pad with direct drainage to a 10-foot by 10-foot sump can be very effective.

PART 3 EXECUTION

3.01 PREPARATION

A. Contractor's acceptance of Subcontractor's updated/revised SESC Plan required prior to starting earth disturbing activities.

B. Subcontractor shall be responsible for phasing Work in areas allocated for their exclusive use during Project, including proposed stockpile areas and installation of temporary and permanent BMPs, ditches, or other facilities.

C. Areas set aside for Subcontractor's use during Project may be temporarily developed to provide satisfactory working, staging, and administrative areas. Preparation of these areas shall be in accordance with other requirements contained within Specifications and completed in a manner to control sediment transport away from area.

3.02 INSTALLATION

A. Installation and maintenance will be in accordance with the *Michigan Nonpoint Source Best Management Practices Manual* and the *Soil Erosion and Sedimentation Control Guidebook* – see References and in accordance with manufacturer's instructions.

3.03 SOIL STOCKPILES

A. Protect from erosion with silt fence.

3.04 FIELD QUALITY CONTROL

A. Conduct inspections jointly with Contractor every week to evaluate conformance to requirements of Specifications.

B. Replace or repair failed or overloaded silt fences, check dams, or other temporary erosion control devices within 2 days after Site inspections.

3.05 MAINTENANCE

A. Promptly repair or replace silt fence that becomes damaged.

B. Provide and maintain soil stabilization seeding at all times.

C. Silt Traps:

1. Clean silt traps of collected sediment after every storm or as determined from biweekly inspections.

2. Perform cleaning in a manner that will not direct sediment into storm drain piping system.
3. Take removed sediment to area selected by Contractor where it can be cleaned of sticks and debris, then allowed to dry.
4. Dispose of final sediment onsite as designated by Contractor.
5. Dispose of debris offsite.

D. Regrade unpaved earth drainage ditches as needed to maintain original grade and remove sediment buildup. If ditch becomes difficult to maintain, install additional erosion control devices such as check dams, temporary paving, or silt fences as directed by Contractor.

E. Inspect, repair, and replace as necessary erosion control measures during the time period from start of construction to completion of construction.

3.06 CLEANING

A. Dress sediment deposits remaining after fence has been removed to conform to existing grade.

3.07 PREPARATION

A. Contractor's acceptance of the SESC Plan is required prior to starting earth disturbing activities.

B. Include proposed stockpile areas and installation of temporary erosion control devices, ditches, or other facilities in Work phasing plans.

C. Areas designated for Subcontractor's use during Project may be temporarily developed as specified to provide working, staging, and administrative areas. Include control of sediment from these areas in the SESC Plan.

D. Provide stabilization, as needed, to enhance establishment of vegetation.

E. Filtration System:

1. Sand: Rapid sand filtration systems shall have stormwater pumped from a trap, pond, or tank through filtration system. Slow sand filtration systems shall have flow through using gravity. Sand media filter shall have automatic backwashing features that can filter to 50 μm particle size. Screen or bag filters shall filter down to 5 μm. Fiber wound filters shall remove particles down to 0.5 μm. Sequence filters from the largest to the smallest pore opening. Filtration may be used in conjunction with polymer treatment in a portable system to assure capture of the flocculated solids.

2. Chemical: Prior to discharge, sample each batch of treated and test for compliance with pH and turbidity limits, which may be established by water quality standards or a Site-specific discharge permit. Sampling and testing for other pollutants may be necessary. Obtain regulatory approval and provide a qualified, trained operator, if required by law.

F. High Visibility Fencing: Install high visibility fencing in accordance with the Drawings.

G. Inlet Protection: Install inlet protection below or above, or as a prefabricated cover at each inlet grate, as shown on the Drawings. Install inlet protection devices prior to beginning clearing, grubbing or earthwork activities. Geotextile fabric used in prefabricated inlet protection devices must meet or exceed the requirements for Moderate Survivability and minimum filtration properties. When depth of accumulated sediment and debris reaches approximately one-half the height of an internal device or one-third the height of external device (or less when so specified by the manufacturers) or as designated by Contractor, remove deposits and stabilize onsite.

1. Below Inlet Grate:
    a. Prefabricated units specifically designed for inlet protection.
    b. Must remain securely attached to drainage structure when fully loaded with sediment and debris or at the maximum level of sediment and debris specified by manufacturer.
2. Above Inlet Grate:
    a. Devices may be silt fence, sandbags, or prefabricated units specifically designed for inlet protection.
    b. Must remain securely in place around drainage structure under all conditions.
3. Inlet Grate Cover:
    a. Prefabricated units specifically designed for inlet protection and:
        1) Be a sewn geotextile fabric unit fitted to individual grate and completely enclosing grate.
        2) Have built-in lifting devices to allow manual access of stormwater system.
        3) Use an orange monofilament geotextile fabric.
    b. Check dams or functionally equivalent devices may be used as inlet protection devices with approval of Contractor.

H. Outlet Protection: Provide outlet protection to prevent scour at outlets of ponds, pipes, ditches, or other conveyances.

I. Plastic Covering: Use clear plastic covering to promote seed germination when seeding is performed outside of specified dates. Use black plastic covering for stockpiles or other areas where vegetative growth is unwanted. Place plastic with at least a 12-inch overlap of all seams. Install and maintain plastic cover to prevent water from cutting under the plastic and to prevent cover from blowing open in the wind.

J. Sediment Control Barriers: Install sediment control barriers in accordance with SESC Plan or manufacturer's recommendations in the areas of clearing, grubbing, earthwork, or drainage prior to starting those activities. Maintain sediment control barriers until soils are stabilized.

K. Seeding: See Section 32 92 00, Turf and Grasses.

L. Silt (Sediment) Fence:

1. Silt fence shall be installed in accordance with the Drawings. When backup support is used, use steel wire with a maximum mesh spacing of 2 inches by 4 inches, or plastic mesh as resistant to ultraviolet radiation as the geotextile it supports. Provide wire or plastic mesh with strength equivalent to or greater than as required for unsupported geotextile (for example, 180 pounds grab tensile strength in the machine direction).
2. Attach geotextile to posts and support system using staples, wire, or in accordance with manufacturer's recommendations. Geotextile shall be sewn together at the point of manufacture, or at a location approved by Contractor, to form geotextile lengths as required.
3. Provide wood or steel support posts at sewn seams and overlaps and as shown on the Drawings and necessary to support fence.
4. Wood Posts: Minimum dimensions of 2-inch by 2-inch by the minimum length shown on the Drawings.
5. Steel Posts: Minimum weight of 0.90 lb/ft.
6. When sediment deposits reach approximately one-third the height of the silt fence, remove and stabilize deposits.

M. Street Cleaning: Use self-propelled pickup street sweepers whenever required by Contractor to prevent transport of sediment and other debris off Project Site. Provide street sweepers designed and operated to meet air quality standards. Street washing with water will require approval by Contractor. Intentional washing of sediment into storm sewers or drainage ways must not occur. Vacuuming or dry sweeping and material pickup must be used to cleanup released sediments.

N. Tackifiers:

1. Mix and apply tackifier in accordance with manufacturer's recommendations. If applied with a hydroseeder, add Short-Term Mulch as a tracer at a rate of 125 pounds to 250 pounds per acre to visibly aid uniform application.
2. Soil Binding Using Polyacrylamide (PAM): Apply PAM on bare soil completely dissolved and mixed in water or applied as a dry powder. Apply dissolved PAM at a rate of not more than 2/3 pound per 1,000 gallons of water per acre. Apply a minimum of 200 pounds per acre of Short-Term Mulch with the dissolved PAM. Dry powder applications may be at a rate of 5 pounds per acre using a hand-held fertilizer spreader or a tractor-mounted spreader.
    a. Apply PAM only to areas that drain to completed sedimentation control BMPs in accordance with the SESC Plan. PAM may be reapplied on actively worked areas after a 48-hour period.
    b. PAM shall not be applied during rainfall or to saturated soils.

O. Tire Wheel Wash Facility: When the Subcontract requires a tire wash (in conjunction with a stabilized entrance), include details for tire wash and method for containing and treating sediment-laden runoff as part of the SESC Plan. All vehicles leaving the Site shall stop and wash sediment from their tires. Keep the water level 12 inches to 14 inches deep. Change wash water a minimum of once per day. Polymers may be used to promote coagulation and flocculation in a closed-loop system. Polyacrylamide (PAM) added to the wheel wash water at a rate of 0.25 pound to 0.5 pound per 1,000 gallons of water increases effectiveness and reduces cleanup time.

3.08 ADDITIONAL REQUIREMENTS

A. Natural Buffer or Equivalent:

1. Unless natural buffer between the Project Site and receiving waters has previously been eliminated by pre-existing development disturbances, comply with one of the following alternatives if stormwater from construction will discharge to surface water:
    a. Provide a 50-foot, undisturbed natural buffer between construction disturbances and surface water.
    b. Provide an undisturbed natural buffer that is less than 50 feet supplemented by additional erosion and sediment controls, which in combination, achieve a sediment load reduction that is equivalent to a 50-foot buffer.

c. If it is infeasible to provide an undisturbed natural buffer of any size, implement erosion and sediment controls that achieve a sediment load reduction that is equivalent to a 50-foot buffer.

3.09 MAINTENANCE

A. The SESC measures described in this specification are minimum requirements for anticipated Site conditions. During the construction period, upgrade these measures as needed to comply with all applicable local, state, and federal erosion and sediment control regulations.

B. Maintain erosion and sediment control BMPs so they properly perform their function until Contractor determines they are no longer needed.

C. Construction activities must avoid or minimize excavation and creation of bare ground during wet weather.

D. The intentional washing of sediment into storm sewers or drainage ways must not occur. Vacuuming or dry sweeping and material pickup must be used to cleanup released sediments.

E. Inspect BMPs in accordance with the schedule in the Construction Stormwater Discharge Permit(s) or as directed by Contractor.

F. Complete an inspection report within 24 hours of an inspection. Each inspection report shall be signed and identify corrective actions. Document that corrective actions are performed within 7 days of identification. Keep a copy of all inspection reports at the Site or at an easily accessible location.

G. Unless otherwise specified, remove deposits before the depth of accumulated sediment and debris reaches approximately height of BMP. Dispose of debris or contaminated sediment at approved locations. Clean sediments may be stabilized onsite using BMPs as approved by Contractor.

H. Sediment Fence: Remove trapped sediment before it reaches one-third of the above ground fence height and before fence removal.

I. Initiate repair or replacement of damaged erosion and sediment control BMPs immediately, and work completed by end of next work day. Significant replacement or repair must be completed within 7 days, unless infeasible.

J. Within 24 hours, remediate any significant sediment that has left construction site. Investigate cause of the sediment release and implement steps to prevent a recurrence of discharge within same 24 hours. Perform in-stream cleanup of sediment according to applicable regulations.

K. At end of each work day, stabilize or cover soil stockpiles or implement other BMPs to prevent discharges to surface waters or conveyance systems leading to surface waters.

L. Temporarily stabilize soils at end of shift before holidays and weekends, if needed. Ensure soils are stable during rain events at all times of year.

M. Initiate stabilization by no later than end of next work day after construction work in an area has stopped permanently or temporarily.

N. Within 14 days of initiating stabilization or as specified in permit, either seed or plant stabilized area (see Section 32 92 00, Turf and Grasses); or apply non-vegetative measures and cover all areas of exposed soil. Seed dry areas as soon as Site conditions allow. Ensure that vegetation covers at least 70 percent of stabilized area. In areas where Subcontractor's activities have compromised erosion control functions of existing grasses, overseed existing grass. Non-vegetative measures may include blown straw and a tackifier, loose straw, or an adequate covering of compost mulch. Complete initial stabilization within 7 days if storm water discharges to surface waters impaired for sediment or nutrients, or high quality waters.

O. Provide stabilization measures on all exposed areas. Do not remove temporary sediment control practices until exposed areas are stabilized. However, do remove all temporary erosion and sediment control BMPs measures as exposed areas become stabilized, unless doing so conflicts with local requirements. Properly dispose of construction materials and waste, including sediment retained by temporary BMPs.

3.10 REMOVAL

A. When Contractor determines that a BMP is no longer required, remove BMP and all associated hardware from the Project limits. When materials are biodegradable, Contractor may approve leaving temporary BMP in place.

B. Permanently stabilize all bare and disturbed soil after removal of erosion and sediment control BMPs. Dress sediment deposits remaining after BMPs have been removed to conform to existing grade. Prepare and seed graded area. If installation and use of erosion control BMPs have compacted or otherwise rendered soil inhospitable to plant growth, such as construction entrances, take measures to rehabilitate soil to facilitate plant growth. This may include, but is not limited to, ripping the soil, incorporating soil amendments, or seeding with specified seed.

END OF SECTION

SECTION 01 72 00
DECONTAMINATION OF PERSONNEL AND EQUIPMENT

PART 1 GENERAL

1.01 GENERAL

A. Onsite decontamination stations as shown on the drawings, large enough to accommodate the largest piece of construction equipment to be used at the site, shall be provided by the Subcontractor in conformance with this section and the Subcontractor's Site Health and Safety Plan. The Subcontractor will be responsible for providing the appropriate decontamination tools, equipment, solutions, liquids, containers, and supplies.

B. All water generated during decontamination activities shall be collected, contained, and stored at staging area in accordance with the approved Transportation and Disposal Plan. The Contractor will sample the water for disposal at an appropriate treatment facility. The treatment facility is subject to the approval of USEPA.

C. All personnel shall be decontaminated before leaving the site, as specified in the Subcontractor's Site Health and Safety Plan. "Leaving the site" is defined as leaving the exclusion area and entering the contamination reduction area. Decontamination shall be required prior to breaks, when picking up tools, equipment, or materials in the support zone, or any other activities where the potential exists for contaminant transfer.

D. Equipment shall be cleaned and decontaminated prior to use onsite, and prior to leaving the site.

E. All equipment shall be washed and cleaned under Level D requirements or as specified by the Site Safety Officer prior to initiation of work at the site.

F. All decontamination operations shall be conducted by Subcontractor personnel wearing Level D protective equipment and a face shield or additional protection as specified by the Site Safety Officer.

1.02 SUBMITTALS

A. Action Submittals: Subcontractor shall prepare and submit a decontamination station design for approval.

PART 2 PRODUCTS

2.01 GENERAL

A. The Subcontractor shall furnish all equipment and supplies necessary for the decontamination process such as clean water supply tank, tri-sodium phosphate detergent, a mobile steam cleaner or hot water high pressure washer, buckets, brushes, etc., as required.

B. The Subcontractor shall furnish new, sealable United States Department of Transportation (U.S. DOT)-approved containers (55-gallon drums) having watertight lids stored in a containment area as required, or new poly tank for the storage of decontamination water.

C. Tanks or drums shall be stored in a lined containment area or on a containment pad.

D. The Subcontractor shall also supply labeling materials and appropriately label all containers.

PART 3 EXECUTION

3.01 GENERAL

A. The Subcontractor shall follow the general decontamination plans, as specified in the Subcontractor's Site Health and Safety Plan and Transportation and Disposal Plan. Prior to mobilization, the Subcontractor shall finalize all personnel decontamination needs, equipment, and procedures with the Contractor. A decontamination station, meeting specifications and equipped with a means of catching all water, shall be constructed by the Subcontractor at the locations shown on the drawings.

3.02 EQUIPMENT DECONTAMINATION

A. General Decontamination:

1. The Subcontractor shall decontaminate the equipment after use and trucks hauling sediment offsite for disposal in the following manner:
   a. Scrape and remove all earthen materials from the equipment.
   b. Hose down equipment with a portable high-pressure, hot-water washer (steam cleaner).
   c. Collect rinsate and scrapings. Place rinsate in approved tanks or drums, if needed, and transport to the staging area for offsite disposal.
   d. Scrapings shall be stored on-site and covered until it can be disposed of at an approved offsite disposal facility.

e. Contractor is responsible for waste characterization sampling, shipment of samples to Laboratory Subcontractor, and analyzing results for offsite disposal.
f. Subcontractor is responsible for management, assisting the Contractor with waste characterization sample collection, and disposal of all decontamination water.
g. Subcontractor is responsible for management, assisting the Contractor with waste characterization sample collection, and disposal of all scrapings.

B. On the completion of the Work the Subcontractor shall remove the decontamination pad.

C. Contact Contractor for inspection and approval of intermediate and final clean-ups of equipment and transfer and disposal sites.

3.03 PERSONNEL DECONTAMINATION

A. Personnel decontamination procedures to be used shall be performed prior to leaving the excavation location. The Subcontractor shall provide all protective clothing and the equipment necessary for its own personnel to comply with the decontamination procedures as specified in the Subcontractor's Site Health and Safety Plan.

END OF SECTION

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Submit prior to application for final payment.
   a. Record Documents: All remaining record documents not previously submitted.
   b. Approved Shop Drawings and Samples: As required in the General Conditions.
   c. Special bonds, Special Guarantees, and Service Agreements.
   d. Consent of Surety to Final Payment: As required in General Conditions.
   e. Releases or Waivers of Liens and Claims: As required in General Conditions.
   f. Releases from Agreements.
   g. Final Application for Payment: Submit in accordance with procedures and requirements stated in Section 01 29 00, Payment Procedures.
   h. Extra Materials: As required by individual Specification sections.
   i. Summary of communications with OSHA.

1.02 RECORD DOCUMENTS

A. Quality Assurance:

1. Furnish qualified and experienced person, whose duty and responsibility shall be to maintain record documents.
2. Accuracy of Records:
   a. Coordinate changes within record documents, making legible and accurate entries on each sheet of Drawings and other documents where such entry is required to show change.
   b. Purpose of Project record documents is to document factual information regarding aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive Site measurement, investigation, and examination.
3. Make entries within 24 hours after receipt of information that a change in the Work has occurred.

4. Prior to submitting each request for progress payment, request Contractor's review and approval of current status of record documents. Failure to properly maintain, update, and submit record documents may result in a deferral by Contractor to recommend whole or any part of Subcontractor's Application for Payment, either partial or final.

1.03 RELEASES FROM AGREEMENTS

A. Furnish Owner written releases from property owners or public agencies where side agreements or special easements have been made, or where Subcontractor's operations have not been kept within the Owner's construction right-of-way.

B. In the event Subcontractor is unable to secure written releases:

1. Inform Owner or Contractor of the reasons.
2. Owner or its representatives will examine the Site, and Owner or Contractor will direct Subcontractor to complete the Work that may be necessary to satisfy terms of the side agreement or special easement.
3. Should Subcontractor refuse to perform this Work, Contractor reserves right to have it done by separate subcontract and deduct cost of same from Subcontract Price, or require Subcontractor to furnish a satisfactory bond in a sum to cover legal Claims for damages.
4. When Contractor is satisfied that the Work has been completed in agreement with Subcontract Documents and terms of side agreement or special easement, right is reserved to waive requirement for written release if: (i) Subcontractor's failure to obtain such statement is due to grantor's refusal to sign, and this refusal is not based upon any legitimate Claims that Subcontractor has failed to fulfill terms of side agreement or special easement, or (ii) Subcontractor is unable to contact or has had undue hardship in contacting grantor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 MAINTENANCE OF RECORD DOCUMENTS

A. General:

1. Promptly following commencement of Subcontract Times, secure from Contractor at no cost to Subcontractor, one complete set of Subcontract Documents. Drawings will be full size.

2. Label or stamp each record document with title, “RECORD DOCUMENTS,” in neat large printed letters.
3. Record information concurrently with construction progress and within 24 hours after receipt of information that change has occurred. Do not cover or conceal Work until required information is recorded.

B. Preservation:

1. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
2. Make documents and Samples available at all times for observation by Contractor.

C. Making Entries on Drawings:

1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe change by graphic line and note as required.
   a. Color Coding:
      1) Green when showing information deleted from Drawings.
      2) Red when showing information added to Drawings.
      3) Blue and circled in blue to show notes.
2. Date entries.
3. Call attention to entry by “cloud” drawn around area or areas affected.
4. Legibly mark to record actual changes made during construction, including, but not limited to:
   a. End coordinates for the excavation limits on applicable drawings.
   b. If applicable, horizontal and vertical locations of existing and new Underground Facilities/above ground pipelines, and appurtenances, and other underground structures, equipment, or Work. Reference to at least two measurements to permanent surface improvements.
   c. Locate existing facilities, piping, equipment, and items critical to the interface between existing physical conditions or construction and new construction.
   d. Changes made by Addenda and Field Orders, Work Change Directive, Change Order, and Contractor’s written interpretation and clarification using consistent symbols for each and showing appropriate document tracking number.
5. Dimensions on Schematic Layouts: Show on record drawings, by dimension, the centerline of each run of items such as are described in previous subparagraph above.
   a. Clearly identify the item by accurate note such as “cast iron drain,” “galv. water,” and the like.

b. Show, by symbol or note, vertical location of item - “existing”, “abandoned.”
c. Make identification so descriptive that it may be related reliably to Specifications.

3.02 FINAL CLEANING

A. At completion of the Work or of a part thereof and immediately prior to Subcontractor’s request for certificate of Substantial Completion; or if no certificate is issued, immediately prior to Subcontractor’s notice of completion, clean entire Site or parts thereof, as applicable.

1. Leave the Work and adjacent areas affected in a cleaned condition satisfactory to Owner and Contractor.
1. Clean all heavy equipment with power washer before leaving the site.
2. Remove all stockpiles of dirt and debris from the site, which may have been accumulated during construction activities.
3. Repair, patch, and touch up marred surfaces to specified finish and match adjacent surfaces.
4. Broom clean exterior paved driveways and parking areas.
5. Hose clean sidewalks, loading areas, and others contiguous with principal structures.
6. Leave no traces of sediment on the tracks, haul roads and public access roads.
7. Leave water courses, gutters, and ditches open and clean.

3.03 FINAL TOPOGRAPHICAL SURVEY

A. The Subcontractor shall be responsible for providing all personnel and equipment necessary to complete the following:

1. Research, recover, and confirm the existing horizontal and vertical control as found on the design drawings and provide a report that includes definition of the monumentation to be used as a basis of survey.
2. A final topographical survey of the former plant site where Work has been completed as part of this effort.
3. Provide additional deliverables as described in Exhibit 1 of Section 01 31 13, Project Coordination.

END OF SECTION

SECTION 31 10 00
SITE CLEARING

PART 1 GENERAL

1.01 DEFINITIONS

A. Interfering or Objectionable Material: Trash, rubbish, and junk; vegetation and other organic matter, whether alive, dead, or decaying; topsoil.

B. Clearing: Removal of interfering or objectionable material lying on or protruding above ground surface.

C. Grubbing: Removal of vegetation and other organic matter including stumps, buried logs, and roots greater than 2-inch caliper to a depth of 6 inches below subgrade.

D. Topsoil Removal: Removal of topsoil and other organic soils to a depth between 6 and 12 inches below existing ground surface elevations, or as approved by the Contractor.

E. Sand Layer Removal: Removal of existing drainage layer, consisting of sand and gravel to a depth between 4 and 18 inches below existing topsoil, or as approved by the Contractor.

F. Clay Cap Removal: Removal of existing clay cap material to a depth between 2 and 10 feet below the existing sand layer, or as approved by the Contractor. One foot of the clay cap will be left in place over the proposed excavation boundary shown on the Drawings to minimize odors over the area while excavation of contaminated material occurs.

G. Project Limits: Areas, as shown or specified, within which Work is to be performed.

1.02 QUALITY ASSURANCE

A. Obtain Contractor’s approval of staked clearing, grubbing, and stripping limits, prior to commencing clearing, grubbing, or stripping.

PART 2 PRODUCTS

2.01 HIGH-VISIBILITY FENCE

A. As specified in Section 01 57 13, Temporary Erosion and Sediment Control.

PART 3 EXECUTION

3.01 GENERAL

A. Clear and grub areas actually needed for construction activities within limits shown or specified.

B. Do not injure or deface vegetation that is not designated for removal.

C. Orange plastic construction barrier fence shall be installed around the excavation and work area using steel “T” posts spaced at 6-foot centers to secure open excavations before the end of each work day.

D. Ensure that stormwater runoff control is installed and erosion and sediment controls are in place according to the SESC Plan and best management practices prior to excavation. Stormwater runoff controls shall, at a minimum, prevent migration to storm sewers, street gutters, streets, and sidewalks.

3.02 CLEARING

A. Clear areas only within limits shown or specified.

B. Fell trees so that they fall away from facilities and vegetation not designated for removal.

C. Cut stumps flush with ground surface.

D. Cut off shrubs, brush, weeds, and grasses to within 2 inches of ground surface.

E. Conduct the clearing in a manner that prevents, to the extent possible, soil or soil- like material from being collected with the cleared material.

3.03 LIMITS

A. Clearing and excavation is not to extend beyond excavation limits established in the drawings and as verified during the Pre-construction Meetings.

B. Remove rubbish, trash, and junk from entire area within Project limits.

3.04 GRUBBING

A. Grub areas within limits shown or specified.

3.05 TOPSOIL REMOVAL

A. Remove topsoil within limits shown or specified.

B. Stockpile removed topsoil onsite for reuse during site restoration.

3.06 SAND LAYER REMOVAL

A. Remove drainage layer, consisting of sand and gravel, within limits shown or specified.

B. Stockpile removed drainage layer material onsite for reuse during backfill and restoration.

3.07 CLAY CAP REMOVAL

A. Remove clay cap within limits shown or specified, leaving 1 foot of clay cap in-place over the proposed excavation boundary shown on the Drawings to minimize odors during excavation.

B. Stockpile removed clay cap material onsite for reuse during backfill and restoration.

3.08 DISPOSAL

A. Clearing Debris:

1. Dispose of debris offsite at an appropriate disposal facility as approved by the Contractor.
2. Burning of debris onsite will not be allowed.
3. Woody debris may be chipped. Chips may be spread over existing clay cap at locations approved by Contractor.
4. Limit offsite disposal of clearing debris to locations that are approved by federal, state, and local authorities, and that will not be visible from Project.

END OF SECTION

SECTION 31 23 16
EXCAVATION

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Occupational Safety and Health Administration:
   a. Title 29, Labor, Chapter XVII Occupational Safety and Health Administration (OSHA), Part 1910, Occupational Safety and Health Standards: Part 1910.120, Hazardous Waste Operations and Emergency Response.
2. U.S. Environmental Protection Agency:
   a. Resource Conservation and Recovery Act (RCRA).
      1) Title 40 of the Code of Federal Regulations, Part 261 (40 CFR 261), Subpart C Characteristics of Hazardous Waste.
      2) 40 CFR 263, Standards Applicable to Transporters of Hazardous Waste.
      3) 40 CFR 268, Land Disposal Restrictions.
   b. Toxic Substances Control Act (TSCA), 40 CFR 761
3. U.S. Department of Transportation:
   a. 49 CFR 171, General Information, Regulations, and Definitions.
   b. 49 CFR 172, Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements.
   c. 49 CFR 173, Shippers - General Requirements for Shipments and Packaging.
   d. 49 CFR 178, Specifications for Packaging.
4. State of Michigan:
   a. Transportation Standards and Recordkeeping (Mich. Admin. Code R 299.9608-9609).
   b. Solid Waste Management (Mich. Admin. Code R 299.4101 - 299.4922).

1.02 DEFINITIONS

A. Excavated Waste: Buried solid waste, excavated soil, soil from borehole drilling, refuse, and construction waste, and special waste. Excavated waste does not include, solid waste, refuse, or construction waste created by Subcontractor incidental to the Work.

B. Free Product: Free-standing petroleum or chemical liquid product present in excavation or floating on water in excavation.

C. Hazardous Soil and Debris: Material which meets the definition of hazardous waste as defined by the Resources Conservation and Recovery Act (RCRA) in 40 CFR 261, Subpart C, or contains polychlorinated biphenyls subject to TSCA.

D. Nonhazardous Soil and Debris: Material which does not qualify as a hazardous or toxic waste as defined by RCRA or contain PCBs subject to TSCA, and includes excavated waste as defined above.

E. Wastewater: Water produced by Subcontractor's operation, including groundwater removed, stormwater entering excavation pits despite controls, washdown water, used decontamination water, and other water that requires handling by Subcontractor to accomplish the Work. Wastewater may be hazardous or nonhazardous and shall require special handling.

1.03 SUBMITTALS

A. Informational Submittals:

1. Excavation Plan, Detailing:
    a. Methods and sequencing of excavation.
    b. Numbers and types of proposed equipment.
    c. Design detailing excavation support in accordance with Section 31 41 00, Shoring and Section 31 80 00, Geotechnical Instrumentation.
        1) Drawings.
        2) Calculations.
    d. Transportation and Disposal Plan – as specified in Section 01 50 00, Temporary Facilities and Controls.
    e. Qualifications:
        1) Subcontractor and lower-tiered subcontractor documentation of experience.
        2) Subcontractor's Personnel and lower-tier Subcontractor Personnel: Documentation personnel proposed for Work with contaminated materials have been 40-hour trained in accordance with 29 CFR 1910.120.
        3) Subcontractors, lower-tiered subcontractor, and Licensed Site Professional's documentation of experience and registration.
        4) Waste Transporter: Documentation of licensing and equipment capabilities.

5) Offsite Disposal and Treatment Facilities: Documentation of licensing, disposal requirements, and acceptance of waste.

f. Proposed sequencing.
g. Anticipated difficulties and proposed resolutions.
h. Proposed odor control procedures.
i. Emergency Response Plan: Details how to handle an emergency during execution of the Work (for example, encountering drums with unknown contents; encountering pockets of hazardous atmospheres; response to spills caused by excavation of materials by Subcontractor or Subcontractor's equipment; response to fire or injured personnel).

B. Survey Plan:

1. Within 7 days after Notice to Proceed, submit a Survey Plan that is consistent with the Specifications provided including but not limited to:
   a. Type of survey to be used.
   b. Proposed Surveyor's relevant qualifications.
   c. Approximate number of survey points within a given area.
   d. Precision of the equipment.
   e. Accuracy of the survey.
   f. The reporting format to meet the Specifications.

C. Daily Reports:

1. Submit draft filled-in waste manifest prior to the start of excavation.
2. Submit a daily report to the Contractor describing each calendar day's activities (12 am to 11:59 pm) beginning with mobilization to the site and ending with demobilization from the site. Submit no later than 5:00 p.m. following the reported day.
3. Include the following:
   a. Project name, day, and date.
   b. Weather conditions for the site, including high and low temperature, precipitation levels, maximum and average wind velocity and direction, and sky conditions.
   c. Location of excavation performed for the day with figure indicating excavation area.
   d. Include active excavation times, time when excavation was not conducted due to mechanical failure, time when excavation was not conducted due to maintenance of equipment, time and reason for excavation downtime due to delays by others.
   e. Approximate volume (cubic yards) excavated.
   f. Debris type, approximate volume (CY/Tons), location encountered, and location placed.

g. Health and Safety reporting to include accidents, spills, and near-misses, and actions taken to contain and correct each incident with the name of the individual reporting the event.
h. Description of all monitoring performed by the Subcontractor, including surveys, dust/air monitoring, geotechnical monitoring results, and groundwater level fluctuations.
i. Safety topics, images of day's activities, meeting or inspections with applicable decisions, and/or miscellaneous notes appropriate to the day's activities.
j. Certificates of destruction/disposal.
k. Haul tickets.
l. Completed waste manifests.
m. Submit weekly progress reports as described in Section 01 32 00, Construction Progress Documentation.

D. Codes and Regulations:

1. Comply with federal, state, and local regulations in handling, testing, transporting, and disposing materials and in performing the Work.
2. Prior to commencing removal operations, obtain applicable local, state, and federal permits and licenses that directly impact Subcontractor's ability to perform the Work.

1.04 QUALITY ASSURANCE

A. Provide adequate survey control to avoid unauthorized over excavation (lateral and vertical).

1.05 WEATHER LIMITATIONS

A. Material excavated when frozen or when air temperature is less than 32 degrees F shall not be used as fill or backfill until material completely thaws.

B. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction.

1.06 SEQUENCING AND SCHEDULING

A. Clearing, and Grubbing: Complete applicable Work specified in Section 01 11 00 Summary of Work, Section 01 50 00, Temporary Facilities and Controls, and Section 31 10 00, Site Clearing, prior to excavating.

B. Dewatering: Sufficiently dewater during excavation to permit excavation activities and if necessary continue dewatering the excavated material to meet requirements for transportation and offsite disposal.

C. Excavation Support: Design, install and maintain, as necessary to support sides of excavations and prevent detrimental settlement and lateral movement of material outside of excavation limits, existing facilities, adjacent property, and completed Work in accordance with Section 31 41 00, Shoring and Section 31 80 00, Geotechnical Instrumentation. Follow Health and Safety Plan and include the safety controls.

D. Subcontractor shall sequence the work to minimize the time that the excavation remains open.

1.07 TOPOGRAPHIC, PRE-EXCAVATION, PROGRESS, AND POST-EXCAVATION SURVEYS

A. Surveys shall meet requirements provided in Exhibit 1 of Section 01 31 13, Project Coordination.

B. Engage a registered Surveyor licensed in Michigan and experienced in excavation surveying to perform the topographic and the pre-excavation surveys of excavation areas and limits of topsoil removal areas, post-removal surveys, and post-excavation surveys to document conditions at completion for each layer of material removed in each excavated section and post-backfill surveys to document each layer of material removed in each excavated section was restored to original grade.

C. Surveys will be conducted as follows:

1. Pre-excavation survey.
2. Post-excavation survey after removal of existing topsoil.
3. Post-excavation survey after removal of existing sand layer.
4. Post-excavation survey after removal of existing clay cap.
5. Post-excavation survey after removal of impacted material.
    a. Describe survey methods for above vs. below water table.
6. Post-backfilling survey after placement of general backfill to confirm bottom of clay cap elevation.
    a. Within 0.50 foot of original grade.
7. Post-backfilling survey after placement of clay cap material to confirm top of clay cap elevation/bottom of sand layer elevation.
    a. Within 0.10 foot of original grade.
8. Post-backfilling survey after placement of sand layer to confirm top of sand layer elevation/bottom of topsoil elevation.
    a. Within 0.10 foot of original grade.

9. Post-backfilling survey after placement of topsoil to confirm pre-seeding placement grade.
    a. Within 0.10 foot of original grade.

D. Contractor must approve all surveys before proceeding with next stage/layer of excavation or backfill. Contractor and Subcontractor will each sign and date a reconciliation form agreeing that the specified area is approved to move forward with the next stage of excavation or backfill.

E. Perform post-excavation surveys after removal of each layer (i.e. topsoil, sand, clay cap and impacted material) while excavation work is performed to layout the extent of excavation as shown on Drawings. Determine elevation shots to the nearest 0.05 feet, approximately evenly spaced over each area and obtained at a minimum density of one point per 100 square feet.

F. Perform progress surveys on a weekly basis during excavation activities and provide results to the Contractor. Determine elevation shots to the nearest 0.05 feet, approximately evenly spaced over each area and obtained at a minimum density of one point per 100 square feet.

G. Use the same Surveyor to complete all surveys. In the event a different Surveyor is required, submit a modified Survey Plan with the proposed Surveyor. Subcontractor shall receive approval from Contractor prior to using the proposed Surveyor to perform surveys.

H. Location and elevation of bench marks and control points are to be provided by the Contractor. If additional benchmarks are needed, Subcontractor shall establish bench marks convenient to Work.

I. Survey accuracy shall meet the following requirements provided in Exhibit 1 of Section 01 31 13, Project Coordination.

J. Survey methods and means for verifying excavated elevations shall be by electronic means, calibrated to Project datum prior to the beginning of the Work.

K. Compute the volume of material excavated in cubic yards, for acceptance or payment purposes based on the pre- and post-excavation surveys. In the event that the post-excavation completion survey discloses that the excavation is not satisfactorily completed, the Subcontractor shall resume excavation until the Work is deemed complete.

PART 2 PRODUCTS

2.01 MATERIALS

A. Plastic Sheeting:

1. Nylon-reinforced polyethylene sheeting, opaque/frosted.
2. Thickness: Minimum 10 mils.

B. Tape and Glue: Capable of sealing joints of adjacent sheets of plastic and capable of adhering under wet conditions.

C. Geomembrane: 30-mil thick Linear low-density polyethylene (LLDPE) containing no plasticizers, fillers, extenders, reclaimed polymers, or chemical additives, except following:

1. Approximately 2 percent by weight of carbon black to resin for ultraviolet resistance.
2. Antioxidants and heat stabilizers, not to exceed 1.5 percent total by weight, may be added as required for manufacturing.
3. Ballast: Sandbags or other ballast materials of sufficient weight and quantity to maintain polyethylene sheeting securely in place.

PART 3 EXECUTION

3.01 GENERAL

A. Subcontractor shall be responsible for the following:

1. Providing means, methods, and equipment necessary for excavating, collecting, handling, processing, loading, and disposing of hazardous and nonhazardous soil, debris, excavated waste, and wastewater generated as part of the Work.
2. Selecting, providing, and coordinating with qualified transporters, disposal facilities, and treatment facilities for transporting, disposing, and documenting hazardous and nonhazardous waste transportation and disposal in accordance with this specification.
3. Complying with federal, state, and local requirements for transporting solid and liquid materials from Site through applicable jurisdictions, and be responsible for associated fines, penalties, and other costs for noncompliance.
4. Obtaining and submitting acceptance letters and receipts for materials disposed at each facility.
5. Including provisions in its construction sequence and schedule for sampling, analysis, and review of sampling results.

6. Stockpiling of contaminated materials awaiting loading for offsite disposal shall be stored in a geomembrane-lined, bermed area to contain runoff, and will be securely covered with plastic sheeting at the end of the work day. The staging areas will be constructed and maintained by the Subcontractor.

B. Excavation and removal limits are shown on the Drawings. The limits may be adjusted prior to excavation, depending on the confirmation sampling results.

C. Excavate to lines, grades, and dimensions shown and as necessary to accomplish Work. Excavate to within tolerance of plus or minus 0.1 foot, except where dimensions or grades are shown or specified as maximum or minimum. Allow for forms, working space, granular base, topsoil, and similar items, wherever applicable.

D. Do not overexcavate without written authorization of Contractor. If Subcontractor overexcavated without Contractor approval, Subcontractor will not be compensated for time, material, or labor for excavation or backfill in the overexcavated area.

E. If free product is encountered, the Subcontractor shall segregate free product from the wastewater for separate waste characterization. The Subcontractor is responsible for offsite disposal of free product, if encountered.

F. The Subcontractor shall segregate free product-stained soil from other excavated material for separate waste characterization. The Subcontractor is responsible for offsite disposal of free product-stained soil, if encountered.

G. Subcontractor may use an odor suppressant, with Contractor’s approval.

H. Remove or protect obstructions as shown and as specified in Section 01 50 00, Temporary Facilities and Controls, Article Protection of Work and Property.

I. Install and maintain erosion and sediment control measures before and during earth disturbing and stockpiling activities. Remove all temporary control measures following completion of construction activities and prior to restoration.

J. Perform air monitoring in accordance with Air Monitoring Plan.

3.02 EMBANKMENT AND CUT SLOPES

A. Shape, trim, and finish cut slopes to conform with lines, grades, and cross-sections shown on Drawings and a minimum finished slope of 2H:1V, unless conditions require 3H:1V, with proper allowance for slope protection, where shown. Where such slopes are not possible, design and construct temporary excavation support systems in accordance with Section 31 41 00, Shoring.

B. Round tops of cut slopes in soil to not less than a 6-foot radius, provided such rounding does not extend offsite or outside designated excavation area or easements and rights-of-way, or adversely impacts existing facilities, adjacent property, or completed Work.

C. Remove stones and rock that exceed 3-inch diameter and that are loose and may roll down slope. Remove exposed roots from cut slopes.

3.03 STOCKPILING EXCAVATED MATERIAL

A. Obtain approval from Contractor prior to stockpiling excavated material onsite as directed by Contractor.

B. As directed by Contractor, stockpile excavated material that is suitable for use as fill or backfill until material is needed.

C. To the extent possible, impacted material that is excavated will be live-loaded into trucks and immediately transported offsite for disposal. If excavated material is saturated, or deemed too wet for live-loading by the Contractor, soil will be placed on 10 mil polyethylene or approved equivalent and stabilized prior to offsite disposal. A pozzolanic agent, approved by the Contractor, may be used to facility drying and stabilizing of the load-out piles. The leachate from the wet/saturated soil will be collected, managed, and disposed offsite in accordance with the Subcontractor’s Transportation and Disposal Plan.

D. Post signs indicating proposed use of material stockpiled. Post signs that are readable from all directions of approach to each stockpile. Signs should be clearly worded and readable by equipment operators from their normal seated position.

E. Confine stockpiles to within approved work areas. Do not obstruct roads.

F. Do not stockpile excavated material adjacent to trenches and other excavations, unless excavation side slopes and excavation support systems are designed, constructed, and maintained for stockpile loads.

G. Do not stockpile excavated materials near or over existing facilities, adjacent property, or completed Work, if weight of stockpiled material could induce instability and/or excessive settlement.

3.04 LOADING OF EXCAVATED MATERIAL

A. This task includes all moving, handling and loading of excavated material for transportation. Sequencing of moving, handling and loading of trucks is to be done in accordance with the Subcontractor's Transportation and Disposal Plan.

B. Trucks shall be fully loaded, within allowable hauling weight limits, prior to transporting the excavated materials to the approved licensed disposal facility.

C. A temporary ground covering, 10 mil polyethylene or equivalent, shall extend a minimum of 2 feet under trucks to minimize the potential for soil to spill into roadways or other areas not requiring remediation. In lieu of a temporary ground covering, the Subcontractor may submit an alternative plan to prevent spills in roadways and other areas not requiring remediation to the Contractor for approval.

3.05 TRANSPORTATION AND DISPOSAL

A. The exterior of each transportation vehicle and load of waste shall be visually inspected and all loose soil/material removed and collected before leaving the site.

B. Each truck and/or container shall be lined prior to loading with excavated material.

C. Each truckload shall be covered with a fully functioning tarp system that satisfies local, county, state and federal regulations prior to transporting the excavated materials to the approved licensed disposal facility.

D. The Subcontractor will coordinate waste pickup with the Contractor once all analytical, profiles and manifests are in order.

E. Transportation of nonhazardous wastes shall be completed by a transporter licensed for commercial transportation in the State of Michigan. The transporter shall adhere by and be in compliance with all regulatory requirements under 49 Code of Federal Regulations (CFR).

F. Subcontractor shall provide documentation indicating that the selected transporter and any lower tier subs has appropriate licenses, permits as a commercial transporter of nonhazardous and hazardous wastes including a valid U.S. DOT number. Transporters of hazardous waste must also maintain hazardous certification and a valid EPA ID number. Transporter must be in good standing with the State and U.S. DOT as well as the USEPA.

G. Transporters will be required to abide by all health and safety requirements of Contractor and the installation when driver is out of the truck. At a minimum, each driver will be REQUIRED to wear a hard hat (at all times while on premises of the facility while the driver is out of the truck), long pants, appropriate work shirts, steel-toe safety shoes and safety glasses. Gloves are required when detaching or attaching trailers. Contractor reserves the right to turn away any driver who does not meet these minimum health and safety requirements. Contractor will not be responsible for any demurrage or other costs as a result of turning away a driver who does not meet Contractor's health and safety requirements.

H. Each driver will also be required to produce proof of insurance for his truck, and the driver's valid commercial driver's license. Hardcopies of these documents must be kept onsite during execution of the Work.

I. Each driver shall follow the site traffic signs including stop and speed limit signs and transportation routes. Talking on cell phones while driving is prohibited.

J. Transporter shall prevent contamination of soil, water, or atmosphere by the discharge of noxious substances resulting from their activities; prevent the tracking of soil and debris from the work areas to other facility locations as well as off-site; and perform emergency measures (if required) to contain and address any releases resulting from Subcontractor operations. The Subcontractor should report any releases to the Contractor. Should the Subcontractor cause a release, the Subcontractor will be held financially responsible for cleanup and removal of impacted material, sampling and analysis of waste for disposal purposes, and disposal costs associated with the release.

K. Vehicle fueling, lubrication, and maintenance will be performed on site in designated areas approved by the Contractor. Secondary containment systems must be used during fueling activities, and spill kits must be available nearby.

L. Soil waste removed from the site shall be transported and disposed of at a licensed facility approved by USEPA. Disposal facilities will be required to provide proof of USEPA approval under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Offsite Rule, set forth in the National Contingency Plan, at 40 Code of Federal Regulations 300.440.

M. Non-hazardous waste manifests will be prepared by the Subcontractor and signed by the Contractor on behalf of Owner. A completed draft manifest will be provided to Contractor prior to beginning excavation work. A manifest will accompany each load.

N. Waste characterization samples will be collected by the Contractor prior to the start of excavation activities to confirm excavated soil is characterized as nonhazardous. Contractor will provide the results of analysis to the Subcontractor.

O. The quantities of waste shall be recorded by documented weighing at the approved disposal facility. For each load of material, weight measurements will be obtained for each full and empty container or dump truck. Disposal quantities will be based on the difference of weight measurements between the full and empty container or dump truck. Copies of haul tickets shall be signed and provided to Contractor on a daily basis.

P. The following procedures also will be observed when transporting wastes offsite:

1. The Subcontractor will coordinate waste pickup with the Contractor once all analytical, profiles and manifests are in order.
2. Waste material transportation shall comply with federal, state and local regulations.
3. Impacts to general public traffic will be minimized.
4. All truck traffic shall enter and exit the site through the south site gate, located off of M-46/Washington Avenue, unless directed otherwise by Contractor.
5. If road damage is caused by construction and/or hauling traffic, the damage will be repaired at no additional cost to the Contractor or Owner.
6. Material spilled in transit will be cleaned up.
7. Safety and spill response procedures will be followed.
8. Sealed trucks will be used to transport liquids or wet materials.
9. No materials from other projects shall be combined with materials from this site.
10. The approved Transportation and Disposal Plan will be followed.

END OF SECTION

SECTION 31 23 19.01
DEWATERING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Occupational Safety and Health Administration:
   a. Title 29, Labor, Chapter XVII Occupational Safety and Health Administration (OSHA), Part 1910, Occupational Safety and Health Standards: Part 1910.120, Hazardous Waste Operations and Emergency Response.
2. U.S. Environmental Protection Agency:
   a. Resource Conservation and Recovery Act (RCRA).
      1) Title 40 of the Code of Federal Regulations, Part 261 (40 CFR 261), Subpart C Characteristics of Hazardous Waste.
      2) 40 CFR 263, Standards Applicable to Transporters of Hazardous Waste.
      3) 40 CFR 268, Land Disposal Restrictions.
3. U.S. Department of Transportation:
   a. 49 CFR 171, General Information, Regulations, and Definitions.
   b. 49 CFR 172, Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements.
   c. 49 CFR 173, Shippers - General Requirements for Shipments and Packaging.
   d. 49 CFR 178, Specifications for Packaging.
4. State of Michigan:
   a. Transportation Standards and Recordkeeping (Mich. Admin. Code R 299.9608-9609).
   b. Solid Waste Management (Mich. Admin. Code R 299.4101 - 299.4922).
   c. Part 121 of the Natural Resource and Environmental Protection Act (Liquid Industrial By-Products).

1.02 SUBMITTALS

A. Informational Submittals: Water control plan.

1.03 WATER CONTROL PLAN

A. Develop plan to address removal and management of ground and stormwater accumulated in excavations PSA-1 and PSA-2. It is anticipated that an average of 22,000 gallons / day of water from PSA-1 and 1,200 gallons/day of water from PSA-2 will accumulate in respective excavations.

B. As a minimum, include:

1. Descriptions of proposed groundwater seepage control facilities including, but not limited to, equipment; methods; standby equipment and power supply, means of measuring inflow and precipitation to excavations, pollution control facilities, discharge locations to be utilized, and provisions for immediate temporary water supply as required by this section.
2. Drawings showing locations, dimensions, and relationships of elements of each system.
3. Design calculations demonstrating adequacy of proposed dewatering systems and components.

PART 2 PRODUCTS

2.01 PUMPS

A. Subcontractor shall provide pumps that can dewater excavation areas without hindering the excavation and backfill process and also without compromising safety.

B. Subcontractor may use a biodegradable, water-based surfactant to address odors coming from the groundwater (similar to the use for the soils), and also to help manage any free product present in the water and prevent it from smearing and adsorbing onto other materials in the excavation (such as the clay till).

PART 3 EXECUTION

3.01 GENERAL

A. Continuously control excavation water during course of construction, including weekends and holidays and during periods of work stoppages, and provide adequate backup systems to maintain control of water.

3.02 SURFACE WATER CONTROL

A. See Section 01 50 00, Temporary Facilities and Controls, Article Temporary Controls and Section 01 57 13 Temporary Erosion and Sediment Control.

B. Install pumps with controls to quickly discharge water from the work area.

C. Remove surface runoff controls when no longer needed.

3.03 DEWATERING SYSTEMS

A. Provide, operate, and maintain dewatering systems of sufficient size and capacity to permit excavation and subsequent construction in dry and to lower and maintain excavation water level a minimum of 1 foot below the lowest point of excavation, but no lower than elevation 715 feet above mean sea level. Continuously maintain excavations free of water, regardless of source, and until backfilled to final grade.

B. Design and Operate Dewatering Systems:

1. To prevent loss of ground as water is removed.
2. To avoid inducing settlement or damage to existing facilities, completed Work, or adjacent property.
3. To relieve artesian pressures and resultant uplift of excavation bottom.

C. Provide sufficient redundancy in each system to keep excavation free of water in event of component failure.

D. Provide 100 percent emergency power backup with automatic startup and switchover in event of electrical power failure.

E. Provide supplemental ditches and sumps only as necessary to collect water from local seeps. Do not use ditches and sumps as primary means of dewatering.

3.04 MONITORING FLOWS

A. Monitor volume of water pumped per calendar day from excavations, as Work progresses. Also monitor volume of water introduced each day into excavations for performance of Work. Monitor flows using measuring devices acceptable to Contractor.

3.05 DISPOSAL OF WATER

A. Excavation water in contact with soil in an open excavation will be taken offsite for disposal. Stormwater accumulated on an excavation liner or cover will be discharged as clean stormwater in accordance with the approved Soil Erosion and Sedimentation Control plan.

B. Liquid waste characterization sampling will be conducted by the Contractor prior to excavation activities. Sample results will be provided to the Subcontractor.

C. The Subcontractor is responsible for the following for accumulating and disposing excavation water offsite:

1. All materials, piping, pumps, frac tanks, secondary containment, etc. required for collecting and storing water.
2. A tanker truck shall be utilized to haul the water offsite for treatment/disposal, similar to the operations for the existing groundwater collection system.

D. In the event that free product is encountered during excavation activities, it will be pumped with the groundwater into a frac tank. After the free product separates from the groundwater in the frac tank, it will be pumped into a 55-gallon drum and analyzed for disposal and/or reclamation.

END OF SECTION

SECTION 31 23 23
FILL AND BACKFILL

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. C117, Standard Test Method for Materials Finer Than 75-Micrometers (No. 200) Sieve in Mineral Aggregates by Washing.
   b. C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
   c. D422, Standard Test Method for Particle Size Analysis of Soils
   d. D75, Standard Practice for Sampling Aggregates.
   e. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).
   f. D1556, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   g. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
   h. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   i. D4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
   j. D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
2. Michigan Department of Transportation (MDOT): 2012 Standard Specifications.

1.02 DEFINITIONS

A. Relative Compaction:

1. Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM D698.
2. Apply corrections for oversize material to either as-compacted field dry density or maximum dry density, as determined by Contractor.

B. Optimum Moisture Content:

1. Determined in accordance with ASTM Standard specified to determine maximum dry density for relative compaction.
2. Determine field moisture content on basis of fraction passing 3/4-inch sieve.

C. Relative Density: Calculated in accordance with ASTM D4254 based on maximum index density determined in accordance with ASTM D4253 and minimum index density determined in accordance with ASTM D4254.

D. Prepared Ground Surface: Ground surface after completion of required demolition, clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade, and subgrade preparation.

E. Completed Course: A course or layer that is ready for next layer or next phase of Work.

F. Lift: Loose (uncompacted) layer of material.

G. Geosynthetics: Geotextiles, geogrids, or geomembranes.

H. Well-Graded:

1. A mixture of particle sizes with no specific concentration or lack thereof of one or more sizes.
2. Does not define numerical value that must be placed on coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters.
3. Used to define material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

I. Influence Area: Area within planes sloped downward and outward at 60-degree angle from horizontal measured from:

1. 1 foot outside outermost edge at base of foundations or slabs.
2. 1 foot outside outermost edge at surface of roadways or shoulder.
3. 0.5 foot outside exterior at spring line of pipes or culverts.

J. Borrow Material: Material from required excavations or from designated borrow areas on or near Site. Borrow soils anticipated for use during this Work are as follows:

1. Gravel fill below the groundwater table (if encountered), as defined in this section.

2. General fill between the groundwater table (if encountered) and bottom elevation of clay cap, as defined in this section.
3. Clay fill, as defined in this section, if clay cap material removed prior to excavation of impacted material is not 100 percent salvageable.
4. Granular fill, as defined in this section, if drainage layer material removed prior to excavation of impacted material is not 100 percent salvageable.
5. Topsoil, as defined in this section, if topsoil removed prior to excavation of impacted material is not 100 percent salvageable.

K. Selected Backfill Material: Materials available onsite that Contractor determines to be suitable for specific use. Selected backfill material anticipated for this Work is as follows:

1. Existing topsoil removed prior to excavating impacted material.
2. Existing drainage material, composed of sand and gravel, removed prior to excavating impacted material.
3. Existing clay cap material, removed prior to excavating impacted material.
4. Soil from City of St. Louis construction activities.

L. Imported Material: Materials obtained from sources offsite, suitable for specified use.

M. Embankment Material: Fill materials required to raise existing grade in areas other than under structures.

1.03 SUBMITTALS

A. Action Submittals:

1. Samples:
   a. Each imported material taken at source, prior to construction.
   b. Gravel fill.
   c. General fill.
   d. Clay fill.
   e. Granular fill.

B. Informational Submittals:

1. Manufacturer’s data sheets for compaction equipment.
2. Certified gradation test results and compaction test results.
3. Certification of chemically clean material.
4. Certified test results from independent testing agency.

1.04 QUALITY ASSURANCE

A. Notify Contractor when:

1. Whenever subgrade is ready for backfilling or when backfilling operations are resumed after a period of inactivity.
2. Soft or loose subgrade materials are encountered wherever embankment or site fill is to be placed.
3. Fill material appears to be deviating from Specifications.

1.05 SEQUENCING AND SCHEDULING

A. Complete applicable Work specified in Section 31 10 00, Site Clearing; Section 31 23 16, Excavation; and Section 31 23 19.01, Dewatering prior to placing fill or backfill.

B. Complete Work specified in this Section after receiving authorization from Contractor upon inspection of final excavation depth.

PART 2 PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. The Subcontractor shall submit the all laboratory reports to Contractor for approval within one day of receipt from the laboratory. Subcontractor must receive approval from Contractor prior to placement of borrow source materials.

B. Gradation Tests:

1. As necessary to locate acceptable sources of imported material.
2. During production of imported material, test as follows:
    a. Gravel fill: One test every 3,000 CY.
    b. General Fill: One test every 3,000 CY.
    c. Clay Fill: One test every 3,000 CY.
    d. Granular Fill: One test every 3,000 CY.
3. Clearly mark to show source of material and intended use.

C. Final approval of imported source materials will be based on test results. The borrow source material will meet the Michigan Part 201 Residential Soil criteria to be determined to be “clean.” Should the borrow source fail to meet Michigan Part 201 Residential Soil criteria only for chemicals commonly found at elevated background levels such as arsenic, the borrow source might still be approved for use by the appropriate regulatory agencies.

D. Chemical Analysis: Collect one sample per 3,000 cubic yards of imported source material to be analyzed for the following parameters:

1. Target compound list (TCL) volatile organic compounds (Method SW846 8260C).
   a. Includes 1, 2-dibromo-3-chloropropane (DBCP).
2. Target compound list (TCL) semivolatile organic compounds (Method SW846 8270D).
   a. Includes Tris (2,3-dibromopropyl) phosphate (TRIS).
3. Target compound list (TCL) Pesticides/PCBs (Method SW846 8081A/8082).
   a. Includes Polybrominated biphenyls (PBB), Hexabromobiphenyls (HBB), and Dichlorodiphenyl trichloroethane (DDT).
4. Target analyte list (TAL) metals (23), ICP and CVAA (Method SW846 6010/7470 or 7471.
5. Total Cyanide (Method EPA 335.4/SW 846 9014.
6. Target compound list (TCL) Acid Fraction Compounds (Method SW846 8270D).
7. Target compound list (TCL) Base Neutral Compounds (Method SW846 8270D).

2.02 GRAVEL FILL

A. Free from clods, organic matter, or other deleterious material.

B. Provide materials in accordance with MDOT Standard Specifications for Construction 2012, gradation 6A.

C. Physical Qualities: Per Section 902 of the MDOT Standard Specifications 2012.

D. Gradation: Per Table 902-1 of the MDOT Standard Specifications 2012

2.03 GENERAL FILL

A. General fill shall consist of natural sand. The material shall be suitably graded Class II sand in accordance with Michigan Department of Transportation Standard Specifications for Construction (2012 or current) Table 9.02-3, Grading Requirements for Granular Materials.

B. General fill material shall be free from rocks larger than 3 inches, from roots, peat and other organic matter, ashes cinders, trash, and other deleterious materials.

C. General fill shall not contain more than 10 percent gravel, stones, or shale particles.

2.04 CLAY FILL

A. Free from clods, organic matter and other deleterious material.

B. Consist of cohesive soils.

C. Maximum particle size – 2 inches.

D. USCS Classification: CH, MH, CL, ML, CL-ML, SC.

E. Permeability of $1x10^{-7}$ cm/sec or less.

2.05 SAND FILL

A. Free from clay, organic matter, or other deleterious material.

B. Gradation as determined in accordance with ASTM C117 and ASTM C136:

Sieve Size	Percent Passing by Weight
1/4-inch	100
No. 4	95 - 100
No. 200	0 – 5

C. USCS Classification: SP.

D. Hydraulic Conductivity: Minimum 1.0×10^{-3} cm/sec.

2.06 COMPACTION (ASTM D698):

1. Gravel fill: Not required.
2. General fill: 1 per 3,000 CY.
3. Clay fill: 1 per 3,000 CY.
4. Granular fill: 1 per 3,000 CY.
5. Topsoil: as specified in Section 32 91 13, Soil Preparation

B. Hydraulic Conductivity (ASTM D5084, ASTM D1587):

1. Clay fill: 1 per 5,000 CY.
   a. Minimum 1 per source remolded sample during pre-qualification.
   b. Minimum 1 per 1,000 CY field Shelby tube sample.

C. Permeability (ASTM D2434):

1. Granular fill: 1 per 3,000 CY.
   a. Minimum 1 per source remolded sample during pre-qualification.

2.07 WATER FOR MOISTURE CONDITIONING

A. Free of hazardous or toxic contaminates, or contaminants deleterious to proper compaction.

PART 3 EXECUTION

3.01 GENERAL

A. Keep placement surfaces free of water, debris, and foreign material during placement and compaction of fill and backfill materials.

B. This work includes transportation and installation of all material to project site.

C. Place and spread fill and backfill materials in horizontal lifts of uniform thickness, in a manner that avoids segregation, and compact each lift to specified densities prior to placing succeeding lifts. Slope lifts only where necessary to conform to final grades or as necessary to keep placement surfaces drained of water.

D. Compaction of clay fill shall be performed with a sheepsfoot roller.

E. During filling and backfilling, keep level of fill and backfill around each structure and buried tank even.

F. Do not place fill or backfill, if fill or backfill material is frozen, or if surface upon which fill or backfill is to be placed is frozen.

G. Tolerances:

1. Final Lines and Grades: Within a tolerance of 0.1 foot unless dimensions or grades are shown or specified otherwise. Acceptable tolerance for bottom of clay layer is within 0.5 foot.
2. Grade to establish and maintain slopes and drainage as shown. Reverse slopes are not permitted.

H. Settlement: Correct and repair any subsequent damage to structures, pavements, curbs, slabs, piping, and other facilities, caused by settlement of fill or backfill material.

3.02 PLACEMENT

A. Place fill and backfill in accordance with the lines and grades shown in the drawings and to the thickness indicated below:

1. Gravel fill: refer to drawings, place in lift thickness not to exceed 12-inches, compacted.
2. General fill: place in lift thickness not to exceed 12-inches, compacted.
3. Clay fill: place in lift thickness not to exceed 12-inches, compacted.
4. Granular Fill: place in lift thickness not to exceed 12-inches, compacted.

3.03 SITE TESTING

A. A qualified independent testing agency shall provide proper site testing. The Subcontractor will be responsible for removing any material that does not meet the Specification requirements at no additional cost to the Owner.

B. In Place Density Tests (ASTM D2974): In accordance with ASTM D6938. During placement of materials, test as follows:

1. Gravel fill: Not required.
2. General Fill: 1 test per 10,000 square feet per lift. Compacted to minimum of 98 percent of standard proctor maximum density.
3. Clay Fill: 1 test per 10,000 square feet per lift. Compacted to minimum of 98 percent of standard proctor maximum density and above optimum moisture content.
4. Granular Fill: 1 test per 10,000 square feet per lift. Compacted to minimum of 98 percent of standard proctor maximum density.

3.04 PLACING FILL OVER GEOSYNTHETICS

A. General:

1. Damage to existing site roads may require use of geosynthetics. The use of geosynthetics for road repair will be determined in the field by the Contractor.
2. Place fill over geosynthetics with sufficient care so as not to damage them.
3. Place fill only by back dumping and spreading only.
4. Dump fill only on previously placed fill.
5. While operating equipment, avoid sharp turns, sudden starts or stops that could damage geosynthetics.

B. Hauling: Operate hauling equipment on minimum of 3 feet of covering.

C. Spreading:

1. Spreading equipment shall be track mounted, low ground pressure, D-6 or lighter.
2. Operate spreading equipment on minimum of 12 inches of fill over geosynthetics.
3. Spread fill in same direction as unseamed overlaps to avoid separation of seams and joints.
4. Never push fill downslope. Spread fill over sideslopes by pushing up from slope bottom.
5. Maintain proper overlap (12 inches minimum) of unseamed geosynthetics.
6. Avoid overstressing geosynthetics and seams.

D. Compaction: Compact fill only after uniformly spread to full thickness shown.

E. Geosynthetic Damage:

1. Mark punctures, tears, or other damage to geosynthetics, so repairs may be made.
2. Clear overlying fill as necessary to repair damage.
3. Repairs to geosynthetics shall be made by respective installers as specified in respective specification section for each geosynthetic.

3.05 ACCESS ROAD SURFACING

A. Place and compact as specified in MDOT 2012 Standard Specifications.

END OF SECTION

SECTION 31 41 00
SHORING

PART 1 GENERAL

1.01 WORK INCLUDED

A. This section addresses the provisions and responsibilities to be considered by the Subcontractor and excavation support system design engineer in meeting requirements to design, furnish and install, and remove when applicable, the excavation support to facilitate the excavation specified in the plans and Subcontract provisions.

B. The geometry, extent, and type of excavation support system(s) must be such to successfully complete the construction stated in the plans and Subcontract provisions. The design requirements are contained in this Specification. Excavations will be made in silts, clays, sand/gravel mixtures and may extend through water-bearing materials. Consequently some excavation support systems will be complicated, may require dewatering, and may require anchorage or other external bracing mechanisms.

C. The excavation support system is the support installed prior to or concurrent with the excavation, to maintain stability of an excavation to be occupied by workmen, or to maintain the stability of existing structures, until the excavation is backfilled.

1.02 RESPONSIBILITY

A. The Subcontractor shall be responsible for the selection of appropriate type, design details and preparation of shop drawings of all excavation support systems to successfully complete the construction. Subcontractor’s design details shall be developed in accordance with the Subcontract Documents which includes all drawings and Specifications. The Subcontractor shall submit Shop Drawings to provide details of support systems, attachments, embedment, finishes and other construction that affects the work covered under this section.

B. It is the Subcontractor’s responsibility and his professional engineer to review the Plans, Specifications, and assess and visit existing site conditions prior to bidding to ascertain the extent of the work requiring ground support systems which meets his specific equipment, methods, and schedule.

C. The design, furnishing of materials, installation, monitoring and removal of ground support systems is the sole responsibility of the Subcontractor. Ground support system and safety elements necessary for protection of adjacent property, excavation stability and safety of workers during construction are not shown on the Plans but shall be designed, furnished and installed by the Subcontractor.

D. The Subcontractor shall verify the existing utility locations which are identified within or adjacent to some of the work areas on the Drawings prior to construction. For utilities that are shown on the Plans, the Subcontractor is responsible for the protection of and/or relocation of existing utilities, and the removal of abandoned utilities, as required for the required construction. This work is considered incidental to the construction and therefore shall not be compensated separately. If existing utilities shown on the Drawings are damaged as the result of the Subcontractor's construction activities, the Subcontractor is responsible for the cost of repairing damaged utilities. Unless otherwise shown, inside diameters of the utilities are shown on the Drawings. The Subcontractor shall field verify all utilities within 15 feet of the construction areas using potholing or other positive means of verification.

E. The Subcontractor is responsible for the health and safety of his workers, disposal of all excavated materials in accordance with Section 31 23 16, Excavation, and disposal of water in accordance with Section 31 23 19.01, Dewatering.

F. The Subcontractor shall install and maintain shoring systems without detriment to adjacent private land and private structures. This includes impacts due to the use of vibration equipment. Supplement monitoring activities in Section 31 80 00, Geotechnical Instrumentation as appropriate.

1.03 DESIGN OF EXCAVATION SUPPORT SYSTEMS

A. The shop drawings for the excavation support systems shall be prepared for the Subcontractor by a professional engineer licensed in the State of Michigan, and employed or retained by the Subcontractor. This individual is referred to herein as the Subcontractor's engineer. The Subcontractor's engineer shall have at least 3 years of experience with design and construction of similar types of ground support systems and excavations. The qualification of such engineer shall be submitted for approval. The Subcontractor's engineer shall maintain involvement and responsibility from design through installation, performance and abandonment or removal of ground support systems. The design documents for the excavation support systems shall be stamped by the Subcontractor's engineer.

B. All ground support system elements, including sheeting, shoring, and bracing of excavations shall conform to the requirements of Subpart P, Excavations (Standard Number 1926.650 of 29 CFR) of the Occupational Safety and Health Administration (OSHA).

C. The design shall provide groundwater control or cut-off, bottom stability and system stiffness sufficient to meet the Subcontract requirements for control of water and for protection of adjacent work and property as specified in Section 31 23 19.01, Dewatering, and Section 31 80 00, Geotechnical Instrumentation. The design shall be compatible with the Subcontractor's selected method of excavation and construction practices. The design shall provide for placement of excavation support systems and removal of the excavation support systems where required and feasible. The design shall provide for all other construction operations and requirements.

D. The Subcontractor's engineer shall design the excavation support systems to withstand earth pressures, groundwater pressures, bottom heave, equipment loads, applicable traffic and construction loads, and other surcharge loads to allow safe construction without excessive movement or settlement of the ground, and to prevent damage to or movement of adjacent private land, structures, and utilities. Design excavation support systems to be compatible with the geologic conditions described in the Solicitation Scope of Work and included in the specification as Exhibits 1 and 2 and in accordance with AISC and ACI code provisions, as applicable.

1. Design each member or support element to support the maximum loads that can occur during construction with appropriate safety factors. Provide a minimum factor of safety of 1.5 for all structural members when subjected to the maximum combination of loads or stresses.
2. Design the excavation support system to minimize horizontal and vertical movements, and to protect adjacent structures and utilities from damage. The type and stiffness of each ground support system and the methods of ground support installation shall be designed and constructed in order to meet the ground movement limits and adjacent property protection requirements specified in Section 31 80 00, Geotechnical Instrumentation.
3. Design the excavation support system to maintain the stability of the excavation against piping or bottom heave. Provide a minimum factor of safety against piping of 1.5. Provide a minimum factor of safety against bottom heave due to adjacent surcharge pressures and hydrostatic uplift pressures or upward seepage pressures of 1.5.

E. The excavation support system shall be designed to positively ensure that no earth or other loading will be placed on the new work prior to the completion and until design strength has been reached. The Subcontractor shall be solely and completely responsible for any loss due to premature loading of the new work.

F. The design shall specify the following items as a minimum: the quality of materials to be used for ground support systems; constraints on maximum excavation limits relative to support systems; constraints on maximum excavation limits relative to support installation steps; tolerances for size and position of ground support elements; required preloading of ground support elements; restrictions on surcharge loads and other loads that may act on the ground support system; ground support system and adjacent ground movement limits; provisions for subgrade stability and protection; and constraints on removal of support system elements as the backfilling is completed.

G. The Subcontractor's design engineer shall periodically observe the installation of Excavation support systems to determine that the work is being put in place in accordance with the design. Site observations shall be made by the Subcontractor's engineer as often as necessary, to ascertain the installation conformance thereto. The Subcontractor's engineer shall provide the Subcontractor, and the Contractor on a monthly basis, a signed and sealed certification of the consistency of the installation with the design, as determined from his site observations and available data. The Subcontractor's engineer shall also indicate any significant concerns with the performance of ground support systems and his recommendations for mitigating these concerns.

1.04 DEFINITIONS

A. Excavation Support System/Shoring System: A system provided to maintain stability of an excavation made for any purpose and to be occupied by workmen, and construction activity, until the final support system structure is complete in place, and the excavation is closed, and the area is backfilled.

1.05 SUBMITTALS

A. Action Submittals:

1. Shoring Plan: Submit for review by the Contractor prior to start of any field work drawings and computations for excavation support systems and other related information. As a minimum, the submittal shall contain the following information:
   a. Name and qualifications (including evidence of professional registration in the State of Michigan) of person responsible for excavation support system.
   b. Location and alignment of each excavation support system.
   c. Construction method to be used for the installation of each system, including sequence of installation and equipment description.
   d. Shop drawings and design calculations showing assumed loading conditions, codes and reference standards used as a basis for design, estimated ground movements, system component design, arrangement of supports and construction sequence for proposed support system(s). Show the elevation of struts, braces, anchors, or other supports as related to the depth of excavation at intermediate stages of construction. Provide details of bottom slab, drains, and sump construction. Indicate sizes, shapes, and material specifications for all support elements including lagging, if used. Calculations shall include estimates of likely deflections or deformations of the support system and maximum tolerable values.
   e. Water Control Plan, as per Section 31 23 19.01, Dewatering.
   f. Plans and procedures for protecting adjacent structures, utilities and facilities including: excavation, control of water, ground improvement, underpinning, monitoring and restoration of any damage.
   g. Quality Control Procedures: address materials testing requirements and excavation monitoring provisions.
   h. Plans for backfilling excavations and removal of support elements.
2. Movement Monitoring Plan: Submit a, addressing the following topics:
   a. Survey control.
   b. Location of monitoring points.
   c. Plots of data trends.
   d. Intervals between surveys.

B. Informational Submittals:

1. Submit the following data and reports during the work:
   a. Summary of ground and groundwater conditions encountered.
   b. Any excavation monitoring analyses, including: horizontal and vertical deflections of supports, horizontal and vertical movements of adjacent ground and facilities, and measurements of strut loads being collected by the Subcontractor as specified by the Subcontractor's ground support design engineer, and as required by Section 31 80 00, Geotechnical Instrumentation.
   c. Monthly reports from Subcontractor's ground support design engineer on performance of ground support system elements and associated adjacent ground movements and protection of adjacent property, as required by Section 31 80 00, Geotechnical Instrumentation.
2. The Subcontractor shall obtain from his engineer and submit to the Contractor that, based on his observations, the work completed during the previous month pertaining to his (Subcontractor's engineer) design was installed and is performing substantially in accordance with the design concepts prepared by him. The Subcontractor's engineer shall also report any significant deviations from the submitted design concepts, any performance concerns observed and actions recommended to remediate these items. The Subcontractor's engineer certifications shall be made monthly during a period commencing with the start of excavation and excavation support system installation, continuing during construction, and ending when the excavation support system has been abandoned in place, abandoned and backfilled, or removed and backfilled.

PART 2 PRODUCTS

2.01 GENERAL

A. The Subcontractor's ground support system design engineer shall specify ground support system material requirements in accordance with the submitted designs. The materials, however, shall meet the minimum requirements listed below.

B. Incorporation of used prefabricated elements into excavation support systems is permitted, provided the strength and stability of used elements is verified prior to incorporation, and allowances made for lost strengths, if any, due to existing damage or deterioration.

2.02 MATERIALS

A. Materials used in construction of the excavation support systems shall meet these requirements:

1. All timber and structural steel used for the supporting systems, whether new or used, shall be sound and free from deflects that may impair their strength.
2. Structural Steel:
   a. Walers, struts, chamfers, stiffeners: conform to ASTM A572 Grade 50 or better unless approved otherwise.
   b. Soldier piles: Conform to ASTM A572 Grade 50 or better unless approved otherwise.
   c. Steel Sheet Piles: Conform to ASTM A572 Grade 50 or better unless approved otherwise.
3. Timber: All timber shall be structural grade with a minimum allowable flexural strength of 1,100 psi.

PART 3 EXECUTION

3.01 GENERAL

A. Whenever necessary to prevent caving during excavation to protect adjacent structures, property, workmen, and the public, excavations shall be adequately sheeted and braced. All sheeting, shoring, and bracing or excavations shall conform to the safety requirements of the Federal, State, or local public agency having jurisdiction over such matters. The most stringent of these requirements shall apply.

B. Design and install excavation support systems to support all anticipated loads and prevent detrimental settlement and/or lateral movement of existing facilities, adjacent property, and the completed work. Subcontractor designed elements shall be in accordance with these Subcontract documents and shop drawings submitted to provide details of support systems, attachments, embedments, finishes and other construction that affects the work covered under this section.

C. Review the Drawings, Specifications, and existing site conditions prior to bidding.

D. Control of Water: conform to Section 31 23 19.01, Dewatering.

E. Excavation ventilation: conform to OSHA regulations.

F. Design and furnish materials for installing, monitoring, maintaining, and removing ground support systems. Design, furnish and install excavation support system and safety elements necessary for protection of adjacent property, excavation stability and safety of workmen during construction.

3.02 INSTALLATION OF EXCAVATION SUPPORT SYSTEMS

A. Support systems shall be installed to permit the safe execution of the work, and to ensure that no ground loading or other loading will be placed on the new work prior to completion and until design strength of the structure being constructed has been reached.

B. Excavation support systems shall be installed in a manner to control groundwater inflow into the trench and workshaft excavations; minimize loss of soil into excavations; minimize ground movements outside the excavations; maintain stability

3.03 REMOVAL OF EXCAVATION SUPPORT

A. Remove excavation support in a manner that will maintain support as excavation is backfilled.

B. Do not begin to remove excavation support until support can be removed without damage to existing facilities or adjacent property.

C. Remove excavation support in a manner that does not leave voids in the backfill.

D. The Subcontractor shall be responsible for repairing any settlement or damage to the Work or to adjacent property as a result of removing Excavation support systems. Excavation support systems that cannot be safely removed without causing settlement or damage to the work or adjacent property shall be left in place, at no additional cost to the Owner. Support of excavation systems that are left in place shall be cut and removed 5 feet below grade.

E. If backfill material is loosened to an extent that it settles more than 1 inch as a result of attempts to remove sheeting or other ground support members, the Subcontractor shall be responsible for remedial measures to re-compact or consolidate the loosened backfill. The Subcontractor’s engineer shall be responsible for determining if the ground support system can be safely removed. Excavation support system elements that are left in place shall be at the Subcontractor’s expense. Restoration of any damage and the cost of remediating disturbed backfill or adjacent property damage caused by removal of ground support systems shall be at the Subcontractor’s expense.

3.04 SUPPLEMENTS

A. The supplements listed below, following “End of Section”, are part of this specification.

1. Exhibit 1 - Velsicol Former Plant Site Remedial Design Investigation Potential Source Area 1 and Potential Source Area 2, St. Louis, Michigan, May 2015.
2. Exhibit 2 - Velsicol Former Plant Site Geotechnical Investigation, November 2016.

END OF SECTION

Exhibit 1

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

FINAL DATA EVALUATION REPORT
VELSICOL FORMER PLANT SITE
POTENTIAL SOURCE AREA 1 AND
POTENTIAL SOURCE AREA 2

Velsicol Chemical Corporation Superfund Site
Remedial Design Investigation
St. Louis, Michigan
WA No. 178-RDRD-0532/Contract No. EP-S5-06-01

May 2015

PREPARED FOR

U.S. Environmental Protection Agency

PREPARED BY

CH2M HILL
Ecology and Environment, Inc.
Environmental Design International, Inc.
Teska Associates, Inc.
Critigen, LLC

Final Data Evaluation Report

Velsicol Former Plant Site Remedial Design Investigation Potential Source Area 1 and Potential Source Area 2 St. Louis, Michigan

WA No. 178-RDRD-0532/Contract No. EP-S5-06-01

Prepared for

May 2015

CH2MHILL®

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Acronyms and Abbreviations

µg/kg	micrograms per kilogram
ANP	Adjacent or Nearby Properties
bgs	below ground surface
C_{sat}	soil saturation concentration
DBCP	dibromochloropropane
DDT	dichlorodiphenyltrichloroethane
EM31	electromagnetic
EPA	U.S. Environmental Protection Agency
FPS	former plant site
FS	Feasibility Study
IDW	investigation-derived waste
MAG	Magnetometer
MCC	Michigan Chemical Corporation
MDEQ	Michigan Department of Environmental Quality
MVS	Mining Visualization Software
NAPL	nonaqueous phase liquid
NTK	NAPL soil test kit
OU	operable unit
PBB	polybrominated biphenyl
PCB	polychlorinated biphenyl
PID	photoionization detector
PSA	potential source area
RDI	remedial design investigation
ROD	Record of Decision
SVOC	semivolatile organic compound
TCLP	Toxicity Characteristic Leaching Procedure
TRIS	tris(2,3-dibromopropyl) phosphate
USCS	Unified Soil Classification System
Velsicol	Velsicol Chemical Corporation
VOC	volatile organic compound
WA	Work Assignment
Weston	Weston Solutions of Michigan, Inc.

SECTION 1

Introduction

1.1 General

CH2M HILL 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 *Revised Work Plan, Velsicol Chemical Corporation Superfund Site St. Louis, Michigan Operable Unit 1-Former Plant Site Remedial Design* (CH2M HILL 2014a), the work described herein was performed to support the design of remedial components specified by the June 22, 2012, Record of Decision (ROD).

This report describes only the RDI activities associated with potential source area (PSA)-1 and PSA-2. Tasks specific to the RDI in other areas of the site identified in the ROD will be captured and presented for agency approval independently. The work was performed under Work Assignment (WA) No. 178-RDRD-0532, Contract No. EP-S5-06-01, and in accordance with the approved *Investigation Work Plan*, *Velsicol Former Plant Site Remedial Design St. Louis, Michigan Potential Source Area 1 and Potential Source Area 2* (CH2M HILL 2014b).

1.2 Site Description

The Velsicol Chemical/Pine River 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). A chemical manufacturing plant formerly occupied the FPS. 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 FPS is fenced and is bordered on the south and east by the ANP, with Washington Avenue along the southern edge. Watson and North Street mark the eastern edge. The Pine River and Mill Pond form the western and northern boundaries.

The site consists of three operable units (OUs):

OU1—FPS and ANP, for which remedial design activities are in progress.

OU2—Pine River and Mill Pond sediment adjacent and upstream from the St. Louis hydroelectric dam, for which remedial action was completed in 2006.

OU3—Pine River sediment downstream from the St. Louis hydroelectric dam to the confluence of the Pine, Chippewa, and Tittabawassee rivers, for which the investigation activities are in progress.

Figure 1-1 presents a map of the study areas and OUs.

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 (PBB) and tris(2,3-dibromopropyl) phosphate (TRIS); and pesticides dichlorodiphenyl trichloroethane (DDT) and dibromochloropropane (DBCP).
- In 1977, production operations were terminated, and by 1978 Velsicol initiated demolition and decommissioning of the facility. Aboveground buildings were demolished, and some structures were buried onsite, including storage tanks and process piping. Building and tank foundations were not removed, and a significant amount of debris remains buried.

1.4 Previous Investigations

Previous investigative work completed at the FPS is extensive and is described in the following documents:

- Source Migration Investigation Report, Velsicol Chemical/Pine River Site, OU1, St. Louis, Michigan (CH2M HILL 2005)
- Remedial Investigation Report for Operable Unit One, Velsicol Chemical Corporation Superfund Site, St. Louis, Gratiot County, Michigan (Weston Solutions of Michigan, Inc. [Weston] 2006)
- Remedial Investigation Addendum Report for Operable Unit One, Velsicol Chemical Corporation Superfund Site, St. Louis, Gratiot County, Michigan (Weston 2009)
- Feasibility Study Operable Unit One, Velsicol Chemical Corporation Superfund Site, St. Louis, Gratiot County, Michigan (Weston 2011)
- Record of Decision, Velsicol Chemical Corporation/Pine River Superfund Site Former Plant Site—Operable Unit 1, St. Louis, Michigan (EPA 2012)
- Draft Geophysical Survey and Test Pit Results for Velsicol Chemical/Pine River Superfund Site, St. Louis, Michigan (CH2M HILL 2014c)

1.5 Remedial Design Investigation Objectives

Site remediation will require treatment of soil and groundwater over large areas of the FPS. As detailed in the ROD, remediation of four PSAs requires the implementation of multiple treatment technologies. Excavation was selected for remediation of PSA-1 and PSA-2; treatment consists of excavating unsaturated soil that exceeds the Michigan Department of Environmental Quality (MDEQ) Part 201 soil saturation concentration (C_{sat}) for xylene and chlorobenzene in PSA-1, and TRIS and chlorobenzene in PSA-2. To support the remedial design, an RDI was completed in PSA-1 and PSA-2, with the following objectives:

- Refine the delineation of chlorobenzene, xylene, and TRIS present in the unsaturated zone
- Collect representative soil samples for analysis to assist in remedial design
- Visually characterize subsurface soils and debris.

SECTION 2

Remedial Design Investigation

This section describes the approach and methodology for RDI activities completed in PSA-1 and PSA-2. The RDI activities were conducted in two successive stages: (1) geophysical surveying between December 2013 and June 2014 and (2) drilling and sample collection from July 2014 through August 2014. Figure 2-1 shows the location of PSA-1 and PSA-2 in the FPS.

2.1 Drilling Investigation

A Rotosonic drill rig was used to advance 125 soil borings within PSA-1 and PSA-2 to refine the lateral extent of soil contaminants and optimize subsequent RD and implementation efforts. The location of soil borings completed in PSA-1 and PSA-2 are illustrated on Figures 2-2 and 2-3, respectively**.** In general, borings were advanced to depths ranging from 15 to 40 feet below ground surface (bgs), with the majority of the borings terminating at 20 to 25 feet bgs. Within the investigation areas, groundwater was encountered at an approximate range of 10 to 28 feet bgs. Borings were completed by continuously advancing a 4-inch-core barrel (and a 6-inch override casing as needed to prevent borehole collapse) through the subsurface soils to depths at which saturated soils were observed. Continuous soil samples were collected within the 4-inch-core barrel and extracted into a plastic liner for subsequent evaluation. Soil cores were provided to the CH2M HILL field geologist for logging, field screening, and analytical soil sampling. Upon completion, the soil borings were backfilled with hydrated bentonite.

Soil cores were logged by a CH2M HILL geologist in accordance with the Unified Soil Classification System (USCS). Soil attributes such as color, particle size, consistency, moisture content, structure, plasticity, and odor (if present) were noted. In addition to USCS logging procedures, soil cores were screened at 1-foot intervals for organic vapors using a photoionization detector (PID). At each location, the soil classification and PID screening results were recorded in a soil boring log. Field logs for soil borings completed during the RDI are presented in Appendix A.

The drilling investigation boundaries for PSA-1 and PSA-2, were defined in the OU1 Feasibility Study (FS) (Weston 2011). However, RDI efforts focused on an extended boundary in each area which CH2M HILL developed through supplemental data analysis using Mining Visualization Software (MVS) as shown on Figures 2-2 and 2-3. The expansion of the PSAs was intended to minimize the need for additional drilling or supplemental field mobilization efforts to define the lateral boundaries of areas where remediation was necessary. A 100-foot grid spacing was placed over the expanded PSA boundaries, with a 50-foot grid spacing placed over the interior of each PSA to establish soil boring locations. The investigation approach resulted in 56 boring locations in PSA-1 and 57 boring locations in PSA-2. In addition to the predetermined soil boring locations, field observations necessitated eight supplemental boring locations in PSA-1, and four supplemental locations in PSA-2. Further discussion of supplemental step out borings is included in Section 2.9.

2.2 Soil Sample Collection

A minimum of three soil samples were collected from each soil boring and submitted for laboratory analysis. Continuous soil characterization and field-screening methods were used to determine sample collection intervals as described below:

- A soil sample was collected from the interval directly below the cap material.
- A soil sample was collected from visibly contaminated intervals. If there was no visual contamination, a soil sample was collected from the interval exhibiting the highest PID reading. If more than one interval was visually contaminated or exhibited elevated PID readings, an additional soil sample was collected, and a soil sample directly beneath the cap material was not collected.

- A soil sample was collected from the interval directly above the groundwater table.
- If visible contamination or elevated PID readings were not observed, a soil sample was collected from the mid-point between the cap material and the groundwater table.

2.3 Sample Analysis

Three hundred eighty-one soil samples, plus associated quality assurance/quality control samples, were collected from RDI activities completed within PSA-1 and PSA-2. In accordance with the FS and RDI work plan, field soil samples were analyzed for specific compounds based on collection location. In PSA-1, soil samples were analyzed for chlorobenzene and xylene; PSA-2 soil samples were analyzed for chlorobenzene and TRIS. In both locations soil samples destined for laboratory analysis were collected using TerraCores and methanol preservation.

2.4 Field Screening for Non-aqueous Phase Liquids

In addition to soil sample collection, soil cores were visually screened for the presence or absence of non-aqueous phase liquids (NAPL) by the CH2M HILL field geologist. Visual observations were premised on the following characteristics: coated, stained, or otherwise discolored soils; NAPL-saturated soils; the presence of sheen in saturated zones; and the appearance of NAPL or NAPL staining on drilling equipment. PID measurements provided additional support to visual screening efforts. Additionally, NAPL soil test kits (NTKs) were used to evaluate the presence of NAPL. In general, NTKs were used primarily when stained soils and/or elevated PID readings were encountered, but visually identifiable NAPL was not. In selected locations, NTKs were also used to confirm the presence of NAPL visually identified. During the RDI the presence or absence of NAPL in soil boring was documented in the field under the following classifications:

- **No evidence of NAPL—**No visual evidence of NAPL and/or negative NAPL soil test kit result.
- **Evidence of NAPL—**Soil exhibits visible signs of coating or staining; stains or sheens noted on drilling and/or sampling equipment. Positive NAPL soil test kit result.
- **Zone of potentially mobile NAPL—**Soil is saturated with NAPL or exhibits signs of NAPL ganglia. Soil is discolored and readily stains sampling and drilling equipment. In the absence of agitation, NAPL does not readily flow out of the soil core. The NAPL soil test kit result is positive.
- **Zone of mobile NAPL—**Soil is visibly saturated with NAPL that is present as free-phase liquid. NAPL readily flows from the soil core with little or no agitation. In these cases, NAPL confirmation by the soil test kit result is not required.

The NTKs were used in accordance with manufacturer's instructions and recommended procedures. Under field conditions the Oil-In-Soil Sudan IV test kits can determine the presence of NAPL in 30 to 60 seconds based on manufacturer's specifications. To confirm that the Sudan IV dye in the NTK had thoroughly reacted with the sample materials, every test kit yielding a negative result was labeled by sampling location and retained for re-examination 48 hours after collection to verify initial test results. After re-examination, test kits and media samples exposed to Sudan IV dye were disposed of in accordance with RDI waste management procedures. Test kits that provided an immediate indication of NAPL were discarded after soil boring completion.

2.5 Soil Boring Survey

Soil boring locations in PSA-1 and PSA-2 were surveyed for horizontal coordinates and ground surface elevation by a licensed professional land surveyor following the completion of drilling activities. All survey points were referenced to the Michigan State Plane, North American Datum of 83, South Zone horizontal coordinate system and North America Vertical Datum of 1988 vertical coordinate system. Soil boring survey data are included in Appendix B.

2.6 Air Monitoring

Air monitoring was required during drilling operations. The potential presence of VOCs within PSA-1 and PSA-2 required air monitoring by using a PID to monitor the breathing zone near the drill rig, at perimeter locations, and near the soil core processing and sample collection table. Air monitoring activities were documented in the field logbook, and results were recorded on an air monitoring form.

2.7 Geophysical Survey

A geophysical survey was conducted in two stages between December 2013 and June 2014 over the study areas (PSA-1, PSA-2, PSA-3, and PSA-4, NAPL/DBCP Areas 1 and 2). Phase 1 consisted of surveying the study areas by using electromagnetics (EM31) and a magnetometer (MAG). The EM31 simultaneously measured surface magnetic susceptibility (in-phase response) and terrain conductivity (quadrature-phase response). Phase 2 consisted of a two-line seismic refraction survey where elevation data were acquired, processed, and loaded into a graphing routine for plotting layer depths/thicknesses as a function of elevation with corresponding seismic velocities. A detailed discussion of the geophysical survey is included in the *Draft Geophysical Survey and Test Pit Results for Velsicol Chemical/Pine River Superfund Site, St. Louis, Michigan* (CH2M HILL 2014c).

2.8 Investigation-derived Waste

Soil cuttings generated during RDI activities were placed in Department of Transportation–approved 55-gallon drums. The drums were labeled with the site name, media, date generated, generator contact information, and drum number. Solid investigation-derived waste (IDW) generated by RDI activities was transported to an onsite drum storage area. Liquid IDW (decontamination water) was stored in a 5,000-gallon, double-walled tank that provided for secondary containment of the vessel contents.

Soil waste characterization samples were collected at a rate of 1 sample per 10 drums of waste for each PSA. The samples were submitted for toxicity characteristic leaching procedure (TCLP) tests for VOCs, semivolatile organic compounds (SVOCs), RCRA metals, pesticides and herbicides, and polychlorinated biphenyls (PCBs). The TCLP analytical data was used to complete a waste profile for every 10 drums containing IDW. If the soil sample from a given drum grouping failed TCLP standards for site related contaminants, a total VOCs sample was collected and analyzed to confirm material classification as hazardous by characteristic.

Hazardous and non-hazardous solid IDW was removed from the site over the course of 2014 field work completion as indicated by the waste characterization information.

Liquid waste characterization samples were collected at the completion of 2014 field activities. The sample was submitted for VOCs, SVOCs, Resource Conservation and Recovery Act metals, pesticides and herbicides, and PCBs. Liquid IDW was characterized as non-hazardous waste and removed from the site in December 2014.

2.9 Deviations from Work Plan

Deviations from the RDI work plan included (1) additional soil borings and collection of additional soil samples and (2) the selective use of the 6-inch override sonic drill casing during borehole advancement.

As determined by field observations, additional step-out soil borings were completed to bound areas where visibly impacted soils were encountered and positive NAPL test kits were recorded at perimeter boring locations. Step-out boring locations were selected with input from the CH2M HILL project team and in consultation with EPA work assignment manager. Eight step out borings were completed in PSA-1 (locations PSA1-SB057 through PSA1-SB064), and four step-out boring locations were completed at PSA-2 (locations SB058 through PSA2-SB061) to bound areas where NAPL was observed.

The 6-inch override drill casing was selectively used throughout the installation of soil borings at PSA-1 and PSA-2. The purpose of the override drill casing is to prevent borehole collapse during extraction of the 4-inch soil core collection barrel when drilling in unconsolidated formations. The use of the override casing becomes more critical as borehole depth increases and when less cohesive materials such as loose sand and gravel are encountered. During the RDI, the majority of boreholes drilled did not collapse at depths less than or equal to 20 feet bgs. In such cases, the override drill casing was not used. An evaluation of borehole stability was made during the advancement of each borehole; as determined by the observed potential for borehole collapse, the override casing was deployed to ensure representative soil cores were collected.

SECTION 3

Investigation Findings and Analytical Results

Sections 3.1 through 3.3 present the investigation findings and analytical results of the RDI at PSA-1 and PSA-2. Select visual observations made while performing investigation activities are presented in the photo log in Appendix C. Laboratory analytical reports are included in Appendix D.

3.1 PSA-1 and PSA-2 Geology and Subsurface Findings

The subsurface at PSA-1 consists of the following:

- **Clay cap—**The constructed clay cap consists of approximately 1 foot of topsoil, underlain by approximately 0.5 foot of fine to medium sand, followed by approximately 4 to 10 feet of hard silty clay to clayey silt. Boring results suggest the cap is continuous across PSA-1. Varying amounts of debris (concrete, brick, glass, wood, and metal rebar) from the plant demolition were observed within the lower portion of the cap and in the zone from 0 to 5 feet below the cap.
- **Interbedded sand, silt, and clay—**Underlying the cap are fine to medium sands with occasional coarse sands and interbedded silts and clays. Boring results indicate this lithology is generally continuous across PSA-1 and is present to depths ranging from approximately 10 to 23 feet bgs. Soil exhibiting staining and/or containing NAPL was frequently encountered in this unit. Groundwater was typically encountered at depths ranging from approximately 10 to 20 feet bgs.
- **Glacial till—**glacial till is present at depths ranging from approximately 13 to 25 feet bgs at PSA-1. The till consists primarily of hard silty clay to clayey silt with trace to little amounts of fine sand and trace amounts of gravel. Sand and silty sand seams are occasionally encountered within the till.

Subsurface conditions observed in PSA-1 are represented graphically through geologic cross sections. Cross section orientation is illustrated in Figure 3-1. The interpretation of subsurface conditions observed in PSA-1 is depicted in Figure 3-2, Figure 3-3 and Figure 3-4. Soil sample collection intervals and NTK depth intervals are illustrated on the geologic cross sections for reference.

Also notable within PSA-1 is a slurry wall constructed around an area of the site previously used for fuel handling and storage. Historic site documents indicate fuel releases occurred within and adjacent to the PSA-1 boundary. The fuel release was allegedly contained by a slurry wall which was constructed in conjunction with the site containment slurry wall, however construction details of the wall within PSA-1 are poorly documented. In general, the existing slurry wall within PSA-1 contains a mitten shaped area of approximately 2 acres, of which approximately three-quarters of an acre overlaps the northeast portion of PSA-1. The presence of NAPL was confirmed both inside and outside the slurry wall during the RDI.

The subsurface at PSA-2 consists of the following:

- **Clay cap—**The constructed clay cap is consistent with that described for PSA-1. Boring results suggest the cap is continuous across PSA-2.
- **Reworked sand, silt, and clay—**Underlying the cap are interbedded layers of reworked sand, silt, and clay. Boring results indicate this lithology is generally continuous across PSA-2 and is present to depths ranging from approximately 12 to 25 feet bgs. Some soils exhibiting staining were encountered in this unit; however, staining was observed less frequently than at PSA-1, and indications of NAPL were significantly less.
- **Silt—**Soft to firm silt with grey and black laminations was observed underlying the reworked sand, silt, and clay in the southwest portion of PSA-2. Boring results indicate this lithology is continuous across PSA-2 to

the south of boring PSA2-SB047 and to the west of boring PSA2-SB039, with thicknesses up to 9 feet in some areas. This lithology may be related to the historical impoundments or storage areas that historically occupied this area of the FPS.

- **Glacial till—**glacial till is present at depths ranging from approximately 18 to 33 feet bgs at PSA-2. The till is consistent with that described for PSA-1.

Subsurface conditions observed in PSA-2 are represented graphically through geologic cross sections. Cross section orientation is illustrated on Figure 3-8. The interpretation of subsurface conditions observed in PSA-2 is depicted on Figure 3-9 and Figure 3-10. Soil sample collection intervals and NTK depth intervals are illustrated on the geologic cross sections for reference.

3.2 PSA-1 Analytical Results and NAPL Findings

Chlorobenzene was detected in 56 of the 64 soil boring locations in PSA-1, with concentrations ranging from 8.8 to 1,500,000 µg/kg. Two locations, PSA1-SB009 and PSA1-SB011, exceeded the Michigan Part 201 C_{sat} value of 260,000 µg/kg (Figure 3-1).

- Location PSA1-SB009 exceeded the C_{sat} criteria in two sampling intervals: 7 feet bgs (300,000 µg/kg) and at 9 feet bgs (1,500,000 µg/kg).
- Location PSA1-SB011 exceeded the C_{sat} criteria at 8 feet bgs (410,000 µg/kg).

Xylene was detected in 57 of the 64 soil boring locations within PSA-1. Concentrations ranged from 37 to 330,000 µg/kg. Two locations, PSA1-SB023 and PSA1-SB033, exceeded the Michigan Part 201 xylene C_{sat} value of 150,000 µg/kg (Figure 3-1).

- Location PSA1-SB023 exceeded the C_{sat} criteria at 13 feet bgs (330,000 µg/kg), and
- Location PSA1-SB033 exceeded the C_{sat} criteria at 12 feet bgs (240,000 µg/kg).

The presence of NAPL was confirmed in 29 of 64 soil borings at PSA-1. The presence of NAPL was based on a combination of field observations, NTK results, and fixed laboratory analysis of PSA-1 soil samples, as depicted by color coding on Figure 3-1 which shows the horizontal extent. In general, NAPL was observed at depths ranging from 6 to 22 feet bgs. The vertical extent of NAPL in the subsurface is illustrated on the geologic cross sections where NTK results and/or visual results, and laboratory results are shown on each soil boring (Figures 3-2 through 3-4). Additionally, the estimated extent of soil containing NAPL was extrapolated between boring locations and depicted in cross section view, as shown on Figures 3-5 through 3-7.

The PSA-1 soil sample analytical results and supporting NTK observations are presented in Tables 3-1 and 3-2, respectively.

3.3 PSA-2 Analytical Results and NAPL Findings

Chlorobenzene was detected in 60 of the 61 soil boring locations at PSA-2, with concentrations ranging from 8.8 to 620,000 µg/kg. One location, PSA2-SB051, exceeded the Michigan Part 201 chlorobenzene C_{sat} value of 260,000 µg/kg (Figure 3-8).

- Location PSA2-SB051 exceeded the C_{sat} criteria at 10 feet bgs (620,000 µg/kg).

TRIS was detected in 21 of the 61 soil boring locations, with concentrations ranging from 960 to 1,400,000 µg/kg. One location, PSA2-SB028, exceeded the Michigan Part 201 C_{sat} value of 27,000 µg/kg (Figure 3-8).

- Location PSA1-SB028 exceeded the C_{sat} criteria at 16 feet bgs (1,400,000 µg/kg).

The presence of NAPL was confirmed in 6 of 61 soil borings at PSA-2. The presence of NAPL was based on a combination of field observations, NTK results, and fixed laboratory analysis of PSA-2 soil samples, and is

depicted in color coding on Figure 3-8 which shows the horizontal extent. The vertical extent of NAPL in the subsurface is illustrated on the geologic cross sections where NTK results and/or visual results, and laboratory results are shown for each soil boring (Figures 3-9 and 3-10).

The PSA-2 soil sample analytical results and supporting NTK observations are presented in Tables 3-3 and 3-4, respectively.

SECTION 4

Conclusion

RDI activities were conducted for PSA-1 and PSA-2 between July and August 2014. The primary objectives for this investigation were to refine the vertical and horizontal delineation of chlorobenzene, xylene, and TRIS present in the unsaturated zone above the till, collect representative soil samples for analysis to assist in the remedial design, and visually characterize subsurface debris within the PSAs.

Based on the data collected during the activities summarized within this RDI data evaluation for PSA-1, the potential area requiring remediation is sufficiently delineated. Investigation results indicate that PSA-1 spans approximately 2.4 acres, as shown on Figure 3-1. This area is slightly larger than that estimated in the FS (Weston 2011). The total volume estimate of material requiring removal at PSA-1 will be determined during design.

For PSA-2, the potential area requiring remediation is sufficiently delineated and approximately 0.3 acres as shown on Figure 3-8. This area is smaller than the area estimated in the FS (Weston 2011). The total volume estimate of material requiring removal at PSA-2 2 will be determined during design.

Data generated for this portion of the RDI adequately meet project objectives. In light of the RDI findings, the lateral and vertical extent of contamination in PSA-1 and PSA-2 is defined, and the project can proceed to the design phase.

SECTION 5

References

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Tables

TABLE 3-1

PSA 1 Soil Analytical Results

Velsicol Chemical Corporation Superfund Site, St. Louis, Michigan

Boring Location	Sample ID	Date	Sample Depth (feet bgs)	Chlorobenzene [µg/kg][a]	Xylene [µg/kg][b]
SB-001	VCS-PSA1-SO-001-5/6	7/29/2014	5 - 6	36 J	4,700
	VCS-PSA1-SO-001-5/6-FD	7/29/2014	5 - 6	50 J	6,200
	VCS-PSA1-SO-001-7/8	7/29/2014	7 - 8	9.1 U	37 U
	VCS-PSA1-SO-001-9/10	7/29/2014	9 - 10	10 U	42 U
SB-002	VCS-PSA1-SO-002-12/13	7/29/2014	12 - 13	7.9 U	32 U
	VCS-PSA1-SO-002-7/7.3	7/29/2014	7 - 7.3	9 U	37 U
SB-003	VCS-PSA1-SO-003-11.5/12	7/29/2014	11.5 - 12	9.3 U	38 U
	VCS-PSA1-SO-003-5/6	7/29/2014	5 - 6	13 U	53 U
	VCS-PSA1-SO-003-9/10	7/29/2014	9 - 10	9.2 U	38 U
SB-004	VCS-PSA1-SO-004-13.5-14	7/29/2014	13.5 - 14	9.2 U	38 U
	VCS-PSA1-SO-004-20/21	7/29/2014	20 - 21	9 U	37 U
	VCS-PSA1-SO-004-5/6	7/29/2014	5 - 6	32 J	41 U
SB-005	VCS-PSA1-SO-005-11/11.5	7/29/2014	11 - 11.5	55	2,800
	VCS-PSA1-SO-005-6/6.2	7/29/2014	6 - 6.2	8.3 U	34 U
	VCS-PSA1-SO-005-9/10	7/29/2014	9 - 10	49 J	1,700
SB-006	VCS-PSA1-SO-006-11/11.5	7/29/2014	11 - 11.5	430	3,000
	VCS-PSA1-SO-006-12.5/13	7/29/2014	12.5 - 13	670	2,700
	VCS-PSA1-SO-006-13.5/14	7/29/2014	13.5 - 14	890	1,600
SB-007	VCS-PSA1-SO-007-11.5/12	7/30/2014	11.5 - 12	1,300	1,700
	VCS-PSA1-SO-007-7.5/8	7/30/2014	7.5 - 8	930	5,000
	VCS-PSA1-SO-007-9/10	7/30/2014	9 - 10	800	2,600
	VCS-PSA1-SO-007-9/10-FD	7/30/2014	9 - 10	880	2,600
SB-008	VCS-PSA1-SO-008-10.5/11	7/30/2014	10.5 - 11	590	720
	VCS-PSA1-SO-008-6.5/7	7/30/2014	6.5 - 7	27 J	1,100
	VCS-PSA1-SO-008-9/9.5	7/30/2014	9 - 9.5	340	560
SB-009	VCS-PSA1-SO-009-12.5	7/30/2014	12.5	35,000	1,200
	VCS-PSA1-SO-009-7.0	7/30/2014	7	300,000	9,300
	VCS-PSA1-SO-009-8.0	7/30/2014	8	1,500,000	60,000

TABLE 3-1

PSA 1 Soil Analytical Results

Velsicol Chemical Corporation Superfund Site, St. Louis, Michigan

Boring Location	Sample ID	Date	Sample Depth (feet bgs)	Chlorobenzene [µg/kg][a]	Xylene [µg/kg][b]
SB-010	VCS-PSA1-SO-010-11.0	7/30/2014	11	120	11,000
	VCS-PSA1-SO-010-6.3	7/30/2014	6.3	64 UB	710
	VCS-PSA1-SO-010-7.0	7/30/2014	7	78 UB	8,200
SB-011	VCS-PSA1-SO-011-13.0	7/30/2014	13	110,000	690 U
	VCS-PSA1-SO-011-13.0-FD	7/30/2014	13	120,000	760 U
	VCS-PSA1-SO-011-6.5	7/30/2014	6.5	74,000	5,800
	VCS-PSA1-SO-011-8.0	7/30/2014	8	410,000	18,000
SB-012	VCS-PSA1-SO-012-13.0	7/30/2014	13	17,000	620
	VCS-PSA1-SO-012-6.5	7/30/2014	6.5	1,500	390
	VCS-PSA1-SO-012-9.5	7/30/2014	9.5	7,600	240
SB-013	VCS-PSA1-SO-013-10.0	7/30/2014	10	3,400	1,600
	VCS-PSA1-SO-013-12.0	7/30/2014	12	4,800	750
	VCS-PSA1-SO-013-13.5	7/30/2014	13.5	4,900	580
SB-014	VCS-PSA1-SO-014-11.0	7/30/2014	11	640	7,800
	VCS-PSA1-SO-014-12.5	7/30/2014	12.5	500	2,000
	VCS-PSA1-SO-014-9.0	7/30/2014	9	160	10,000
SB-015	VCS-PSA1-SO-015-11.0	7/30/2014	11	10 J	1,300
	VCS-PSA1-SO-015-12.0	7/30/2014	12	16	1,800 J
	VCS-PSA1-SO-015-12.0-FD	7/30/2014	12	14 J	1,300 J
	VCS-PSA1-SO-015-13.5	7/30/2014	13.5	20 J	760
SB-016	VCS-PSA1-SO-016-11.0	7/31/2014	11	62 J	4,800
	VCS-PSA1-SO-016-15.0	7/31/2014	15	15 J	310
	VCS-PSA1-SO-016-8.5	7/31/2014	8.5 - 8.5	18 J	3,600
SB-017	VCS-PSA1-SO-017-10.5	7/31/2014	10.5	42 J	280
	VCS-PSA1-SO-017-11.5	7/31/2014	11.5	89 J	300 J
	VCS-PSA1-SO-017-11.5-FD	7/31/2014	11.5	30 J	37 J
	VCS-PSA1-SO-017-9.5	7/31/2014	9.5	9.1 U	37 U

TABLE 3-1

PSA 1 Soil Analytical Results

Velsicol Chemical Corporation Superfund Site, St. Louis, Michigan

Boring Location	Sample ID	Date	Sample Depth (feet bgs)	Chlorobenzene [µg/kg][a]	Xylene [µg/kg][b]
SB-018	VCS-PSA1-SO-018-10.0	7/31/2014	10	110	35 U
	VCS-PSA1-SO-018-11.0	7/31/2014	11	830	61 U
	VCS-PSA1-SO-018-12.5	7/31/2014	12.5	17 J	41 U
SB-019	VCS-PSA1-SO-019-10.0	7/31/2014	10	64	3,700
	VCS-PSA1-SO-019-11.0	7/31/2014	11	3,800	12,000
	VCS-PSA1-SO-019-12.0	7/31/2014	12	2,000	5,700
SB-020	VCS-PSA1-SO-020-10.0	7/31/2014	10	4,600	4,400
	VCS-PSA1-SO-020-12.0	7/31/2014	12	10,000	250 J
	VCS-PSA1-SO-020-9.5	7/31/2014	9.5	620	1,500
SB-021	VCS-PSA1-SO-021-10.0	7/31/2014	10	96	1,100 J
	VCS-PSA1-SO-021-10.0-FD	7/31/2014	10	8.8	1,500 J
	VCS-PSA1-SO-021-13.0	7/31/2014	13	23 J	220
	VCS-PSA1-SO-021-8.5	7/31/2014	8.5 - 8.5	53 U	27,000
SB-022	VCS-PSA1-SO-022-11.0	8/1/2014	11	130 J	68,000
	VCS-PSA1-SO-022-12.5	8/1/2014	12.5	87 J	25,000
	VCS-PSA1-SO-022-8.0	8/1/2014	8	12 J	100 J
SB-023	VCS-PSA1-SO-023-13.0	8/1/2014	13	3,000	330,000
	VCS-PSA1-SO-023-14	8/1/2014	14	230	17,000
	VCS-PSA1-SO-023-8.0	8/1/2014	8	500	380
SB-024	VCS-PSA1-SO-024-11.0	8/1/2014	11	48 J	200
	VCS-PSA1-SO-024-13.0	8/1/2014	13	3,700	35,000
	VCS-PSA1-SO-024-14.5	8/1/2014	14.5	14 J	41 J
SB-025	VCS-PSA1-SO-025-12.5	8/1/2014	12.5	210	23,000
	VCS-PSA1-SO-025-12.5-FD	8/1/2014	12.5	170	17,000
	VCS-PSA1-SO-025-14.0	8/1/2014	14	250	10,000
	VCS-PSA1-SO-025-9.0	8/1/2014	9	11 U	74 J

TABLE 3-1

PSA 1 Soil Analytical Results

Velsicol Chemical Corporation Superfund Site, St. Louis, Michigan

Boring Location	Sample ID	Date	Sample Depth (feet bgs)	Chlorobenzene [µg/kg][a]	Xylene [µg/kg][b]
SB-026	VCS-PSA1-SO-026-10.5	8/1/2014	10.5	8.9 U	37 U
	VCS-PSA1-SO-026-12.0	8/1/2014	12	25 J	4,600
	VCS-PSA1-SO-026-13.0	8/1/2014	13	33 J	5,300 J
	VCS-PSA1-SO-026-13.0-FD	8/1/2014	13	21 J	3,200 J
	VCS-PSA1-SO-026-14.5	8/1/2014	14.5	9.8 U	40 U
SB-027	VCS-PSA1-SO-027-12.0	8/1/2014	12	24 J	52 U
	VCS-PSA1-SO-027-7.5	8/1/2014	7.5	8.4 U	34 U
SB-028	VCS-PSA1-SO-028-12	8/4/2014	12	9.5 U	2,700
	VCS-PSA1-SO-028-13	8/4/2014	13	10 U	3,100
	VCS-PSA1-SO-028-13-FD	8/4/2014	13	77	2,900
	VCS-PSA1-SO-028-7	8/4/2014	7	13 J	40 U
SB-029	VCS-PSA1-SO-029-11	8/4/2014	11	10 J	270
	VCS-PSA1-SO-029-13	8/4/2014	13	10 U	1,200
	VCS-PSA1-SO-029-5.3	8/4/2014	5.3	15 J	76 J
SB-030	VCS-PSA1-SO-030-12	8/4/2014	12	25 J	9,100
	VCS-PSA1-SO-030-15	8/4/2014	15	18 J	1,600
	VCS-PSA1-SO-030-7	8/4/2014	7	11 J	38 U
SB-031	VCS-PSA1-SO-031-16	8/4/2014	16	400	90 J
	VCS-PSA1-SO-031-19	8/4/2014	19	33 J	42 U
	VCS-PSA1-SO-031-6	8/4/2014	6	13 J	85 J
SB-032	VCS-PSA1-SO-032-14	8/4/2014	14	49,000	3,000
	VCS-PSA1-SO-032-15	8/4/2014	15	47,000	2,900
	VCS-PSA1-SO-032-8	8/4/2014	8	66	43 U
SB-033	VCS-PSA1-SO-033-12	8/4/2014	12	200,000	230,000
	VCS-PSA1-SO-033-12-FD	8/4/2014	12	210,000	240,000
	VCS-PSA1-SO-033-14	8/4/2014	14	120,000	110,000
	VCS-PSA1-SO-033-8	8/4/2014	8	1,700	96 J

TABLE 3-1

PSA 1 Soil Analytical Results

Velsicol Chemical Corporation Superfund Site, St. Louis, Michigan

Boring Location	Sample ID	Date	Sample Depth (feet bgs)	Chlorobenzene [µg/kg][a]	Xylene [µg/kg][b]
SB-034	VCS-PSA1-SO-034-14	8/4/2014	14	31,000	19,000
	VCS-PSA1-SO-034-15	8/4/2014	15	8,700	2,500
	VCS-PSA1-SO-034-18	8/4/2014	18	190	460
	VCS-PSA1-SO-034-8	8/4/2014	8	51 J	53 U
SB-035	VCS-PSA1-SO-035-10	8/4/2014	10	540	22,000
	VCS-PSA1-SO-035-13	8/4/2014	13	1,200	40,000
	VCS-PSA1-SO-035-17	8/4/2014	18	590	9,400
SB-036	VCS-PSA1-SO-036-14	8/5/2014	14	9 U	37 U
	VCS-PSA1-SO-036-5	8/5/2014	5	11 U	82 J
	VCS-PSA1-SO-036-7	8/5/2014	7	8.1 U	33 U
	VCS-PSA1-SO-036-7-FD	8/5/2014	7	8.4 U	34 U
SB-037	VCS-PSA1-SO-037-16	8/5/2014	16	680	14,000
	VCS-PSA1-SO-037-19.5	8/5/2014	19.5	9.2 U	810
	VCS-PSA1-SO-037-6	8/5/2014	6	12 U	91 J
SB-038	VCS-PSA1-SO-038-11	8/5/2014	11	10 U	84 J
	VCS-PSA1-SO-038-19	8/5/2014	19	8 U	33 U
	VCS-PSA1-SO-038-9	8/5/2014	9	9.3 U	4,100
SB-039	VCS-PSA1-SO-039-15	8/5/2014	15	140 J	71,000
	VCS-PSA1-SO-039-17	8/5/2014	17	820	31,000
	VCS-PSA1-SO-039-17-FD	8/5/2014	17	820	30,000
	VCS-PSA1-SO-039-9	8/5/2014	9	3,400	82 J
SB-040	VCS-PSA1-SO-040-10	8/5/2014	10	580	930
	VCS-PSA1-SO-040-14	8/5/2014	14	570	1,100
	VCS-PSA1-SO-040-15	8/5/2014	15	190	430
SB-041	VCS-PSA1-SO-041-15.5	8/6/2014	15.5	150	2,600
	VCS-PSA1-SO-041-16.5	8/6/2014	16.5	74	990
	VCS-PSA1-SO-041-16.5-FD	8/6/2014	16.5	61	800
	VCS-PSA1-SO-041-9	8/6/2014	9	20 J	36 U

TABLE 3-1

PSA 1 Soil Analytical Results

Velsicol Chemical Corporation Superfund Site, St. Louis, Michigan

Boring Location	Sample ID	Date	Sample Depth (feet bgs)	Chlorobenzene [µg/kg][a]	Xylene [µg/kg][b]
SB-042	VCS-PSA1-SO-042-15	8/6/2014	15	360	47 J
	VCS-PSA1-SO-042-18.5	8/6/2014	18.5	11 U	640
	VCS-PSA1-SO-042-7	8/6/2014	7	14 J	97 J
SB-043	VCS-PSA1-SO-043-16	8/6/2014	16	110	3,800
	VCS-PSA1-SO-043-18.5	8/6/2014	18.5	8.8 U	76 J
	VCS-PSA1-SO-043-9	8/6/2014	9	250	110 J
SB-044	VCS-PSA1-SO-044-15	8/6/2014	15	160 J	3,800 J
	VCS-PSA1-SO-044-15-FD	8/6/2014	15	310 J	2,400 J
	VCS-PSA1-SO-044-16	8/6/2014	16	15 J	6,000
	VCS-PSA1-SO-044-9.5	8/6/2014	9.5	220	40 U
SB-045	VCS-PSA1-SO-045-13	8/6/2014	13	9.2 U	49 J
	VCS-PSA1-SO-045-18	8/6/2014	18	9.5 U	39 U
	VCS-PSA1-SO-045-8	8/6/2014	8	11 J	53 J
SB-046	VCS-PSA1-SO-046-17	8/6/2014	17	9 U	100 J
	VCS-PSA1-SO-046-19	8/6/2014	19	9.4 U	38 U
	VCS-PSA1-SO-046-8	8/6/2014	8	8.1 U	530
SB-047	VCS-PSA1-SO-047-19	8/7/2014	19	8.9 U	490
	VCS-PSA1-SO-047-20	8/7/2014	20	11 U	130 J
	VCS-PSA1-SO-047-20-FD	8/7/2014	20	12 U	47 U
	VCS-PSA1-SO-047-7	8/7/2014	7	10 J	590
SB-048	VCS-PSA1-SO-048-15	8/7/2014	15	2,500	29,000
	VCS-PSA1-SO-048-16.5	8/7/2014	16.5	650	5,500
	VCS-PSA1-SO-048-6	8/7/2014	6	11 U	2,400
SB-049	VCS-PSA1-SO-049-11	8/7/2014	11	820	2,100
	VCS-PSA1-SO-049-15.5	8/7/2014	15.5	1,900	29,000
	VCS-PSA1-SO-049-9	8/7/2014	9	500	200 J

TABLE 3-1

PSA 1 Soil Analytical Results

Velsicol Chemical Corporation Superfund Site, St. Louis, Michigan

Boring Location	Sample ID	Date	Sample Depth (feet bgs)	Chlorobenzene [µg/kg][a]	Xylene [µg/kg][b]
SB-050	VCS-PSA1-SO-050-15	8/7/2014	15	110 J	26,000
	VCS-PSA1-SO-050-19	8/7/2014	19	10 U	440 J
	VCS-PSA1-SO-050-19-FD	8/7/2014	19	9.4 U	310 J
	VCS-PSA1-SO-050-9	8/7/2014	9	28 J	64 J
SB-051	VCS-PSA1-SO-051-14	8/7/2014	14	97 U	95,000
	VCS-PSA1-SO-051-17	8/7/2014	17	49 U	30,000
	VCS-PSA1-SO-051-8	8/7/2014	8	40 J	52 J
SB-052	VCS-PSA1-SO-052-11	8/7/2014	11	110 U	64,000
	VCS-PSA1-SO-052-16	8/7/2014	16	8.4 U	530
	VCS-PSA1-SO-052-9.5	8/7/2014	9.5	9.2 U	3,100
SB-053	VCS-PSA1-SO-053-12	8/7/2014	12	9.2 U	13,000
	VCS-PSA1-SO-053-6	8/7/2014	6	8.5 U	110 J
	VCS-PSA1-SO-053-8	8/7/2014	8	42 U	35,000
SB-054	VCS-PSA1-SO-054-14	8/7/2014	14	9.3 U	310
	VCS-PSA1-SO-054-15	8/7/2014	15	8.8 U	320
	VCS-PSA1-SO-054-8	8/7/2014	8	19 J	73 J
SB-055	VCS-PSA1-SO-055-14	8/8/2014	14	61	76 J
	VCS-PSA1-SO-055-15.5	8/8/2014	15.5	190 J	530 J
	VCS-PSA1-SO-055-15.5-FD	8/8/2014	15.5	580 J	1,700 J
	VCS-PSA1-SO-055-9	8/8/2014	9	2,500	210
SB-056	VCS-PSA1-SO-056-14	8/8/2014	14	9.1 U	37 U
	VCS-PSA1-SO-056-20.5	8/8/2014	20.5	12 J	44 J
	VCS-PSA1-SO-056-8	8/8/2014	8	30 J	74 J
SB-057	VCS-PSA1-SO-057-13.5	8/22/2014	13.5	9.3 U	38 U
	VCS-PSA1-SO-057-6	8/22/2014	6	14	120 J
	VCS-PSA1-SO-057-9	8/22/2014	9	10 U	87 J
SB-058	VCS-PSA1-SO-058-14	8/22/2014	14	8.4 U	34 U
	VCS-PSA1-SO-058-4.5	8/22/2014	4.5	20 J	34 U
	VCS-PSA1-SO-058-8.5	8/22/2014	8.5 - 8.5	11 U	45 U

TABLE 3-1

PSA 1 Soil Analytical Results

Velsicol Chemical Corporation Superfund Site, St. Louis, Michigan

Boring Location	Sample ID	Date	Sample Depth (feet bgs)	Chlorobenzene [µg/kg][a]	Xylene [µg/kg][b]
SB-059	VCS-PSA1-SO-059-4.5	8/22/2014	4.5	17 J	450
	VCS-PSA1-SO-059-6	8/22/2014	6	9.7 U	40 U
	VCS-PSA1-SO-059-8.5	8/22/2014	8.5 - 8.5	10 U	41 U
SB-060	VCS-PSA1-SO-060-6	8/25/2014	6	44 J	3,800
	VCS-PSA1-SO-060-8	8/25/2014	8	9.9 U	140 J
	VCS-PSA1-SO-060-8-FD	8/25/2014	8	9.9 U	460 J
	VCS-PSA1-SO-060-9.5	8/25/2014	9.5	10 U	1,400 J
SB-061	VCS-PSA1-SO-061-14	8/25/2014	14	9.3 U	38 U
	VCS-PSA1-SO-061-6.5	8/25/2014	6.5	110	1,500
	VCS-PSA1-SO-061-8	8/25/2014	8	10 U	130 J
SB-062	VCS-PSA1-SO-062-11	8/25/2014	11	49 U	17,000 J
	VCS-PSA1-SO-062-12.5	8/25/2014	12.5	9.8 U	11,000 J
	VCS-PSA1-SO-062-7	8/25/2014	7	34 J	250
SB-063	VCS-PSA1-SO-063-12	8/25/2014	12	9 U	43 J
	VCS-PSA1-SO-063-14	8/25/2014	14	9.7 U	1,800
	VCS-PSA1-SO-063-8	8/25/2014	8	28 J	36 U
SB-064	VCS-PSA1-SO-064-12	8/25/2014	12	8.5 U	35 U
	VCS-PSA1-SO-064-6	8/25/2014	6	8.4 U	35 U
	VCS-PSA1-SO-064-8	8/25/2014	8	9.6 U	39 U

[a] Highlighted results exeed Michigan Part 201 soil saturation criteria 260,000 ug/kg.

[b] Highlighted results exeed Michigan Part 201 soil saturation criteria 150,000 ug/kg.

Notes:

U = The analyte was analyzed for but not detected above the reported sample method detection limit (MDL).

J = The analyte was present, but the reported value may not be accurate or precise; the result is estimated because it is less than the referenced reporting limit (RL) but greater than the MDL or due to a QC exceedance.

UB = The analyte was detected in the associated blank above the level of the associated limit of detection or quantitation. The associated data were found to be less than 5 times the concentration detected in the blank (10 times for common laboratory contaminants) and were qualified as not detected at the concentration measured.

TABLE 3-2

PSA 1 NAPL Test Kit Results

Velsicol Chemical Corporation Superfund Site, St. Louis, Michigan

Sampling Area	Sample Location	Depth (feet bgs)	NAPL Test Kit ID	Date	Result
PSA 1	SB-001	5-7	NTK-PSA1-SO-001-5-7	7/29/2014	-
PSA 1	SB-005	6	NTK-PSA1-SO-005-6	7/29/2014	-
PSA 1	SB-005	14	NTK-PSA1-SO-005-14	7/29/2014	+
PSA 1	SB-005	19	NTK-PSA1-SO-005-19	7/29/2014	-
PSA 1	SB-006	11	NTK-PSA1-SO-006-11	7/29/2014	+
PSA 1	SB-006	14.5	NTK-PSA1-SO-006-14.5	7/29/2014	+
PSA 1	SB-006	17	NTK-PSA1-SO-006-17	7/29/2014	+
PSA 1	SB-007	9	NTK-PSA1-SO-007-9	7/30/2014	+
PSA 1	SB-008	10.5	NTK-PSA1-SO-008-10.5	7/30/2014	+
PSA 1	SB-010	6	NTK-PSA1-SO-014-6	7/30/2014	+
PSA 1	SB-014	15	NTK-PSA1-SO-016-15	7/30/2014	+
PSA 1	SB-015	14	NTK-PSA1-SO-018-14	7/30/2014	+
PSA 1	SB-016	11	NTK-PSA1-SO-018-11	7/31/2014	-
PSA 1	SB-018	11	NTK-PSA1-SO-022-11	7/31/2014	-
PSA 1	SB-022	12.5	NTK-PSA1-SO-023-12.5	8/1/2014	+
PSA 1	SB-023	13	NTK-PSA1-SO-023-13	8/1/2014	+
PSA 1	SB-023	14	NTK-PSA1-SO-024-14	8/1/2014	+
PSA 1	SB-024	12	NTK-PSA1-SO-024-12	8/1/2014	-
PSA 1	SB-025	11.5	NTK-PSA1-SO-025-11.5	8/1/2014	+
PSA 1	SB-025	14	NTK-PSA1-SO-025-14	8/1/2014	+
PSA 1	SB-028	12	NTK-PSA1-SO-028-12	8/4/2014	-
PSA 1	SB-030	13	NTK-PSA1-SO-030-13	8/4/2014	-
PSA 1	SB-030	15	NTK-PSA1-SO-030-15	8/4/2014	-
PSA 1	SB-030	18.5	NTK-PSA1-SO-030-18.5	8/4/2014	-
PSA 1	SB-031	18	NTK-PSA1-SO-031-18	8/4/2014	+
PSA 1	SB-032	16-17	NTK-PSA1-SO-032-16-17	8/4/2014	+
PSA 1	SB-033	12	NTK-PSA1-SO-033-12	8/4/2014	+
PSA 1	SB-037	16.5	NTK-PSA1-SO-037-16.5	8/5/2014	+
PSA 1	SB-037	15-16	NTK-PSA1-SO-037-15-16	8/5/2014	+
PSA 1	SB-038	11	NTK-PSA1-SO-038-11	8/5/2014	-
PSA 1	SB-039	15	NTK-PSA1-SO-039-15	8/5/2014	-
PSA 1	SB-039	19	NTK-PSA1-SO-039-19	8/5/2014	+
PSA 1	SB-040	16-17	NTK-PSA1-SO-040-16-17	8/5/2014	+
PSA 1	SB-041	15.5	NTK-PSA1-SO-041-15.5	8/6/2014	+
PSA 1	SB-041	22	NTK-PSA1-SO-041-22	8/6/2014	+
PSA 1	SB-042	19	NTK-PSA1-SO-042-19	8/6/2014	+
PSA 1	SB-042	21	NTK-PSA1-SO-042-21	8/6/2014	-
PSA 1	SB-043	17	NTK-PSA1-SO-043-17	8/6/2014	-
PSA 1	SB-043	19	NTK-PSA1-SO-043-19	8/6/2014	-
PSA 1	SB-044	15	NTK-PSA1-SO-044-15	8/6/2014	+
PSA 1	SB-044	19	NTK-PSA1-SO-044-19	8/6/2014	+
PSA 1	SB-044	21	NTK-PSA1-SO-044-21	8/6/2014	+
PSA 1	SB-046	19	NTK-PSA1-SO-046-19	8/6/2014	-

TABLE 3-2

PSA 1 NAPL Test Kit Results

Velsicol Chemical Corporation Superfund Site, St. Louis, Michigan

Sampling Area	Sample Location	Depth (feet bgs)	NAPL Test Kit ID	Date	Result
PSA 1	SB-047	20	NTK-PSA1-SO-047-20	8/7/2014	-
PSA 1	SB-048	15	NTK-PSA1-SO-048-15	8/7/2014	+
PSA 1	SB-051	17	NTK-PSA1-SO-051-17	8/7/2014	+
PSA 1	SB-055	16	NTK-PSA1-SO-055-16	8/8/2014	+
PSA 1	SB-057	9	NTK-PSA1-SO-057-9	8/22/2014	+
PSA 1	SB-058	7.5	NTK-PSA1-SO-058-7.5	8/22/2014	-
PSA 1	SB-058	8.5	NTK-PSA1-SO-058-8.5	8/22/2014	+
PSA 1	SB-060	6	NTK-PSA1-SO-060-6	8/25/2014	-
PSA 1	SB-060	8	NTK-PSA1-SO-060-8	8/25/2014	-
PSA 1	SB-061	7.8	NTK-PSA1-SO-061-7.8	8/25/2014	-
PSA 1	SB-062	13	NTK-PSA1-SO-062-13	8/25/2014	+
PSA 1	SB-063	14	NTK-PSA1-SO-063-14	8/25/2014	-

TABLE 3-3

PSA 2 Soil Analytical Results

Velsicol Chemical Corporation Superfund Site, St. Louis, Michigan

Boring Location	Sample ID	Date	Sample Depth (feet bgs)	Chlorobenzene [µg/kg][a]	TRIS	[µg/kg][b]
PSA2-SB-001	VCS-PSA2-SO-001-13	8/13/2014	13	12 U		45 UJ
	VCS-PSA2-SO-001-6	8/8/2014	6	33 J		810 U
	VCS-PSA2-SO-001-9	8/13/2014	9	12 J		3,100 U
PSA2-SB-002	VCS-PSA2-SO-002-14	8/8/2014	14	270		2,100 U
	VCS-PSA2-SO-002-16	8/8/2014	16	2,000 J		2,200 J
	VCS-PSA2-SO-002-16-FD	8/8/2014	16	8,000 J		780 U
	VCS-PSA2-SO-002-8	8/8/2014	8	27,000		3,200 J
PSA2-SB-003	VCS-PSA2-SO-003-15	8/8/2014	15	51 J		1,000 U
	VCS-PSA2-SO-003-19	8/8/2014	19	11 J		760 U
	VCS-PSA2-SO-003-8	8/8/2014	8	78		820 U
PSA2-SB-004	VCS-PSA2-SO-004-15	8/11/2014	15	43 J		820 U
	VCS-PSA2-SO-004-18	8/11/2014	18	43 J		830 U
	VCS-PSA2-SO-004-8.5	8/11/2014	8.5	15 J		960 U
PSA2-SB-005	VCS-PSA2-SO-005-12	8/11/2014	12	170		1,000 U
	VCS-PSA2-SO-005-15	8/11/2014	15	4,000		1,700 U
	VCS-PSA2-SO-005-7.5	8/11/2014	7.5	130 J		990 U
	VCS-PSA2-SO-005-7.5-FD	8/11/2014	7.5	31 J		3,200 J
PSA2-SB-006	VCS-PSA2-SO-006-11	8/11/2014	11	10 U		200 U
	VCS-PSA2-SO-006-15	8/11/2014	15	810		710 U
	VCS-PSA2-SO-006-5.5	8/11/2014	5.5	330		1,100 U
PSA2-SB-007	VCS-PSA2-SO-007-14	8/11/2014	14	56 J		520 U
	VCS-PSA2-SO-007-18	8/11/2014	18	540		730 U
	VCS-PSA2-SO-007-8	8/11/2014	8	9.3 U		40 U
	VCS-PSA2-SO-007-8-FD	8/11/2014	8	9.3 U		40 U
PSA2-SB-008	VCS-PSA2-SO-008-14.5	8/11/2014	14.5	9.3 U		80 U
	VCS-PSA2-SO-008-16	8/11/2014	16	60 J		130 UJ
	VCS-PSA2-SO-008-9	8/11/2014	9	15 J		200 U
PSA2-SB-009	VCS-PSA2-SO-009-14	8/11/2014	14	26 J		42 U
	VCS-PSA2-SO-009-16.5	8/11/2014	16.5	68		84 U
	VCS-PSA2-SO-009-7	8/11/2014	7	31 J		810 U
PSA2-SB-010	VCS-PSA2-SO-010-11	8/11/2014	11	10 J		40 U
	VCS-PSA2-SO-010-17	8/11/2014	17	500		320 U
	VCS-PSA2-SO-010-7.5	8/11/2014	7.5	120		26,000
PSA2-SB-011	VCS-PSA2-SO-011-14	8/11/2014	14	13,000		4,800 U
	VCS-PSA2-SO-011-15.5	8/11/2014	15.5	560		420 U
	VCS-PSA2-SO-011-9	8/11/2014	9	38 J		820 U
PSA2-SB-012	VCS-PSA2-SO-012-15	8/12/2014	15	27 J		790 U
	VCS-PSA2-SO-012-19	8/12/2014	19	7.9 U		750 U
	VCS-PSA2-SO-012-19-FD	8/12/2014	19	11 U		190 U
	VCS-PSA2-SO-012-7	8/12/2014	7	200		760 U
PSA2-SB-013	VCS-PSA2-SO-013-14	8/12/2014	14	12 J		37 U
	VCS-PSA2-SO-013-19	8/12/2014	19	9.3 U		190 U
	VCS-PSA2-SO-013-9	8/12/2014	9	25 J		860 U

TABLE 3-3

PSA 2 Soil Analytical Results

Velsicol Chemical Corporation Superfund Site, St. Louis, Michigan

Boring Location	Sample ID	Date	Sample Depth (feet bgs)	Chlorobenzene [µg/kg][a]	TRIS	[µg/kg][b]
PSA2-SB-014	VCS-PSA2-SO-014-14	8/12/2014	14	16 J		3,800 U
	VCS-PSA2-SO-014-16	8/12/2014	16	8.1 U		40 U
	VCS-PSA2-SO-014-6.5	8/12/2014	6.5	9.2 U		400 U
PSA2-SB-015	VCS-PSA2-SO-015-13	8/12/2014	13	19 U		89 U
	VCS-PSA2-SO-015-15	8/12/2014	15	19 U		370 U
	VCS-PSA2-SO-015-7	8/12/2014	7	32 J		800 U
PSA2-SB-016	VCS-PSA2-SO-016-10	8/12/2014	10	10 U		3,900 U
	VCS-PSA2-SO-016-13	8/12/2014	13	9.7 U		37 U
	VCS-PSA2-SO-016-13-FD	8/12/2014	13	11 U		37 U
	VCS-PSA2-SO-016-9	8/12/2014	9	10 U		200 U
PSA2-SB-017	VCS-PSA2-SO-017-10	8/12/2014	10	9.4 U		3,300 U
	VCS-PSA2-SO-017-12.5	8/12/2014	12.5	8 U		39 UJ
	VCS-PSA2-SO-017-7	8/12/2014	7	12 J		760 U
PSA2-SB-018	VCS-PSA2-SO-018-10	8/13/2014	10	9 U		39 U
	VCS-PSA2-SO-018-10-FD	8/13/2014	10	9.1 U		39 U
	VCS-PSA2-SO-018-7	8/13/2014	7	14 J		1,500 U
	VCS-PSA2-SO-018-8	8/13/2014	8	10 U		1,600 U
PSA2-SB-019	VCS-PSA2-SO-019-12	8/13/2014	12	22 J		940 U
	VCS-PSA2-SO-019-15	8/13/2014	15	9.8 U		1,600 U
	VCS-PSA2-SO-019-6.5	8/13/2014	6.5	850		1,600 U
PSA2-SB-020	VCS-PSA2-SO-020-12.5	8/13/2014	12.5	44 J		1,600 U
	VCS-PSA2-SO-020-17	8/13/2014	17	13 J		41 U
	VCS-PSA2-SO-020-7	8/13/2014	7	42 J		800 U
PSA2-SB-021	VCS-PSA2-SO-021-13	8/13/2014	13	18 J		770 U
	VCS-PSA2-SO-021-17	8/13/2014	17	9.9 U		38 U
	VCS-PSA2-SO-021-6	8/13/2014	6	240		1,600 U
PSA2-SB-022	VCS-PSA2-SO-022-14	8/13/2014	14	9.2 U		40 U
	VCS-PSA2-SO-022-14-FD	8/13/2014	14	9.7 U		39 U
	VCS-PSA2-SO-022-19	8/13/2014	19	9.7 U		37 U
	VCS-PSA2-SO-022-8.5	8/13/2014	8.5	39 J		790 U
PSA2-SB-023	VCS-PSA2-SO-023-13	8/13/2014	13	190		3,400 U
	VCS-PSA2-SO-023-15	8/13/2014	15	810 J		23,000 U
	VCS-PSA2-SO-023-5	8/13/2014	5	25 J		1,600 U
PSA2-SB-024	VCS-PSA2-SO-024-14	8/13/2014	14	210		3,800 U
	VCS-PSA2-SO-024-18.5	8/13/2014	18.5	300		1,400 U
	VCS-PSA2-SO-024-9	8/13/2014	9	32 J		790 U
PSA2-SB-025	VCS-PSA2-SO-025-11	8/13/2014	11	12 J		800 U
	VCS-PSA2-SO-025-19	8/13/2014	19	4,000		870 U
	VCS-PSA2-SO-025-7	8/13/2014	7	1,800		800 U
PSA2-SB-026	VCS-PSA2-SO-026-14	8/14/2014	14	10 J		400 U
	VCS-PSA2-SO-026-22	8/14/2014	22	140		1,100 J
	VCS-PSA2-SO-026-6.5	8/14/2014	6.5	30 J		400 U

TABLE 3-3

PSA 2 Soil Analytical Results

Velsicol Chemical Corporation Superfund Site, St. Louis, Michigan

Boring Location	Sample ID	Date	Sample Depth (feet bgs)	Chlorobenzene [µg/kg][a]	TRIS	[µg/kg][b]
PSA2-SB-027	VCS-PSA2-SO-027-11	8/14/2014	11	24 J		2,800
	VCS-PSA2-SO-027-18	8/14/2014	18	15 U		400 U
	VCS-PSA2-SO-027-18-FD	8/14/2014	18	9.3 U		400 U
	VCS-PSA2-SO-027-6	8/14/2014	6	14 J		810 U
PSA2-SB-028	VCS-PSA2-SO-028-13	8/14/2014	13	8.8 J		1,200 J
	VCS-PSA2-SO-028-16	8/14/2014	16	700		1,400,000
	VCS-PSA2-SO-028-5.5	8/14/2014	5.5	19 J		2,200 U
PSA2-SB-029	VCS-PSA2-SO-029-11	8/14/2014	11	190		2,200 J
	VCS-PSA2-SO-029-17.5	8/14/2014	17.5	63 J		490 U
	VCS-PSA2-SO-029-9	8/14/2014	9	54 J		840 U
PSA2-SB-030	VCS-PSA2-SO-030-10	8/14/2014	10	17 J		2,400 J
	VCS-PSA2-SO-030-15	8/14/2014	15	58 J		810 U
	VCS-PSA2-SO-030-25	8/14/2014	25	40 J		380 U
PSA2-SB-031	VCS-PSA2-SO-031-17.5	8/14/2014	17.5	12 J		410 U
	VCS-PSA2-SO-031-23	8/14/2014	23	360 J		540 U
	VCS-PSA2-SO-031-23-FD	8/14/2014	23	1,100 J		1,400 J
	VCS-PSA2-SO-031-8.5	8/14/2014	8.5	27 J		2,600 J
PSA2-SB-032	VCS-PSA2-SO-032-14	8/14/2014	14	190		4,800 J
	VCS-PSA2-SO-032-14-FD	8/14/2014	14	240		2,500 J
	VCS-PSA2-SO-032-17	8/14/2014	17	110		870 U
	VCS-PSA2-SO-032-7	8/14/2014	7	18 J		380 U
PSA2-SB-033	VCS-PSA2-SO-033-13	8/15/2014	13	49 J		5,500 J
	VCS-PSA2-SO-033-13-FD	8/15/2014	13	12 J		3,100 J
	VCS-PSA2-SO-033-16.5	8/15/2014	16.5	860		1,500 U
	VCS-PSA2-SO-033-8.5	8/15/2014	8.5	32 J		810 U
PSA2-SB-034	VCS-PSA2-SO-034-11	8/15/2014	11	26 J		400 U
	VCS-PSA2-SO-034-15	8/15/2014	15	750		1,500 U
	VCS-PSA2-SO-034-8	8/15/2014	8	28 J		800 U
PSA2-SB-035	VCS-PSA2-SO-035-16	8/15/2014	16	250		430 U
	VCS-PSA2-SO-035-17	8/15/2014	17	13 J		400 U
	VCS-PSA2-SO-035-17-FD	8/15/2014	17	15 J		390 U
	VCS-PSA2-SO-035-7.5	8/15/2014	7.5	71		810 U
PSA2-SB-036	VCS-PSA2-SO-036-13	8/15/2014	13	10		750 U
	VCS-PSA2-SO-036-15	8/15/2014	15	24 J		2,000 U
	VCS-PSA2-SO-036-5	8/15/2014	5	10 U		460 U
	VCS-PSA2-SO-036-5-FD	8/15/2014	5	9.3 U		410 U
PSA2-SB-037	VCS-PSA2-SO-037-14	8/18/2014	14	300		4,300 U
	VCS-PSA2-SO-037-17.5	8/18/2014	17.5	9 U		1,900 U
	VCS-PSA2-SO-037-6.5	8/18/2014	6.5	10 U		400 U
PSA2-SB-038	VCS-PSA2-SO-038-10.5	8/18/2014	10.5	29 J		430 U
	VCS-PSA2-SO-038-14.5	8/18/2014	14.5	330		3,700 U
	VCS-PSA2-SO-038-8.5	8/18/2014	8.5	54 J		1,900 U
	VCS-PSA2-SO-038-8.5-FD	8/18/2014	8.5	45 J		420 U

TABLE 3-3

PSA 2 Soil Analytical Results

Velsicol Chemical Corporation Superfund Site, St. Louis, Michigan

Boring Location	Sample ID	Date	Sample Depth (feet bgs)	Chlorobenzene [µg/kg][a]	TRIS	[µg/kg][b]
PSA2-SB-039	VCS-PSA2-SO-039-13	8/18/2014	13	32 J		420 U
	VCS-PSA2-SO-039-18.5	8/18/2014	18.5	870		1,500 U
	VCS-PSA2-SO-039-8	8/18/2014	8	22 J		960 J
PSA2-SB-040	VCS-PSA2-SO-040-06	8/19/2014	6	8.1 U		400 U
	VCS-PSA2-SO-040-14	8/19/2014	14	58 J		950 U
	VCS-PSA2-SO-040-16	8/19/2014	16	180		930 U
PSA2-SB-041	VCS-PSA2-SO-041-11	8/19/2014	11	250		400 U
	VCS-PSA2-SO-041-15	8/19/2014	15	46 J		400 U
	VCS-PSA2-SO-041-23	8/19/2014	23	220		2,700
PSA2-SB-042	VCS-PSA2-SO-042-10	8/20/2014	10	12 U		420 U
	VCS-PSA2-SO-042-18.5	8/20/2014	18.5	270		880 U
	VCS-PSA2-SO-042-26	8/20/2014	26	45 J		420 U
	VCS-PSA2-SO-042-26-FD	8/20/2014	26	62 J		1,500 J
PSA2-SB-043	VCS-PSA2-SO-043-13	8/20/2014	13	490		450 UJ
	VCS-PSA2-SO-043-21	8/20/2014	21	12 U		5,300
	VCS-PSA2-SO-043-8	8/20/2014	8	93		8,500 U
PSA2-SB-044	VCS-PSA2-SO-044-15	8/20/2014	15	9 U		410 U
	VCS-PSA2-SO-044-18	8/20/2014	18	590		430 U
	VCS-PSA2-SO-044-27	8/20/2014	27	41 J		400 U
PSA2-SB-045	VCS-PSA2-SO-045-10	8/20/2014	10	17 J		400 U
	VCS-PSA2-SO-045-18	8/20/2014	18	740		410 U
	VCS-PSA2-SO-045-26	8/20/2014	26	43 J		1,300 J
PSA2-SB-046	VCS-PSA2-SO-046-12	8/20/2014	12	46,000		420 U
	VCS-PSA2-SO-046-14.5	8/20/2014	14.5	10,000		920 U
	VCS-PSA2-SO-046-14.5-FD	8/20/2014	14.5	7,900		930 U
	VCS-PSA2-SO-046-23	8/20/2014	23	100		2,400
PSA2-SB-047	VCS-PSA2-SO-047-13.5	8/21/2014	13.5	850		1,700 U
	VCS-PSA2-SO-047-16	8/21/2014	16	120		440 U
	VCS-PSA2-SO-047-9	8/21/2014	9	160		410 U
PSA2-SB-048	VCS-PSA2-SO-048-11	8/19/2014	11	47 J		390 U
	VCS-PSA2-SO-048-19	8/19/2014	19	29 J		390 U
	VCS-PSA2-SO-048-9.5	8/19/2014	9.5	240		1,400 J
PSA2-SB-049	VCS-PSA2-SO-049-14	8/19/2014	14	23 J		430 U
	VCS-PSA2-SO-049-19	8/19/2014	19	12 U		400 U
	VCS-PSA2-SO-049-8.5	8/19/2014	8.5	360		410 U
PSA2-SB-050	VCS-PSA2-SO-050-13	8/21/2014	13	8,900		830 U
	VCS-PSA2-SO-050-21	8/21/2014	21	2,300		430 U
	VCS-PSA2-SO-050-6	8/21/2014	6	27 J		400 U
PSA2-SB-051	VCS-PSA2-SO-051-10	8/21/2014	10	620,000		13,000
	VCS-PSA2-SO-051-12	8/21/2014	12	35,000 J		840 U
	VCS-PSA2-SO-051-12-FD	8/21/2014	12	18,000 J		410 U
	VCS-PSA2-SO-051-23.5	8/21/2014	23.5	180		860 U
PSA2-SB-052	VCS-PSA2-SO-052-12	8/21/2014	12	12 J		380 U
	VCS-PSA2-SO-052-17	8/21/2014	17	140		830 U
	VCS-PSA2-SO-052-25	8/21/2014	25	24 J		380 U

TABLE 3-3

PSA 2 Soil Analytical Results

Velsicol Chemical Corporation Superfund Site, St. Louis, Michigan

Boring Location	Sample ID	Date	Sample Depth (feet bgs)	Chlorobenzene [µg/kg][a]	TRIS	[µg/kg][b]
PSA2-SB-053	VCS-PSA2-SO-053-10	8/21/2014	10	76		390 U
	VCS-PSA2-SO-053-21	8/21/2014	21	18 J		820 U
	VCS-PSA2-SO-053-23	8/21/2014	23	29 J		390 UJ
PSA2-SB-054	VCS-PSA2-SO-054-20	8/21/2014	20	57,000		400 U
	VCS-PSA2-SO-054-23	8/21/2014	23	120,000		400 U
	VCS-PSA2-SO-054-23-FD	8/21/2014	23	160,000		410 U
	VCS-PSA2-SO-054-9.5	8/21/2014	9.5	650		400 U
PSA2-SB-055	VCS-PSA2-SO-055-10	8/21/2014	10	61		420 U
	VCS-PSA2-SO-055-15	8/21/2014	15	30,000		3,300 J
	VCS-PSA2-SO-055-19.5	8/21/2014	19.5	110		1,100 J
PSA2-SB-056	VCS-PSA2-SO-056-15	8/22/2014	15	120,000		860 U
	VCS-PSA2-SO-056-18	8/22/2014	18	13,000		420 U
	VCS-PSA2-SO-056-18-FD	8/22/2014	18	17,000		990 J
	VCS-PSA2-SO-056-7	8/22/2014	7	11 U		370 U
PSA2-SB-057	VCS-PSA2-SO-057-15	8/22/2014	15	29,000		1,500 U
	VCS-PSA2-SO-057-17.5	8/22/2014	17.5	2,000		800 U
	VCS-PSA2-SO-057-8	8/22/2014	8	8.8 U		390 U
PSA2-SB-058	VCS-PSA2-SO-058-7	10/9/2014	7	45 J		410 U
	VCS-PSA2-SO-058-11	10/9/2014	11	9 U		410 U
	VCS-PSA2-SO-058-15	10/9/2014	15	16 U		560 U
PSA2-SB-059	VCS-PSA2-SO-059-11	10/9/2014	11	28 J		750 U
	VCS-PSA2-SO-059-14	10/9/2014	14	69 J		760 U
	VCS-PSA2-SO-059-8	10/9/2014	8	21 J		410 U
PSA2-SB-060	VCS-PSA2-SO-060-10	10/9/2014	10	39 J		560 U
	VCS-PSA2-SO-060-14	10/9/2014	14	150		650 U
	VCS-PSA2-SO-060-8	10/9/2014	8	630		480 U
PSA2-SB-061	VCS-PSA2-SO-061-17	10/9/2014	17	36 J		390 U
	VCS-PSA2-SO-061-19	10/9/2014	19	24 J		580 U
	VCS-PSA2-SO-061-9	10/9/2014	9	110		440 U
	VCS-PSA2-SO-061-9-FD	10/9/2014	9	140		390 U

[a] Highlighted results exeed Michigan Part 201 soil saturation criteria 260,000 ug/kg

[b] Highlighted results exeed Michigan Part 201 soil saturation criteria 27,000 ug/kg

Notes:

U = The analyte was analyzed for but not detected above the reported sample method detection limit (MDL).

J = The analyte was present, but the reported value may not be accurate or precise; the result is estimated because it is less than the referenced reporting limit (RL) but greater than the MDL or due to a QC exceedance.

UJ = The analyte was analyzed for but not detected above the reported sample MDL; the result is estimated due to a possible low bias in the analytical data.

TABLE 3-4

PSA 2 NAPL Test Kit Results

Velsicol Chemical Corporation Superfund Site, St. Louis, Michigan

Sampling Area	Sample Location	Depth (feet bgs)	NAPL Test Kit ID	Date	Result
PSA 2	SB-010	24	NTK-PSA2-SO-010-24	8/11/2014	-
PSA 2	SB-011	19	NTK-PSA2-SO-011-19	8/11/2014	-
PSA 2	SB-019	18.5	NTK-PSA2-SO-019-18.5	8/13/2014	+
PSA 2	SB-023	15	NTK-PSA2-SO-023-15	8/13/2014	-
PSA 2	SB-023	20	NTK-PSA2-SO-023-20	8/13/2014	-
PSA 2	SB-034	20	NTK-PSA2-SO-034-20	8/15/2014	-
PSA 2	SB-035	19	NTK-PSA2-SO-035-19	8/15/2014	-
PSA 2	SB-036	18	NTK-PSA2-SO-036-18	8/15/2014	+
PSA 2	SB-036	19	NTK-PSA2-SO-036-19	8/15/2014	+
PSA 2	SB-037	17	NTK-PSA2-SO-037-17	8/18/2014	-
PSA 2	SB-037	19	NTK-PSA2-SO-037-19	8/18/2014	+
PSA 2	SB-038	18.5	NTK-PSA2-SO-038-18.5	8/18/2014	-
PSA 2	SB-044	18	NTK-PSA2-SO-044-18	8/20/2014	-
PSA 2	SB-046	27.7	NTK-PSA2-SO-046-27.7	8/20/2014	-
PSA 2	SB-050	19	NTK-PSA2-SO-050-19	8/21/2014	-
PSA 2	SB-051	10	NTK-PSA2-SO-051-10	8/21/2014	-

Figures

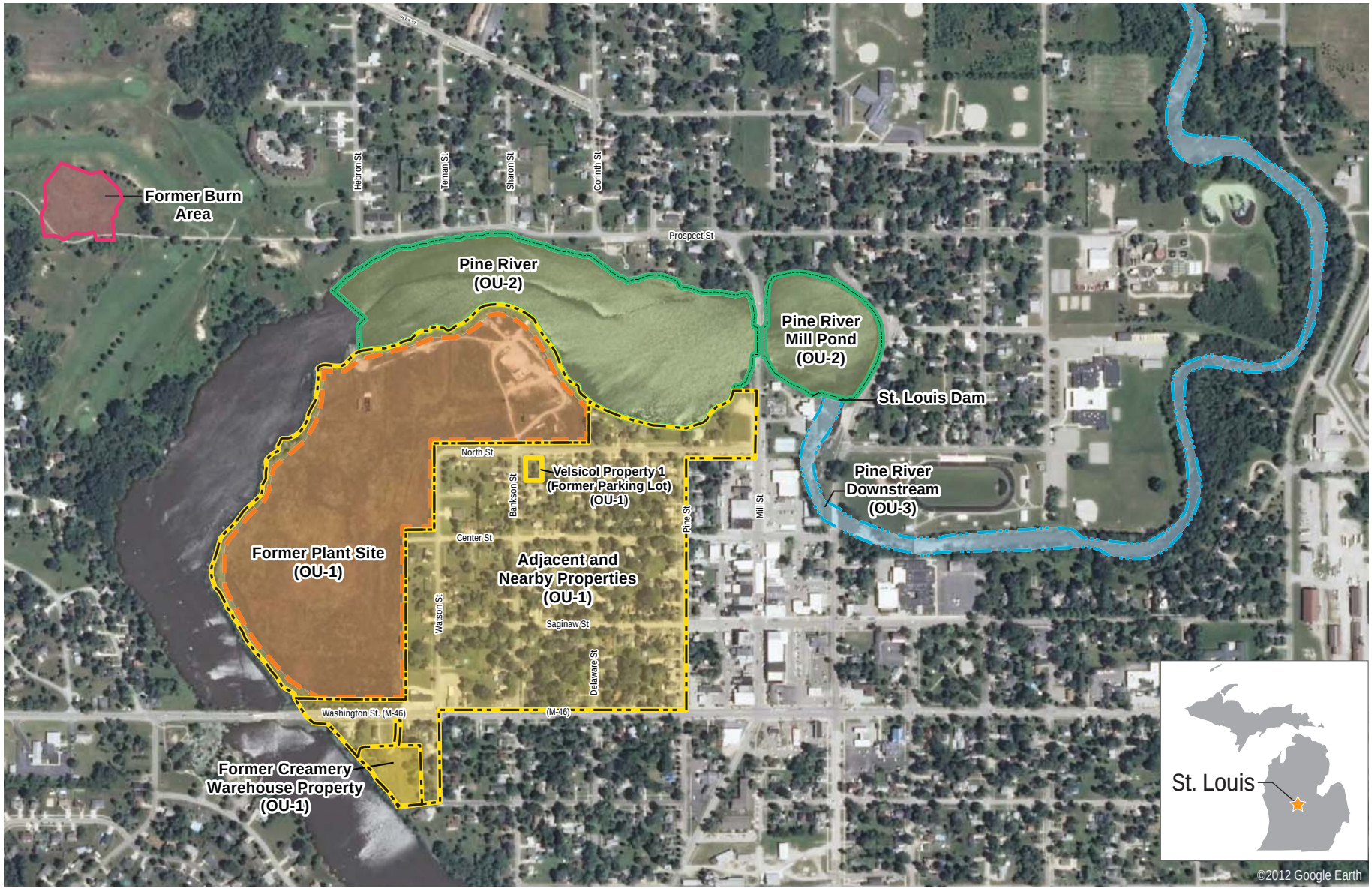

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Figure 1-1
Study Areas and Operable Units
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

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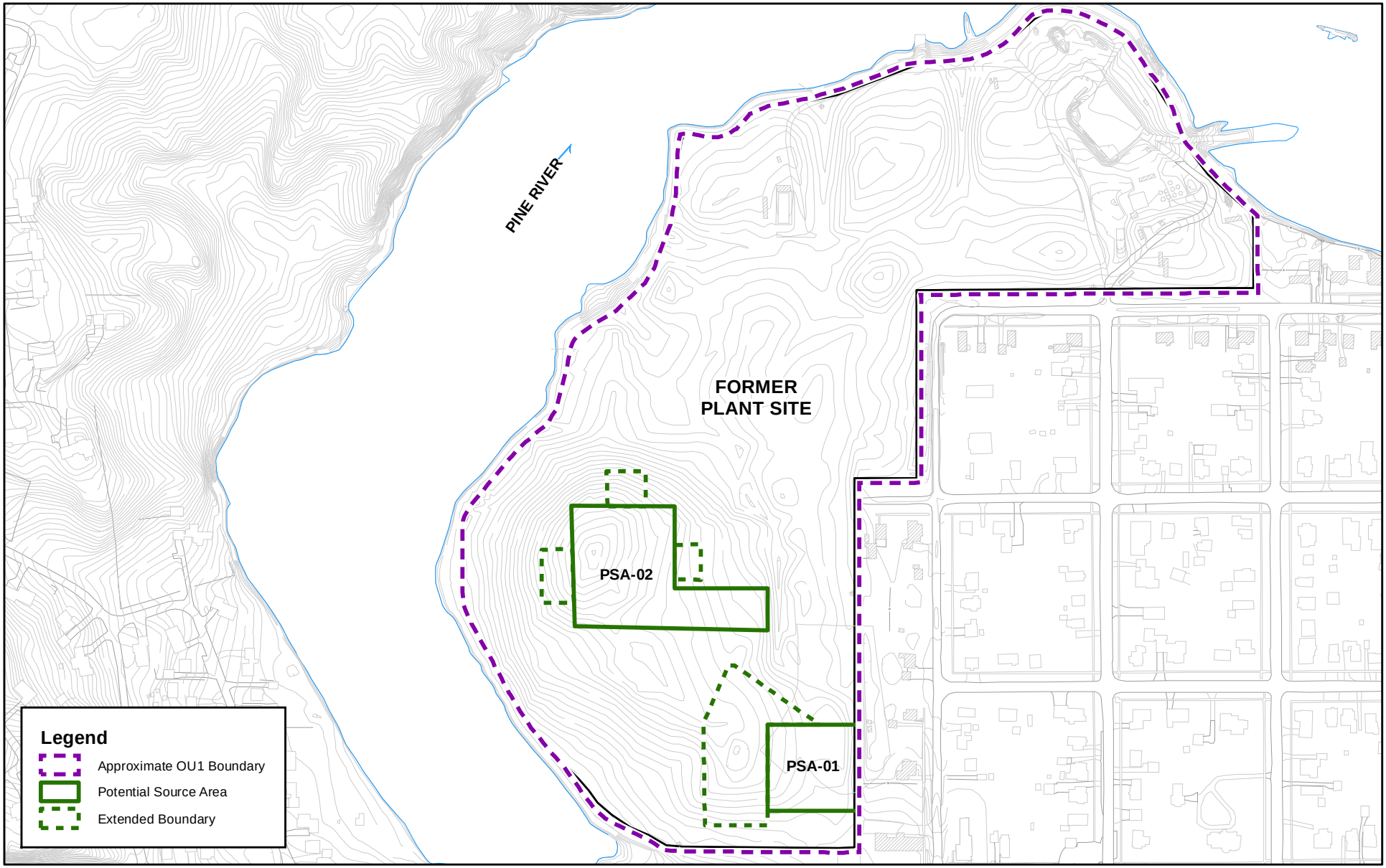

N

0 350 700

Feet

FIGURE 2-1
Potential Source Areas 1 and 2
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

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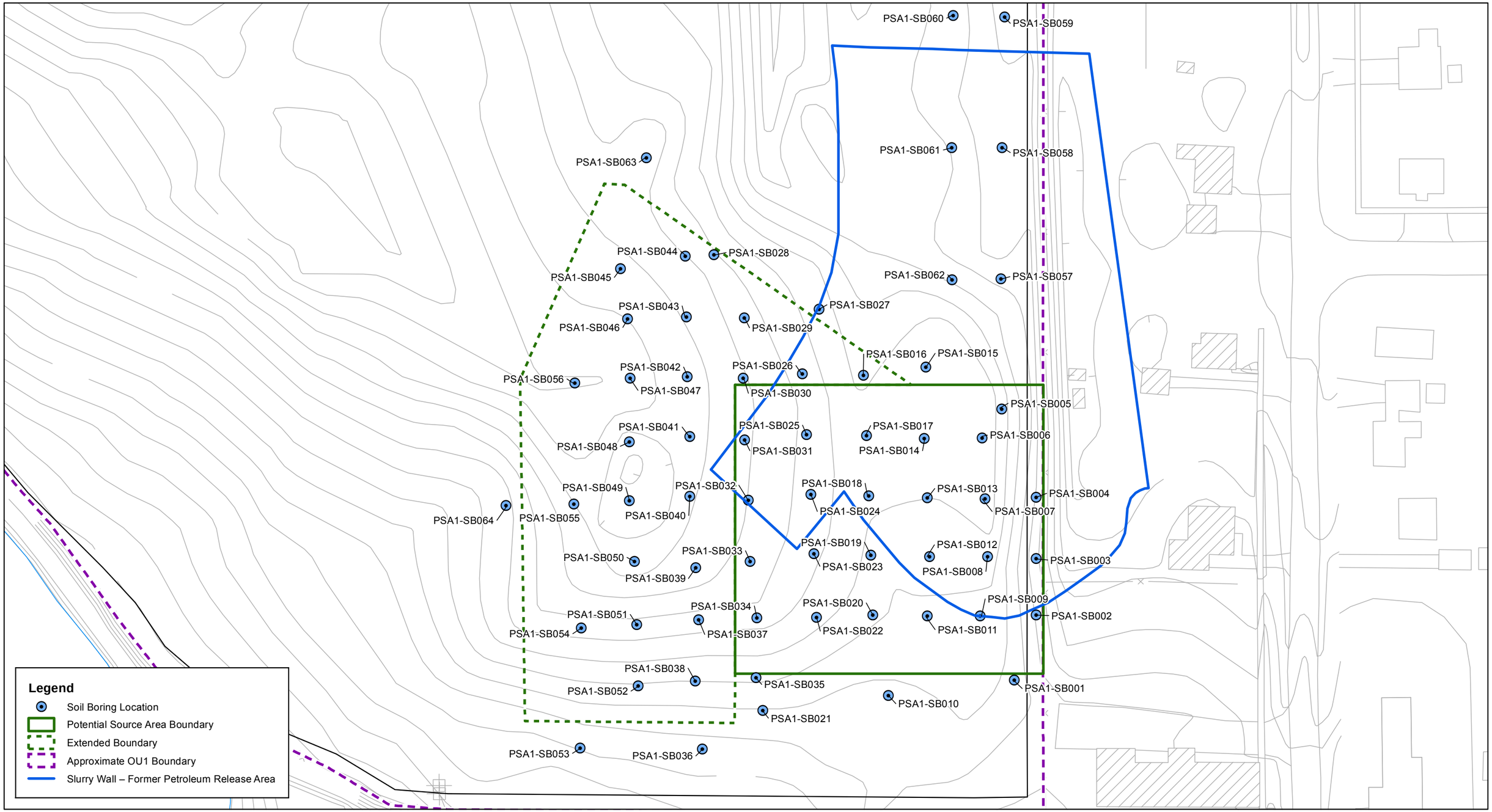

FIGURE 2-2
Potential Source Area 1
Soil Boring Locations
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

CH2MHILL

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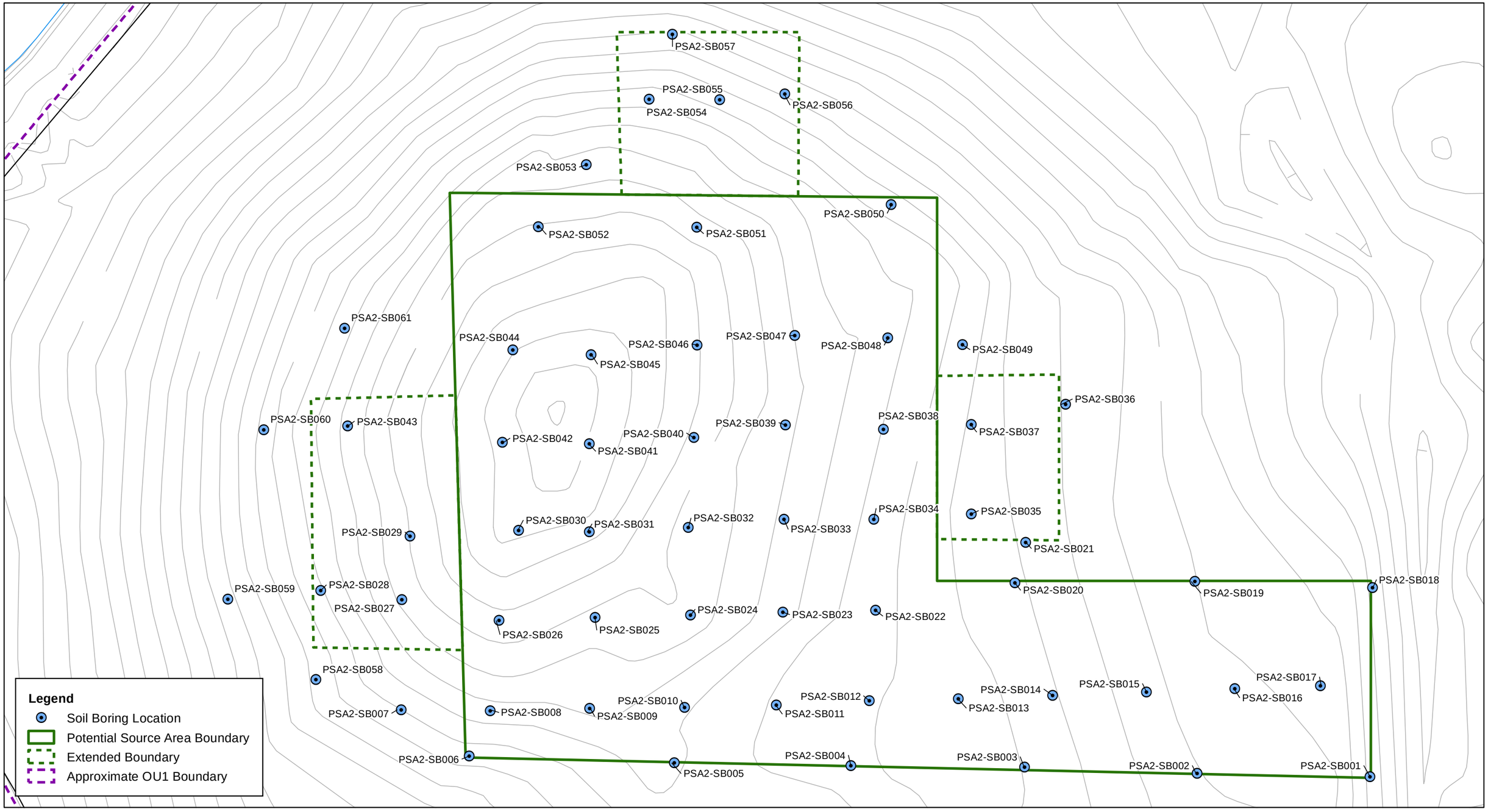

FIGURE 2-3
Potential Source Area 2
Soil Boring Locations
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

CH2MHILL

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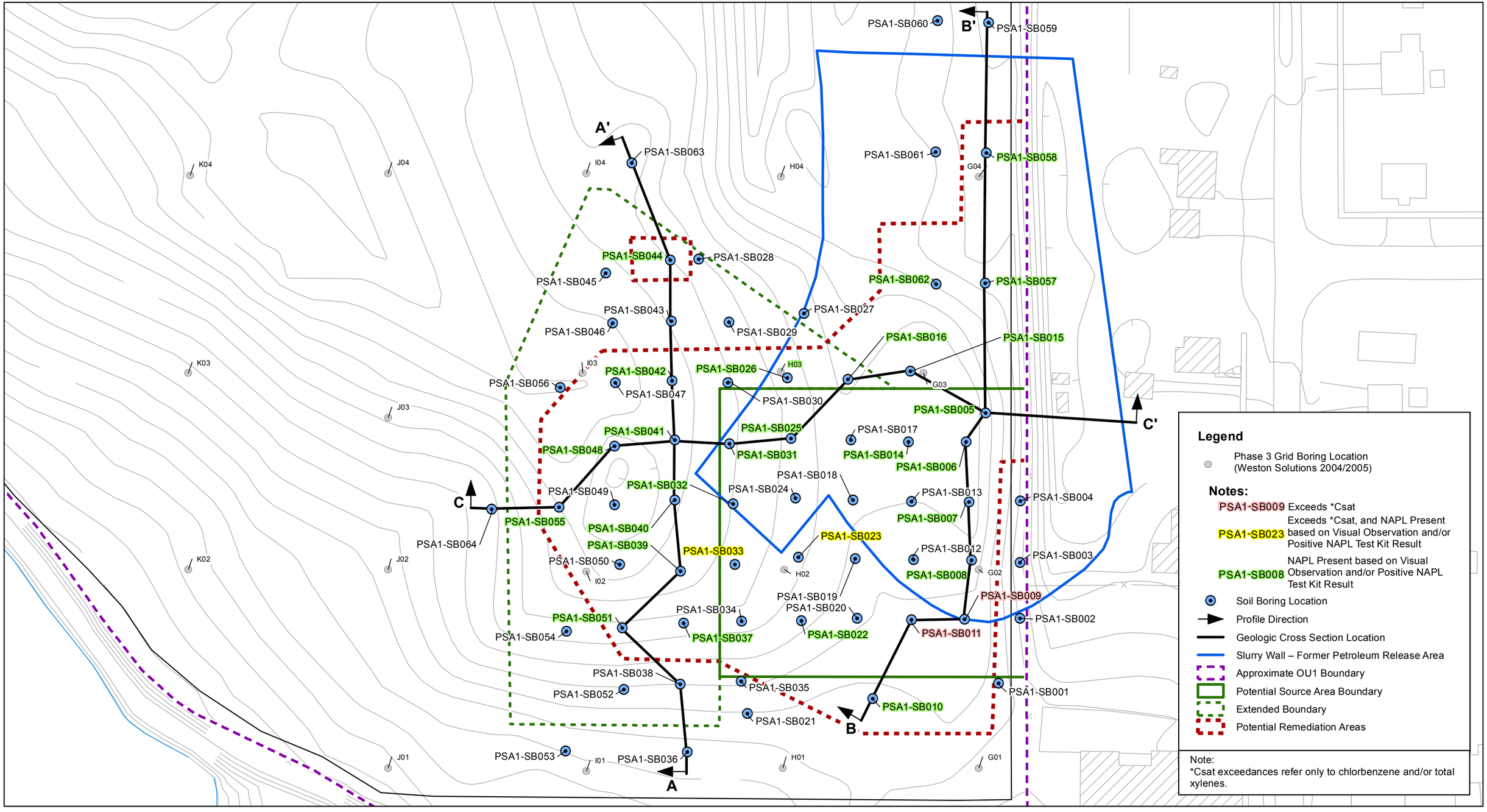


FIGURE 3-1
Potential Source Area 1
NAPL and Csat Exceedances
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

CH2MHILL

South
A

North
A'

Intersection C-C'

Elevation (Feet AMSL)

745
740
735
730
725
720
715

SB-036
SB-038
SB-051
SB-039
SB-040
SB-041
SB-042
SB-043
SB-044
SB-063

LEGEND

- Silty Clay to Clayey Silt - Cap Material
- Silty to Sandy Clay
- Clayey Sand to Sandy Clay
- Sand - Primarily fine to medium sand with occasional layers of fine to coarse sand and silty sand. Variable degrees of staining present throughout.
- Silt
- Silty Clay to Clayey Silt with occasional sand and silty sand seams
- Concrete
- Soil Boring
- Soil Sample Location - Analytical Result < Csat Criteria (Chlorobenzene and Total Xylenes)
- NAPL Test Kit (-)
- NAPL Test Kit (+)
- Water Table (Approximate)
- Inferred Geologic Contact

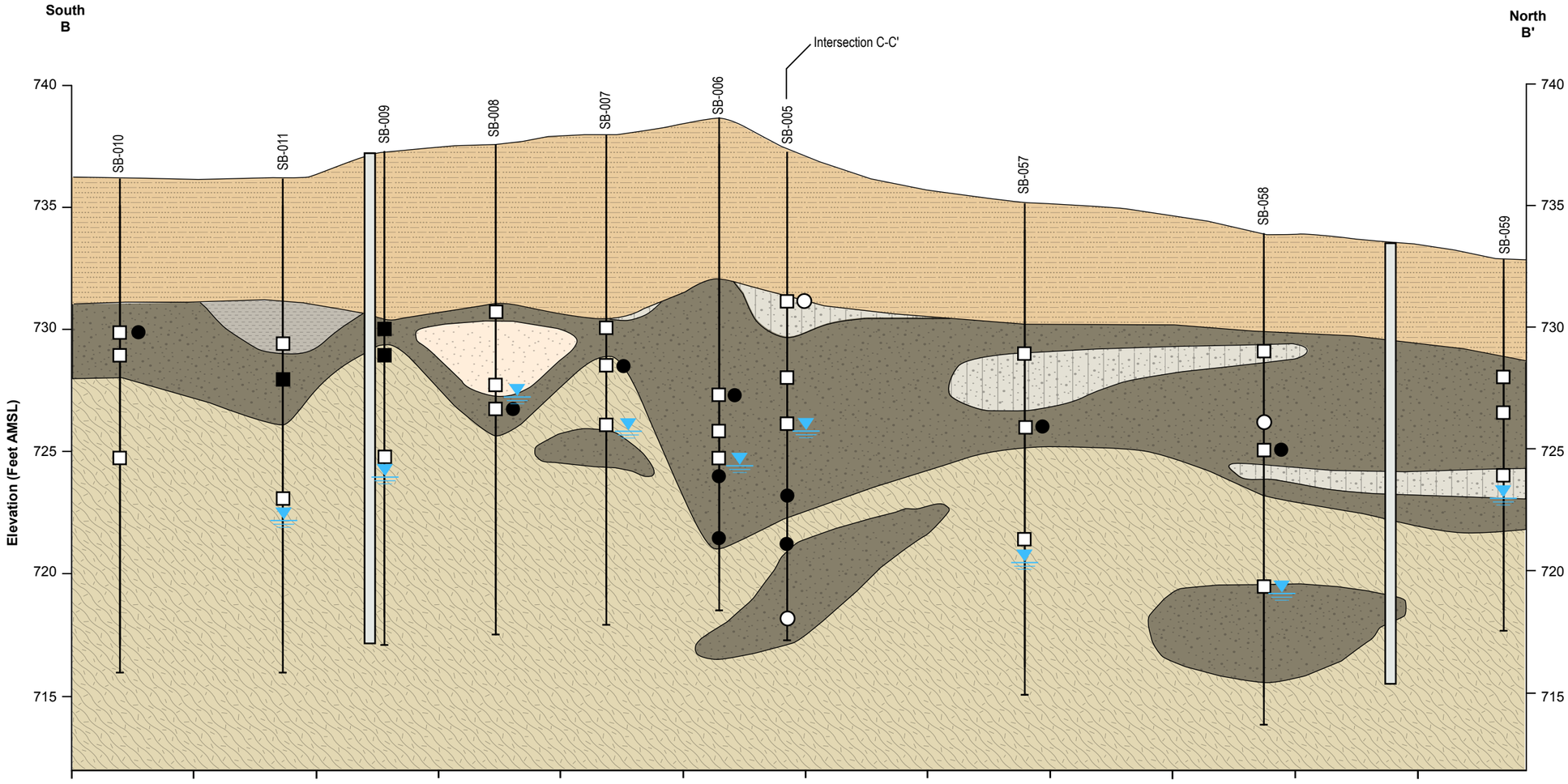
Horizontal : 1" = 50'
Vertical: 1" = 5'
V.E. = 10x

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 3-2
Potential Source Area 1
Cross Section A-A'
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

CH2MHILL

EN0203151050SAC RDI_CrossSection_A-A'_v2.ai 02.09.15 it



LEGEND

- Silty Clay to Clayey Silt - Cap Material
- Silty to Sandy Clay
- Clayey Sand to Sandy Clay
- Sand - Primarily fine to medium sand with occasional layers of fine to coarse sand and silty sand. Variable degrees of staining present throughout.
- Gravel
- Silty Clay to Clayey Silt with occasional sand and silty sand seams
- Soil Boring
- Slurry Wall (Location and Depth are Approximate)
- Water Table (Approximate)
- Inferred Geologic Contact
- Soil Sample Location - Analytical Result < Csat Criteria (Chlorobenzene and Total Xylenes)
- Soil Sample Location - Analytical Result > Csat Criteria (Chlorobenzene and/or Total Xylenes)
- NAPL Test Kit (-)
- NAPL Test Kit (+)

Horizontal : 1" = 50'
Vertical: 1" = 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 3-3
Potential Source Area 1
Cross Section B-B'
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

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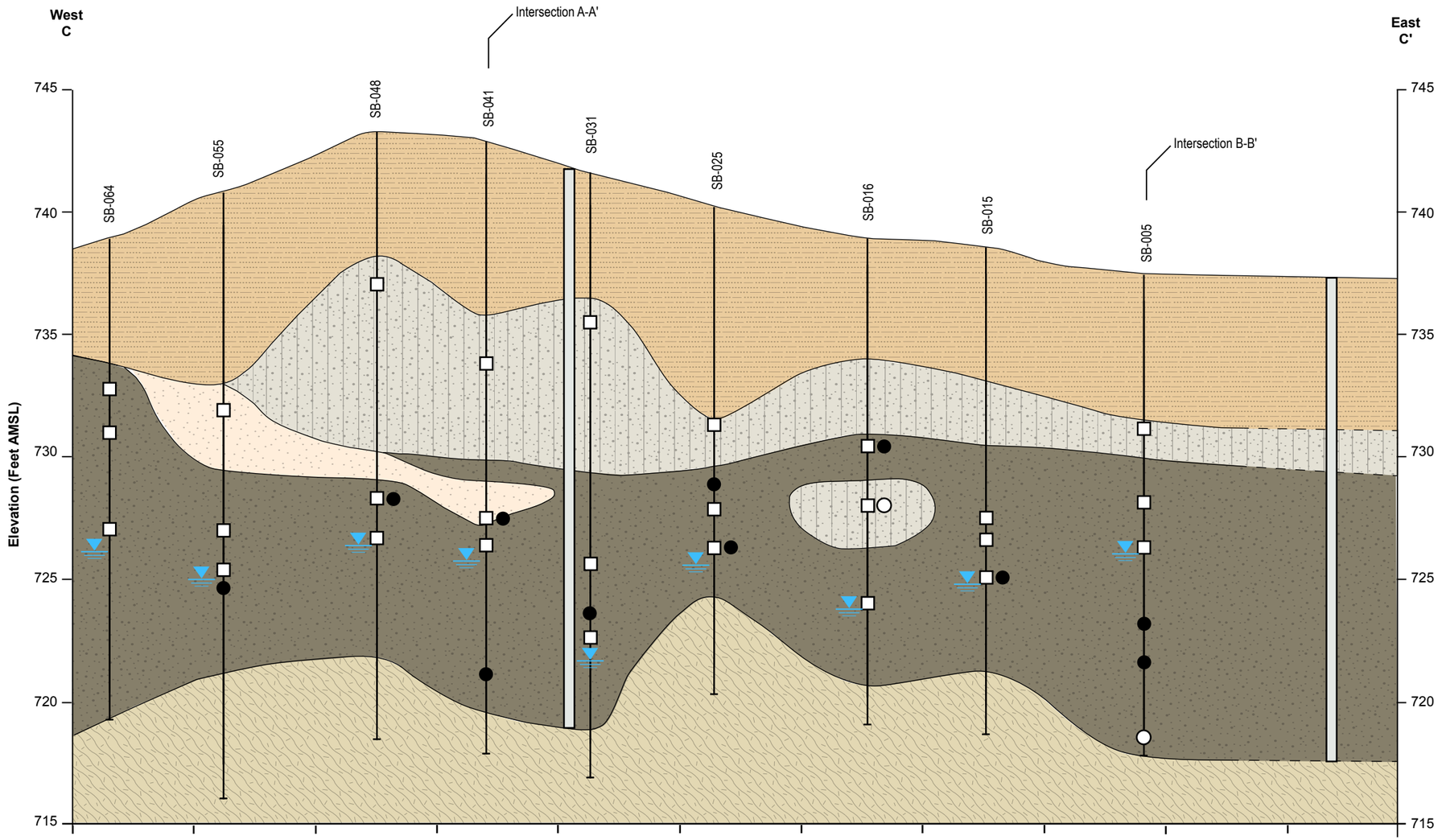

Note: Stratigraphy lines are based on interpretations between soil borings and represent approximate boundaries. Actual transitions between soil boring locations may vary from those presented in this cross section.

Figure 3-4
Potential Source Area 1
Cross Section C-C'
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

CH2MHILL

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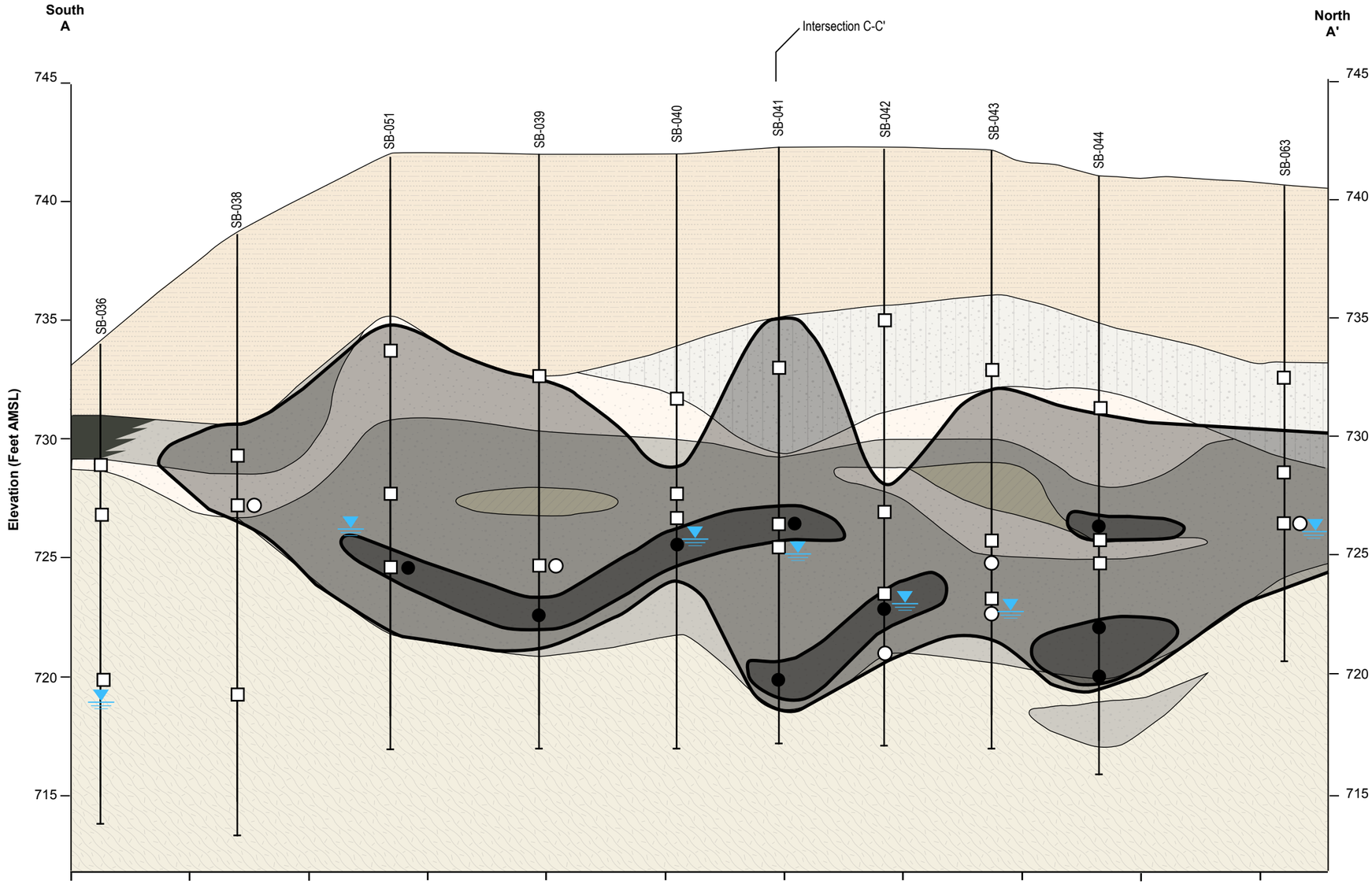


LEGEND

- Silty Clay to Clayey Silt - Cap Material
- Silty to Sandy Clay
- Clayey Sand to Sandy Clay
- Sand - Primarily fine to medium sand with occasional layers of fine to coarse sand and silty sand. Variable degrees of staining present throughout.
- Silt
- Silty Clay to Clayey Silt with occasional sand and silty sand seams
- Concrete
- Soil Boring
- Soil Sample Location - Analytical Result < Csat Criteria (Chlorobenzene and Total Xylenes)
- NAPL Test Kit (-)
- NAPL Test Kit (+)
- Water Table (Approximate)
- Inferred Geologic Contact
- Area of potential impacts based on observed soil staining, elevated PID screening results, or presence of non native material. No NAPL indications were noted during completion of soil borings.
- Area indicating presence of NAPL based on visual observation during completion of soil borings, positive NAPL soil test kit result, or analytical result exceeding Michigan Part 201 soil saturation criteria (C_{sat})

Horizontal : 1" = 50'
Vertical: 1" = 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 3-5
Potential Source Area 1
Cross Section A-A' Impacted Zone
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

CH2MHILL

South
B

North
B'

Intersection C-C'

SB-010 SB-011 SB-009 SB-008 SB-007 SB-006 SB-005 SB-057 SB-058 SB-059

Elevation (Feet AMSL)

740
735
730
725
720
715

LEGEND

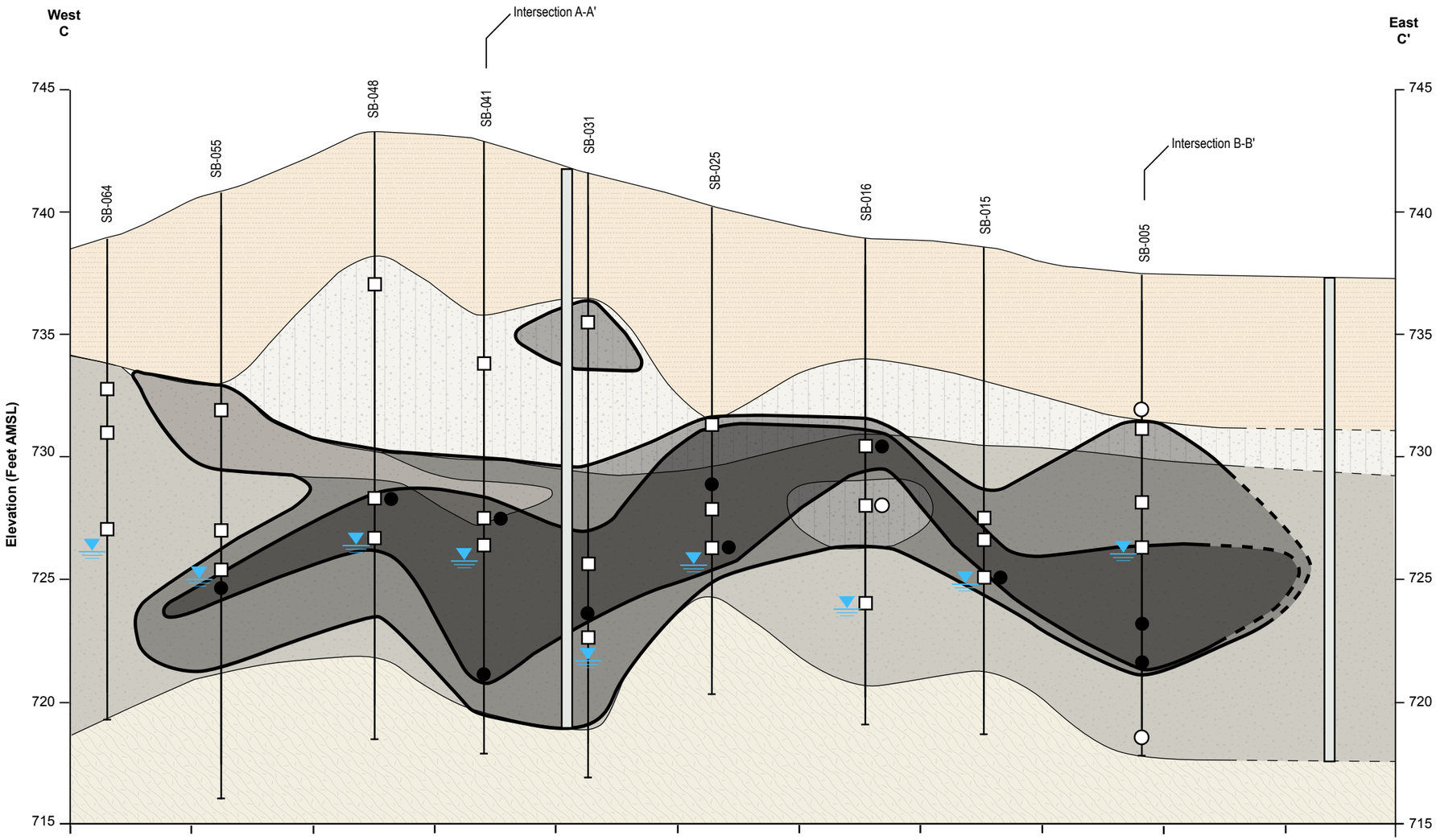
- Silty Clay to Clayey Silt - Cap Material
- Silty to Sandy Clay
- Clayey Sand to Sandy Clay
- Sand - Primarily fine to medium sand with occasional layers of fine to coarse sand and silty sand. Variable degrees of staining present throughout.
- Gravel
- Silty Clay to Clayey Silt with occasional sand and silty sand seams
- Soil Boring
- Slurry Wall (Location and Depth are Approximate)
- Water Table (Approximate)
- Inferred Geologic Contact
- Soil Sample Location - Analytical Result < Csat Criteria (Chlorobenzene and Total Xylenes)
- Soil Sample Location - Analytical Result > Csat Criteria (Chlorobenzene and/or Total Xylenes)
- NAPL Test Kit (-)
- NAPL Test Kit (+)
- Area of potential impacts based on observed soil staining, elevated PID screening results, or presence of non native material. No NAPL indications were noted during completion of soil borings.
- Area indicating presence of NAPL based on visual observation during completion of soil borings, positive NAPL soil test kit result, or analytical result exceeding Michigan Part 201 soil saturation criteria (C_{sat})

Horizontal : 1" = 50'
Vertical: 1" = 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 3-6
Potential Source Area 1
Cross Section B-B' Impacted Zone
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

CH2MHILL



LEGEND

- Silty Clay to Clayey Silt - Cap Material
- Silty to Sandy Clay
- Clayey Sand to Sandy Clay
- Sand - Primarily fine to medium sand with occasional layers of fine to coarse sand and silty sand. Variable degrees of staining present throughout.
- Silty Clay to Clayey Silt with occasional sand and silty sand seams
- Soil Boring
- Soil Sample Location - Analytical Result < Csat Criteria (Chlorobenzene and Total Xylenes)
- NAPL Test Kit (-)
- NAPL Test Kit (+)
- Water Table (Approximate)
- Slurry Wall (Location and Depth are Approximate)
- Inferred Geologic Contact
- Area of potential impacts based on observed soil staining, elevated PID screening results, or presence of non native material. No NAPL indications were noted during completion of soil borings.
- Area indicating presence of NAPL based on visual observation during completion of soil borings, positive NAPL soil test kit result, or analytical result exceeding Michigan Part 201 soil saturation criteria (C_{sat})

Horizontal : 1" = 50'
Vertical: 1" = 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 3-7
Potential Source Area 1
Cross Section C-C' Impacted Zone
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

CH2MHILL

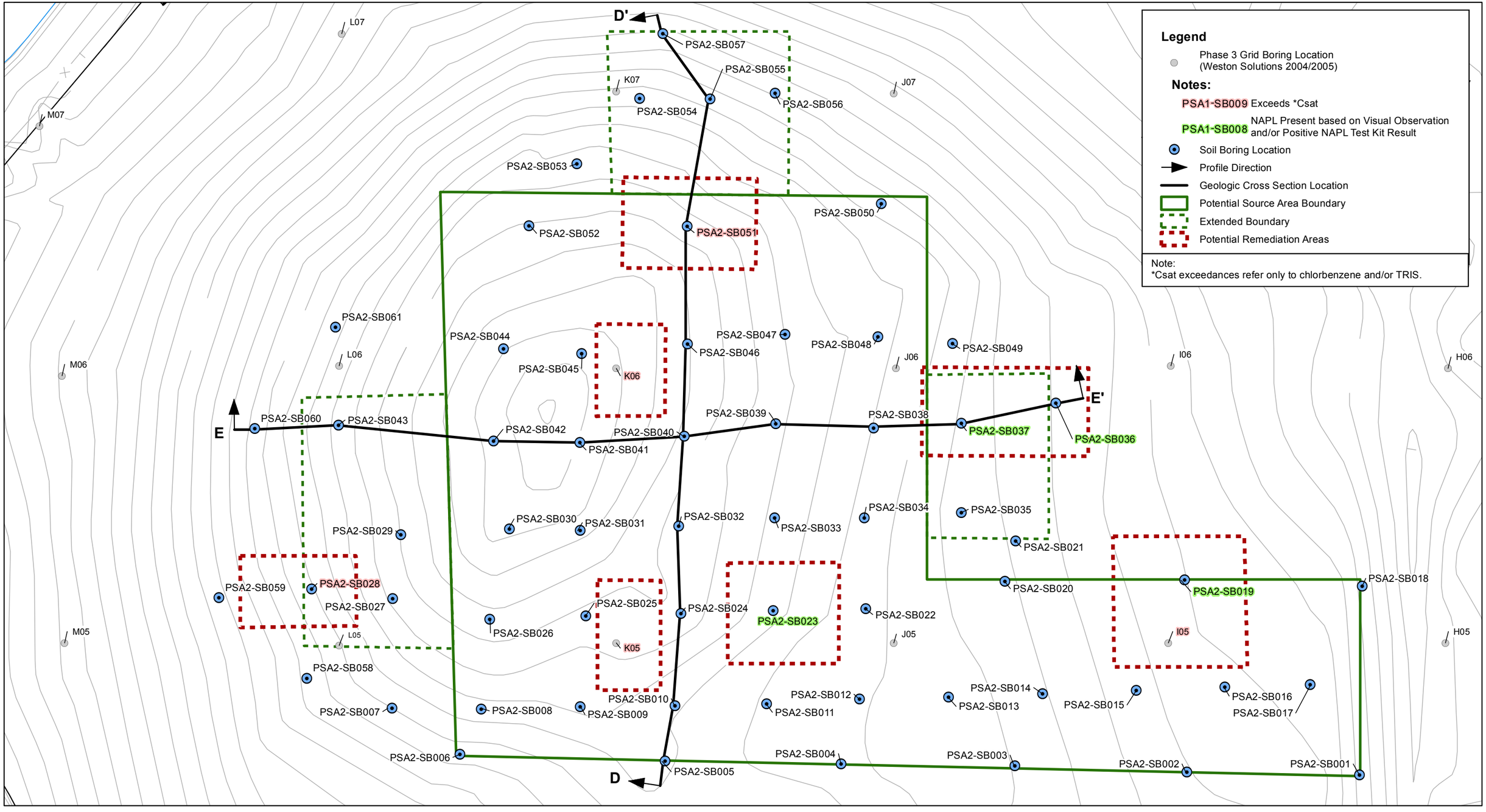
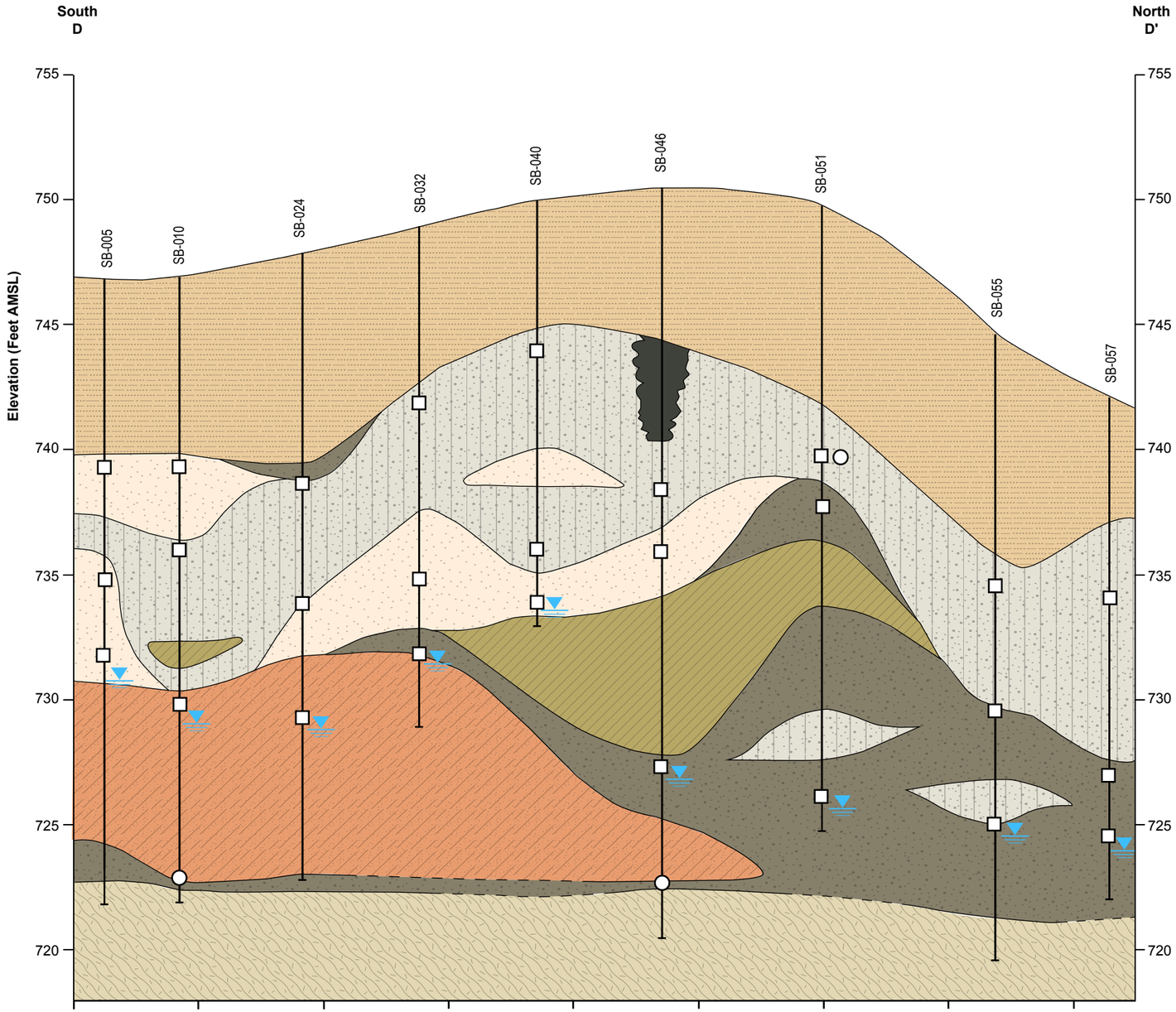


FIGURE 3-8
Potential Source Area 2
NAPL and Csat Exceedances
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

CH2MHILL



LEGEND

- Silty Clay to Clayey Silt - Cap Material
- Silty to Sandy Clay
- Clayey Sand to Sandy Clay
- Sand - Primarily fine to medium sand with occasional layers of fine to coarse sand and silty sand. Variable degrees of staining present throughout.
- Silt
- Silty Clay to Clayey Silt with occasional sand and silty sand seams
- Silt - soft to firm with grey and black laminations
- Concrete
- Soil Boring
- Soil Sample Location - Analytical Result < Csat Criteria (Chlorobenzene and TRIS)
- NAPL Test Kit (-)
- NAPL Test Kit (+)
- Water Table (Approximate)
- Inferred Geologic Contact

Horizontal : 1" = 50'
Vertical: 1" = 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 3-9
Potential Source Area 2
Cross Section D-D'
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

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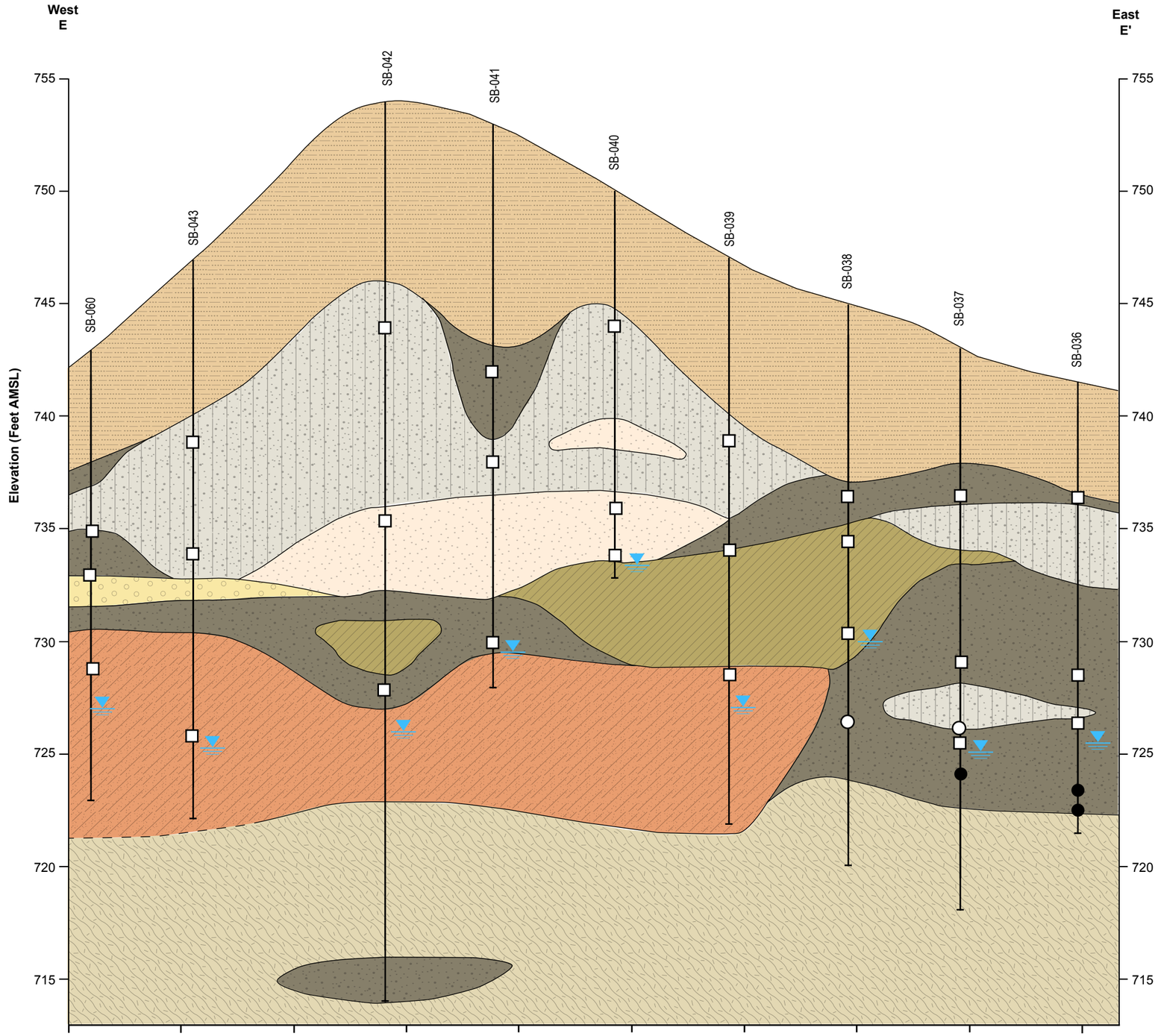
EN0203151050SAC RDI_CrossSection_D-D'_v1.ai 02.10.15 it



LEGEND

- Silty Clay to Clayey Silt - Cap Material
- Silty to Sandy Clay
- Clayey Sand to Sandy Clay
- Sand - Primarily fine to medium sand with occasional layers of fine to coarse sand and silty sand. Variable degrees of staining present throughout.
- Silt
- Silty Clay to Clayey Silt with occasional sand and silty sand seams
- Silt - soft to firm with grey and black laminations
- Possible Magnesium Oxide Fill - soft, moist white granular material
- Soil Boring
- Soil Sample Location - Analytical Result < Csat Criteria (Chlorobenzene and TRIS)
- NAPL Test Kit (-)
- NAPL Test Kit (+)
- Water Table (Approximate)
- Inferred Geologic Contact

Horizontal : 1" = 50'
Vertical: 1" = 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 3-10
Potential Source Area 2
Cross Section E-E'
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

CH2MHILL

EN0203151050SAC RDI_CrossSection_E-E'_v2.ai 02.09.15 it

Appendix A
Soil Boring Logs

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB001	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 736.01 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13057043.916, N 695550.405 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 10.0 ft bgs START : 7/29/14 09:19 END : 7/29/14 09:40 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Dark brown, fine to medium grain silty sand, trace clay (TOP SOIL)	
			0.0		**CLAY (CL)** Gray, silty clay, trace gravel, brittle, dry (CAP)	
		5.0 ---- 5.0	0.0			
			0.0		**CLAY (CL)** Gray, silty clay, some gravel, trace sand, stiff (CAP)	
5	731.01		4.3		**SLAG** Black, slag material, trace gravel, wood	Soil sample collected from 5' to 6'
			9.1		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	Soil sample collected from 7' to 8'
		5.0 ---- 5.0	46.0		**SAND (SP)** Light brown, poorly graded, fine to medium grain sand, trace gravel	Soil sample collected from 9' to 10'
10	726.01		0.4		**SAND (SP)** Same as above, wet	
			0.0		**CLAY (CL)** Gray, silty clay, trace gravel, dry, stiff	
			0.0			
			0.0			
			0.0			
15	721.01	10.0 ---- 10.0	0.0			
			0.0			
			0.0			
			0.0			
			0.0			
20	716.01		0.0			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB002	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 734.20 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13057060.332, N 695599.77 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 10.0 ft bgs START : 7/29/14 10:20 END : 7/29/14 10:56 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace clay, trace gravel, organics. (TOP SOIL)	
			0.0		**CLAY (CL)** Gray, silty clay, trace gravel, brittle, dry. (CAP)	
			0.0			
			0.0			
			0.0			
5	729.20	7.3 ---- 10.0	0.0			
			0.0		**SAND (SW)** Brown, well graded, fine to medium grain sand, some silt, some gravel.	
			0.0		**CLAY (CL)** Brown, sandy clay, some silt, some gravel, very stiff.	Soil sample collected from 7' to 7.3'
			0.0			
			0.0			
10	724.20		0.0		▼	
			0.0		**CLAY (CL)** Same as above - moist to wet	
			0.0		**CLAY (CL)** Gray, silty clay, wet, stiff.	
			0.0			Soil sample collected from 12' to 13'
			0.0		**SAND (SP)** Gray, poorly graded, fine to medium grain sand, trace gravel.	
			0.0		**CLAY (CL)** Gray, silty clay, trace gravel, dry, hard.	
15	719.20	10.0 ---- 10.0	0.0			
			0.0			
			0.0			
			0.0			
			0.0			
20	714.20		0.0			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB003	SHEET 1 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 733.66 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13057060.262, N 695642.129 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 11.9 ft bgs START : 7/29/14 11:00 END : 7/29/14 11:40 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel (TOP SOIL)	
			0.0		**CLAY (CL)** Gray, silty clay, trace gravel, stiff, brittle, dry (CAP)	
			0.0			
			0.0			
5	728.66	8.5 ---- 10.0	0.0		**CLAY (CL)** Brown, silty clay, trace gravel, stiff, dry	Soil sample collected from 5' to 6'
			0.0			
			0.0			
			0.0			
			0.0			Soil sample collected from 9' to 10'
10	723.66		0.0		**CLAY (CL)** Same as above	
			0.0			
			0.0		▼	Soil sample collected from 11.5' to 12'
			0.0		**SAND (SP)** Gray, poorly graded, medium to coarse grain sand, trace gravel, wet to moist	
			0.0		**CLAY (CL)** Gray, silty clay, trace gravel, hard, dry	
			0.0			
15	718.66	10.0 ---- 10.0	0.0			
			0.0			
			0.0			
			0.0			
			0.0			
20	713.66		0.0		**CLAY (CL)** Same as above	
			0.0			
			0.0			
		5.0 ---- 5.0	0.0			
			0.0			
25	708.66		0.0		**CLAY (CL)** Gray, silty clay, trace to little gravel, hard	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB003	SHEET 2 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 733.66 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13057060.262, N 695642.129 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 11.9 ft bgs START : 7/29/14 11:00 END : 7/29/14 11:40 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					Boring terminated at 25.0 ft bgs.	
30	703.66					
35	698.66					
40	693.66					
45	688.66					
50	683.66					

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB004	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 733.38 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13057060.464, N 695688.717 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 12.5 ft bgs START : 7/29/14 13:30 END : 7/29/14 14:10 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**CLAY (CL)** Brown, silty clay, trace gravel, stiff, dry (CAP)	
			0.0			
			0.0			
5	728.38	6.5 ---- 10.0	0.0		**SAND (SM)** Brown, silty sand, trace gravel, some clay, loose	Soil sample collected from 5' to 6'
			0.0			
			0.0		**CLAY (CL)** Gray, silty clay, firm	
			0.0			
			0.0			
10	723.38		0.0		**CLAY (CL)** Same as above	
			0.0			
			0.0			
			0.0		**SAND (SP)** Gray, poorly graded, fine to medium grain sand, trace gravel, loose, moist	
			0.0			Soil sample collected from 13.5' to 14'
			0.0		**CLAY (CL)** Gray, silty clay, trace gravel, hard	
15	718.38	10.0 ---- 10.0	0.0		**SAND (SP)** Gray, poorly graded, fine to medium grain sand, trace gravel, moist	
			0.0		**CLAY (CL)** Gray, silty clay, trace gravel, hard	
			0.0			
			0.0			
			0.0			
20	713.38		0.0		**CLAY (CL)** Same as above	Soil sample collected from 20' to 21'
			0.0			
			0.0		**SAND (SP)** Gray, poorly graded, fine to medium grain sand, trace gravel, loose, wet	
			0.0		**CLAY (CL)** Gray, silty clay, trace gravel, stiff to very stiff	
			0.0			
25	708.38	9.0 ---- 9.0	0.0		**CLAY (CL)** Gray, silty clay, trace to little gravel, hard	
			0.0			
			0.0			
			0.0			
			0.0			

Boring terminated at 29.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB005	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 737.46 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13057034.28, N 695755.493 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 11.5 ft bgs START : 7/29/14 14:40 END : 7/29/14 15:30 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**CLAY (CL)** Brown, silty clay, trace gravel, dry, brittle (CAP)	
			0.0			
			0.0			
5	732.46	10.0 ---- 10.0	0.0			
			3.3		**CLAY (CL)** Black stained, silty clay, trace gravel, firm	Diesel fuel odor Soil sample collected from 6' to 6.2' NTK collected at 6'. No evidence of NAPL
			86.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard	
			0.0		**SAND (SM)** Brown, silty sand, some gravel, trace clay. Stained black last 4 inches of core.	Diesel fuel odor
			0.0			Soil sample collected from 9' to 10'
10	727.46		0.0		**SAND (SM)** Same as above	
			326			Soil sample collected from 11' to 11.5' Strong diesel fuel odor
			71.6		**SAND (SW)** Brown to gray, well graded, fine to coarse grain sand, some silt, trace gravel, wet	
			231			
			130			NTK collected at 14'. Evidence of NAPL
15	722.46	10.0 ---- 10.0			**CLAY (CL)** Brown, silty clay, trace gravel, very stiff	
			305		**SAND (SP)** Brown, poorly graded, fine to medium grain sand	Diesel fuel odor Mobile NAPL present from 15.8' to 16.4'
			0.0		**SAND (SM)** Gray, silty sand, trace clay, wet	
			0.0			
			0.0			NTK collected at 19'. No evidence of NAPL
20	717.46		0.0			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB006	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 738.82 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13057019.345, N 695733.45 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 14.0 ft bgs START : 7/29/14 15:40 END : 7/29/14 16:15 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					SAND (SM) Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**CLAY (CL)** Brown, silty clay, trace gravel, dry, brittle, hard (CAP)	
			0.0			
			0.0			
			0.0			
5	733.82	7.5 ---- 10.0	0.0			
			0.0		**CLAY (CL)** Brown, silty clay, trace gravel, firm. Stained from 5.4' to 5.6'	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel, trace silt	
			0.0			
			0.0			
10	728.82		0.0		**SAND (SP)** Same as above - stained black from 11' to 11.2'.	Diesel odor
			226			Diesel odor
					SAND (SP) Brown, poorly sorted, fine to medium grain sand, trace gravel	Soil sample collected from 11' to 11.5' NTK collected at 11'. Evidence of NAPL Diesel odor
			113			Soil sampled collected from 12.5' to 13'
			214			Soil sampled collected from 13.5' to 14'
					SAND (SP) Stained black, poorly graded, very fine to medium grain sand, wet	Diesel odor
15	723.82	10.0 ---- 10.0	209			NTK collected at 14.5'. Evidence of NAPL
			120		**SAND (SW)** Brown, well graded, fine to coarse grain sand, trace gravel	NTK collected at 17'. Evidence of NAPL
					CLAY (CL) Gray, silty clay, trace gravel, hard	
			12.0			
20	718.82					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB007	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 738.15 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13057021.624, N 695687.661 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 12.0 ft bgs START : 7/30/14 08:10 END : 7/30/14 08:55 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					SAND (SM) Brown, silty sand, trace gravel, organics (TOP SOIL)	
					CLAY (CL) Brownish gray, silty clay, trace gravel, brittle, dry (CAP)	
		4.3 ---- 5.0	12.0			
5	733.15				**CLAY (CL)** Same as above	
			14.0			
		4.7 ---- 5.0	12.0		**SAND (SM)** Stained black, fine to medium grain silty sand, trace gravel	Soil sample collected from 7.5' to 8'
					SAND AND GRAVEL (GW) Brown, fine to medium grain sand and gravel	Diesel odor
					CLAY (CL) Stained black, silty clay, trace gravel	Soil sample collected from 9' to 10' NTK collected at 9'. Evidence of NAPL
10	728.15		14.0		**CLAY (CL)** Same as above - with more sand	
			262			
			15.0			Soil sample collected from 11.5' to 12'
					SAND (SP) Brown to gray, poorly graded, fine to coarse sand, trace gravel	
			360			
			330		**CLAY (CL)** Gray, silty clay, trace gravel, stiff to very stiff 6" wet sand seam (SP) at 13.7' and 3" wet sand seam (SP) at 16'.	
15	723.15	9.3 ---- 10.0	1110			
			260			
			41.0			
			11.0			
			11.0			
20	718.15		11.0			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB008	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 737.65 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13057023.709, N 695643.691 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 10.5 ft bgs START : 7/30/14 09:00 END : 7/30/14 09:45 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = PID)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					SAND (SM) Brown, silty sand, trace gravel, organics (TOP SOIL)	
			4.0		**CLAY (CL)** Gray, silty clay, trace gravel, hard, brittle, dry (CAP)	
			0.0			
		4.5 ---- 5.0	4.8			
			57.0			
5	732.65		17.0			
					CLAY (CL) Same as above	
			21.0			
			10.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	Soil sample collected from 6.5' to 7'
		5.0 ---- 5.0	98.5		**SAND (SC)** Stained black, clayey sand, trace gravel	
			262			
10	727.65		1463			Soil sample collected from 9.5' to 10'
					SAND (SP) Dark brown, stained, poorly graded, fine to coarse grain, wet ▼	Diesel fuel odor
			510			Soil sample collected from 10.5' to 11' NTK collected at 10.5'. Evidence of NAPL
					SAND (SP) Gray, poorly graded, fine to medium grain sand, trace gravel, wet	
			61.1		**CLAY (CL)** Gray, silty clay, trace gravel, stiff to very stiff More sand from 11.7' to 12.8'	
			2.0			
			16.0			
15	722.65	10.0 ---- 10.0	7.0			
			2.0			
20	717.65					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB009	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 737.42 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13057018.151, N 695598.935 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 13.2 ft bgs START : 7/30/14 09:50 END : 7/30/14 10:25 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (Soil sample collected from 7' at 10:19 = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			7.3		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.6		**CLAY (CL)** Gray, silty clay, trace gravel, hard, brittle, dry	
		5.0 ---- 5.0	0.0			
			0.0			
5	732.42		7.9		**CLAY (CL)** Same as above	
			3.9			
			111		**SAND (SW)** Gray, well graded, fine to coarse grain sand, some gravel	Soil sample collected at 7'
		5.0 ---- 5.0	1810		**CLAY (CL)** Stained black, sandy clay, some silt, trace gravel	Diesel fuel odor Soil sample collected at 8'
			677			
10	727.42		240		**CLAY (CL)** Gray, silty clay, some sand, firm	
			1.8			
			18.2			
			15.0		▼	Soil sample collected at 12.5'
			7.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, wet **CLAY (CL)** Gray, silty clay, trace gravel, stiff to very stiff	
15	722.42	10.0 ---- 10.0	1.6			
			1.5			
20	717.42					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB010	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 736.40 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056948.542, N 695538.754 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : NA START : 7/30/14 10:33 END : 7/30/14 11:08 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.8		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**CLAY (CL)** Brown gray, silty clay, trace gravel, hard, dry, brittle (CAP)	
		4.0 ---- 5.0	0.0			
			0.1			
5	731.40		1.4			
			79.0		**SAND (SP)** Stained, poorly graded, fine to medium grain sand, trace gravel Sand had shean from 6' to 6.3' Stained, sandy clay (CL) lens from 5.6' to 6'	NTK collected at 6'. Evidence of NAPL Soil sample collected at 6.3'
			1023		**SAND (SW)** Stained, well graded, fine to coarse grain sand, trace gravel	Chemical odor from 6.3' to 10' Soil sample collected at 7'
		5.0 ---- 5.0	378			
			1257		**CLAY (CL)** Brown, sandy clay, firm to stiff Stained from 8.1' to 9.1'	
10	726.40		1150			
			188		**CLAY (CL)** Same as above	Soil sample collected at 11'
					CLAY (CL) Grayish brown, silty clay, stiff to very stiff	
			3.4			
15	721.40	10.0 ---- 10.0	6.1			
			1.9			
			4.9			Groundwater not encountered
20	716.40					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB011	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 736.44 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056977.917, N 695598.762 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 13.8 ft bgs START : 7/30/14 11:17 END : 7/30/14 11:55 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			5.3		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.7		**SAND (SW)** Red brown, well graded, fine to coarse grain sand, trace gravel	
		5.0			**CLAY (CL)** Gray, silty clay, trace gravel, hard, brittle, dry (CAP)	
		----	0.9			
		5.0				
			3.5			
5	731.44		41.2			
					GRAVEL (GW) Gray to white, fine to coarse gravel, some white granular material present	
			184			
			667			Soil sample collected at 6.5'
					SAND (SW) Brown, well graded, fine to coarse grain sand, some gravel Stained from 7' to 9.4'	
		5.0	1120			Soil sample collected at 8'

		5.0	769			
10	726.44		3818			
					CLAY (CL) Gray to brown, silty clay, stiff to very stiff Gray, fine to coarse grain sand (SW) lens, trace gravel, wet from 13.8' to 14' Gray, poorly graded, silty sand (SM), wet from 15' to 15.2'	
			68.0			
			165			
			36.4			Soil sample collected at 13'
			102		▼	
15	721.44	10.0	221			

		10.0				
			6.7			
			3.0			
20	716.44					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB012	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 737.30 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056979.58, N 695644.025 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 14.0 ft bgs START : 7/30/14 13:28 END : 7/30/14 14:05 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					SAND (SM) Brown, silty sand, trace gravel, organics (TOP SOIL)	
			1.5		**CLAY (CL)** Brown, silty clay, trace gravel, firm	
			0.2		**SAND (SW)** Red brown, well graded, fine to coarse grain sand, trace gravel	
		3.5 ---- 5.0	1.8		**CLAY (CL)** Gray to brown, silty clay, trace gravel, hard, brittle (CAP)	
5	732.30		29.8		**CLAY (CL)** Same as above	
			8.4		**SAND (SC)** Stained, clayey sand, trace gravel, wood fragments	
					CLAY (CL) Gray brown, silty clay, trace gravel, soft	Soil sample collected at 6.5'
		5.0 ---- 5.0	37.9			
			21.8			Soil sample collected at 9.5'
10	727.30		10.1		**SAND (SC)** Gray, poorly graded, fine to medium clayey sand, trace gravel Wet from 14' to 17.4'	
			72.6			
			60.5			Soil sample collected at 13'
			41.4		▼	
15	722.30	10.0 ---- 10.0	22.7			
			32.2			
			1.3			
			0.9		**CLAY (CL)** Gray, silty clay, stiff, dry	
20	717.30					

Boring terminated at 20.0 ft bgs.

CH2MHILL®

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB013	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 737.94 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056977.9, N 695688.229 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 14.0 ft bgs START : 7/30/14 14:08 END : 7/30/14 15:00 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (Soil sample collected from 12" = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.8		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
					CLAY (CL) Brown, silty clay, soft	
			0.2		**SAND (SW)** Red to brown, well graded, fine to coarse grain sand, trace gravel	
		5.0 ---- 5.0			**CLAY (CL)** Brown to gray, silty clay, trace gravel, stiff, dry (CAP)	
			0.2			
			0.4			
5	732.94		0.2			
					CLAY (CL) Same as above	
			3.6			
			0.5			
		5.0 ---- 5.0	8.0			
			9.6		**SAND (SW)** Light gray, well graded, fine to coarse grain sand with fine to coarse gravel, trace silt	
					SAND (SM) Stained, fine to medium grain silty sand, trace gravel	Chemical odor
10	727.94		1252			
					SAND (SM) Same as above	Soil sample collected at 10'
			385			
			450			Soil sample collected at 12'
			638			
			446			Soil sample collected at 13.5'
					SAND (SW) Gray to brown, well graded, fine to coarse sand, trace gravel, wet	
15	722.94	10.0 ---- 10.0				
					CLAY (CL) Gray to brown, silty clay, very stiff, dry	
20	717.94					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB014	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 738.18 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056975.77, N 695733.311 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 13.3 ft bgs START : 7/30/14 15:05 END : 7/30/14 15:42 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			5.3		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
					SAND (SP) Red brown, poorly graded, fine to coarse sand, trace gravel	
			1.0		**CLAY (CL)** Gray, silty clay, trace gravel, stiff, brittle (CAP)	
		5.0 ---- 5.0	0.7			
			0.8			
5	733.18		0.3		**CLAY (CL)** Same as above	
			0.4			
			0.5			
		5.0 ---- 5.0	20.9		**SAND (SW)** Stained, well graded, fine to coarse grain sand with clay, trace gravel	Chemical odor from 8' to 10'
			335			Soil sample collected at 9'
10	728.18				**SAND (SW)** Same as above	
			408		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel Stained from 11' to 11.6'	Soil sample collected at 11' Chemical odor
			552			Soil sample collected at 12'
			330		▼	
			573		**SAND (SW)** Brown, well graded, fine to coarse sand, trace gravel, wet	
15	723.18	10.0 ---- 10.0	402			
			11.5		**CLAY (CL)** Gray, silty clay, stiff to very stiff	NTK collected at 15.7'. Evidence of NAPL
20	718.18					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB015	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 738.90 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056976.94, N 695787.051 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 14.0 ft bgs START : 7/30/14 15:47 END : 7/30/14 16:20 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			6.5		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			1.3		**CLAY (CL)** Brown to gray, silty clay, hard, brittle, dry (CAP)	
		4.0 ---- 5.0	1.2			
			2.2			
5	733.90		6.1		**CLAY (CL)** Same as above	
			1.5			
			2.1			
		5.0 ---- 5.0	0.7			
			0.9			
10	728.90		35.7		**SAND (SC)** Stained, well graded, clayey sand, trace gravel	
			119			Soil sample collected at 11'
			241		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	Soil sample collected at 12'
			241			Shean observed from 13' to 14'
			141			Soil sample collected at 13.5' NTK collected at 13.5. Evidence of NAPL
15	723.90	10.0 ---- 10.0	181		**SAND (SW)** Gray, well graded, fine to coarse grain sand, trace gravel, wet	
			121			
			16.6		**CLAY (CL)** Gray, silty clay, stiff to very stiff	
20	718.90					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB016	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 739.03 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056929.82, N 695780.864 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.0 ft bgs START : 7/31/14 08:30 END : 7/31/01 09:10 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SW)** Brown, well graded, fine to coarse sand, some gravel	
		4.0 ---- 5.0	3.8		**CLAY (CL)** Gray, silty clay, trace gravel, very stiff, brittle (CAP)	
			1.2			
5	734.03		18.6		**CLAY (CL)** Brown, silty clay, some sand, trace gravel, stiff Staining from 5' to 6'	
			18.7			
			4.3			
		5.0 ---- 5.0	39.8		**SAND (SP)** Brown, poorly graded, fine to medium sand, trace gravel, brick	
			59.6		**SAND (SP)** Dark brown, poorly graded, fine to medium grain sand	Black NAPL ganglia - Potential mobile NAPL at 8.5' 1" rubber hose found at 8.5' Soil sample collected at 8.5'
10	729.03		42.7		**CLAY (CL)** Stained, sandy clay, trace gravel, soft	
			46.0			Soil sample collected at 11' NTK collected at 11'. No evidence of NAPL
			20.2			
			71.5		**SAND (SP)** Light brown to brown, poorly graded, fine to medium grain sand	
			22.0			
15	724.03	10.0 ---- 10.0	7.8			Soil sample collected at 15'
					SAND (SW) Gray, well graded, fine to coarse grain sand, trace gravel, wet	
			8.1			
					CLAY (CL) Gray, silty clay, very stiff, dry	
20	719.03		1.9			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB017	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 738.79 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056932, N 695735.098 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 12.0 ft bgs START : 7/31/14 09:20 END : 7/31/14 09:59 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			17.2		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			6.1		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel **CLAY (CL)** Gray to brown, silty clay, hard, brittle, dry (CAP)	
		5.0 ---- 5.0	0.7			
			163			
5	733.79		48.0		**CLAY (CL)** Same as above	
			5.4			
		5.0 ---- 5.0	2.2			
			1.5		**SAND (SP)** Dark brown, stained, poorly graded, fine to medium grain sand, little gravel	Fuel odor
10	728.79		19.2			Soil sample collected at 9.5'
			94.9		**SAND (SP)** Same as above - less gravel	Soil sample collected at 10.5' Chemical odor
					SAND (SW) Gray, well graded, fine to coarse grain sand, trace gravel, wet at 12' ▼	Soil sample collected at 11.5'
			8.6			
15	723.79	8.0 ---- 10.0	6.2			
			2.0			
			1.5		**CLAY (CL)** Gray, silty clay, stiff to very stiff, dry	
			1.9			
20	718.79					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB018	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 738.17 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056933.627, N 695689.579 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 13.2 ft bgs START : 7/31/14 09:55 END : 7/31/01 10:35 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					SAND (SM) Brown, silty sand, trace gravel, organics (TOP SOIL)	
			1.3		**CLAY (CL)** Gray, silty clay, trace gravel, stiff, brittle (CAP)	
			0.2			
		5.0 ---- 5.0	0.3			
			0.4			
5	733.17		0.3			
					CLAY (CL) Same as above	
			0.1			
			1.2			
		5.0 ---- 5.0	0.6			
			72.5		**SAND (SM)** Fine to medium grain silty sand, trace gravel	
10	728.17		75.3			
					SAND (SM) Same as above - stained	Soil sample collected at 10' Slight chemical odor at 10'
			11.3			Soil sample collected at 11' NTK collected at 11'. No evidence of NAPL
			2.5		**SAND (SW)** Brown, well graded, fine to coarse grain sand, trace gravel, wet at 13.2'	
			11.6		▼	Soil sample collected at 12.5'
			48.2			
15	723.17	10.0 ---- 10.0	3.5			
			1.9			
					SAND (SW) Brown, well graded, coarse sand and gravel, wet	
			1.1		**CLAY (CL)** Gray, silty clay, stiff to very stiff, dry at 17.5'	
20	718.17					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB019	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 738.53 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056935.351, N 695644.862 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 14.7 ft bgs START : 7/31/14 10:42 END : 7/31/14 11:18 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Red brown, poorly graded, fine to medium grain sand, trace gravel	
		5.0 ---- 5.0	0.1		**CLAY (CL)** Gray, silty clay, trace gravel, stiff, brittle (CAP)	
			1.6			Staining in cap from 4' to 4.5'
5	733.53		0.3		**CLAY (CL)** Same as above	
			0.3			
			1.6			
		5.0 ---- 5.0	0.8			Staining in cap from 8.2' to 8.9'
			66.9		**SAND (SW)** Gray brown, well graded, fine to coarse sand, trace fine to coarse gravel	
10	728.53		372		**SAND (SM)** Stained, silty sand, trace gravel, trace clay	Soil sample collected at 10'
			1855		**SAND (SM)** Same as above - brown, not stained	Soil sample collected at 11'
			1644			Soil sample collected at 12'
			1290		**SAND (SW)** Brown, well graded, fine to coarse grain sand, trace fine gravel, wet at 14.7'	
			1253			
15	723.53	10.0 ---- 10.0	480		**CLAY (CL)** Gray, silty clay, trace gravel, stiff to very stiff	
			64.0			
			41.0			
20	718.53					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB020	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 737.97 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056936.827, N 695599.698 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 13.0 ft bgs START : 7/31/14 11:22 END : 7/31/14 12:05 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			5.4		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
					SAND (SP) Brown, poorly graded, fine to medium grain sand, trace gravel	
			2.1		**CLAY (CL)** Gray, silty clay, trace gravel, stiff, brittle (CAP)	
		4.0 ---- 5.0	1.4			
			1.9			
5	732.97		14.0		**CLAY (CL)** Same as above	
			17.6		**SAND (SW)** Gray brown, well graded, fine to coarse sand, some fine to coarse gravel	
			29.3			
		5.0 ---- 5.0	2.3		**CLAY (CL)** Stained, silty clay, trace gravel, stiff	Chemical odor
			85.9		**SAND (SP)** Brown, poorly graded, fine to medium sand, some fine to coarse gravel	
10	727.97		264			Soil sample collected at 9.5' Chemical odor Soil sample collected at 10'
					SAND (SW) Brown, well graded, fine to coarse sand, trace gravel, wet at 13'	
			818			
			312			Soil sample collected at 12'
					CLAY (CL) Gray, silty clay, trace gravel, stiff to very stiff	
15	722.97	10.0 ---- 10.0	46.0			
			8.7			
20	717.97					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB021	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 737.08 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056853.693, N 695527.296 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 14.3 ft bgs START : 7/31/14 13:40 END : 7/31/14 14:30 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.1		**SAND (SW)** Brown, well graded, fine to coarse grain sand, trace gravel	
		5.0			**CLAY (CL)** Gray, silty clay, trace gravel, stiff, brittle (CAP)	
		----	1.5			
		5.0				
			59.4			
5	732.08		30.4			
					CLAY (CL) Same as above	
			28.0			
					SAND (SW) Brown to gray, well graded, fine to coarse grain sand and gravel ranging from fine to cobbles	
			315			
		5.0				
		----	365			
		5.0				
			2047		**SAND (SW)** Black, sand and slag, trace gravel	Soil sample collected at 8.5'
					SAND (SM) Dark brown, silty sand	Slight chemical ordor
10	727.08		2402		**SAND (SP)** Light brown, poorly graded, fine to medium grain sand, trace gravel	Soil sample collected at 10'
					CLAY (CL) Brown, silty clay, trace gravel, stiff to very stiff	
			52.9			
			28.0			
			7.0			Soil sample collected at 13'
			3.3		▼	
					SAND (SW) Well graded, fine to coarse grain sand seam, trace gravel, wet	
15	722.08	10.0	1.5		**CLAY (CL)** Gray, silty clay, trace gravel	

		10.0	1.4			
					SAND (SM) Gray, fine grain sand and silt with some clay, moist to wet	
			0.5		**CLAY (CL)** Gray, silty clay, stiff to very stiff	
			0.7			
20	717.08					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB022	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 738.86 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056894.34, N 695597.958 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 13.0 ft bgs START : 8/1/14 08:30 END : 8/1/14 09:15 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			2.2		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
					SAND (SW) Brown, well graded, fine to coarse grain sand, trace fine gravel	
			1.8		**CLAY (CL)** Gray, silty clay, trace gravel, stiff, brittle	
		5.0 ---- 5.0	1.3			
			4.6			
5	733.86				**CLAY (CL)** Same as above	
			2.3			
			138			
		5.0 ---- 5.0	53.2		**SAND (SW)** Gray, well graded, fine to coarse grain sand and fine to coarse gravel with cobbles	Soil sample collected at 8'
10	728.86				**SAND (SW)** Same as above	
			4244		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	Chemical odor Soil sample collected at 11'
						Soil sample collected at 12.5' NTK collected at 12.5'. Evidence of NAPL Strong chemical odor
			9804		**SAND (SW)** Stained, well graded, fine to coarse grain sand, trace gravel, moist to wet	
15	723.86	10.0 ---- 10.0	11.0		**CLAY (CL)** Gray, silty clay, trace gravel, stiff to very stiff Gray, fine to coarse grain sand seam from 19.2' to 19.3'	
			4.0			
20	718.86					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB023	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 739.65 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056892.3, N 695645.972 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 14.8 ft bgs START : 8/1/14 09:20 END : 8/1/14 10:08 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			4.5		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.6		**SAND (SW)** Brown, well graded, fine to coarse grain sand, trace gravel	
		5.0			**CLAY (CL)** Gray, silty clay, trace gravel, stiff, brittle	
		----	0.6			
		5.0				
			1.2			
5	734.65		0.7		**CLAY (CL)** Same as above	
			6.7			
			4.3			
		5.0			**SAND (SP-SC)** Dark brown, slightly stained, poorly graded, sand with clay and gravel, wire and metal debris	
		----	84.5			Soil sampled collected at 8'
		5.0				
			123			
10	729.65		39.1		**SAND (SP-SC)** Same as above	
			542		**SAND (SW)** Brown to gray, well graded, fine to coarse grain sand, little gravel	
			1002		**SAND (SC)** Stained, clayey sand, trace gravel	
			2629			Soil sampled collected at 13' NTK collected at 13'. Evidence of NAPL
			3830		**SAND (SP-SM)** Brown to gray, poorly graded, fine to medium grain sand with silt	NTK collected at 14'. Evidence of NAPL
15	724.65	10.0	259		**SAND (SW)** Gray, well graded, fine to coarse grain sand, trace gravel, wet	
		----			**CLAY (CL)** Gray, silty clay, trace gravel	
		10.0				
			0.6			
20	719.65					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB024	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 739.67 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056889.99, N 695690.757 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 15.0 ft bgs START : 8/1/14 10:15 END : 8/1/14 10:55 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			28.2		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			12.8		**SAND (SW)** Brown, well graded, fine to coarse grain sand, little gravel	
		5.0			**CLAY (CL)** Gray to brown, silty clay, stiff, brittle (CAP)	
		----	8.1			
		5.0				
			9.0			
5	734.67		3.5		**CLAY (CL)** Same as above	
			0.4			
			2.4			
		5.0				
		----	1.6			
		5.0				
			1.8		**CONCRETE** White, pulverized concrete	
10	729.67		275		**CONCRETE** Same as above	
			151		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel Stained from 11.3' to 13.6'	Soil sample collected at 11'
			4140			Strong odor from 12' to 15' NTK collected at 12'. No evidence of NAPL
		5.0				
		----	3782			Soil sample collected at 13'
		5.0				
			2288		**SAND (SW)** Brown, slightly stained, well graded, fine to medium grained sand, trace gravel, moist	
15	724.67		17.2			Soil sample collected at 14.5'
			43.8		**SAND (SW)** Brown, well graded, fine to coarse grain sand, some gravel, wet	
			7.5		**CLAY (CL)** Brown, silty clay, firm to stiff	
					SILT WITH SAND (ML) Brown silt with sand, trace gravel	
		5.0	4.3			

		5.0			**CLAY (CL)** Gray to brown, silty clay, trace gravel	
			1.2			
20	719.67					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB025	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 740.36 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056886.68, N 695736.135 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 15.0 ft bgs START : 8/1/14 11:00 END : 8/1/14 11:45 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			4.1		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.7		**SAND (SW)** Brown, well graded, fine to coarse grain sand, trace gravel	
		4.0 ---- 5.0	8.0		**CLAY (CL)** Brown, silty clay, stiff, brittle, dry (CAP)	
			1.1			
5	735.36				**CLAY (CL)** Same as above	
			142			
			136			
		5.0 ---- 5.0	18.2			
			28.5		**SAND (SP)** Stained, poorly graded, fine to medium grain sand, some silt, little gravel, wood fragments	Soil sample collected at 9'
10	730.36		158		**SAND (SM)** Stained, silty sand, saturated with what appears to be oil, trace gravel	Oil and diesel fuel odor from 10' to 13.3' Mobile oil and diesel fuel
			102			
			304			NTK collected at 11.5'. Evidence of NAPL
			267			Soil sample collected at 12.5'
			703		**SAND (SM)** Stained, silty sand, trace gravel	Chemical odor from 13.3' to 15'
15	725.36	10.0 ---- 10.0	645			Soil sample collected at 14' NTK collected at 14'. Potential evidence of NAPL (too oily to see indicator ball)
					SAND (SP) Gray to brown, poorly graded, medium to coarse grain sand, little gravel, wet	
			6.4		**CLAY (CL)** Gray, silty clay, trace gravel, stiff to very stiff	
			1.6			
20	720.36					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB026	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 740.48 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056883.73, N 695782.064 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 15.0 ft bgs START : 8/1/14 13:10 END : 8/1/14 13:55 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					SAND (SM) Brown, silty sand, trace gravel, organics (TOP SOIL)	
			2.8		**SAND (SW)** Brown, well graded, fine to coarse grain sand, little gravel	
			1.2		**CLAY (CL)** Brown to gray, silty clay, trace gravel, stiff, brittle (CAP)	
		5.0 ---- 5.0	0.7			
			0.4			
5	735.48		9.6		**SAND (SP)** Stained, poorly graded, fine to medium grain sand, trace clay, trace gravel	
			220			
			140			
		5.0 ---- 5.0	30.2		**CLAY (CL)** Brown, sandy clay, trace gravel, stiff	
			4.2			
10	730.48		29.0		**SAND (SP)** Brown, poorly graded, fine to medium sand, trace gravel	
			69.0		**SAND (SP)** Oil grease and sludge with sand	Soil sample collected at 10.5' Bulk sample collected of oil grease and sludge (not for analysis)
			94.9		**SAND (SM)** Stained, silty sand, trace gravel	Soil sample collected at 12'
			1057			Soil sample collected at 13'
			121		**SAND (SP)** Light brown, poorly graded, fine to medium grain sand, trace gravel	
15	725.48	10.0 ---- 10.0	31.9		**SAND (SW)** Brown to gray, well graded, fine to coarse grain sand, trace gravel, wet Coarser at 17.5'	Soil sample collected at 14.5'
			20.7			
			15.4			
			15.2		**SAND (SP)** Gray, poorly graded, coarse grain sand and fine gravel	
			3.1		**CLAY (CL)** Gray to brown, silty clay, trace gravel, stiff to very stiff	
20	720.48					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB027	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 740.04 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056896.31, N 695830.796 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 12.5 ft bgs START : 8/1/14 14:00 END : 8/1/14 14:32 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					SAND (SM) Brown, silty sand, trace gravel, organics (TOP SOIL)	
			1.7		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
			2.4		**CLAY (CL)** Gray, silty clay, trace gravel, stiff, brittle, dry (CAP)	
		5.0 ---- 5.0	0.5			
			0.5			
5	735.04		10.9		**CLAY (CL)** Same as above - stained from 6' to 6.2'	
			37.2			
			10.2		**SAND (SP)** Light brown, poorly graded, medium to coarse grain sand, trace to little gravel	
		5.0 ---- 5.0	10.3			Soil sample collected at 7.5'
			9.6			
10	730.04		4.0		**SAND (SC)** Stained black, clayey sand, rubber, wood debris, wire	
			105			
			50.4			Soil sample collected at 12'
		5.0 ---- 5.0	25.3		**SAND (SP)** Brown, poorly graded, fine to medium rain sand, trace gravel, wet	
			10.1			
15	725.04		4.9		**SAND (SM)** Gray, silty sand, wet	
			3.9		**CLAY (CL)** Gray, silty clay, trace gravel, stiff to very stiff	
		5.0 ---- 5.0	0.0			
20	720.04					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB028	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 740.35 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056816.55, N 695872.036 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 14.0 ft bgs START : 8/4/14 08:40 END : 8/4/14 09:25 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			1.8		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			1.8		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		5.0			**CLAY (CL)** Gray, silty clay, trace gravel, stiff, brittle (CAP)	
		----	0.3			
		5.0				
			4.1			
5	735.35		0.6		**CLAY (CL)** Same as above	
			3.0			
			28.0		**SAND (SW)** Brown, well graded, fine to coarse grain sand, little gravel	Soil sample collected at 7'
		5.0			**CLAY (CL)** Brown, silty clay, trace gravel, stiff Glass and metal debris	
		----	3.3			
		5.0				
			30.0			
10	730.35		28.0		**SAND (SC)** Stained black, clayey sand	
			72.0			
			1151		**SAND (SP)** Stained, poorly graded, fine to medium grain sand, trace gravel	Soil sample collected at 12' Chemical odor NTK collected at 12'. No evidence of NAPL Soil sample collected at 13'
		5.0	1417			
		----			**SAND (SW)** Gray, well graded, fine to coarse grain sand, trace gravel, wet at 14'	
		5.0				
			127			
15	725.35		48.0		**SAND (SW)** Same as above	
			26.5		**CLAY (CL)** Gray, silty clay, soft	
			10.4			
		5.0				
		----	2.5			
		5.0				
			8.7			
20	720.35					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB029	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 740.81 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056839.49, N 695824.396 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 15.0 ft bgs START : 8/4/14 09:30 END : 8/4/14 10:05 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA ()	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					SAND (SM) Brown, silty sand, trace gravel, organics (TOP SOIL)	
					SAND (SW) Brown, well graded, fine to coarse grain sand, some gravel	
		5.0 ---- 5.0			**CLAY (CL)** Brown to gray, silty clay, stiff, brittle (CAP)	
5	735.81				**CLAY (CL)** Brown, silty clay, trace gravel, very stiff to hard Stained from 5.2' to 5.5'	Soil sample collected at 5.3'
		5.0 ---- 5.0				
10	730.81				**CLAY (CL)** Brown, silty clay, little sand, little gravel	Soil sample collected at 11'
		5.0 ---- 5.0			**SAND (SW)** Brown, some staining, well graded, fine to medium grain sand, some clay, some coarse sand, some gravel	Soil sample collected at 13'
15	725.81				▼ **SAND (SP)** Brown to gray, some staining, poorly graded, fine to medium grain sand, trace gravel, wet, metal debris	
					CLAY (CL) Gray, silty clay, trace gravel, firm to medium stiff	
		5.0 ---- 5.0				
20	720.81					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB030	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 741.67 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056838.81, N 695778.557 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 15.0 ft bgs START : 8/4/14 10:13 END : 8/4/14 10:55 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.5		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.1		**SAND (SW)** Brown, well graded, fine to coarse grain sand, trace gravel	
		4.5			**CLAY (CL)** Brown, silty clay, trace gravel, hard (CAP)	
		----	0.3			
		5.0				
			0.2			
5	736.67		0.1		**CLAY (CL)** Same as above	
			5.6			
			41.0		**SAND (SP)** Stained black, poorly graded, fine to medium grain sand, trace gravel	Soil sample collected at 7'
		5.0	10.0		**CLAY (CL)** Brown, silty clay, some gravel, stiff to very stiff	

		5.0	3.0			
10	731.67		0.8		**CLAY (CL)** Same as above	
			9.5			
			84.0		**SAND (SM)** Stained, silty sand, white granular material	Soil sample collected at 12'
		5.0	47.0			NTK collected at 13'. No evidence of NAPL

		5.0	64.0			
15	726.67		104		**WHITE GRANULAR MATERIAL** White granular material, metal debris ▼	
					SAND (SW) Stained, well graded, fine to medium grain sand, trace coarse sand, saturated with visible free product	Soil sheany Soil sample collected at 15' NTK collected at 15'. Evidence of NAPL. Potential mobile NAPL.
		5.0			**SAND (SW)** Brown, well graded, fine to coarse grain sand, trace gravel	

		5.0				
					SAND AND GRAVEL (GW) Stained sand and gravel, trace cobbles	NTK collected at 18.5. No evidence of NAPL
					CLAY (CL) Brown, silty clay, trace gravel, stiff to very stiff	
20	721.67				Boring terminated at 20.0 ft bgs.	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB031	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 741.77 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056839.79, N 695731.928 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 20.0 ft bgs START : 8/4/14 11:02 END : 8/4/14 11:50 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.1		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.1		**SAND (SW)** Brown, well graded, fine to coarse grain sand, little gravel	
		4.0 ---- 5.0	0.1		**CLAY (CL)** Gray to brown, silty clay, trace gravel, hard (CAP)	
			0.1			
5	736.77		83.0		**CLAY (CL)** Stained, sandy clay, trace gravel	
			69.0			Soil sample collected at 6'
			14.0			
		5.0 ---- 5.0	6.0		**CLAY (CL)** Brown, silty clay, trace gravel, soft	
			2.3			
10	731.77		8.3		**CLAY (CL)** Partially stained, sandy clay, trace gravel, firm	
			11.2			
			0.3			
		5.0 ---- 5.0	13.2		**SAND (SP)** Brown, partially stained, poorly graded, fine to medium grain sand, little gravel	
15	726.77				**SAND (SP)** Same as above	
			330		**SAND (SP)** Stained black, fine to medium grain sand, moist to slightly wet	Soil sample collected at 16'
			142			
		5.0 ---- 5.0	407			NTK collected at 18'. Evidence of NAPL
			32.0			Soil sample collected at 19'
20	721.77				▼	
					SAND (SP) Same as above, wet Coarse grain at 22.5'	
		5.0 ---- 5.0				
					CLAY (CL) Gray, silty clay, trace gravel, stiff to very stiff	
25	716.77					

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB032	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 740.94 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056842.7, N 695686.604 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 15.5 ft bgs START : 8/4/14 12:50 END : 8/4/14 13:25 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					SAND (SM) Brown, silty sand, trace gravel, organics (TOP SOIL)	
			5.3		**SAND (SW)** Brown, well graded, fine to coarse grain sand, little gravel	
			2.9		**CLAY (CL)** Brown, silty clay, trace gravel, stiff to very stiff (CAP)	
		5.0 ---- 5.0	5.7			
			16.4			
5	735.94		8.2			
					CLAY (CL) Same as above	
			50.5			
			9.9			
		5.0 ---- 5.0	25.5		**CLAY (CL)** Brown, slightly stained, sandy clay, little gravel, soft, glass shards	Soil sample collected at 8'
			5.1			
10	730.94		57.4		**CONCRETE** Crushed concrete	
			34.3			
			103		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel Slightly stained from 12.3' to 13.8'	
		5.0 ---- 5.0	229			
			450		**SAND (SP)** Stained, poorly graded, fine to medium grained sand, trace clay, trace gravel	Soil sample collected at 14'
15	725.94		582		**SAND (SW)** Gray, well graded, fine to medium grained sand, trace coarse sand, trace gravel Stained from 15' to 17.2'	Soil sample collected at 15' NTK collected from 16' to 17'. Evidence of NAPL
			286			
			241			
		5.0 ---- 5.0	128			
					SAND (SW) Brown, well graded, fine to coarse grain sand, some gravel, trace cobbes	
			50.2		**CLAY (CL)** Gray to brown, silty clay, trace gravel, very stiff	
20	720.94					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB033	SHEET 1 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 740.93 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056844.13, N 695640.326 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 15.0 ft bgs START : 8/4/14 13:30 END : 8/4/14 14:05 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					SAND (SM) Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.3		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
			0.4		**CLAY (CL)** Brown to gray, silty clay, trace gravel (CAP)	
		5.0				
		----	0.2			
		5.0				
			0.2			
5	735.93		0.3			
					CLAY (CL) Same as above	
			61.9			
			71.0			
		5.0			**SAND (SC)** Stained, clayey sand, little gravel, glass shards, brick	
		----	66.6			
		5.0				Soil sample collected at 8'
			221			
10	730.93		173			
					SILT (ML) Stained, clayey silt, some fine sand, trace gravel	
			518			
			2689			Soil sample collected at 12' NTK collected at 12'. Evidence of NAPL
		5.0				
		----	2317		**SAND (SP)** Brown, slightly stained, poorly graded, fine to medium grain sand, trace gravel	
		5.0				
			1698			Soil sample collected at 14'
15	725.93		1711		▼	
					SAND (SW) Brown, well graded, fine to coarse grain sand, little gravel, wet	
			1305			
					CLAY (CL) Gray, silty clay, trace gravel, stiff to very stiff	
		5.0				
		----	13.3			
		5.0			**SAND (SP)** Gray, poorly graded, fine to medium grain sand	
			6.3		**SILT (ML)** Gray, silt, moist to slightly wet	
20	720.93				**CLAY (CL)** Gray, silty clay, trace gravel, very stiff to hard	

CH2MHILL®

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB033	SHEET 2 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 740.93 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056844.13, N 695640.326 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 15.0 ft bgs START : 8/4/14 13:30 END : 8/4/14 14:05 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					Boring terminated at 20.0 ft bgs.	
25	715.93					
30	710.93					
35	705.93					
40	700.93					

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB034	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 740.10 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056849.13, N 695597.547 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 15.0 ft bgs START : 8/4/14 14:15 END : 8/4/14 15:00 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					SAND (SM) Brown, silty sand, trace gravel, organics (TOP SOIL)	
			1.3		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
			0.9		**CLAY (CL)** Brown, silty clay, trace gravel, hard (CAP)	
		5.0 ---- 5.0	1.3			
			1.1			
5	735.10		2.5			
			18.5		**CLAY (CL)** Same as above	
			16.7		**SAND (SC)** Stained, clayey sand, some gravel, glass and rubber debris Red brick from 6.9' to 7.1'	
		5.0 ---- 5.0	5.9			Soil sample collected at 8'
			6.0		**SAND AND GRAVEL (GW)** Brown, poorly graded, fine to medium grain sand with fine to coarse gravel	
10	730.10		76.9		**SAND AND GRAVEL (GW)** Same as above	
			309		**SAND (SM)** Stained, silty sand	
			3828			
		5.0 ---- 5.0	4223		**SAND (SP)** Gray to brown, poorly graded, fine to medium grain sand, little gravel	
			2990			Soil sample collected at 14'
15	725.10		754		**CLAY (CL)** Brown, sandy clay, trace gravel, very stiff	Soil sample collected at 15'
			1253		**CLAY (CL)** Brown, sandy clay, little gravel, moist	
			216		**CLAY (CL)** Brown, silty clay, trace gravel, very stiff Wet silt seam from 18.8' to 18.9'	
		5.0 ---- 5.0	34.3			Soil sample collected at 18'
			11.5			
20	720.10					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB035	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 738.45 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056848.72, N 695551.922 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : NA START : 8/4/14 14:45 END : 8/4/14 15:35 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			1.4		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.8		**SAND (SW)** Brown, well graded, fine to medium grain sand, trace coarse sand, trace gravel	
		5.0 ---- 5.0	1.1		**CLAY (CL)** Brown, silty clay, trace gravel, hard (CAP)	
			3.8			
5	733.45		1.4		**CLAY (CL)** Same as above	
			86.9		**SAND AND GRAVEL (GW)** Gray, sand and gravel	
			79.1			
		5.0 ---- 5.0	103			Metal debris
			202		**SAND (SC)** Stained, clayey sand, trace gravel	
10	728.45		4467			
			1260		**SAND (SP-SC)** Brown, poorly graded, fine to medium grain sand, some gravel, trace clay	Soil sample collected at 10'
			2831			
			7511		**CLAY (CL)** Brown, silty clay, trace gravel, stiff to very stiff Moist silty sand seam from 17.5' to 17.7'	Soil sample collected at 13' Slight chemical odor
15	723.45	8.0 ---- 10.0	52.0			
			33.0			
			6.7			Soil sample collected at 17'
			4.0			
						Groundwater not encountered
20	718.45					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB036	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 734.31 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056808, N 695498.216 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 15.0 ft bgs START : 8/5/14 10:15 END : 8/5/14 11:00 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.5		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		4.0	1.3		**CLAY (CL)** Brown, silty clay, trace gravel, very stiff, brittle (CAP)	
		---- 5.0	6.0		**CONCRETE** Crushed concrete	
5	729.31		63.3		**SAND (ML)** Possibly stained, sandy silt, some clay, little gravel	Soil sample collected at 5' Slight chemical odor
			214		**CLAY (CL)** Brown to gray, silty clay, trace sand, trace gravel, very stiff to hard Brown, poorly graded, fine to medium sand seam from 6' to 6.5'	
			409			Soil sample collected at 7' Slight chemical odor from 7' to 10'
		5.0	370			
		---- 5.0	224			
10	724.31		5.7		**CLAY (CL)** Same as above	
			7.8			
			0.0			
		5.0	0.0			
		---- 5.0			**SILT (ML)** Gray, clayey silt, trace gravel, wet seam at 13.4'	
			0.0			Soil sample collected at 14'
15	719.31		0.0		**CLAY (CL)** Gray, silty clay, trace gravel, very stiff to hard, dry ▼	
			0.0		**CLAY (CL)** Same as above - wet at 15' Soft and wet 15' to 16'	
			0.0			
		5.0	0.3			
		---- 5.0				
20	714.31					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB037	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 741.30 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056805.16, N 695596.078 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 20.0 ft bgs START : 8/5/14 11:17 END : 8/5/14 12:03 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
			0.0		**CLAY (CL)** Brown, silty clay, trace gravel, very stiff, brittle (CAP)	
			0.0			
5	736.30	10.0 ---- 10.0	0.0		**SAND (SC-SM)** Clayey to silty sand, some gravel, trace cobbles, trace white granular material, metal debris, glass shards	
			0.1			Soil sample collected at 6'
			0.0			
			0.5			
			0.8			
10	731.30				**SAND (SC-SM)** Same as above	
			9.4		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
			3.0		**SILT (SM)** Brown, clayey silt, some sand, trace gravel	
			17.3			
			14.4			
15	726.30	10.0 ---- 10.0	447		**SAND (SP)** Stained, poorly graded, fine to medium grain sand, some gravel, little to some coarse sand Stained silty sand from 15' to 15.5'	Strong hydrocarbon odor Soil sample collected at 16'
			425			NTK collected at 16.5'. Evidence of NAPL
			274		**CLAY (CL)** Brown, silty clay, trace gravel, stiff to very stiff Moist sand seam at 19'	
			32.5			
			2.4			
20	721.30		12.3		▼	Soil sample collected at 19'
			9.7		**CLAY (CL)** Same as above Wet silty sand seam at 20.5'	Suspected stained sluff at 20' NTK collected at 20'. Evidence of NAPL
			5.9			
		5.0 ---- 5.0	2.5			
25	716.30					

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB038	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 738.92 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056802.59, N 695549.618 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : NA START : 8/5/14 13:23 END : 8/5/14 14:15 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			1.4		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.3		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		5.0 ---- 5.0	0.0		**CLAY (CL)** Brown, silty clay, trace gravel, stiff, brittle (CAP)	
			0.0			
5	733.92		0.0		**CLAY (CL)** Same as above	
			13.8			
			28.1			
		5.0 ---- 5.0	30.0		**SAND (SP)** Stained black, poorly graded, fine to medium grain sand, some silt, some gravel, metal and glass debris, wood	
			680			Soil sampled collected at 9'
10	728.92		389		**SAND (SC)** Brown, slightly stained, clayey sand, trace gravel	
			984			Soil sampled collected at 11' NTK collected at 11'. No evidence of NAPL
			942		**CLAY (CL)** Brown, silty clay, some gravel, stiff Mottled brown and gray from 11.8' to 15'. Less gravel from 13' to 20' Sand seams at 16.8', 17' Moist sand seams at 17.6', 17.9', and 18.5'	
			566			
			130			
15	723.92	10.0 ---- 10.0	85.1			
			6.2			
			5.3			
			5.4			
			3.8			Soil sampled collected at 19'
20	718.92		3.2			
			3.9		**CLAY (CL)** Same as above	Wet sluff (sand/clay mixture) at 20'
			1.8			
		5.0 ---- 5.0	0.7			
			0.2			Groundwater not encountered
25	713.92		1.0			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB039	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 742.05 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056802.87, N 695635.528 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : NA START : 8/5/14 14:30 END : 8/5/14 15:20 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.4		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		5.0 ---- 5.0	0.3		**CLAY (CL)** Brown, silty clay, trace gravel, stiff, brittle (CAP)	
			0.0			
5	737.05		0.0		**CLAY (CL)** Same as above	
			1.0			
			28.3			
		5.0 ---- 5.0	87.2			
			130			Soil sample collected at 9' Strong chemical odor
10	732.05		774		**SAND (SC)** Stained, clayey sand, little gravel, glass shards	
			109		**SAND (SC)** Same as above	
			91.9		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
		5.0 ---- 5.0	404			
			227			
			1205		**SILT (SM)** Stained, black, silt and sand, trace gravel	Hydrocarbon odor
15	727.05		1960		**SAND (SW)** Brown, well graded, fine to coarse grain sand, some gravel	Soil sample collected at 15' NTK collected at 15'. No evidence of NAPL
			2050			Soil sample collected at 17'
			1413			
			1099		**SAND (SP)** Slightly stained, poorly graded, fine to medium grain sand, trace gravel	NTK collected at 19'. Evidence of NAPL Strong chemical odor
20	722.05	10.0 ---- 10.0	838		**SAND (SW)** Slightly stained, well graded, fine to coarse grain sand, some fine to coarse gravel	
			24.5		**CLAY (CL)** Brown to gray, silty clay, trace gravel, very stiff	
			21.8			
						Groundwater not encountered
25	717.05					

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB040	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 742.07 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056798.37, N 695689.368 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.0 ft bgs START : 8/5/14 15:30 END : 8/5/14 16:05 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.8		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.5		**SAND (SW)** Brown, well graded, fine to coarse grain sand, little gravel	
		4.0 ---- 5.0	0.3		**CLAY (CL)** Brown, silty clay, trace gravel, very stiff, brittle (CAP)	
			0.6			
5	737.07		0.4			
			0.4		**CLAY (CL)** Same as above	
			1.6			
		4.0 ---- 5.0	11.1			
			78.6		**CLAY (CL)** Brown, silty clay, trace gravel, glass shards	
10	732.07		259			
			153		**SAND (SC)** Brown, clayey sand and fine to coarse gravel	Soil sample collected at 10'
			56.3		**SAND (SW)** Brown, well graded, fine to coarse grain sand, trace cobbles	
		5.0 ---- 5.0	76.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, little gravel Stained from 13.8' to 15'	
			115			Soil sample collected at 14'
15	727.07		479			
					SAND (SP) Same as above - Stained	Soil sample collected at 15'
			348			
			1012		**SAND (SM)** Stained, silty sand Wet at 16'	NTK collected from 16' to 17'. Evidence of NAPL
			25.8		**SAND (SW)** Brown to gray, well graded, fine to coarse grain sand, some gravel, wet	
			24.1			
20	722.07	10.0 ---- 10.0	9.2		**CLAY (CL)** Brown, silty clay, trace gravel, stiff to very stiff	
			4.9			
			4.3			
25	717.07					

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB041	SHEET 1 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 742.79 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056798.41, N 695734.762 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 17.0 ft bgs START : 8/6/14 09:30 END : 8/6/14 10:35 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
		5.0	0.6		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		---- 5.0	0.1			
5	737.79		1.9		**CLAY (CL)** Same as above	
			1.9			
			15.3		**CLAY (CL)** Brown, silty clay, trace gravel, stiff Stained black from 9.5' to 10'	
		5.0	1.5			
		---- 5.0	0.6			Soil sample collected at 9'
10	732.79		0.0		**CLAY (CL)** Brown to gray, some staining, silty clay, trace gravel, trace cobbles, wood fragments	
			12.7			
		4.0	31.0			
		---- 4.0	3.7		**SAND (SP)** Stained, poorly graded, fine to medium grain sand, trace clay, trace gravel	
			135		**CLAY (CL)** Stained, sandy clay, trace gravel	
15	727.79	1.0	28.4		**CLAY (CL)** Same as above	
		---- 1.0	1870		**CLAY (CL)** Same as above	Soil sample collected at 15.5' NTK colected at 15.5'. Evidence of NAPL Chemical odor
			1590		**SAND (SP)** Stained black, poorly graded, fine to medium grain sand with silt, moist to wet	Soil sample collected at 16.5'
		5.0	750			
		---- 5.0	300			
20	722.79		150		**SAND (SW)** Stained black, well graded, fine to coarse grain sand, trace gravel, wet	Chemical odor from 20' to 25'
			382			
			130			NTK collected at 22'. Evidence of NAPL
		5.0	104			
		---- 5.0	53.0		**CLAY (CL)** Brown, slightly stained, silty clay, very stiff to hard	
25	717.79		6.0		**SAND (SM)**	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB041	SHEET 2 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 742.79 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056798.41, N 695734.762 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 17.0 ft bgs START : 8/6/14 09:30 END : 8/6/14 10:35 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					Stained black, silty to very fine sand **CLAY (CL)** Brown, silty clay, very stiff to hard Boring terminated at 25.0 ft bgs.	
30	712.79					
35	707.79					
40	702.79					
45	697.79					
50	692.79					

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB042	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 742.82 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056796.5, N 695779.835 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 19.0 ft bgs START : 8/6/14 10:40 END : 8/6/14 11:30 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.7		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.2		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
		5.0 ---- 5.0	0.3		**CLAY (CL)** Brown, silty clay, trace gravel, stiff, brittle (CAP)	
			0.8			
5	737.82		18.0		**CLAY (CL)** Same as above	
			2.1			
			2.5		**CLAY (CL)** Brown, silty clay, trace gravel, very stiff to hard Slightly stained from 6.4' to 7'	Soil sample collected at 7'
		5.0 ---- 5.0	1.3			
			1.9			
10	732.82		0.6		**CLAY (CL)** Same as above	
			2.5		**SAND (SC)** Brown, clayey sand, little gravel, trace cobbles, rubber	
			1.5			
		5.0 ---- 5.0	7.5		**SAND (SP)** Gray to brown, poorly graded, fine to medium grain sand, trace gravel	Chemical odor
			9.2		**SAND (SC)** Stained, clayey sand, trace gravel	
15	727.82		323		**SAND (SM)** Stained black, silty sand, trace gravel	Soil sample collected at 15' Chemical odor
			17.0		**CLAY (CL)** Stained, silty clay, trace gravel, medium to stiff, glass shards	
			246			
			411		**SAND (SP)** Stained black, poorly graded, fine to medium grain sand, trace gravel, moist	
			766			Soil sample collected at 18.5'
					SAND (SW) Gray, stained, well graded, fine to coarse grain sand, trace gravel, wet	NTK collected at 19'. Evidence of NAPL
20	722.82	10.0 ---- 10.0	30.0			
			37.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard Medium to coarse grain sand seam from 21.4' to 21.6'	NTK collected at 21'. No evidence of NAPL
			11.3			
			3.4			
25	717.82					

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB043	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 742.07 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056795.85, N 695824.997 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 19.0 ft bgs START : 8/6/14 13:20 END : 8/6/14 13:55 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.3		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.1		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
		5.0	0.0		**CLAY (CL)** Brown to gray, silty clay, trace gravel, hard, brittle (CAP)	
		---- 5.0	0.0			
5	737.07		1.0		**CLAY (CL)** Same as above	
			1.4		**CLAY (CL)** Brown, sandy clay, little gravel, hard Stained from 8.7' to 10'	
			1.3			
		5.0	0.1			
		---- 5.0	1.3			Soil sample collected at 9'
10	732.07		3.0		**SAND (SC)** Stained, clayey sand, trace gravel, glass shards	
			7.6			
			9.2		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		5.0	29.0		**SILT (ML)** Brown, silt with fine sand Stained black from 14' to 15'	
		---- 5.0	83.0			
15	727.07		159		**SAND (SC-SM)** Stained, clayey silty sand, trace gravel	
			65.0			Soil sample collected at 16'
			284			NTK collected at 17'. No evidence of NAPL
			514		**SAND (SP)** Stained black to gray, poorly graded, fine to medium grain sand, wet at 19'	
			300		▼	Soil sample collected at 18.5'
20	722.07	9.0	87.0			NTK collected at 19'. No evidence of NAPL
		---- 10.0	8.7		**SAND AND GRAVEL (GW)** Brown, well graded, sand and fine to coarse gravel with clay	
			3.6		**CLAY (CL)** Gray, silty clay, trace gravel, medium to stiff from 21.5' to 22.5' and very stiff from 23' to 25' Wet, fine sand and silt seam from 22.5' to 23'	
			0.7			
25	717.07					

Boring terminated at 25.0 ft bgs.

CH2MHILL®

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB044	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 741.25 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056795.07, N 695871.179 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 17.0 ft bgs START : 8/6/14 14:10 END : 8/6/14 14:55 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
		5.0	0.0		**CLAY (CL)** Gray to brown, silty clay, trace gravel, hard, brittle (CAP)	
		---- 5.0	0.0			
5	736.25		0.0		**CLAY (CL)** Same as above	
			0.0			
			0.0			
		5.0	0.0			
		---- 5.0	0.0			
10	731.25		2.0		**SAND (SC)** Stained black, clayey sand, little gravel, glass shards, plastic debris	Soil sample collected at 9.5' Chemical odor
			11.7		**SAND (SC)** Same as above	
			26.0			
		5.0	7.0			
		---- 5.0			**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel Stained from 14' to 14.3'	
			151			
15	726.25		1500		**SAND (SC)** Stained, clayey sand, trace gravel	Soil sample collected at 15' NTK collected at 15'. Evidence of NAPL Chemical odor Soil sample collected at 16' Slight chemical odor
			172		**SAND (SW)** Brown to gray, light staining, well graded, fine to coarse grain sand Medium to coarse grain sand from 21' to 21'.2'	
			668			
			510			
			1000			NTK collected at 19'. Evidence of NAPL
20	721.25	10.0	1130			
		---- 10.0	17.0			NTK collected at 21'. Evidence of NAPL
					CLAY (CL) Gray, silty clay, medium to stiff	
					SAND (SM) Brown, silty sand	
			58.0			
			4.2		**CLAY (CL)** Gray to brown, silty clay, trace gravel, very stiff to hard	
25	716.25				Boring terminated at 25.0 ft bgs.	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB045	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 743.14 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056746.08, N 695861.493 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 18.5 ft bgs START : 8/6/14 15:05 END : 8/6/14 15:55 LOGGER : H. Ott & S. Chumney

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.1		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
		4.0 ---- 5.0	0.1		**CLAY (CL)** Gray to brown, silty clay, trace gravel, hard, brittle (CAP)	
			0.0			
5	738.14		0.1		**SAND (SM)** Stained, very fine silty sand, little clay, trace gravel	
			0.5			
			40.0			
		4.5 ---- 5.0	484			Soil sample collected at 8'
			2484			
					CLAY (CL) Brown, silty clay, trace gravel, hard, brittle	
10	733.14		157		**CLAY (CL)** Gray, light staining, clay, trace sand, trace gravel, medium stiff, moist, reworked	
			10.7		**CLAY (CL)** Dark grayish brown, sandy to silty clay, little sand, little gravel	
			230		**CLAY (CL)** Brown, clay, little sand, little gravel, stiff, moist	
		5.0 ---- 5.0	345		**CLAY (CL)** Brownish gray, light staining, sandy to silty clay, medium stiff, moist	Soil sample collected at 13'
			30.0			
15	728.14		3.8		**SILT (ML)** Dark grayish brown, clayey silt, trace sand, trace gravel, medium dense, moist	
			123			
			60.0		**SAND (SP)** Light brown becoming brown, poorly graded, fine to medium grain sand, trace gravel, moist to wet at 18.5'	
			12.0			Soil sample collected at 18'
			38.0			
20	723.14	5.0 ---- 10.0	1.2		**CLAY (CL)** Gray, clay, trace gravel, medium stiff, moist	
25	718.14					

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB046	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 743.75 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056751.32, N 695823.493 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 19.5 ft bgs START : 8/6/14 16:00 END : 8/6/14 16:38 LOGGER : S. Chumney

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.7		**SILT (ML)** Brown, silt, firm, some organics, moist (TOP SOIL)	
			0.3		**SAND (SP)** Light brown, poorly graded, fine to medium grain sand, loose, dry	
		5.0	0.3		**CLAY (CL)** Light grayish brown, clay, trace sand, trace gravel, stiff, slightly moist (CAP)	
		---- 5.0	0.1			
5	738.75		0.2		**SILT (ML)** Grayish brown to gray, clayey silt, some fine sand, trace gravel, trace brick	
			4.1			
			148			
		5.0	299			Soil sample collected at 8'
		---- 5.0	9.4		**CLAY (CL)** Light gray, clay, trace sand, trace gravel, very stiff, slightly moist	
10	733.75		2.1		**CLAY (CL)** Brownish gray, sandy to silty clay, trace gravel, firm, moist	
			7.5		**CLAY (CL)** Grayish brown, sandy clay becoming clayey to silty sand with depth, trace debris (glass, brick), firm	
			13.0			
		5.0	1.3			
		---- 5.0	3.1			
			0.5		**CLAY (CL)** Brownish gray, silty clay, little sand, trace gravel, medium stiff, moist	
15	728.75		60.0		**CLAY (CL)** Brownish gray, silty clay,	
			250			
			100		**SAND (SP)** Brown to gray, poorly graded, fine to medium grain sand, little coarse sand, little gravel, moist becoming wet at 19.5' Some staining 18.5' to 20.5'	Soil sample collected at 17'
			200			
					▼	Soil sample collected at 19' NTK collected at 19'. No evidence of NAPL
20	723.75	10.0	12.0			
		---- 10.0	25.0			
			4.0		**SILT (ML)** Gray, sandy silt, dense, wet	
			3.0		**CLAY (CL)** Gray, clay, trace sand, trace gravel, stiff, moist	
			0.5			
25	718.75		0.6			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB047	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 744.00 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056753.34, N 695778.524 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 21.0 ft bgs START : 8/7/14 08:35 END : 8/7/14 09:15 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.8		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
		5.0 ---- 5.0	0.1		**CLAY (CL)** Brown, silty clay, trace gravel, hard (CAP)	
			0.2			
5	739.00		2.0		**CLAY (CL)** Same as above	
			4.1		**SAND (SM)** Brown, silty sand, trace clay, trace gravel Stained from 6.5' to 7'	
			180		**CLAY (CL)** Brown, silty clay, trace gravel, hard	Soil sample collected at 7' Slight chemical odor
		5.0 ---- 5.0	4.4			
			1.3			
10	734.00		1.4		**CLAY (CL)** Same as above Stained from 11.5' to 11.7'	
			17.6			
			11.2			
		5.0 ---- 5.0	2.6		**SAND (SC)** Stained, clayey sand, little to some gravel, glass shards	Slight chemical odor
			12.3			
15	729.00		9.4		**SAND (SM)** Brown, silty sand, trace gravel, moist	
			15.2		**CLAY (CL)** Brown, slightly stained, sandy clay, firm to stiff	
			31.0		**SILT WITH SAND (ML)** Brown, slightly stained, silt with sand	
		5.0 ---- 5.0	125		**SAND (SM)** Stained, silty sand, moist	
			300			Soil sample collected at 19' Strong hydrocarbon odor
20	724.00		320		**SAND (SM)** Same as above Silty clay from 20.5' to 21'	Soil sample collected at 20' NTK collected at 20'. No evidence of NAPL
			9.7		**SAND (SW)** Stained, well graded, fine to coarse grain sand, trace gravel, wet	
			2.1		**SAND (SM)** Gray to brown, very fine silty sand, moist	
		5.0 ---- 5.0	1.2			
			0.9			
25	719.00					

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB048	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 743.35 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056752.82, N 695730.435 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 17.0 ft bgs START : 8/7/14 09:30 END : 8/7/14 10:15 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.1		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
		4.0	0.0		**CLAY (CL)** Brown to gray, silty clay, trace gravel, hard, brittle (CAP)	
		---- 5.0	1.7			
5	738.35		45.0		**CLAY (CL)** Brown, silty clay, trace gravel, very stiff Stained from 5' to 6.4'	Hydrocarbon odor from 5' to 6.'4 Soil sample collected at 6'
			53.0			
			6.0			
		5.0	1.5			
		---- 5.0	9.8			
10	733.35		1.8		**CLAY (CL)** Same as above - partially stained	
			13.3			
			14.4			
		5.0	36.4			
		---- 5.0	281		**SAND (SC)** Stained, clayey sand, some gravel, glass shards	Strong chemical odor
			318		**SAND (SM)** Light brown, fine silty sand Stained black 14.7' to 15'	
15	728.35		345		**SAND (SM)** Same as above - stained black	Hydrocarbon odor from 14.7' to 15' Soil sample collected at 15' NTK collected at 15'. Evidence of NAPL
			371		▼	Soil sample collected at 16.5'
			60.0		**SAND (SP)** Stained, poorly graded, fine to medium grain sand, trace gravel, wet	
			95.0		**SAND (SW)** Stained, well graded, fine to coarse grain sand, trace gravel, wet	
20	723.35	10.0	17.0			
		---- 10.0	5.0		**SAND (SW)** Same as above Sand and gravel seam from 21.3' to 21.5, wet	
			1.6		**CLAY (CL)** Brown, silty clay, trace gravel, stiff to very stiff	
			1.5			
			1.7			
25	718.35		1.5			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB049	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 742.44 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056752.78, N 695685.865 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.0 ft bgs START : 8/7/14 10:25 END : 8/7/14 11:10 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.2		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.3		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
		5.0 ---- 5.0	0.0		**CLAY (CL)** Brown to gray, silty clay, trace gravel, hard, brittle (CAP)	
			0.1			
5	737.44		37.0		**CLAY (CL)** Same as above	
			0.1			
			1.3			
		5.0 ---- 5.0	18.0		**SAND (SC)** Stained, clayey sand, some gravel, trace white granular material, glass, wood fragments	Strong chemical odor
			46.0			Soil sample collected at 9'
10	732.44		191		**SAND (SC)** Same as above	
			130			Soil sample collected at 11'
			100		**SAND (SW)** Light brown to gray, well graded, fine to coarse grain sand, some gravel	
		5.0 ---- 5.0	83.0			
			12.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel, trace cobbles, moist	
15	727.44		48.0		**SAND (SM)** Stained, silty sand, trace gravel, moist	
			130		**SAND (SM)** Same as above	Soil sample collected at 15.5'
			46.0		**SAND (SW)** Gray, slightly stained, well graded, fine to coarse grain sand, little gravel, wet at 16'	
			41.0			
			19.0			
20	722.44	10.0 ---- 10.0	9.5			
			2.9		**SAND (SW)** Same as above	
			1.2		**CLAY (CL)** Gray to brown, silty clay, trace gravel, very stiff	
			0.7			
			0.3			
25	717.44		1.2			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB050	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 742.73 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056756.67, N 695640.35 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 19.5 ft bgs START : 8/7/14 11:20 END : 8/7/14 11:55 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.3		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.2		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
		5.0	0.0		**CLAY (CL)** Brown to gray, silty clay, trace gravel, hard (CAP)	
		---- 5.0	0.1			
5	737.73		0.5		**CLAY (CL)** Same as above	
			0.0			
			0.2			
		5.0	9.0		**SAND (SC)** Stained, clayey sand, some gravel, trace white granular material, glass, wood fragments	
		---- 5.0	32.0			Soil sample collected at 9'
10	732.73		78.0		**SAND (SC)** Same as above	
			31.0		**SAND (SW)** Light brown to gray, well graded, fine to coarse grain sand, some gravel	
			54.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel Stained black from 13.3 to 14'	
		5.0	9.0			
		---- 5.0	387		**SAND (SM)** Brown, stained, silty sand, trace gravel	
15	727.73		440		**SAND (SM)** Same as above	Soil sample collected at 15'
			205		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel, moist	
			493			
			548			Soil sample collected at 19'
20	722.73	10.0	155		**SAND (SW)** Gray, lightly stained, well graded, fine to coarse grain sand, trace gravel, wet	
		---- 10.0	130		**CLAY (CL)** Gray, silty clay, trace gravel, hard	
			10.5			
			9.6			
			3.9			
25	717.73					

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB051	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 742.11 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056758.5, N 695592.448 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : NA START : 8/7/14 13:10 END : 8/7/14 14:00 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.8		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.3		**CLAY (CL)** Brown to gray, silty clay, trace gravel, hard, brittle (CAP)	
		4.5 ---- 5.0	0.1			
			0.4			
5	737.11		6.3			
			0.8		**CLAY (CL)** Same as above	
			19.0		**SAND (SC)** Brown, stained, clayey sand, some gravel, glass, brick	Chemical odor
		5.0 ---- 5.0	3.0			Soil sample collected at 8'
			1.8			
10	732.11		7.4			
			5.6		**SAND (SC)** Same as above	
			170		**SAND (SP)** Brown, some staining, poorly graded, very fine to medium grain sand, little gravel Some clay 12' to 12.5'	
		5.0 ---- 5.0	400		**SAND (SM)** Stained black, very fine silty sand, trace gravel	Hydrocarbon odor
			800		**SAND (SP)** Gray to brown, poorly graded, fine to medium grain sand, some coarse sand, trace gravel, moist	Soil sample collected at 14'
15	727.11		600		**SAND (SC)** Brown, slightly stained, clayey sand, little gravel	
			219		**SAND (SM)** Brown, slightly stained, very fine silty sand, trace gravel, moist to slightly wet	
			844			Soil sample collected at 17' NTK collected at 17'. Evidence of NAPL
			750			
			626			
20	722.11	10.0 ---- 10.0	150		**CLAY (CL)** Brown, silty clay, trace gravel, hard Very fine silty sand seam 21.3' to 21.5'	
			9.8			
			6.1			
			2.5			
			0.6			Groundwater not encountered
25	717.11					

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB052	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 739.01 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056759.65, N 695545.793 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : NA START : 8/7/14 14:10 END : 8/7/14 14:55 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.1		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
		4.0	0.2		**CLAY (CL)** Brown, silty clay, trace gravel, firm to hard (CAP)	
		---- 5.0	3.8			
5	734.01		12.0		**CLAY (CL)** Same as above	
			6.1			
			47.0			
		5.0	8.7			
		---- 5.0	179		**SAND (SP)** Brown, slightly stained, poorly graded, fine to medium grain sand, some gravel, metal and wood debris, insulation	
10	729.01		199		**SAND (SM)** Stained black, silty sand, trace gravel	Soil sample collected at 9.5'
			839		**SAND (SP)** Brown, poorly graded, very fine to medium grain sand, trace gravel	Soil sample collected at 11'
			630		**SAND (SP)** Brown, slightly stained, poorly graded, fine to medium grain sand, some coarse sand, some gravel, moist	
		5.0	261		Clay lens from 11.5' to 11.8'	
		---- 5.0	682		**CLAY (CL)** Brown, slightly stained, silty clay, trace gravel, very stiff to hard	
15	724.01		305		**CLAY (CL)** Same as above	
			491			Soil sample collected at 16'
			187			
			352			
			150			
20	719.01	10.0	21.5			
		---- 10.0	9.7			
			7.2			
			6.2			
			6.0			Groundwater not encountered
25	714.01		6.3			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB053	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 733.25 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056715.51, N 695498.857 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : NA START : 8/7/14 15:05 END : 8/7/14 15:35 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.3		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
					SAND (SP) Brown, poorly graded, fine to medium grain sand, some gravel	
			0.8		**CLAY (CL)** Brown, silty clay, trace gravel, hard (CAP)	
		4.5 ---- 5.0	1.6			
			85.0			
5	728.25		5.3		**CLAY (CL)** Brown, stained, silty to sandy clay, trace gravel, medium dense	
			88.0			Soil sample collected at 6
			72.0		**CLAY (CL)** Brown and gray, mottled, silty clay, trace gravel	
		5.0 ---- 5.0	334			Soil sample collected at 8'
			292			
10	723.25		53.0		**CLAY (CL)** Brown, silty clay, trace gravel, moist, medium to firm 10' to 11.5' and very stiff to hard from 11.5' to 15'	
			228			
			209			Soil sample collected at 12'
		5.0 ---- 5.0	24.0			
			8.7			
15	718.25		0.8			

Boring terminated at 15.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB054	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 741.25 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056716.28, N 695589.811 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 15.0 ft bgs START : 8/7/14 15:45 END : 8/7/14 16:30 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.2		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
		4.2 ---- 5.0	0.1		**CLAY (CL)** Brown, silty clay, trace gravel, hard (CAP)	
			0.2			
5	736.25		0.5			
			0.8		**CLAY (CL)** Same as above	
			5.2		**SAND (SM)** Gray to brown, silty sand and gravel	
		5.0 ---- 5.0	5.8		**SAND (SC)** Brown, stained, clayey sand, some gravel, glass	Chemical odor Soil sample collected at 8'
			5.7		**SILT (ML)** Stained black, clayey silt, some sand, some gravel, glass	
10	731.25		2.9		**SILT (ML)** Same as above Stained, clay lens from 11.1' to 11.6'	
			5.9			
			6.6		**SAND (SP)** Brown, poorly graded, fine to medium sand, some coarse grain sand, some gravel	
		5.0 ---- 5.0	203		**SAND (SM)** Brown, silty sand, little gravel, stained black from 12.8' to 14'	
			381		**SAND (SW)** Gray, slightly stained, well graded, fine to coarse grain sand, little gravel, moist	Soil sample collected at 14' Hydrocarbon odor
15	726.25		336		**SAND (SP)** Gray, stained, poorly graded, fine to medium grain sand, little gravel, wet	Soil sample collected at 15'
			340			
			9.3		**CLAY (CL)** Gray to brown, silty clay, trace gravel, very stiff to hard Silt seam from 22' to 24.5'	
			4.8			
			4.5			
20	721.25	10.0 ---- 10.0	2.6			
			1.3			
			0.4			
			0.4			
			0.6			
25	716.25					

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB055	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 741.11 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056710.78, N 695683.733 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.0 ft bgs START : 8/8/14 08:10 END : 8/8/14 08:50 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
		5.0	0.2		**CLAY (CL)** Gray to brown, silty clay, trace gravel, hard, brittle (CAP)	
		---- 5.0	0.4			
5	736.11		0.5		**CLAY (CL)** Same as above	
			1.4			
			1.3			
		5.0	18.0			
		---- 5.0	43.0		**SAND (SC)** Brown, stained, clayey sand, some gravel, trace white granular matieral, wood fragments	Strong chemical odor Soil sample collected at 9'
10	731.11		20.0		**SAND (SC)** Same as above	
			66.0			Strong chemical odor
			23.0		**SAND AND GRAVEL (GW)** Light brown, fine to coarse grain sand and gravel	
		5.0	14.8			
		---- 5.0	14.0		**SAND (SM)** Brown, silty sand, little clay, trace gravel, moist	Soil sample collected at 14'
15	726.11		110			
			435		**SAND (SM)** Same as above - stained black	Soil sample collected at 15.5'
			88.0		**SAND AND GRAVEL (GW)** Stained black, sand and gravel, trace cobbles, wet	Hydrocarbon odor NTK collected at 16'. Evidence of NAPL
			75.0		**SAND (SP)** Gray, stained, poorly graded, fine to medium grain sand, some coarse grain sand, trace gravel, wet	
			17.0			
20	721.11	5.0	15.0			
		---- 10.0	6.6		**CLAY (CL)** Brown, silty clay, trace gravel, very stiff to hard Wet, very fine silty sand seam from 20.8' to 21.2'	
			0.4			
			2.1			
			1.1			
25	716.11		0.9			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB056	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 745.02 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056711.5, N 695774.912 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 21.0 ft bgs START : 8/8/14 08:55 END : 8/8/14 09:50 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard (CAP)	
		4.0 ---- 5.0	0.0			
			0.0			
5	740.02		0.4			
			0.4		**CLAY (CL)** Same as above	
			3.0			
		5.0 ---- 5.0	18.0		**SAND (SC)** Brown, stained, clayey sand, some gravel	Soil sample collected at 8' Chemical odor
			13.0		**SAND (CL)** Brown, slightly stained, sandy clay, trace gravel, very stiff, glass	
10	735.02		2.1			
			1.2		**SAND (CL)** Same as above	
			3.4		**SAND (SW)** Light brown, well graded, fine to coarse grain sand, some gravel	
		5.0 ---- 5.0	1.7			
			0.8			Soil sample collected at 14'
15	730.02		1.2		**CLAY (CL)** Brown, sandy clay, trace gravel, medium to stiff	
			16.0		**CLAY (CL)** Same as above	
			2.7		**SAND (SW)** Light brown, well graded, fine to coarse grain sand, little gravel	
			5.8			
			5.8			
20	725.02	10.0 ---- 10.0	5.4			
			34.0		**CLAY (CL)** Brown, silty clay, trace gravel, stiff, moist	Soil sample collected at 20.5 Slightly stained sand at water table
			1.0		**SAND (SW)** Brown, well graded, fine to coarse grain sand, trace gravel, wet	
			0.2		**SAND (SM)** Brown, fine silty sand	
			5.1		**CLAY (CL)** Brown, silty clay, trace gravel, hard	
25	720.02		0.2			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB057	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 735.27 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13057033.85, N 695853.837 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 14.3 ft bgs START : 8/22/14 10:30 END : 8/22/14 11:07 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					SAND (SM) Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.8		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
			0.1		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP) Slightly stained from 4' to 5'	
		5.0 ---- 5.0	0.5			
			1.1			
5	730.27		0.8		**SAND AND GRAVEL (GW)** Brown, stained, sand and gravel	Slight chemical odor
			176		**SAND (SM)** Brown, stained, fine to medium silty sand, trace gravel	Soil sample collected at 6' Chemical odor
			553		**CLAY (CL)** Brown, stained, silty clay, trace gravel, stiff, moist	
		5.0 ---- 5.0	238			
			1135		**SAND (SM)** Stained black, silty sand, little clay, trace gravel, less stained 9.5' to 10'	Very strong hydrocarbon odor from 8.3' to 10' Soil sample collected at 9' NTK collected at 9'. Evidence of NAPL
10	725.27		1257		**CLAY (CL)** Gray, silty clay, trace gravel, hard Gray, wet, silt seam, some clay from 14.3' to 14.5'	
			182			
			143			
		5.0 ---- 5.0	5.3			
			57.6			Soil sample collected at 13.5'
15	720.27		27.5		**CLAY (CL)** Same as above - dry	
			4.6			
			9.6			
		5.0 ---- 5.0	2.9			
			2.8			
20	715.27		0.4			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB058	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 734.21 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13057034.69, N 695952.858 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 14.5 ft bgs START : 8/22/14 11:15 END : 8/22/14 12:00 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					SAND (SM) Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.8		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, little gravel	
			0.2		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		5.0 ---- 5.0	1.2			
			2.7		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel moist	
5	729.21		41.7		**CLAY (CL)** Brown, stained, sandy clay, trace gravel, stiff, moist	Soil sample collected at 4.5'
			24.3		**SAND (SW)** Brown, stained, well graded, fine to coarse grain sand, some gravel	
			114		**SAND (SP)** Stained dark brown, poorly graded, fine to medium grain sand, trace clay, trace gravel, moist	
		5.0 ---- 5.0	316			Strong hydrocarbon odor NTK collected at 7.5'. No evidence of NAPL
			367		**SAND (SP)** Brown, stained, poorly graded, fine to medium grain sand, trace gravel, moist	Strong hydrocarbon odor Soil sample collected at 8.5' NTK collected at 8.5'. Evidence of NAPL
10	724.21		53.1		**CLAY (CL)** Gray and brown, mottled silty clay, hard	
			80.9		**SAND (SP)** Brown, stained, poorly graded, fine to medium grain sand, some coarse sand, little gravel	Strong hydrocarbon odor
			9.6		**CLAY (CL)** Gray, silty clay, trace gravel, hard Moist gray silt lens from 11.5' to 12' Gray silt lens from 13.3' to 13.5'	
		5.0 ---- 5.0	5.0			
			6.3			Soil sample collected at 14'
15	719.21		6.4		**SAND (SP)** Gray, poorly graded, fine to medium grain sand, some coarse grain sand, trace gravel, wet	
			2.0		**SAND (SP)** Same as above - less coarse from 18' to 18.5'	
			0.7			
		5.0 ---- 5.0	0.9			
			0.4		**CLAY (CL)** Gray, silty clay, trace gravel, hard	
20	714.21		0.5			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB059	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 733.11 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13057036.41, N 696051.627 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 9.5 ft bgs START : 8/22/14 12:05 END : 8/22/14 12:40 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					SAND (SM) Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.2		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
			0.2		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		5.0 ---- 5.0	2.5			
			17.7		**SAND (SP)** Brown, stained, poorly graded, fine to medium grain sand, trace gravel, trace clay, moist	Soil sample collected at 4.5'
5	728.11		20.3		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel, moist Slightly stained from 5' to 6'	
			11.1			Soil sample collected at 6'
			39.9			
		5.0 ---- 5.0	28.9			
			2.7		**CLAY (CL)** Brown, sandy clay, trace gravel, stilff, moist	Soil sample collected at 8.5'
					▼	
10	723.11		7.5		**SAND (SW)** Brown, well graded, fine to coarse grain sand, trace gravel, wet	
					SAND (SW) Same as above	
			5.8			
			0.3		**CLAY (CL)** Gray, silty clay, trace gravel, hard Medium to stiff and wet from 12' to 15' Wet silt seam from 13.5' to 14'	
		5.0 ---- 5.0	0.1			
			0.4			
15	718.11		0.2			

Boring terminated at 15.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB060	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 734.18 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056997.71, N 696052.912 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 10.0 ft bgs START : 8/25/14 08:45 END : 8/25/14 09:45 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					SAND (SM) Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**CLAY (CL)** Brown, silty clay, some gravel, hard (CAP)	
			17.2			
		5.0				
		----	9.5			
		5.0				
			7.4			Hard drilling
5	729.18		6.3			
					SAND AND GRAVEL (GW) Gray, silty sand and gravel	
			380		**SAND (SP)** Brown, stained, poorly graded, fine to medium grain sand, some gravel, little clay, trace wood and brick	Soil sample collected at 6' Hydrocaron odor NTK collected at 6'. No evidence of NAPL
			696			
					SAND (SP) Brown, slightly stained, poorly graded, fine to medium grain sand, trace gravel, moist	
		5.0				
		----	1913			Soil sample collected at 8' Strong hydrocarbon odor NTK collected at 8'. No evidence of NAPL
		5.0				
			1547		**SAND (SP)** Gray to brown, poorly graded, fine to medium grain sand, little coarse sand, trace to little gravel Moist, stained dark brown from 8.7' to 9.2'	
10	724.18		135			Soil sample collected at 9.5'
					SAND (SP) Same as above	
			393		**SAND (SW)** Brown, well graded, medium to coarse grain sand, little gravel, wet	
			180		**SAND (SP)** Light brown, slightly stained, poorly graded, fine to medium grain sand, trace gravel, wet	
		5.0				
		----	54.4			
		5.0			**CLAY (CL)** Gray, silty clay, trace gravel, hard Wet, medium to coarse grain sand seam from 14.2' to 15'	
			5.2			
15	719.18		68.8			
					CLAY (CL) Same as above	
			3.0			
			4.2			
		5.0				
		----	2.1			
		5.0				
			0.0			
20	714.18		0.0			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB061	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 735.28 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056996.49, N 695953.212 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 14.3 ft bgs START : 8/25/14 10:00 END : 8/25/14 11:05 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.1		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		5.0	7.9		**CLAY (CL)** Brown, silty clay, trace gravel, hard (CAP)	
		---- 5.0	2.3			
5	730.28		6.9		**CLAY (CL)** Same as above	
			13.1		**SAND AND GRAVEL (GW)** Stained black, sand and gravel, little clay	
			14.1		**SAND (SP)** Stained black, poorly graded, fine to medium grain sand, some gravel, moist Black tar from 7' to 7.5' Light brown from 8' to 10'	Soil sample collected at 6.5' NTK collected at 7.8'. No evidence of NAPL Soil sample collected at 8'
		5.0	48.0			
		---- 5.0	2.1			
10	725.28		1.9		**CLAY (CL)** Gray and brown, mottled silty clay, trace gravel, stiff to hard Wet medium to coarse grain sand seam from 14.3' to 14.6' Not mottled 12' and below	
			0.0			
			0.0			
		5.0	0.0			
		---- 5.0	0.0			Soil sample collected at 14'
15	720.28		0.0		**CLAY (CL)** Same as above Wet, gray silt seam from 15' to 15.5' Wet, gray fine to coarse grain sand seam from 19.5' to 20'	
			0.0			
			0.0			
		5.0	0.0			
		---- 5.0	0.0			
20	715.28		2.6			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB062	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 737.44 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056996.64, N 695853.071 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 12.5 ft bgs START : 8/25/14 11:10 END : 8/25/14 12:00 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			1.1		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, little gravel **CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		5.0 ---- 5.0	0.0			
			0.0			
5	732.44		18.9		**CLAY (CL)** Same as above	
			12.4			
			111		**SAND (SM)** Stained dark brown, silty sand, some gravel, some wood fragments	
		5.0 ---- 5.0	36.1		**CLAY (CL)** Brown, stained, silty clay, trace gravel, hard Sand and gravel seam with some clay from 7.5' to 8' Brown, stained, silty sand seams with some gravel and some clay from 9' to 9.5' and 9.7' to 9.8'	Soil sample collected at 7' Hydrocarbon odor
			389			
10	727.44		488		**SAND (SP)** Brown, stained, poorly graded, fine to medium grain sand, trace gravel, wet	Strong hydrocarbon odor from 10' to 13'
			975			Soil sample collected at 11'
			783			
		5.0 ---- 5.0	464		▼	Soil sample collected at 12.5'
			322		**CLAY (CL)** Gray, silty clay, trace gravel, hard Silt seam from13.5' to 13.7'	NTK collected at 13'. Evidence of NAPL
15	722.44		852		**SAND (SP)** Brown, stained, poorly graded, fine to medium grain sand, trace gravel, trace cobbles, wet More fine and silty with depth	Strong hydrocarbon odor Evidence of mobile NAPL
			1043			
			617			
		5.0 ---- 5.0	1197			
			111		**CLAY (CL)** Gray, silty clay, trace gravel, hard	
20	717.44		78.6			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB063	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 740.85 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056765.78, N 695945.225 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 15.0 ft bgs START : 8/25/14 13:10 END : 8/25/14 13:50 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
		5.0			**CLAY (CL)** Brown, silty clay, trace gravel, hard (CAP)	
		----	0.0			
		5.0				
			0.0			
5	735.85		0.0		**CLAY (CL)** Same as above	
			0.4			
			0.0			
		5.0				
		----	0.6		**CLAY (CL)** Brown, stained, silty sandy clay, trace gravel, hard Slightly stained from 8.5' to 10'	Sample collected at 8'
		5.0				
			0.7			
10	730.85		1.5		**CLAY (CL)** Same as above - soft and wet from 11' to 11.5'	
			89.8			
			79.0		**SAND (SW)** Brown, well graded, medium to coarse grain sand, some gravel, trace cobbles, moist	Sample collected at 12' Hydrocarbon odor
		5.0				
		----	69.8		**SAND (SP)** Brown, slightly stained, poorly graded, fine to medium grain sand, trace clay, trace gravel Wood at 14' Stained black from 14' to 14.8'	
		5.0				
			177			Sample collected at 14' NTK collected at 14'. No evidence of NAPL
15	725.85		74.6		▼	
			403		**SAND (SP)** Same as above - wet at 15' Stained black from 16' to 16.5'	Hydrocarbon odor
			185		**CLAY (CL)** Gray, silty clay, trace gravel, stiff to hard	
		5.0				
		----	74.0			
		5.0				
			10.0			
20	720.85		7.9			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA1-SB064	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 739.05 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056659.5, N 695682.492 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 13.0 ft bgs START : 8/25/14 14:00 END : 8/25/14 14:40 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand	
		5.0			**CLAY (CL)** Brown, silty clay, trace gravel, stiff to hard, brittle (CAP)	
		----	0.0			
		5.0				
			0.0			
5	734.05		0.2			
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some coarse grain sand, some gravel	Soil sample collected at 6'
			0.6			
		5.0				
		----	0.0			Soil sample collected at 8'
		5.0				
			0.0			
10	729.05		0.0			
			2.6		**SAND (SP)** Same as above - moist	
			0.3			Soil sample collected at 12'
		5.0				
		----	0.0			
		5.0				
			0.0		**SAND (SW)** Brown, well graded, fine to coarse grain sand, some gravel, wet	
15	724.05		0.0			
					SAND (SW) Same as above	
		5.0				

		5.0			**GRAVEL (GP)** Fine to medium gravel Little sand from 18.5' to 20'	
20	719.05					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB001	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 737.52 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056832.27, N 696014.852 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 14.0 ft bgs START : 8/13/14 08:35 END : 8/13/14 09:10 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	Refusal at 8' on 8/8/2014. Step out 11' to the east and redrill on 8/13/2014
		5.0	0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		---- 5.0	0.0			
			0.0			
5	732.52		68.0		**SAND (SP)** Brown, stained, poorly graded, fine to medium grain sand, trace gravel	
			3.2		**SILT (ML)** Brown, clayey silt, little gravel, glass	Soil sample collected at 6' on 8/8/2014
			1.5			
		5.0	25.0		**SAND (SP)** Stained, poorly graded, fine to medium grain sand, trace gravel, moist	Hydrocarbon odor
		---- 5.0	64.0			Soil sample collected at 9'
10	727.52		35.0		**SAND (SP)** Same as above - brown not stained from 10' to 13', becomes more coarse with depth, wet at 14' Stained from 13' to 15'	
			16.0			
			11.0			
		5.0	10.0			Soil sample collected at 13'
		---- 5.0	8.0		▼	
15	722.52		6.0		**SAND (SW)** Brown, well graded, fine to coarse grain sand, trace gravel, wet	
			0.7			
			0.7			
		5.0	0.1			
		---- 5.0			**CLAY (CL)** Gray, silty clay, trace gravel, hard Silt seam from 18.3' to 18.5'	
			0.1			
20	717.52		0.1			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB002	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 740.69 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056738.71, N 696016.323 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.5 ft bgs START : 8/8/14 10:55 END : 8/8/14 11:40 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, little gravel	
		4.0	0.0		**CLAY (CL)** Gray to brown, silty clay, trace gravel, hard (CAP)	
		----	0.0			
		5.0	0.0			
5	735.69		0.0		**CLAY (CL)** Same as above	
			0.0			
			7.5			
		5.0	10.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, stained black from 9.5' to 10'	
		----				Soil sample collected at 8'
		5.0	11.0			
10	730.69		2.6		**CLAY (CL)** Same as above - sandy clay from 12.3' to 12.7'	
			0.0			
			6.3			
		5.0	18.0		**SAND (SC)** Brown, stained, clayey sand, little gravel, trace white granular material, wood fragments	Slight hydrocarbon odor
		----	24.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel, moist Stained from 13.7' to 14.2'	Soil sample collected at 14'
15	725.69	5.0	7.0		**CLAY (CL)** Gray to brown, some staining, sandy clay, trace gravel	
			2.7			Soil sample collected at 16'
			6.4		**SAND (SW)** Brown, well graded, fine to coarse grain sand, trace fine gravel Some fine to coarse gravel from 13' to 13.7'	
			5.3			
			3.1			
			0.2		**CLAY (CL)** Gray, sandy clay, trace gravel, stiff	
20	720.69	10.0			**CLAY (CL)** Gray, silty clay, trace gravel, very stiff	
		----	0.0			
		10.0	0.1			
			0.1			
			0.1			
25	715.69		0.0			

Boring terminated at 25.0 ft bgs.

CH2MHILL®

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB003	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 743.56 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056645.32, N 696019.83 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 20.0 ft bgs START : 8/8/14 11:55 END : 8/8/14 12:35 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		5.0	0.0		**CLAY (CL)** Gray to brown, silty clay, trace gravel, hard (CAP)	
		---- 5.0	0.4			
					SAND (SM) Stained black, fine silty sand	
5	738.56		39.0		**CLAY (CL)** Gray, sandy clay, trace gravel, medium dense	
			0.8		**CLAY (CL)** Same as above - moist at 6.5' Brown, fine to medium grain sand seam, some gravel from 5.3' to 5.6' Wet, fine to coarse grain sand seam, trace gravel from 8' to 8.3'	
			0.6			
		5.0	6.1			
		---- 5.0				Soil sample collected at 8'
			0.4		**CLAY (CL)** Brown, silty clay, trace gravel White granular material at 9.7'	
10	733.56		4.5		**CLAY (CL)** Same as above - some staining, some glass	Slight chemical odor
			30.0			
			0.6			
		5.0	0.5		**SAND (SC)** Brown, stained, clayey sand, little gravel	
		---- 5.0	10.0			
					SAND (SP) Brown, poorly graded, very fine to medium grain sand, trace gravel	
15	728.56		32.0		**CLAY (CL)** Brown, stained, sandy clay, trace gravel, medium dense	Soil sample collected at 15'
			28.0			
			27.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel Stained from 17' to 18'	
			20.0			
			20.0			Soil sample collected at 19'
20	723.56	10.0	6.8		▼	
		---- 10.0	0.7		**SAND (SW)** Gray, well graded, fine to coarse grain sand, trace gravel, wet	
			0.4		**SAND (SM)** Brown to gray, very fine silty sand, wet	
			0.2		**CLAY (CL)** Brown to gray, silty clay, trace gravel, hard	
			0.2			
25	718.56		0.7			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB004	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 746.05 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056551.1, N 696020.68 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 23.0 ft bgs START : 8/11/14 08:40 END : 8/11/14 09:20 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		4.0	0.1		**CLAY (CL)** Gray to brown, silty clay, trace gravel, hard (CAP)	
		---- 5.0	0.0			
5	741.05		0.0		**CLAY (CL)** Same as above	
			1.3			
			6.3			
		5.0	103			
		---- 5.0	91.4		**CLAY (CL)** Brown, silty clay, trace gravel, hard Stained black from 8' to 8.4'	Soil sample collected at 8.5' Chemical odor
10	736.05		22.8		**SAND (SC)** Brown, stained, clayey sand, trace gravel	
			49.7		**SAND (SC)** Same as above - some fine to coarse gravel, glass	
			46.2		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, little gravel Stained dark brown from 11.2' to 12'	
		5.0	54.3			
		---- 5.0	60.1			
15	731.05		76.4			
			26.6		**SAND (SP)** Brown, slightly stained, poorly graded, fine to medium grain sand, trace gravel, trace clay	Soil sample collected at 15' Slight chemical odor
			84.0			
			29.8		**SAND (SM)** Stained black, silty sand	Soil sample collected at 18'
			30.4			
20	726.05	5.0	3.9		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel Fine to coarse grain sand from 23' to 24'	
		---- 10.0	3.6			
			7.7			
			6.7		▼	
			1.7			
25	721.05		1.6		**CLAY (CL)** Brown, silty clay, trace gravel, hard	

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB005	SHEET 1 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 746.79 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056455.65, N 696022.262 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.0 ft bgs START : 8/11/14 09:25 END : 8/11/14 10:15 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		5.0 ---- 5.0	0.0			
			0.2			
5	741.79		0.7			
			0.2		**CLAY (CL)** Same as above	
			8.6		**CLAY (CL)** Gray, silty clay, trace gravel, stiff	
		5.0 ---- 5.0	7.0		**SAND (SC)** Brown, stained, clayey sand, little gravel, rubber, glass, 1/2" plate steel	Soil sample collected at 7.5' Slight chemical odor
			12.0			
10	736.79		1.5		**CLAY (CL)** Brown, silty sandy clay, trace gravel	
			2.5		**CLAY (CL)** Same as above	
			2.0		**SAND (SC)** Stained black, clayey sand, little gravel, glass	Chemical odor Soil sample collected at 12'
		4.0 ---- 5.0	1.5			
			1.5			Pasty white material
15	731.79		3.0			
			4.6		**SAND (SC)** Same as above	Soil sample collected at 15'
			7.8		**SILT (ML)** Brown and gray, stained, varved, very clayey silt, medium dense, wet	Trace white pasty material from 16' to 17'
			1.2			
			7.7			
20	726.79	10.0 ---- 10.0	6.3			
			2.0			
			2.6		**SILT (ML)** Gray, varved, very clayey silt, medium dense	
			10.7		**SAND (SW)** Stained black, well graded, fine to coarse grain sand, some gravel	
			20.0		**SAND (SP)** Gray, poorly graded, fine to medium grain sand, trace gravel	
25	721.79		2.5		**CLAY (CL)**	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB005	SHEET 2 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 746.79 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056455.65, N 696022.262 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.0 ft bgs START : 8/11/14 09:25 END : 8/11/14 10:15 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					Gray, silty clay, trace gravel, hard Boring terminated at 25.0 ft bgs.	
30	716.79					
35	711.79					
40	706.79					
45	701.79					
50	696.79					

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB006	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 744.51 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056344.55, N 696026.041 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.0 ft bgs START : 8/11/14 10:25 END : 8/11/14 11:10 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, very fine to medium grain sand, trace gravel	
		5.0 ---- 5.0	0.1		**CLAY (CL)** Brown, silty clay, trace gravel, stiff, brittle (CAP)	
			1.1		**SAND (SC)** Brown, clayey sand, little gravel Stained black form 4.5' to 5'	Slight chemical odor
5	739.51		10.0		**SAND (SC)** Same as above - stained black to 6'	Soil sample collected at 5.5'
			3.5		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some fine to coarse gravel	
		5.0 ---- 5.0	0.6		**SAND, CLAY, AND GRAVEL (GP-GC)** Red brown, sand, clay, and gravel, wet	
			0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard	
			0.2			
10	734.51		6.6		**CLAY (CL)** Same as above	
			0.6		**CLAY (CL)** Brown, slight staining, silty clay, trace gravel	Soil sample collected at 11'
			5.2			
		5.0 ---- 5.0	0.2			
			0.2			
15	729.51		2.4		**SILT (ML)** Gray, slightly stained, varved, very clayey silt, soft to medium dense, wet at 16' ▼	Soil sample collected at 15'
			3.3			
			2.8			
			3.2			
			5.4			
20	724.51	10.0 ---- 10.0	4.7			
			1.1		**CLAY (CL)** Brown, silty clay, trace gravel, hard	
			5.7			
			1.4			
			1.1			
25	719.51		0.5			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB007	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 745.11 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056307.62, N 696050.961 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 18.5 ft bgs START : 8/11/14 11:15 END : 8/11/14 11:55 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.2		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.5		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		5.0 ---- 5.0	0.2		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP) Stained from 4.5' to 5'	
			3.4			
5	740.11		8.0		**SAND (SC)** Brown, stained, clayey sand, some gravel, trace cobbles	
			4.1			
			7.0			
		5.0 ---- 5.0	1.6		**SAND (SP)** Brown, poorly graded, very fine to medium grain sand, trace gravel, moist	Soil sample collected at 8'
			3.2		**CLAY (CL)** Brown, silty clay, trace gravel, hard	Slight chemical odor
10	735.11		0.5		**SAND (SC)** Brown, slight black staining, clayey sand, trace gravel	
			4.2			
			0.8		**CLAY (CL)** Brown, silty clay, trace gravel, stiff	
		5.0 ---- 5.0	0.4			
			1.7		**CLAY (CL)** Gray, stained, silty clay, trace gravel, soft	Soil sample collected at 14' Slight chemical odor
15	730.11		0.4		**CLAY (CL)** Same as above	
			1.3			
			0.8			
			1.3		**SILT (ML)** Gray, slightly stained, varved, very clayey silt, soft to medium dense, wet at 18.5' ▼	Soil sample collected at 18'
			0.7			
20	725.11	10.0 ---- 10.0	2.4			
			0.4			
			0.8			
			0.6		**CLAY (CL)** Brown, silty clay, trace gravel, hard	
			0.5		**SILT (ML)** Brown, clayey silt, trace gravel	
25	720.11		0.5			

Boring terminated at 25.0 ft bgs.

CH2MHILL®

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB008	SHEET 1 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 747.05 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056356.02, N 696050.427 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 17.0 ft bgs START : 8/11/14 13:15 END : 8/11/14 13:58 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.1		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.4		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		5.0 ---- 5.0	0.0		**CLAY (CL)** Brown to gray, silty clay, trace gravel, hard, brittle (CAP)	
			5.6			
5	742.05		3.7		**SAND (SM)** Brown, silty sand, little gravel, trace clay, glass, red brick	
			34.0			
			7.2			
		5.0 ---- 5.0	16.5			
			1.2		**SAND (SC)** Red to brown, stained, clayey sand, some gravel, glass	Chemical odor Soil sample collected at 9'
10	737.05		12.0		**CLAY (CL)** Brown, silty clay, little gravel, stiff Stained from 14.'3 to 15'	
			6.0			
			12.0			
		5.0 ---- 5.0	4.8			
			3.4			Soil sample collected at 14'
15	732.05		0.5			
			1.0		**CLAY (CL)** Same as above	
			2.2		**SILT (ML)** Gray, varved, very clayey silt, wet ▼	Soil sample collected at 16'
			5.0			
			3.1			
20	727.05	10.0 ---- 10.0	2.2			
			1.5			
			5.3			
			1.2			
			2.0			
25	722.05		0.9		**SAND (SP)** Stained black, poorly graded, fine to medium grain sand seam, trace	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB008	SHEET 2 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 747.05 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056356.02, N 696050.427 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 17.0 ft bgs START : 8/11/14 13:15 END : 8/11/14 13:58 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					gravel **CLAY (CL)** Brown, silty clay, trace gravel, very stiff Wet, brown, poorly graded, fine to medium grain sand seam from 24.6' to 24.8' Boring terminated at 25.0 ft bgs.	
30	717.05					
35	712.05					
40	707.05					
45	702.05					
50	697.05					

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB009	SHEET 1 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 747.54 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056409.69, N 696051.565 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 17.0 ft bgs START : 8/11/14 14:00 END : 8/11/14 14:40 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.2		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.1		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		5.0	0.1		**CLAY (CL)** Brown, silty clay, trace gravel, hard (CAP)	
		---- 5.0	0.1			
5	742.54		0.0		**CLAY (CL)** Same as above	
			0.6			
			0.3		**SAND (SC)** Brown, stained, clayey sand, trace white granular material, glass, wood fragments	Soil sample collected at 7'
		5.0	0.1			
		---- 5.0	0.1			
10	737.54		3.6		**SAND (SC)** Same as above	
			3.1		**SAND (SM)** Brown, silty sand, trace gravel Stained from 13.8' to 15'	
			6.5			
		5.0	0.9			
		---- 5.0	0.3			Soil sample collected at 14'
15	732.54		3.0		**SAND (SM)** Same as above	
			0.1		**SILT (ML)** Gray, varved, very clayey silt Poorly graded, very fine to medium grain sand seam at 17.5' ▼	Soil sample collected at 16.5'
			0.1			
			1.5			
			13.2			
20	727.54	6.0	2.4			
		---- 10.0	1.4			
			4.2			
			3.5			
			6.0			
25	722.54		1.4		**SAND (SP)** Black, stained, poorly graded, fine to medium grain sand seam, trace	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB009	SHEET 2 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 747.54 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056409.69, N 696051.565 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 17.0 ft bgs START : 8/11/14 14:00 END : 8/11/14 14:40 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					gravel **CLAY (CL)** Brown, silty clay, trace gravel, hard Boring terminated at 25.0 ft bgs.	
30	717.54					
35	712.54					
40	707.54					
45	702.54					
50	697.54					

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB010	SHEET 1 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 747.07 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056461.12, N 696052.293 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 18.0 ft bgs START : 8/11/14 14:50 END : 8/11/14 15:40 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		4.0	0.1		**CLAY (CL)** Brown, silty clay, trace gravel, hard (CAP)	
		---- 5.0	0.0			
5	742.07		3.9		**CLAY (CL)** Same as above	
			9.0			
			4.3		**SAND (SC)** Brown, stained, clayey sand, little gravel, glass	
		5.0	6.7			Soil sample collected at 7.5' Chemical odor
		---- 5.0	12.7			
10	737.07		1.3		**SAND (SC)** Same as above	
			47.0		**CLAY (CL)** Brown, silty clay, trace gravel, stiff White granular material at 14.4'	Soil sample collected at 11'
			7.9			
		5.0	8.2			
		---- 5.0	1.2			
15	732.07		61.0		**SILT (ML)** Light brown, very clayey silt, trace white granular material	Slight chemical odor
			7.0		**SILT (ML)** Same as above	
			3.4		**CLAY (CL)** Brown, stained, silty clay, trace gravel, very stiff	
			4.5		**SILT (ML)** Gray and brown, varved, very clayey silt, moist Wet, very fine silty sand seam at 18' to 18.3' ▼	Soil sample collected at 17'
			3.7			
20	727.07	10.0	5.0			
		---- 10.0	5.2			
			3.7			
			11.0			
			8.0		**SAND (SP)** Stained black, poorly graded, fine to medium grain sand, trace fine to	NTK collected at 24'. No evidence of NAPL
25	722.07		2.0			

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB010	SHEET 2 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 747.07 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056461.12, N 696052.293 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 18.0 ft bgs START : 8/11/14 14:50 END : 8/11/14 15:40 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					coarse gravel **CLAY (CL)** Brown, silty clay, trace gravel, hard Boring terminated at 25.0 ft bgs.	
30	717.07					
35	712.07					
40	707.07					
45	702.07					
50	697.07					

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB011	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 746.24 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056510.74, N 696053.5 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.0 ft bgs START : 8/11/14 15:50 END : 8/11/14 16:30 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.1		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		4.0	0.2		**CLAY (CL)** Brown, silty clay, trace gravel, hard (CAP)	
		---- 5.0	0.5			
5	741.24		8.0		**CLAY (CL)** Same as above	
			16.0			
			6.0			
		5.0	9.0			
		---- 5.0	14.0			
			2.4		**SAND (SC)** Stained, clayey sand, trace gravel, glass	Soil sample collected at 9' Chemical odor
10	736.24		40.0		**SAND (SC)** Same as above	
			50.0			
		5.0	19.0			
		---- 5.0	277			
			7.3		**SILT (ML)** Gray to brown, slightly stained, clayey silt, trace gravel, trace white granular material, moist	Soil sample collected at 14'
15	731.24		13.0		**SILT (ML)** Gray, varved, very clayey silt, wet at 16' Slightly stained from 15' to 17.5' Potential black staining 18' to 19.5'	Soil sample collected at 15.5'
			10.0			
			5.6			
			7.2			NTK collected at 19'. No evidence of NAPL
20	726.24	10.0	31.0		**SAND (SP)** Stained black, poorly graded, fine to medium grain sand, some fine to coarse gravel	
		---- 10.0	24.0			
			12.0		**SAND (SW)** Gray, well graded, fine to coarse grain sand, little gravel More coarse from 23.6' to 24' Stained from 21' to 23'	
			12.6			
			41.0			
25	721.24		6.7		**SAND (SC)** Gray, clayey sand, little gravel	

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB012	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 745.06 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056561.26, N 696055.725 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 20.0 ft bgs START : 8/12/14 08:50 END : 8/12/14 09:30 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		5.0	0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		---- 5.0	0.4			
5	740.06		0.0		**CLAY (CL)** Same as above	
			1.3			
			130		**SAND (SP)** Brown, stained black, poorly graded, fine to medium grain sand, trace gravel	Soil sample collected at 7' Hydrocarbon odor from 7' to 8'
		5.0	145		**SAND (SC)** Brown, stained, clayey sand, trace gravel	
		---- 5.0	14.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard	
10	735.06		2.0		**SAND (SC)** Brown, stained, clayey sand, little gravel, glass	
			2.4		**SAND (SC)** Same as above - with brick	
			0.7		**SAND (SP)** Brown, slightly stained, poorly graded, very fine to medium sand, trace gravel	
		5.0	17.3			
		---- 5.0	3.2			
15	730.06		24.0		**SAND (SM)** Stained black, silty sand, trace wood fragments, glass	Soil sample collected at 15' Hydrocarbon odor from 15' to 22'
			4.2		**SAND (SM)** Same as above	
			4.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel, moist Stained from 20' to 20.5'	
			4.1			
			21.0			Soil sample collected at 19'
20	725.06	10.0	103		▼	
		---- 10.0	32.0		**SAND (SW)** Brown, stained, well graded, medium to coarse grain sand, some gravel, wet	
			6.2		**SAND AND GRAVEL (GW)** Brown, stained, sand and fine gravel	
			3.5		**SAND (SP)** Light brown, poorly graded, fine to medium grain sand, trace gravel	
			1.2		**CLAY (CL)** Brown, silty clay, trace gravel	
25	720.06		0.6			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB013	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 743.69 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056609.47, N 696057.112 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 20.0 ft bgs START : 8/12/14 09:35 END : 8/12/14 10:15 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.2		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.2		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		4.5 ---- 5.0	1.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
			1.5			
5	738.69		0.0			
			0.0		**CLAY (CL)** Same as above	
			0.8			
		5.0 ---- 5.0	0.9			
			13.5		**SAND (SC)** Stained, clayey sand, trace gravel, trace white granular material	Soil sample collected at 9' Chemical odor
10	733.69		18.5		**SAND (SC)** Same as above - wood fragments and glass Stained from 12.5' to 13'	
			43.0			
			11.0			
		5.0 ---- 5.0	2.5			
			73.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel Brown clay lens with trace gravel from 13.7' to 13.8' Stained black, silty sand from 14.5' to 15'	Soil sample collected at 14'
15	728.69		21.0			
			6.0		**SAND (SM)** Stained black, silty sand, trace gravel	
			0.8		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel, moist	
			10.0			
			2.7			Soil sample collected at 19'
20	723.69	10.0 ---- 10.0	0.8		▼	
			0.8		**SAND (SW)** Gray, well graded, fine to coarse grain sand, trace gravel, wet	
			1.8			
					CLAY (CL) Gray to brown, silty clay, trace gravel, very stiff to hard	
			0.1			
25	718.69		0.1			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB014	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 742.37 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056660.41, N 696058.839 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.5 ft bgs START : 8/12/14 10:20 END : 8/12/14 11:00 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, little gravel	
		4.5 ---- 5.0	0.8		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
			0.2			
5	737.37		4.1		**CLAY (CL)** Same as above	
			20.0		**SAND (SP)** Brown, stained, poorly graded, fine to medium grain sand, trace fine to coarse gravel, trace clay	Slight hydrocarbon odor Soil sample collected at 6.5'
		5.0 ---- 5.0	54.0			
			4.7			
			2.1		**CLAY (CL)** Brown, slightly stained, silty clay, trace gravel, wood fragments	
10	732.37		3.5		**CLAY (CL)** Same as above	
			11.5		**SAND (SC)** Brown, stained, clayey sand, little gravel, trace white granular material	
			15.0			
		5.0 ---- 5.0	42.0			
			69.0		**SAND (SM)** Dark brown, stained, silty sand, trace gravel	Slight hydrocarbon odor Soil sample collected at 14'
15	727.37		1.7		**SAND (SP)** Light brown, poorly graded, fine to medium grain sand, trace gravel	
			1.9		**SAND (SP)** Same as above - wet at 16.5' Little coarse sand from 16' to 17.2' ▼	Soil sample collected at 16'
			1.0			
			0.6		**SAND (SW)** Gray to brown, well graded, medium to coarse grain sand, some gravel, wet	
			1.3			
20	722.37	10.0 ---- 10.0	0.4		**CLAY (CL)** Brown, sandy clay, trace gravel, very stiff Wet, poorly graded, very fine sand seam from 20.2' to 20.6'	
			0.3		**CLAY (CL)** Gray to brown, silty clay, trace gravel, hard	
			0.2			
			0.2			
			0.3			
25	717.37		0.1			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB015	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 741.13 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056711.24, N 696060.639 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.0 ft bgs START : 8/12/14 11:10 END : 8/12/14 11:45 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.1		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.1		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		4.5 ---- 5.0	0.1		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
			0.1			
5	736.13		0.1			
			0.2		**CLAY (CL)** Same as above	
			43.0		**SAND (SP)** Brown, stained, poorly graded, fine to medium grain sand, some clay, some gravel	Soil sample collected at 7' Slight hydrocarbon odor
		5.0 ---- 5.0	3.1		**CLAY (CL)** Brown, stained, sandy clay, little gravel	
			1.6		**SAND (SP)** Light brown, poorly graded, fine to medium grain sand, some coarse grain sand, some gravel	
10	731.13		7.7			
			0.2		**SAND (SP)** Same as above - moist	
			0.2			
		5.0 ---- 5.0	0.1		**SAND (SC)** Brown, clayey sand, some gravel	Soil sample collected at 13'
			0.1		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel, moist	
15	726.13		0.9		**SAND (SP)** Same as above - some slight staining, wet at 16'	Soil sample collected at 15'
			0.2			
			0.2			
			0.1		**SAND AND GRAVEL (GW)** Brown, medium to coarse sand and gravel	
			0.0		**CLAY (CL)** Gray, silty clay, trace gravel, hard	
20	721.13	10.0 ---- 10.0	0.0			
			0.0			
			0.0			
			0.0			
			0.0			
25	716.13		0.0			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB016	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 739.54 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056759.14, N 696062.355 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 14.5 ft bgs START : 8/12/14 12:55 END : 8/12/14 13:50 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		5.0	0.1		**CLAY (CL)** Brown, silty clay, trace gravel, hard (CAP)	
		---- 5.0	0.1			
5	734.54		0.0		**CLAY (CL)** Same as above	
			0.0			
			0.2			
		5.0	0.3			
		---- 5.0	5.2		**SAND (SC)** Brown, stained, clayey sand, trace gravel	Soil sample collected at 9' Hydrocarbon odor
10	729.54		2.6		**SAND (SP)** Brown, stained, poorly graded, very fine to medium grain sand, trace gravel	Soil sample collected at 10'
			18.0		**SAND (SP)** Same as above - light brown, no staining from 12' to 14'	
			12.0			
		5.0	2.3			Soil sample collected at 13'
		---- 5.0	0.4			
15	724.54		1.1		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, little coarse sand, wet ▼ at 14.5'	
			0.0		**SAND (SW)** Brown, well graded, fine to coarse grain sand, some gravel, wet	
			0.0		**CLAY (CL)** Gray to brown, silty clay, trace gravel Silt seam 16.4 to 16.7' Medium to coarse grain sand seam, some gravel from 22.5' to 22.8'	
			0.0			
			0.0			
20	719.54	10.0	0.0			
		---- 10.0	0.0			
			0.0			
			0.0			
			0.0			
25	714.54		0.0			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB017	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 738.18 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056805.55, N 696063.831 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 12.5 ft bgs START : 8/12/14 14:07 END : 8/12/14 13:10 LOGGER : S. Chumney

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SANDY ORGANIC SOIL (OL)** Brown, silty clayey topsoil, little fine sand, moist (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel, moist	
			0.0		**SILT (ML)** Grayish brown, clayey silt, trace sand, trace gravel, stiff, slightly moist (CAP)	
			0.0			
5	733.18		0.0		**SILT (ML)** Same as above	
			0.9		**SAND (SP)** Light grayish brown, poorly graded, trace gravel, medium dense, moist	
			5.5		**SILT (ML)** Brownish gray, silt, little sand, little gravel, dense, dry to slightly moist	Soil sample collected at 7'
			26.0		**SILT (ML)** Dark brown to black, potential staining, clayey silt, medium dense	Hard drilling
10	728.18					Soil sample collected at 10'
			48.0			
			33.0			
			3.0		**SAND (SP)** Light brown and gray, poorly graded, sand, some fine gravel, wet	Soil sample collected at 12.5'
			5.0			
15	723.18		0.2		**CLAY (CL)** Clay	
			0.0			
			0.0			
			0.0			
			0.0			
20	718.18		0.0			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB018	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 736.43 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056833.73, N 696116.989 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 11.0 ft bgs START : 8/13/14 09:15 END : 8/13/14 09:50 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.1		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
					SAND (SP) Brown, poorly graded, fine to medium grain sand, trace gravel	
			0.1		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		5.0 ---- 5.0	0.0			
			0.1			
5	731.43		28.0		**CLAY (CL)** Same as above	
			8.7			
			7.0		**SAND (SM)** Brown, stained, silty sand, little clay, little gravel	Soil sample collected at 7'
		5.0 ---- 5.0	4.8			Soil sample collected at 8'
			0.5		**SAND (SP)** Light brown, poorly graded, fine to medium grain sand, trace gravel, trace cobbles Stained from 8.3' to 8.6'	
10	726.43		0.3			
					SAND (SP) Same as above - wet at 11'	Soil sample collected at 10'
			0.2		▼	
			0.1			
					SAND (SW) Brown, well graded, fine to coarse grain sand, little gravel	
		5.0 ---- 5.0	0.2			
					CLAY (CL) Gray, silty clay, trace gravel, stiff	
			0.0			
15	721.43		0.0			

Boring terminated at 15.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB019	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 739.51 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056737.44, N 696120.37 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.0 ft bgs START : 8/13/14 10:10 END : 8/13/14 10:50 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		5.0 ---- 5.0	0.1		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
			0.8			
5	734.51		0.0		**CLAY (CL)** Same as above	
			0.2			
			34.0		**SAND (SM)** Brown, stained, silty sand, little to some clay, some gravel	Soil sample collected at 6.5' Chemical odor
		5.0 ---- 5.0	0.8		**CLAY (CL)** Brown, slightly stained, silty clay, trace gravel, hard	
			0.8		**SAND (SC)** Brown, stained, clayey sand, little gravel, glass	
10	729.51		2.3		**SAND (SC)** Same as above	
			2.2			
			2.9			Soil sample collected at 12'
		5.0 ---- 5.0	1.2		**SAND (SP)** Light brown, poorly graded, fine to medium grain sand, trace gravel, moist	
			2.7			
15	724.51		3.0			
			7.0		**SAND (SP)** Same as above - stained gray from 16' to 17.5' Wet at 16' ▼	Soil sample collected at 15'
			77.0			
		5.0 ---- 5.0	187		**SAND (SW)** Gray, stained, well graded, medium to coarse grain sand, some gravel	
			3.4		**CLAY (CL)** Brown, silty clay, trace gravel, hard Brown, medium to coarse grain sand seam, some gravel from 19.4' to 19.8'	NTK collected at 18.5'. Evidence of NAPL
20	719.51		0.7			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB020	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 742.38 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056640, N 696119.604 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 18.0 ft bgs START : 8/13/14 10:55 END : 8/13/14 11:25 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.6		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.1		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, little gravel **CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		5.0 ---- 5.0	0.0			
			7.1			
5	737.38		0.3		**CLAY (CL)** Brown, stained, silty clay, little gravel, firm	
			0.1			
			0.3			Soil sample collected at 7'
		5.0 ---- 5.0	9.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard	
			18.0			
10	732.38		0.3		**SAND (SC)** Stained black, clayey sand, little gravel, trace white granular material, metal debris	
			0.7		**SAND (SC)** Same as above	
			0.8			
		5.0 ---- 5.0	23.0			Soil sample collected at 12.5'
			10.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel, moist	
15	727.38		3.7		**CLAY (CL)** Stained black, silty clay, trace gravel, firm	
			0.5		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel Stained from 16.5' to 18', moist	
			6.1			Soil sample collected at 17'
		5.0 ---- 5.0	18.0		▼	
			0.9		**SAND (SW)** Gray to brown, stained, well graded, fine to coarse grain sand, some gravel, wet More coarse with depth	
20	722.38		8.0			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB021	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 741.98 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056645.79, N 696141.725 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 17.5 ft bgs START : 8/13/14 11:35 END : 8/13/14 12:10 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel **CLAY (CL)** Brown, silty clay, trace gravel, very stiff (CAP)	
		5.0 ---- 5.0	0.1			
			3.2			
5	736.98		2.4		**CLAY (CL)** Stained black, silty clay, trace gravel, stiff Not stained and hard from 7' to 7.5'	
			0.8			Soil sample collected at 6'
			0.9			
		5.0 ---- 5.0	0.5		**SAND (SC)** Stained black, clayey sand, some gravel, glass	Chemical odor
			1.0			
10	731.98		0.5		**CLAY (CL)** Gray, stained, silty clay, trace gravel, medium dense	
			0.7		**SAND (SC)** Brown, stained, clayey sand, some gravel, glass	
			6.2			
		5.0 ---- 5.0	6.1		**SAND (SP)** Brown, stained, poorly graded, fine to medium grain sand, trace gravel, moist	Soil sample collected at 13'
			1.2			
15	726.98		2.1		**SAND (SP)** Same as above - not stained, moist	
			0.2			
			0.1			Soil sample collected at 17' Hydrocarbon odor
		5.0 ---- 5.0	1.5		**SAND (SW)** Stained black, well graded, fine to coarse grain sand, little gravel, wet	
			2.3			
20	721.98		1.2			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB022	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 744.87 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056564.67, N 696104.777 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 19.5 ft bgs START : 8/13/14 13:25 END : 8/13/14 14:00 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
		5.0			**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		----	0.0			
		5.0				
			0.1			
5	739.87		1.0			
					CLAY (CL) Same as above	
			0.6			
			1.5			
		5.0				
		----	2.8			
		5.0			**SAND (SC)** Brown, stained, clayey sand, some gravel, metal and plastic debris, glass	
			1.9			Soil sample collected at 8.5'
10	734.87		8.8		**SAND (SC)** Same as above	
			4.6			
			1.6		**CLAY (CL)** Light brown, silty clay, trace gravel, pasty white material, stiff	
		5.0			**SAND (SP)** Light brown, poorly graded, fine to medium grain sand, trace gravel Stained dark brown from 13' to 15'	
		----	6.6			
		5.0				
			1.3			Soil sample collected at 14'
15	729.87		3.0		**SAND (SM)** Brown, stained, silty sand, trace organics, moist	
			3.0			
			13.2			
		5.0			**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel, wet at 19.5'	
		----	4.5			
		5.0				
			4.7			Soil sample collected at 19'
20	724.87		8.1			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB023	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 746.33 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056514.31, N 696103.808 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.0 ft bgs START : 8/13/14 14:10 END : 8/13/14 15:00 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.4		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.1		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, little gravel	
		5.0			**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		----	0.0			
		5.0				
			1.2			
5	741.33		9.5		**SAND (SC)** Brown, stained, clayey sand, glass, little gravel	Soil sample collected at 5'
					SAND (SC) Same as above	
			5.9			
			0.6		**SILT (ML)** Brown, stained, clayey silt, little gravel, wires, glass	
		5.0				
		----	1.1			
		5.0				
			8.1		**SILT (ML)** Light brown, slightly stained, silt	
10	736.33		4.3		**SAND (SP)** Brown, stained, poorly graded, fine to medium grain sand, some gravel, little clay, little white granular material	Hydrocarbon odor
			65.0			
			62.0			
		5.0				
		----	240			Soil sample collected at 13'
		5.0				
			178			
					SAND (SC) Brown, stained, clayey sand, little gravel	
15	731.33		65.0		**SILT (ML)** White, clayey silt material, trace gravel	Soil sample collected at 15' NTK collected at 15'. No evidence of NAPL
			14.0		**SILT (ML)** Gray, slightly stained, varved, clayey silt, slightly wet to wet Water table potentially between 16' and 18' ▼	
			5.0			Potentially mobile NAPL at 17'
		5.0				
		----	2.1			
		5.0				
			3.0			NTK collected at 20'. No evidence of NAPL
20	726.33		4.4			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB024	SHEET 1 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 748.06 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056464.33, N 696102.327 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 19.0 ft bgs START : 8/13/14 15:05 END : 8/13/14 15:55 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.1		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
		5.0 ---- 5.0	0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
			0.4			
5	743.06		0.7		**CLAY (CL)** Same as above	
			0.4			
			0.1			
		5.0 ---- 5.0	1.1			
			1.5		**SAND (SP)** Brown, stained, poorly graded, fine to medium grain sand, some clay, trace gravel, glass	Soil sample collected at 9'
10	738.06		0.2		**CLAY (CL)** Brown, silty clay, trace gravel, hard	
			0.9		**CLAY (CL)** Same as above - stiff	
			4.7			
		5.0 ---- 5.0	4.3			
			67.5		**SAND (SC)** Brown, stained, clayey sand, little gravel, trace white granular material	Soil sample collected at 14' Slight chemical odor
15	733.06		54.3		**SAND (SC)** Same as above	
			13.0		**WHITE GRANULAR MATERIAL** White granular material, trace gravel	
			1.5		**SILT (ML)** Gray, slightly stained, varved, clayey silt, wet at 19' Silt seam from 17.5' to 17.9'	
		5.0 ---- 5.0	1.8			
			6.4		▼	Soil sample collected at 18.5'
20	728.06		4.3		**SILT (ML)** Same as above	
			1.1			
			7.0			
		5.0 ---- 5.0	0.8			
			1.3			
25	723.06		1.1			

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB024	SHEET 2 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 748.06 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056464.33, N 696102.327 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 19.0 ft bgs START : 8/13/14 15:05 END : 8/13/14 15:55 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					SAND AND GRAVEL (GW) Stained black, sand and gravel, wet Boring terminated at 25.0 ft bgs.	
30	718.06					
35	713.06					
40	708.06					
45	703.06					
50	698.06					

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB025	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 749.84 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056412.64, N 696100.745 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 20.0 ft bgs START : 8/13/14 16:05 END : 8/13/14 16:45 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		5.0	0.4		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		---- 5.0	0.1			
5	744.84		0.4			
			0.3		**CLAY (CL)** Same as above	
			8.0		**SAND (SC)** Brown, stained black, clayey sand, some gravel, glass, wood fragments	Hydrocarbon odor Soil sample collected at 7'
		5.0	3.2			
		---- 5.0	1.4		**CLAY (CL)** Brown, slightly stained, silty clay, trace gravel	
			0.5		**SILT (ML)** Brown, sandy silt, trace clay, little gravel, glass	Slight chemical odor
10	739.84		0.7		**CLAY (CL)** Brown, slightly stained, silty clay, trace gravel, hard	
			0.6		**SAND (SC)** Brown, stained, clayey sand, trace gravel, glass	Soil sample collected at 11'
		5.0	2.7		**CLAY (CL)** Brown, silty clay, trace gravel, hard	
		---- 5.0	4.3			
15	734.84		3.4			
			1.6		**CLAY (CL)** Same as above	
			2.9			
		5.0	6.1		**WHITE GRANULAR MATERIAL** White granular material	
		---- 5.0	6.0		**SAND (SM)** Brown, silty sand, trace gravel, trace organics	
			6.0		**SILT (ML)** Light brown, stained, silt, some clay, trace gravel	Soil sample collected at 19'
20	729.84		6.3		**SAND (SP)** Gray, poorly sorted, fine to medium grain sand	
			7.5		**SILT (ML)** Gray, varved, clayey silt, moist	
			18.0		**SILT (ML)** Same as above - wet at 20' Stained black, sandy silt seam from 21.2' to 21.3'	
			3.4		**CLAY (CL)** Gray to brown, silty clay, trace gravel, hard	
25	724.84	10.0	7.4			
		---- 10.0	2.8			
			1.4			
			1.9			
			0.8			
30	719.84		0.4			

Boring terminated at 30.0 ft bgs.

CH2MHILL®

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB026	SHEET 1 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 751.42 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056360.78, N 696099.201 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 23.0 ft bgs START : 8/14/14 08:35 END : 8/14/14 09:25 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		5.0 ---- 5.0	0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
			0.0			
5	746.42		0.4			
			1.0		**CLAY (CL)** Same as above	
			1.8		**SAND (SC)** Brown, slightly stained, clayey sand, little gravel, glass	Slight chemical odor Soil sample collected at 6.5'
		5.0 ---- 5.0	5.4			
			2.0			
10	741.42		2.3		**CONCRETE** Crushed concrete	
			4.3		**SAND (CL)** Brown, stained, sandy to silty clay, little gravel, glass	Slight chemical odor from 10' to 20'
			6.0			
			1.4			
			2.0			Soil sample collected at 14'
15	736.42	10.0 ---- 10.0	1.5			
			3.7			
			1.6			
			0.6			
			0.3			
20	731.42		0.4			
			4.1		**SAND (SP)** Brown, stained, poorly graded, fine to medium grain sand, trace gravel, moist	
			0.7		**CLAY (CL)** Brown, stained, silty clay, medium dense, trace gravel	Soil sample collected at 22'
			1.9		**SILT (ML)** Gray, varved, clayey silt, wet at 23'	
			18.0		Stained black, silty sand seam from 29.1' to 29.2'	
25	726.42	10.0 ---- 10.0	3.8			
			1.7			
			0.8			
			0.6			
			1.4			
30	721.42		0.2		**CLAY (CL)**	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB026	SHEET 2 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 751.42 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056360.78, N 696099.201 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 23.0 ft bgs START : 8/14/14 08:35 END : 8/14/14 09:25 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					Brown, silty clay, trace gravel, hard Boring terminated at 30.0 ft bgs.	
35	716.42					
40	711.42					
45	706.42					
50	701.42					
55	696.42					
60	691.42					

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB027	SHEET 1 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 748.28 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056308.01, N 696110.453 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 20.0 ft bgs START : 8/14/14 09:30 END : 8/14/14 10:10 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			13.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			6.1		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, little gravel	
		5.0	2.6		**CLAY (CL)** Brown to gray, silty clay, trace gravel, hard, brittle (CAP)	

		5.0	0.8			
5	743.28		0.3			
			5.0		**CLAY (CL)** Same as above	
					SAND (SP) Brown, slightly stained, poorly graded, fine to medium grain sand, some clay, trace gravel	Soil sample collected at 6'
			22.0			
		5.0	0.1			

		5.0	0.8		**SAND (SC)** Brown, stained, clayey sand, little gravel, glass	
10	738.28		0.0			
			1.8		**SAND (SC)** Same as above - trace cobbles	Slight chemical odor Soil sample collected at 11'
			16.4		**CLAY (CL)** Brown, slightly stained, silty clay, trace gravel, very stiff	
		5.0	16.2			

		5.0	3.2			
15	733.28		0.2			
			5.5		**CLAY (CL)** Same as above - stained at 18'	
			10.0			
			0.7			Soil sample collected at 18'
			0.3			
20	728.28	7.0	0.1		**SILT (ML)** Brown to gray, varved, clayey silt, wet at 20' ▼	

		10.0	1.1			
			2.5			Soil fell out of core barrel and not recovered from 22' to 25'

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB027	SHEET 2 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 748.28 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056308.01, N 696110.453 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 20.0 ft bgs START : 8/14/14 09:30 END : 8/14/14 10:10 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
25	723.28				Boring terminated at 25.0 ft bgs.	
30	718.28					
35	713.28					
40	708.28					
45	703.28					

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB028	SHEET 1 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 744.27 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056264.08, N 696115.538 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.5 ft bgs START : 8/14/14 10:15 END : 8/14/14 11:00 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			1.4		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		5.0			**CLAY (CL)** Brown to gray, silty clay, trace gravel, hard, brittle (CAP)	
		----	1.3			
		5.0				
			0.3			
5	739.27		18.0		**SAND (SC)** Dark brown, stained, clayey sand, little gravel, glass	Chemical odor
			4.1			Soil sample collected at 5.5'
			4.6		**SAND (SC)** Brown, slightly stained, silty clay	
		5.0				
		----	1.3			
		5.0				
			2.2			
10	734.27		4.0		**SAND (SM)** Same as above	
			4.0			
			5.7			
			2.1			Soil sample collected at 13'
			16.0		**SAND (SM)** Brown, stained, silty sand, some clay, trace gravel, moist	
15	729.27	7.0	3.1		**SILT (ML)** Gray, slightly stained, varved, clayey silt Gray silt seam from 15.8' to 16'	
		----	28.0			Soil sample collected at 16'
		10.0			▼	
			18.7			
						Soil fell out of core barrel and not recovered from 17.5' to 20'
20	724.27					

CH2MHILL®

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB028	SHEET 2 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 744.27 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056264.08, N 696115.538 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.5 ft bgs START : 8/14/14 10:15 END : 8/14/14 11:00 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					Boring terminated at 20.0 ft bgs.	
25	719.27					
30	714.27					
35	709.27					
40	704.27					

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB029	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 749.37 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056312.53, N 696145.009 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 18.0 ft bgs START : 8/14/14 11:05 END : 8/14/14 12:00 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, little gravel	
		5.0	0.2		**CLAY (CL)** Brown to gray, silty clay, trace gravel, hard, brittle (CAP)	
		---- 5.0	0.2			
5	744.37		1.4		**CLAY (CL)** Same as above	
			14.0			
			36.0		**SAND (SM)** Brown, slightly stained, silty sand, some clay, little gravel	Strong chemical odor
		5.0	91.0			
		---- 5.0	101		**SAND (SC)** Brown, stained, clayey sand, little gravel, glass	Soil sample collected at 9'
10	739.37		27.0		**CLAY (CL)** Brown, slightly stained, silty clay, trace gravel, very stiff to hard Stained black from 10' to 12'	Slight chemical odor
			98.0			Soil sample collected at 11'
			17.0			
		5.0	3.8			
		---- 5.0	1.6			
15	734.37		18.0		**CLAY (CL)** Same as above	
			11.0		**SAND (SM)** Brown, stained, silty sand, some clay, little fine to coarse gravel	
			0.9		**SAND (SM)** White to gray, silty sand, some clay, trace gravel, moist ▼	Soil sample collected at 17.5'
			0.8		**SILT (ML)** Gray, potential staining, varved, clayey silt, wet at 18' White to gray silt seam from 21.6' to 21.7' Brown, silty sand seam, trace gravel from 22.5' to 22.7' Gray silt seam from 23.2' to 23.4'	
			2.1			
20	729.37	10.0	6.3			
		---- 10.0	11.0			
			35.0			
			4.2			
			6.4			
25	724.37		14.6			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB030	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 753.11 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056371.33, N 696148.002 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : NA START : 8/14/14 13:00 END : 8/14/14 14:00 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.1		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	Hard refusal at 8' bgs. Stepped off 10' to the east
		5.0 ---- 5.0	0.3			
			0.0			
5	748.11		0.0		**SILT (ML)** Light grayish brown, clayey silt, little to some fine sand, trace gravel, hard, brittle	
			2.4			
			2.6		Brown silt at tip of core	
		4.0 ---- 5.0	1.6			
			0.4			
10	743.11				**SILT (ML)** Brown and gray, clayey silt, some fine sand, trace gravel, trace crushed brick, moist	Soil sample collected at 10' PID readings ranged from 2 ppm to 16 ppm from 10' to 20'
15	738.11	5.0 ---- 10.0				Soil sample collected at 15'
20	733.11				**SILT (ML)** Same as above - moist Dry silty sand at what about be assumed to be 28' BGS Gray, fine sand in tip of core	PID readings ranged from 2 ppm to 6 ppm from 20' to 30'
25	728.11	4.5 ---- 10.0				Soil sample collected at 25' Groundwater not encountered Material below 10' - high uncertainty of depth origin for samples collected from middle of recovered core intervals with exception of sample collected at 10'
30	723.11					

Boring terminated at 30.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB031	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 751.64 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056409.64, N 696147.294 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 24.0 ft bgs START : 8/14/14 14:15 END : 8/14/14 15:00 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		5.0	0.1			

		5.0	0.1			
5	746.64		0.2		**CLAY (CL)** Same as above	
			0.9			
			0.1			
		5.0	0.0			

		5.0	11.3		**SAND (SM)** Brown, stained, silty sand, little gravel, some clay, glass	Chemical odor Soil sample collected at 8.5'
10	741.64		1.7		**CLAY (CL)** Brown, slightly stained, silty clay, trace gravel, brick	Chemical odor
			5.6		**CLAY (CL)** Same as above	
			3.0		**SAND (SC)** Brown, stained, clayey sand, little gravel, glass	
		5.0	0.4			

		5.0	0.7			
15	736.64		39.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard	
			12.0		**CLAY (CL)** Same as above - stained, trace cobbles, glass, moist at 18'	
			2.1			
		5.0	1.0			Soil sample collected at 17.5'

		5.0	1.0			
20	731.64		1.1			
			1.4		**SILT (ML)** Gray to brown, potential staining, varved, clayey silt, wet at 24' Silt seam from 23.6' to 23.8' Silt seam from 27' to 27.1'	
			14.0			Chemical odor
			28.0			
			10.0		▼	Soil sample collected at 23'
25	726.64	10.0	4.7			

		10.0	0.8			
			1.0			
			1.2			
			1.5			
30	721.64		1.2			

Boring terminated at 30.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB032	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 748.77 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056463.21, N 696149.649 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 17.5 ft bgs START : 8/14/14 15:05 END : 8/14/14 16:00 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.1		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		5.0 ---- 5.0	0.2			
			0.0			
5	743.77		0.2		**CLAY (CL)** Same as above	
			12.0		**CLAY (CL)** Brown, stained, silty clay, little gravel, stiff, glass	
			2.0			Soil sample collected at 7'
		5.0 ---- 5.0	0.9			
			2.8		**CLAY (CL)** Light brown, silty clay, trace gravel, hard	
10	738.77		2.3		**CLAY (CL)** Same as above	
			6.8			
			1.3		**WOOD** Stained black wood	Chemical odor
		5.0 ---- 5.0	82.0		**SAND (SC)** Brown, stained, clayey sand, some gravel, trace white granular material, glass, metal debris	
			169			Soil sample collected at 14'
15	733.77		39.0		**CLAY (CL)** Brown, stained, silty clay, hard, brittle, glass	Chemical odor
			30.0		**SAND (SC)** Brown, stained, clayey sand	
			93.0		**SAND (SM)** Brown, slightly stained, silty sand, some clay, little gravel, wood fragments	
		5.0 ---- 5.0	6.0		**SILT (ML)** Gray to brown, potential staining, varved, clayey silt, wet at 17.5' ▼ Silt seam from 19.7' to 19.9'	Soil sample collected at 17'
			13.0			
20	728.77		11.0			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB033	SHEET 1 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 746.44 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056515.06, N 696154.059 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 17.0 ft bgs START : 8/15/14 09:00 END : 8/15/14 09:50 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, little gravel	
			0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		4.0 ---- 5.0	0.0			
			0.0			
5	741.44		0.0		**CLAY (CL)** Same as above	
			0.0			
			0.0			
		5.0 ---- 5.0	0.5			
			2.4		**SAND (SC)** Brown, stained, clayey sand, little gravel, brick	Slight chemical odor Soil sample collected at 8.5'
10	736.44		0.5		**SILT (ML)** Gray, slightly stained, silt	
			0.8		**CLAY (CL)** Brown, stained, sandy clay, little gravel, trace organics	
			1.1			
			2.8			Soil sample collected at 13'
		7.0 ---- 7.0	0.4		**CLAY (CL)** Gray, silty to sandy clay, little gravel, soft to medium dense	
15	731.44		3.6			
			2.7		**SILT (ML)** Gray, silt, some clay, trace gravel	Hydrocarbon odor
			5.5		**SILT (ML)** Brown, clayey silt Stained from 16.5' to 17.5', varved	Soil sample collected at 16.5'
			13.2		**SILT (ML)** Same as above - wet at 17', potential staining	
			4.3			
20	726.44		1.9			
		8.0 ---- 8.0	3.6			
			2.9			
			2.6			
			1.4			
25	721.44		0.4		**CLAY (CL)**	1/4" metal place recovered from drill bill following end of boring at 25'

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB033	SHEET 2 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 746.44 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056515.06, N 696154.059 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 17.0 ft bgs START : 8/15/14 09:00 END : 8/15/14 09:50 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					Brown, stained mostly black, silty clay, trace gravel, stiff Boring terminated at 25.0 ft bgs.	
30	716.44					
35	711.44					
40	706.44					
45	701.44					
50	696.44					

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB034	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 744.80 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056563.68, N 696154.007 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.0 ft bgs START : 8/15/14 10:00 END : 8/15/14 10:45 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
		5.0	0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		---- 5.0	0.0			
5	739.80		0.0		**CLAY (CL)** Same as above	
			1.8			
			6.9		**SAND (SC)** Brown, stained, clayey sand, little gravel, brick, and brick,	Slight chemical odor
		5.0	1.6			Soil sample collected at 8'
		---- 5.0	3.2			
10	734.80		9.2		**CLAY (CL)** Gray to brown, slightly stained, sandy to silty clay, trace gravel, medium dense	Hydrocarbon odor
			1.5			Soil sample collected at 11'
			1.8			
		5.0	0.3		**SILT (ML)** Gray, silt, some white granular material, little clay, trace gravel	
		---- 5.0	0.7		**SILT (ML)** Gray and brown, varved, clayey silt Stained from 14.5' to 15'	
15	729.80		1.6		**SILT (ML)** Same as above - trace cobbles	Soil sample collected at 15'
			1.8		▼	
			5.0		**SAND (SP)** Brown, poorly graded, medium sand, some coarse sand, some gravel, wet Stained black from 17' to 21' Stained black sand and gravel seam 19' to 19.5'	Hydrocarbon odor
			3.0			
			2.1			
20	724.80	10.0	1.8			NTK collected at 20'. No evidence of NAPL
		---- 10.0	2.4			
			0.0		**CLAY (CL)** Brown, silty clay, trace gravel, very stiff to hard	
			0.3			
			0.2			
25	719.80		0.7			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB035	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 742.96 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056616.48, N 696156.824 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 18.0 ft bgs START : 8/15/14 10:50 END : 8/15/14 11:35 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA ()	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					SAND (SM) Brown, silty sand, trace gravel, organics (TOP SOIL)	
					SAND (SP) Brown, poorly graded, fine to medium grain sand, some gravel	
		5.0 ---- 5.0			**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
5	737.96				**CLAY (CL)** Same as above	
		5.0 ---- 5.0			**SAND (SM)** Brown, stained, silty sand, some gravel, little clay, glass Stained black from 9' to 10'	Chemical odor Soil sample collected at 7.5'
10	732.96				**CLAY (CL)** Brown to gray, slightly stained, sandy clay, trace gravel	
		6.0 ---- 6.0			**SAND (SM)** Brown, very fine silty sand, little gravel, wood fragments, glass Stained black from 12' to 13'	
15	727.96				**CLAY (CL)** Stained black, silty clay, trace gravel, stiff, moist at 16'	Hydrocarbon odor
					CLAY (CL) Same as above	Soil sample collected at 16'
		4.0 ---- 4.0			**SAND (SP)** Brown, stained, poorly graded, fine to medium grain sand, trace gravel, wet at 18' More coarse with depth Stained black from 18' to 20'	Soil sample collected at 17' Hydrocarbon odor NTK collected at 19'. No evidence of NAPL
20	722.96					

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB036	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 741.46 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056667.51, N 696216.36 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.0 ft bgs START : 8/15/14 11:45 END : 8/15/14 12:40 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, little gravel	
		5.0	0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		---- 5.0	0.0			
5	736.46		0.7		**SAND (SP)** Brown, stained, poorly graded	Soil sample collected at 5' Hydrocarbon odor
			0.0		**CLAY (CL)** Brown, silty clay, little gravel, hard Stained from 5.5' to 8' Slightly stained from 8' to 9'	
		5.0	6.3			
		---- 5.0	5.7			
			8.0		**SAND (SM)** Brown, stained, silty sand, little clay, little gravel, trace white granular material, brick, glass	Chemical odor
10	731.46		3.8		**SAND (SP)** Dark brown, stained, poorly graded, fine to medium grain sand, some clay, trace gravel, wet	
			1.2			
			23.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace coarse sand, little gravel, moist Stained dark brown from 13' to 13.5'	
		5.0	14.0			Soil sample collected at 13'
		---- 5.0	14.8			
15	726.46		350		**CLAY (CL)** Brown, stained, sandy clay, trace gravel, stiff, moist	
			80.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel, wet Stained black from 16.5' to 19' Medium to coarse grain sand, some gravel seam from 18.5' to 19'	Soil sample collected at 15' Hydrocarbon odor
			336			
		5.0	275			NTK collected at 18'. Evidence of NAPL
		---- 5.0	333			
20	721.46				**CLAY (CL)** Brown, silty clay, trace gravel, hard	NTK collected at 19'. Evidence of NAPL

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB037	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 743.28 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056616.33, N 696205.204 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 18.0 ft bgs START : 8/18/14 14:05 END : 8/18/14 14:55 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
		4.0	0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		---- 5.0	0.1			
5	738.28		0.4		**SAND (SP)** Brown, slightly stained, poorly graded, fine to medium grain sand, some clay, trace gravel, moist	
			0.4			
			0.0			Soil sample collected at 6.5'
		5.0	0.0		**CLAY (CL)** Brown to gray, slightly stained, sandy to silty clay, trace gravel	
		---- 5.0	3.0			
			49.4		**SILT (ML)** Brown, sandy silt, some clay, trace gravel	
10	733.28				**SAND (SC)** Brown, stained, clayey sand, little gravel	Chemical odor
			0.2		**SAND (SP)** Brown to gray, poorly graded, fine to medium grain sand, some clay, trace gravel	
			9.3		**CLAY (CL)** Brown, silty clay, trace gravel, stiff	
		5.0	27.5		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel, little clay, little silt, wood fragments	
		---- 5.0	104		Stained black from 13.5' to 15'	Soil sample collected at 14'
15	728.28		76.3		**CLAY (CL)** Brown, silty clay, trace gravel, hard	
			0.8			
			8.9		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel, wet at 18' ▼ Black oil and grease from 17' to 17.2' Slightly stained from 17.2' to 17.7' Stained black from 18' to 20'	Strong hydrocarbon odor NTK collected at 17'. No evidence of NAPL Soil sample collected at 17.5'
		5.0	13.3			
		---- 5.0	272			NTK collected at 19'. Evidence of NAPL
20	723.28		278		**SAND (SP)** Same as above	Hydrocarbon odor
			222		**CLAY (CL)** Brown, silty clay, trace gravel, hard	
			3.5			
		5.0	2.6			
		---- 5.0	2.0			
25	718.28		0.6			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB038	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 745.10 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056568.81, N 696202.759 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 15.0 ft bgs START : 8/18/14 15:15 END : 8/18/14 15:55 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.4		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.3		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
		4.0	0.1		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		---- 5.0	0.1			
5	740.10		1.0		**CLAY (CL)** Same as above	
			4.3			
			0.2			
		5.0	0.8			
		---- 5.0	1.2		**SAND (SM)** Brown, stained, silty sand, some clay, little gravel, glass, brick	Soil sample collected at 8.5' Chemical odor
10	735.10		9.3		**CLAY (CL)** Brown, sandy clay, trace gravel, medium to stiff	
			0.2		**SILT (ML)** Light brown, clayey silt, trace gravel White granular material from 10.8' to 11' Stained from 13' to 15'	Soil sample collected at 10.5'
			2.6			
		5.0	0.4			
		---- 5.0	0.9			
15	730.10		9.1		▼	Soil sample collected at 14.5'
			2.1		**SILT (ML)** Same as above - wet	
			6.5		**SAND (SP)** Stained black, poorly graded, fine to medium grain sand, trace gravel Wet, brown, stained, clay lens from 16.2 to 17'	
		5.0	6.6			
		---- 5.0	2.7		**CLAY (CL)** Black, stained, sandy clay, trace gravel, wet	Hydrocarbon odor NTK collected at 18.5'. No evidence of NAPL
20	725.10		4.5		**SAND (SP)** Brown, slightly stained, poorly graded, fine to medium grain sand, trace gravel	Chemical odor
			2.7		**SAND AND GRAVEL (GW)** Stained black, sand and grave, trace cobbles, wet	
			0.7		**CLAY (CL)** Brown, silty clay, trace gravel, hard Wet, stained, poorly graded, fine to medium grain sand seam Brown, silt lens from 23.2' to 23.4'	
		5.0	1.0			
		---- 5.0	1.0			
25	720.10		1.0			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB039	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 747.30 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056515.83, N 696205.165 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 20.0 ft bgs START : 8/18/14 16:05 END : 8/18/14 16:45 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
		4.5	0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		---- 5.0	0.0			
5	742.30		0.0		**CLAY (CL)** Same as above	
			0.0			
			0.0			
		5.0	0.0		**CLAY (CL)** Brown, silty clay, slightly stained, little gravel, medium to stiff, moist	Soil sample collected at 8'
		---- 5.0	0.0			
10	737.30		0.0		**CLAY (CL)** Same as above	
			2.0			
			9.0		**SAND (SM)** Brown, silty sand, some gravel, little clay	
		5.0	12.3		**SAND (SP)** Light brown, poorly graded, fine to coarse grain sand, some gravel	Soil sample collected at 13'
		---- 5.0	5.0		**SILT (ML)** Gray, slightly stained, clayey sandy silt	
15	732.30		1.6		**SILT (ML)** Light brown, clayey silt, trace gravel	
			2.2		**SILT (ML)** Same as above	
			4.4			
		5.0	3.5			
		---- 5.0	2.1		**SILT (ML)** Brown and gray, slightly stained, varved, clayey silt Very fine silty sand moist seam from 19.2' and 19.6'	Soil sample collected at 18.5'
20	727.30		35.8		▼	
			2.5		**SILT (ML)** Same as above - potentially stained, wet	
			2.5			
		5.0	12.0			
		---- 5.0	5.5			
25	722.30		3.8			

Boring terminated at 25.0 ft bgs.

CH2MHILL®

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB040	SHEET 1 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 749.85 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056466.14, N 696198.452 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.5 ft bgs START : 8/19/14 09:00 END : 8/19/14 10:00 LOGGER : H. Ott & S. Chumney

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
			0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
			0.0			
5	744.85		1.4		**SILT (ML)** Brownish gray, clayey silt, some fine sand, little gravel, firm to hard, moist	
			0.0		Clayey sand from 6' to 6.5'	Soil sample collected at 6'
			0.0			
			2.4			
			0.1			
10	739.85		0.0		**SAND (SC)** Brownish gray, clayey sand, traec gravel, wet (perched)	
			0.9			
			2.7		**SILT (ML)** Light brown with some gray, clayey silt, little sand, little gravel, stiff to hard, moist	
			0.8			
			6.1		**SILT (ML)** Dark brown, clayey to silty sand, moist	Soil sample collected at 14'
15	734.85		5.3		**SAND (SC)** Light gray, clayey to silty sand, trace gravel, moist	
			0.5			Soil sample collected at 16'
			14.6		**SILT (ML)** Light gray, silty sand, soft, wet	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB040	SHEET 2 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 749.85 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056466.14, N 696198.452 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.5 ft bgs START : 8/19/14 09:00 END : 8/19/14 10:00 LOGGER : H. Ott & S. Chumney

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					Steel plate at 17' bgs Boring terminated at 17.0 ft bgs.	
20	729.85					
25	724.85					
30	719.85					

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB041	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 753.14 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056409.48, N 696195.04 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 23.5 ft bgs START : 8/19/14 10:45 END : 8/19/01 11:30 LOGGER : S. Chumney

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			1.9		**SILT (ML)** Light brown, sandy silt, little gravel, little organics, slightly moist (TOP SOIL)	
			1.3		**SAND (SP)** Light brown, poorly graded, sand, some silt, trace gravel, dry, loose	
			0.3		**SILT (ML)** Light brownish gray, clayey silt, little fine sand, trace gravel, dense, moist (CAP)	
			0.0			
5	748.14		0.6		**SILT (ML)** Same as above	
			3.2			
			0.8		**SILT (ML)** Same as above - brown, hard, less sand	
			0.5			
			0.4			
10	743.14		105		**SILT (ML)** Brown, sandy silt, little clay, trace gravel, dense, moist	Moderate chemical odors from 1' to 12.8'
			70.0		**SAND (SP)** Brown and gray, potentially stained, poorly graded, fine to medium grain sand, trace gravel, loose, moist	Soil sample collected from 11'
			64.0			
			78.0		**SAND (SM)** Gray, light staining, silty sand with little white coloration, trace metal	Faint chemical odor
			53.0		**CLAY (CL)** Brown, silty clay, trace gravel, very stiff, moist	
15	738.14		146		**CLAY (CL)** Same as above	Soil sample collected from 15'
			70.0			
			27.0		**SAND (SM)** Brown to dark brown, light staining, clayey to silty sand, trace brick, Concrete at 17.5'	
			17.0			
			13.0			
20	733.14		65.0		**SAND (SM)** Same as above	
			9.0		**SAND (SP)** Gray, poorly graded, fine to medium grain sand, some silt, medium dense, moist	Faint chemical odors
			49.0			
			76.0			Soil sample collected from 23'
			8.0		**SILT (ML)** Gray, clayey silt, varved, soft, wet	
25	728.14		15.0			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB042	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 754.03 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056362.6, N 696195.757 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 28.0 ft bgs START : 8/20/14 08:30 END : 8/20/14 09:50 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.5		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.6		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		5.0	0.5		**CLAY (CL)**	

		5.0	0.2		Brown, silty clay, trace gravel, hard, brittle (CAP)	
5	749.03		0.9			
			1.9		**CLAY (CL)** Same as above	
			0.9			
		3.5	1.2			

		5.0			Not Recovered	
10	744.03					
			0.5		**CLAY (CL)** Stained black, silty clay, trace gravel, stiff	Soil sample collected at 10'
			0.1		Steel plate at 11.5' Nails and steel recovered between 11' to 11.5'	
		5.0	1.4		Brown and slightly stained from 14' to 14.8'	

		5.0	3.3			
15	739.03		25.2			
			11.2		**CLAY (CL)** Brown, slightly stained, sandy clay, stiff	
			21.5		**CLAY (CL)** Brown, slightly stained, silty clay, trace gravel, hard	
		5.0	3.4			

		5.0	9.5		**SAND (SC)** Brown, slightly stained, clayey sand, some glass, little gravel, moist	Soil sample collected at 18.5'
20	734.03		2.4			
			7.1		**SAND (SC)** Same as above	
			13.3			
		5.0	16.6		**SAND (SP)** Brown, slightly stained, poorly graded, fine to medium grain sand, some white granular material, trace gravel	

		5.0	28.9			
25	729.03		38.7		**SILT (ML)** Brown, clayey silt	
			40.2		Silt seam from 24.5' to 25'	
			5.6		**SILT (ML)** Same as above	Soil sample collected at 26'
		5.0	0.0		**SAND (SP)**	
		----			Light brown, poorly graded, very fine to medium grain sand, some gravel, little coarse grain sand	
		5.0	0.0			
30	724.03		0.0		**SILT (ML)** Gray, varved, clayey silt, wet at 28'	
			0.0		Silt seam from 28' to 28.3'	
			0.0		**SILT (ML)** Same as above	
			0.0		**CLAY (CL)**	
			0.0		Brown, silty clay, trace gravel, stiff to hard	
35	719.03	10.0	0.0			
		----	0.0			
		10.0				
			0.0			
			0.0			
			0.0		**SAND (SW)**	
			0.0		Poorly graded, fine to coarse grain sand, little gravel, wet	
40	714.03		0.0			

Boring terminated at 40.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB043	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 747.07 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056278.73, N 696204.406 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 21.5 ft bgs START : 8/20/14 10:15 END : 8/20/14 11:05 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
			0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		4.0 ---- 5.0	0.0			
			0.0			
5	742.07		0.0		**CLAY (CL)** Same as above	
			0.0			
			0.0			
		5.0 ---- 5.0	71.7		**CLAY (CL)** Brown, stained, silty clay, trace gravel, hard	Strong chemical odor Soil sample collected at 8'
			24.3			
10	737.07		0.4		**CLAY (CL)** Same as above	
			11.2			
			11.7			
		5.0 ---- 5.0	5.0			Soil sample collected at 13'
			8.1		**WHITE GRANULAR MATERIAL** White granular material	Slight chemical odor
15	732.07		2.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some clay, trace gravel	
			21.5			
			10.3		**SILT (ML)** Brown and gray, varved, clayey silt Potential staining at 17' Silt seam from 17' to 17.8'	
		5.0 ---- 5.0	21.5			
			24.7		**SAND (SM)** Light brown, very fine silty sand, trace gravel, trace cobbles	
20	727.07		14.9		**SILT (ML)** Black, stained, clayey silt, moist	
			5.4		**SAND (SP)** Gray, poorly gray, fine to medium grain sand, some silt, wet at 21.5' ▼	Soil sample collected at 21'
			1.8		**SAND (SC)** Gray, potential staining, varved, clayey sand, wet	
		5.0 ---- 5.0	6.9			
			4.4			
25	722.07		1.9			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB044	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 753.33 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056368.09, N 696245.758 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 28.0 ft bgs START : 8/20/14 11:40 END : 8/20/14 12:30 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, inorganics (TOP SOIL)	
			0.5		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, little gravel	
		4.0 ---- 5.0	0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
			0.0			
5	748.33		0.0			
			0.0		**CLAY (CL)** Same as above	
			0.0			
		2.0 ---- 5.0			Not recovered	
10	743.33		0.4			
			0.0		**CLAY (CL)** Brown, slightly stained, silty clay, trace gravel	Slight chemical odor
			0.9			
		5.0 ---- 5.0	0.9			
			1.2			
15	738.33		129			
			2.2		**CLAY (CL)** Same as above - stained black from 17.3' to 17.5'	Soil sample collected at 15'
			3.1			
		5.0 ---- 5.0	2.0		**SAND (SC)** Stained black, clayey sand, little gravel, trace wood fragments, glass	Strong chemical odor Soil sample collected at 18' NTK collected at 18'. No evidence of NAPL
			4.4			
20	733.33		14.7			
			32.2		**SAND (SC)** Same as above - brown, slightly stained	
			47.4		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, little coarse grain sand, trace gravel, trace white granular material	
		5.0 ---- 5.0	19.2		**SILT (ML)** Brown, varved clayey silt	
			40.5		**SAND (SP)** Light brown, poorly graded, fine to medium grain sand, little coarse grain sand, trace gravel	
25	728.33		52.7			
			36.8		**SAND (SP)** Same as above	
			12.7			
		5.0 ---- 5.0	4.4		**SILT (ML)** Black and gray, potentially stained, varved, clayey silt ▼	Soil sample collected at 27'
			6.1		**SILT (ML)** Gray, silt, some clay, trace gravel, wet	
30	723.33		5.1			

Boring terminated at 30.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB045	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 753.54 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056410.49, N 696243.128 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 27.0 ft bgs START : 8/20/14 14:00 END : 8/20/14 15:00 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		5.0	0.0		**SILT (ML)** Brown, silt, little clay, trace gravel	
		---- 5.0	0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
5	748.54		0.0		**CLAY (CL)** Same as above	
			0.7			
			0.0			
		5.0	0.0			
		---- 5.0	0.0			
			0.4		**CLAY (CL)** Brown, slightly stained, silty clay, trace gravel	
10	743.54		0.0		**CLAY (CL)** Same as above	Soil sample collected at 10'
			0.0			
			3.0			
		5.0	17.6			
		---- 5.0	8.7			
15	738.54		2.5		**CLAY (CL)** Same as above - trace cobbles	
			2.6			
			4.6		**SAND (SP)** Brown, stained, poorly graded, very fine to medium grain sand, little clay, little gravel, glass, wire	Slight chemical odor Soil sample collected at 18'
		5.0	0.7			
		---- 5.0	0.6		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
20	733.54		6.8		**SILT (ML)** Brown, clayey silt, some white granular material, trace gravel	Chemical odor
			1.1		**SAND (SP)** Light brown, poorly graded, fine to medium grain sand, little white granular material, trace coarse grain sand, trace gravel	
		5.0	4.8		**SILT (ML)** Brown, stained, varved, clayey silt	
		---- 5.0	6.6			
25	728.54		4.1			
			4.5		**SAND (SM)** Brown, silty sand, little clay, moist	
			0.9		**SILT (ML)** Gray, potentially stained, clayey silt, wet at 27' ▼ silt seam, some clay from 27.2' to 29'	Soil sample collected at 26'
		5.0	0.7			
		---- 5.0	1.2			
30	723.54		2.7			

Boring terminated at 30.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB046	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 750.46 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056467.87, N 696248.268 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 23.5 ft bgs START : 8/20/14 15:05 END : 8/20/14 16:55 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, trace gravel	
		5.0	0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		---- 5.0	0.0			
5	745.46		1.0		**CLAY (CL)** Same as above	
					CONCRETE Concrete	Hard drilling from 6' to 10'
		5.0				
		---- 5.0				
10	740.46					
			53.4		**CLAY (CL)** Stained dark brown, silty clay, trace gravel, hard	
			243			
		5.0	6.4		**SILT (ML)** Stained darked brown, silt, little clay, trace gravel	Soil sample collected at 12'
		---- 5.0	4.8		**SAND (SC-SM)** Stained black, clayey silty sand, some gravel, trace glass, wood fragments	Slight chemical odor
15	735.46		4.2			Soil sample collected at 14.5'
			2.0		**SAND (SC-SM)** Same as above	
			4.2		**SILT (ML)** Gray to light brown, clayey silt, some white granular material, little gravel	
		5.0	9.5			
		---- 5.0	3.0			
20	730.46		1.5			
			31.2		**SILT (ML)** Same as above - stained, silt with some sand clay seam from 21' to 21.5', moist	
			9.1			
		5.0	40.4		**SAND (SM)** Brown, very fine silty sand, moist ▼	Soil sample collected at 23'
		---- 5.0	18.5		**SAND (SM)** Gray, silty sand, some coarse grain sand, some white granular material, some gravel, wet at 23.5'	
25	725.46		1.0			
			10.4		**SILT (ML)** Gray, potential staining, varved, clayey silt	
			13.1			
		5.0	20.0		**SAND (SP)** Stained black, poorly graded, fine to medium grain sand, trace gravel	NTK collected at 27.7'. No evidence of NAPL
		---- 5.0	1.7		**CLAY (CL)** Brown, silty clay, trace gravel, hard	
30	720.46					

Boring terminated at 30.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB047	SHEET 1 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 748.17 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056520.72, N 696253.649 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 17.0 ft bgs START : 8/21/14 08:30 END : 8/21/14 09:30 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**SAND (SP)** Brown, poorly graded, fine to medium grain sand, some gravel	
			0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		5.0	0.0			

		5.0	0.0			
5	743.17		0.0		**CLAY (CL)** Same as above	
			1.6			
			1.1			
		5.0	1.4			

		5.0	2.1			
10	738.17		0.5		**CLAY (CL)** Brown, stained, silty clay, trace gravel, trace white granular material, stiff	Soil sample collected at 9' Chemical odor
			7.9		**CLAY (CL)** Same as above	
			7.0		**SAND (SC)** Stained, brown, clayey sand, some gravel, some glass, trace white granular material	
		5.0	9.4			
		----				Soil sample collected at 13'
		5.0	6.2			
15	733.17		1.1		**SILT (ML)** Gray and brown, varved, clayey silt, some white granular material, little gravel	
			2.6		**SILT (ML)** Same as above - wet at 17', some sand from 18.5' to 19.5' Potential staining at 19' and from 19.5' to 20'	Soil sample collected at 16'
			8.7		▼	
		5.0	4.4			

		5.0	1.4			
20	728.17		5.2		**SILT (ML)** Gray, varved, clayey silt, potential staining, wet	
			2.8			
			2.0			
		5.0	0.7			

		5.0	6.6			
25	723.17		2.4		**SAND (SP)** Stained black, poorly graded, fine to medium grain sand, wet	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB047	SHEET 2 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 748.17 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056520.72, N 696253.649 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 17.0 ft bgs START : 8/21/14 08:30 END : 8/21/14 09:30 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					CLAY (CL) Brown, silty clay, trace gravel, hard	
					SAND (SP) Brown, stained, poorly graded, fine to medium grain sand, trace gravel, wet	
					Boring terminated at 25.0 ft bgs.	
30	718.17					
35	713.17					
40	708.17					
45	703.17					
50	698.17					

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB048	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 745.87 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056571.17, N 696252.261 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 20.0 ft bgs START : 8/19/14 10:50 END : 8/19/14 11:25 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		5.0	0.0			

		5.0	0.0			
5	740.87		0.0		**CLAY (CL)** Same as above	
			0.0			
			0.0			
		5.0	0.2			

		5.0	0.0			
			1.6		**SAND (SM)** Brown, stained, silty sand, little clay, little gravel	Chemical odor Soil sample collected at 9.5'
10	735.87		2.2		**SAND (SC)** Brown, stained, clayey sand, trace gravel	
			8.7		**SAND (SM)** Brown, silty sand, some gravel	Soil sample collected at 11'
		5.0	1.7		**SAND (SM)** Gray, silty sand, trace clay, trace gravel	
		----			**SILT (ML)** Light brown, clayey silt, trace white granular material, trace gravel	
		5.0	1.2			
15	730.87		0.8		**SILT (ML)** Same as above - majority is white granular material from 17.7' to 18'	
			0.7			
			3.7		**SAND (SP)** Brown, fine to medium grain sand, some clay, trace gravel Wet at 20'	
		5.0	2.9			

		5.0	7.9			Soil sample collected at 19'
20	725.87		8.1		▼	
			7.3		**SAND (SP)** Same as above - stained black Wet, silty clay lens 20.5' to 21'	
			4.8			
		5.0	3.7		**SAND (SP)** Stained black, fine to medium grain sand, trace coarse sand, trace gravel, wet	Hydrocarbon odor
		----				
		5.0	0.6		**CLAY (CL)** Brown, silty clay, trace gravel, hard	
25	720.87		0.2			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB049	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 744.04 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056611.65, N 696248.769 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 20.0 ft bgs START : 8/19/14 09:00 END : 8/19/14 10:00 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.1		**SAND (SP)** Brown, fine to medium grain sand, little gravel	
		5.0	0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		----	0.0			
5	739.04	5.0	0.0		**CLAY (CL)** Same as above	
			0.1			
			0.7			
		5.0	0.1			

		5.0	1.0		**SAND (SM)** Brown, stained, silty sand, some clay, trace gravel	Soil sample collected at 8.5' Chemical odor
10	734.04		5.7			
			15.5		**SAND (SM)** Same as above	
			3.7			
			2.0		**CLAY (CL)** Gray to brown, silty clay, trace gravel, stiff, moist Some stained wood at 12'-14'	
			1.6			
						Soil sample collected at 14'
15	729.04	7.0	0.2			
		----	1.3			
		10.0			**SAND (SP)** Brown, stained, fine to medium grain sand, trace gravel, moist at 19', wet at 20'	
			0.4			
			0.1			
			0.7			
						Soil sample collected at 19 Chemical odor
20	724.04		1.1		▼	
			0.4		**SAND (SP)** Same as above - coarse and some gravel from 21.8' to 22'	
			2.8			
			2.3		**CLAY (CL)** Brown, silty clay, trace gravel, hard Brown silt seam from 27' to 27.5' and 28.4' to 28.8'	
			0.0			
25	719.04	10.0	0.0			
		----	0.0			
		10.0	0.3			
			0.6			
			0.0			
30	714.04		0.1			

Boring terminated at 30.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB050	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 744.02 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056573, N 696324.362 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 21.5 ft bgs START : 8/21/14 09:42 END : 8/21/14 10:20 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.4		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			2.1		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		5.0 ---- 5.0	1.7			
5	739.02		0.8		**CLAY (CL)** Same as above	
			0.6		**CLAY (CL)** Brown, slightly stained, sandy clay, trace gravel, stiff	Soil sample collected at 6'
		5.0 ---- 5.0	0.7			
			3.2			
			1.2			
10	734.02		1.6		**CLAY (CL)** Same as above	
			12.8		**SILT (ML)** Gray, clayey silt, some fine to coarse grain sand, some white granular material	Chemical odor
		5.0 ---- 5.0	57.6		**CLAY (CL)** Brown, silty clay, trace gravel, stained from 11.5' to 14' Stained black silt seam, some clay, trace wood and glass	Soil sample collected at 13'
			175			
			52.4			
15	729.02		90.6		**CLAY (CL)** Same as above	
			117		**SAND (SP)** Brown, slightly stained, fine to medium grain sand, some clay, trace gravel, moist	Slight chemical odor
		5.0 ---- 5.0	76.3			
			39.7		**SAND (SP)** Brown, slightly stained, fine to medium grain sand, trace gravel, moist Stained black silt seam, little clay, from 19' to 19.3'	NTK collected at 19'. No evidence of NAPL
			118			
20	724.02		186		**CLAY (CL)** Brown, stained, silty sandy clay, trace gravel, stiff, moist	
			41.9			Soil sample collected at 21'
			55.5		**SAND (SP)** Brown, slightly stained, fine to medium grain sand, trace gravel, little coarse sand, wet More coarse with depth	Chemical odor
		5.0 ---- 5.0	262			
			147		**CLAY (CL)** Brown, trace staining, silty clay, trace gravel, hard	
25	719.02		71.3			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB051	SHEET 1 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 749.61 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056467.75, N 696312.185 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 24.0 ft bgs START : 8/21/14 10:30 END : 8/21/14 11:15 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.1		**SAND (SP)** Brown, fine to medium grain sand, little gravel	
		5.0	0.5		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		----	0.0			
		5.0				
5	744.61		8.1		**CLAY (CL)** Same as above	
			14.5			
			48.9			
		5.0	34.0			

		5.0			**CLAY (CL)** Brown, stained, silty clay, trace gravel, stiff Stained black from 9' to 10'	Chemical odor
			235			
10	739.61		695		**CLAY (CL)** Same as above	Soil sample collected at 10' NTK collected at 10'. No evidence of NAPL
			176		**SAND (SM)** Brown, silty sand, little clay, little gravel, trace cobbles, trace wood and brick Stained black from 11' to 12.5'	Slight hydrocarbon odor Soil sample collected at 12'
			192			
		5.0	117			

		5.0				
			89.0		**SILT (ML)** Brown, stained, silt, some clay, little gravel	
15	734.61		85.5		**CLAY (CL)** Brown, stained, sandy clay, trace gravel, trace wood, stiff	
			148		**SAND (SP)** Brown, slightly stained, fine to medium grain sand, some clay, some gravel	
			23.2			
		5.0	17.3		**SAND (SP)** Brown, fine to medium grain sand, little gravel, trace clay, trace silt	

		5.0	13.8			
20	729.61		21.2		**CLAY (CL)** Dark brown, stained, silty clay, trace gravel, hard	
			278			
			11.3		**SAND (SM)** Dark brown, stained, silty sand, some clay, moist	
		5.0	3.9			

		5.0	5.9			Soil sample collected at 23.5'
25	724.61		5.8		**SAND (SP)** Brown, slightly sained, fine to medium grain sand, some gravel, little	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB051	SHEET 2 OF 2

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 749.61 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056467.75, N 696312.185 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 24.0 ft bgs START : 8/21/14 10:30 END : 8/21/14 11:15 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
					coarse, wet Boring terminated at 25.0 ft bgs.	
30	719.61					
35	714.61					
40	709.61					
45	704.61					
50	699.61					

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB052	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 751.02 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056381.99, N 696312.577 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 26.0 ft bgs START : 8/21/14 11:30 END : 8/21/14 12:30 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.4		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.1		**SAND (SP)** Brown, fine to medium grain sand, little gravel	
		4.0 ---- 5.0	0.1		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
			0.6			
5	746.02		0.7		**CLAY (CL)** Same as above	
			0.0			
			0.2			
		3.0 ---- 5.0	1.7			
					Not recovered	
10	741.02		12.5		**CLAY (CL)** Brown, silty clay, trace gravel, hard	
			19.0			
			7.2		**CLAY (CL)** Brown, slightly stained, sandy clay, trace gravel	Soil sample collected at 12'
		5.0 ---- 5.0	1.5			
			11.7			
15	736.02		5.1		**CLAY (CL)** Same as above	
			12.5		**SAND (SP)** Light brown, very fine to medium grain sand	
			0.6		**SAND (SP)** Brown, stained, fine to medium grain sand, some clay, little gravel, moist	Soil sample collected at 17'
		5.0 ---- 5.0	0.1			
			0.2			
20	731.02		0.1		**SAND (SP)** Same as above	
			5.1			
			0.7		**CLAY (CL)** Brown, slightly stained, silty clay, trace gravel, hard	
		5.0 ---- 5.0	4.2		**SAND (SP)** Brown, fine to medium grain sand, some clay, little gravel Stained black from 23.5' to 25'	
			0.8			
25	726.02		0.6		**SAND (SP)** Same as above - stained black to 25.5', moist	Soil sample collected at 25'
			2.7		**SAND (SW)** Brown, fine to coarse grain sand, little gravel, trace cobbles, wet	
			1.5			
		5.0 ---- 5.0	0.4			
			1.0			
30	721.02		0.7			

Boring terminated at 30.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB053	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 748.75 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056408, N 696346.03 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 23.5 ft bgs START : 8/21/14 14:00 END : 8/21/14 14:45 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.6		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.8		**SAND (SP)** Brown, fine to medium grain sand	
		4.0 ---- 5.0	0.7		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
			0.4			
5	743.75		1.6			
			1.0		**CLAY (CL)** Same as above	
			7.6			
		5.0 ---- 5.0	12.2			
			11.7		**CLAY (CL)** Brown, slightly stained, sandy silty clay, trace gravel, trace cobbles, stiff	
10	738.75		110			
			19.0		**CLAY (CL)** Same as above	Soil sample collected at 10'
			7.6		**CLAY (CL)** Brown, slightly stained, silty clay, trace gravel, hard	
		5.0 ---- 5.0	2.2			
			4.6			
15	733.75		14.5			
			63.6		**CLAY (CL)** Same as above	
			59.0		**SAND (SM)** Brown, stained, silty sand, some clay, some gravel	Chemical odor
		5.0 ---- 5.0	58.2			
			37.0		**CLAY (CL)** Brown, slightly stained, silty clay, trace gravel, hard	
20	728.75		15.0		**SAND (SP)** Brown, stained, fine to medium grain sand, trace gravel	
			3.1		**SAND (SP)** Same as above	Soil sample collected at 21'
			6.8		**SAND (SP)** Brown, stained, fine to medium grain sand, some clay, little gravel, trace wood Stained black from 11' to 11.3'	
		5.0 ---- 5.0	3.5			
			3.0		**SAND (SP)** Brown, stained, fine to medium grain sand, trace gravel, moist Some gravel from 23.5' to 25' Wet at 23.5'	Soil sample collected at 23'
25	723.75		4.0			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB054	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 745.92 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056442.01, N 696381.503 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 24.0 ft bgs START : 8/21/14 14:50 END : 8/21/14 15:30 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.8		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
					SAND (SP) Brown, fine to medium grain sand, trace gravel	
			0.2		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP)	
		4.0 ---- 5.0	0.3			
			0.0			
5	740.92		0.3		**CLAY (CL)** Same as above	
			0.0			
			0.0			
		5.0 ---- 5.0	0.0			
			0.1		**CLAY (CL)** Brown, stained, silty clay, little sand, little gravel, stiff Stained black from 9.5' to 10'	
10	735.92		0.9			Soil sample collected at 9.5'
			2.7		**CLAY (CL)** Brown, stained, silty clay, little gravel, medium dense to stiff, moist	
			3.3			
		5.0 ---- 5.0	3.8			
			25.1			
15	730.92		63.8			
					CLAY (CL) Same as above	
					No recovered	
		2.0 ---- 5.0				
20	725.92		290		**SAND (SM)** Brown, stained, silty sand, some clay, little gravel	Soil sample collected at 20' Chemical odor
			137		**CLAY (CL)** Brown, stained, silty clay, trace gravel, hard	
			175		**CLAY (CL)** Brown, sandy clay, some gravel, medium dense, moist	
		5.0 ---- 5.0	263			Soil sample collected at 23'
			20.2			
25	720.92		9.2		**SAND (SP)** Brown, fine to medium grain sand, some coarse sand, trace gravel, wet	

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB055	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 744.64 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056480.23, N 696381.127 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 20.0 ft bgs START : 8/21/14 15:40 END : 8/21/14 16:30 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.1		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			1.5		**CLAY (CL)** Brown, silty clay, trace gravel, hard (CAP) Fine to medium grain sand seam, some gravel from 1.3' to 1.5'	
		4.0 ---- 5.0	0.5			
			0.3			
5	739.64		40.5		**CLAY (CL)** Same as above	
			6.0			
			1.0			
		3.5 ---- 5.0	0.3			
10	734.64		1.6		**CLAY (CL)** Same as above - stained from 12.5' to 14', cobble at 14'	Soil sample collected at 10'
			3.1			
			1.2			
		4.0 ---- 5.0	57.7			
			34.2			
15	729.64		342		**SAND (SM)** Brown, stained, silty sand, some clay, some gravel, trace wood, metal debris, and glass	Soil sample collected at 15' Chemical odor
			132			
			110			
		5.0 ---- 5.0	14.5			
			23.7		**CLAY (CL)** Brown, stained, silty clay, trace gravel, hard	
20	724.64		118		**SAND (SP)** Stained black, fine to medium grain sand, trace gravel, moist	Soil sample collected at 19.5'
			40.0		**CLAY (CL)** Stained black, sandy silty clay, trace gravel, soft, wet	
			33.7		**SAND (SW)** Brown, fine to coarse grain sand, trace gravel, wet More gravel and stained from 23' to 23.5'	
		5.0 ---- 5.0	15.5			
			3.4		**CLAY (CL)** Brown, silty clay, trace gravel, hard Fine to medium grain sand seam at 24.5'	
25	719.64		2.2			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB056	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 742.55 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056515.44, N 696384.277 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 20.0 ft bgs START : 8/22/14 08:30 END : 8/22/14 09:20 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.1		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.1		**CLAY (CL)** Brown, silty clay, trace gravel, hard, brittle (CAP) Fine to coarse sand seam, some gravel from 1.3' to 1.4'	
		4.0 ---- 5.0	0.1			
			0.1			
5	737.55		0.2			
			0.1		**CLAY (CL)** Same as above	
			0.1		**CLAY (CL)** Brown, slightly stained, sandy clay, trace gravel, stiff to very stiff	
		5.0 ---- 5.0	0.1			Soil sample collected at 7'
			1.6			
10	732.55		0.6			
			4.4		**CLAY (CL)** Same as above - more stained from 11.5' to 15' Moist to wet, soft to medium dense	
			5.7			
		5.0 ---- 5.0	64.1			
			158			
15	727.55		304			
			179		**SAND (SM)** Brown, stained, silty sand, some clay, little gravel	Soil sample collected at 15' NTK collected at 15'. No evidence of NAPL
			81.0		**SAND (SP)** Stained black, fine to medium grain sand, trace gravel, moist	
		5.0 ---- 5.0	78.1			Soil sample collected at 18' NTK collected at 18'. No evidence of NAPL
			105		**SAND (SP)** Brown, fine to medium grain sand, trace coarse sand, trace gravel, wet	
20	722.55		109		at 20' ▼	
			191		**SAND (SW)** Brown, little staining, fine to coarse grain sand, some gravel, wet	
			108			
		5.0 ---- 5.0	7.6			
			0.8		**CLAY (CL)** Brown, silty clay, trace gravel, hard	
25	717.55		0.4			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB057	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 742.22 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056454.59, N 696416.658 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 18.0 ft bgs START : 8/22/14 09:30 END : 8/22/14 10:00 LOGGER : H. Ott

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SAND (SM)** Brown, silty sand, trace gravel, organics (TOP SOIL)	
			0.2		**SAND (SP)** Brown, fine to medium grain sand, trace gravel	
		4.0 ---- 5.0	0.0		**CLAY (CL)** Brown, silty clay, trace gravel, hard (CAP)	
			0.0			
5	737.22		6.5		**CLAY (CL)** Brown, sandy silty clay, little gravel, stiff to hard Slightly stained from 9' to 10'	
			0.3			
			0.0			
		5.0 ---- 5.0	0.0			
			0.0			Soil sample collected at 8'
10	732.22		0.0		**CLAY (CL)** Brown, slightly stained, silty clay, trace gravel, sitff, moist More stained from 13.5' to 14.5'	
			0.1			
			0.6			
		5.0 ---- 5.0	8.2			
			3.3			
15	727.22		87.6		**SAND (SP)** Brown, stained, fine to medium grain sand, trace clay, trace gravel, trace wood	Soil sample collected at 15'
			23.5		**SAND (SM)** Brown, stained, silty sand, some clay, trace gravel	
			11.9			
		5.0 ---- 5.0	5.8		**SAND (SP)** Brown, fine to medium grain sand, little gravel, trace coarse grain sand, wet at 18' More coarse sand and gravel from 19' to 20'	Soil sample collected at 17.5'
			2.4			
20	722.22		5.6			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB058	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 742.86 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056261.485, N 696067.265 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.0 ft bgs START : 10/9/14 09:25 END : 10/9/14 10:15 LOGGER : S. Chumney

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SILT (ML)** Brown, clayey silt, little fine sand, little organics, medium stiff, moist	
			0.0		**SILT (ML)** Brown, clayey silt, trace sand, trace gravel, stiff to hard, moist	
			0.0			
			0.0			
5	737.86		1.0			
			0.0		**SILT (ML)** Brown, clayey to sandy silt, trace coarse sand, trace gravel,	
			1.0			
			1.0		**SAND (SM)** Dark brown, silty fine to medium grain sand, little coarse sand, trace debris (glass, concrete), trace gavel, medium dense, moist	Soil sample collected at 7' Faint chemical odor from 7' to 9'
			0.0			
			1.0		**CL/ML (CL-ML)** Brown, clayey silt to silty clay, trace sand, trace gravel, stiff, moist	Faint chemical odor from 9' to 10'
10	732.86		3.0		**CLAY (CL)** Brown and gray, silty to sandy clay, Some interbedded black staining, firm to soft, moist	Faint chemical odor from 10' to 16' Soil sample collected at 11'
			6.0			
			11.0			
			3.0			
15	727.86		15.0			Soil sample collected at 15'
			4.0		▼	
			1.0		**CLAY (CL)** Light gray, silty clay, varved, soft, saturated	
			1.0			
			1.0			
20	722.86		1.0		**CLAY (CL)** Brown, silty clay, little fine grain sand, trace gravel, stiff, moist	
			1.0			
			0.5			
			1.0		**SILT (ML)** Gray, silt, medium stiff to stiff, moist	
			0.0			
25	717.86		0.0			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB059	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 740.25 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056213.916, N 696110.778 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 15.0 ft bgs START : 10/9/14 10:30 END : 10/9/14 11:10 LOGGER : S. Chumney

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SILT (ML)** Brown, clayey silt, little fine sand, little organics, medium stiff, moist	
			0.0		**SAND (SP)** Light brown, poorly graded, fine to medium grain sand,	
			0.0		**SILT (ML)** Brown, clayey silt, trace gravel, trace sand, hard, moist	
			0.0			
5	735.25		0.0		**SILT (ML)** Same as above - little to fine grain sand, very stiff	
			0.5			
			2.0			
			1.0			Soil sample collected at 8'
			2.0		**CLAY (CL)** Brown, silty clay,	
10	730.25		1.0		**CLAY (CL)** Same as above	Faint chemical odor throughout core below 10'
			1.0		**SILT (ML)** Gray, silt, firm, moist	Soil sample collected at 11'
			2.0			
			18.0		**SAND (SP)** Gray, poorly graded, fine grain sand, medium dense, moist	
			3.0		**SILT (ML)** Light gray to gray, clayey silt, varved, soft, wet at 15'	Soil sample collected at 14'
15	725.25		11.0		▼	
			28.0			
			13.0			
			4.0			
			3.0			
20	720.25		28.0		**SILT (ML)** Gray, silt, stiff, moist	
			6.0			
			5.0		**SILT (ML)** Gray, silt, trace sand, trace gravel, hard, slightly moist, till	Till
			1.0			
			1.0			
25	715.25		0.0			

Boring terminated at 25.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB060	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 742.95 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056233.236, N 696202.434 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 16.0 ft bgs START : 10/9/14 11:15 END : 10/9/14 12:00 LOGGER : S. Chumney

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SILT (ML)** Brown, clayey silt, little fine grain sand, little organics, medium stiff, moist	
			0.0		**SAND (SP)** Light brown, poorly graded, fine to medium grain sand, little coarse grain sand, medium dense, moist	
			0.0		**SILT (ML)** Brown, clayey silt, trace sand, trace gravel, very stiff to hard, slightly moist	
			12.0			
5	737.95		3.0		**SAND (SW)** Brown, well graded, fine to coarse grain sand, medium dense, moist	
			4.0		**CL/ML (CL)** Brown, clayey silt to silty clay, little fine grain sand, trace gravel, stiff, moist	
			8.0			
			17.0		**SAND (SM)** Black, silty fine grain sand, little medium to coarse grain sand, little gravel, little debris (wood, brick, glass), medium dense, moist	Soil sample collected at 8'
			19.0			
10	732.95		29.0		**WHITE GRANULAR MATERIAL** White pasty material	Soil sample collected at 10'
			4.0			
			12.0		**SAND (SP)** Gray, poorly graded, fine grain sand, little medium grain sand, medium dense, moist	
			11.0		**SILT (ML)** Light gray to gray with some dark gray varves, silt, firm becoming soft at 19', moist becoming wet at 16'	
			24.0			Soil sample collected at 14'
15	727.95		8.0			
			6.0		▼	
			9.0			
			2.0			
			3.0			
20	722.95		2.0			

Boring terminated at 20.0 ft bgs.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
478783	PSA2-SB061	SHEET 1 OF 1

Soil Boring Log

PROJECT : EPA, Velsicol, WA 178, EPA, Velsicol, WA 178 LOCATION : St. Louis, MI

ELEVATION : 746.00 ft msl DRILLING CONTRACTOR AND DRILL RIG : Cascade Drilling, L.P.,

COORDINATES : E 13056277.036, N 696257.437 DRILLING METHOD AND EQUIPMENT : Rotosonic

WATER LEVEL : 20.0 ft bgs START : 10/9/14 00:10 END : 10/9/14 12:15 LOGGER : S. Chumney

DEPTH BELOW GROUND SURFACE (ft)	ELEVATION (ft) MSL	RECOVERY (ft)	ENVIRONMENTAL DATA (PID = ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING DETAILS, INSTRUMENTATION
			0.0		**SILT (ML)** Brown, clayey silt, little fine grain sand, little organics, medium stiff, moist	
			0.0		**SAND (SP)** Light brown, poorly graded, fine to medium grain sand, medium dense, moist	
			0.0		**SILT (ML)** Brown, clayey silt, trace gravel, medium stiff becoming hard, moist Little fine grain sand from 7' to 9'	
			0.0			
5	741.00		0.0			
			0.0			
			0.0			
			0.0			
			0.0			
			0.0		**SAND (SC-SM)** Brown, silty to clayey fine grain sand, medium dense, moist	Soil sample collected at 9'
10	736.00		0.0		**CLAY (CL)** Grayish brown, sandy clay, some silt, trace gravel, firm, moist	
			1.0			
			1.0			
			0.0			
			0.0			
			0.0		**SAND (SP)** Brown becoming light gray, poorly graded, fine to medium grain sand, trace coarse grain sand, trace gravel, medium dense, moist	
15	731.00		1.0			
			5.0			
			31.0			Soil sample collected at 17'
			3.0			
			5.0			Soil sample collected at 19'
20	726.00		2.0		▼	
			7.0		**SILT (ML)** Gray and dark gray, silt, varved, soft, wet	
			2.0			
			2.0			
			4.0		**SAND (SP)** Dark brown and gray, potentially stained, poorly graded, fine to medium grain sand, trace coarse grain sand, trace gravel, medium dense, wet	
25	721.00		5.0			NTK collected at 25'
			1.0		**CLAY (CL)** Brown becoming brownish gray, silty clay, trace sand, trace gravel, stiff to hard, moist, till	Till
			0.0			
			0.0			
			1.0		**SILT (ML)** Brownish gray, clayey silt becoming silt, trace sand, trace gravel, very stiff, moist Fine sand seam at 24' and 24.5' to 25'	
30	716.00		1.0			

Boring terminated at 30.0 ft bgs.

Appendix B
Soil Boring Survey

APPENDIX B

Survey Coordinates and Elevations Measured on September 16, 2014

Velsicol Chemical Corporation Superfund Site, St. Louis, Michigan

Location	Northing[a]	Easting[b]	Ground Elevation[c]
PSA1-SB001	695550.405	13057043.916	736.010
PSA1-SB002	695599.770	13057060.332	734.202
PSA1-SB003	695642.129	13057060.262	733.664
PSA1-SB004	695688.717	13057060.464	733.382
PSA1-SB005	695755.493	13057034.280	737.455
PSA1-SB006	695733.450	13057019.345	738.816
PSA1-SB007	695687.661	13057021.624	738.149
PSA1-SB008	695643.691	13057023.709	737.646
PSA1-SB009	695598.935	13057018.151	737.415
PSA1-SB010	695538.754	13056948.542	736.395
PSA1-SB011	695598.762	13056977.917	736.443
PSA1-SB012	695644.025	13056979.580	737.304
PSA1-SB013	695688.229	13056977.900	737.944
PSA1-SB014	695733.311	13056975.770	738.177
PSA1-SB015	695787.051	13056976.944	738.897
PSA1-SB016	695780.864	13056929.817	739.026
PSA1-SB017	695735.098	13056931.998	738.794
PSA1-SB018	695689.579	13056933.627	738.173
PSA1-SB019	695644.862	13056935.351	738.533
PSA1-SB020	695599.698	13056936.827	737.969
PSA1-SB021	695527.296	13056853.693	737.075
PSA1-SB022	695597.958	13056894.342	738.864
PSA1-SB023	695645.972	13056892.296	739.653
PSA1-SB024	695690.757	13056889.987	739.668
PSA1-SB025	695736.135	13056886.679	740.359
PSA1-SB026	695782.064	13056883.728	740.479
PSA1-SB027	695830.796	13056896.312	740.043
PSA1-SB028	695872.036	13056816.548	740.350
PSA1-SB029	695824.396	13056839.489	740.811
PSA1-SB030	695778.557	13056838.808	741.669
PSA1-SB031	695731.928	13056839.792	741.772
PSA1-SB032	695686.604	13056842.700	740.937
PSA1-SB033	695640.326	13056844.133	740.927
PSA1-SB034	695597.547	13056849.126	740.101
PSA1-SB035	695551.922	13056848.723	738.452
PSA1-SB036	695498.216	13056808.000	734.308
PSA1-SB037	695596.078	13056805.157	741.299
PSA1-SB038	695549.618	13056802.592	738.915
PSA1-SB039	695635.528	13056802.874	742.051
PSA1-SB040	695689.368	13056798.368	742.071
PSA1-SB041	695734.762	13056798.408	742.790
PSA1-SB042	695779.835	13056796.500	742.817
PSA1-SB043	695824.997	13056795.851	742.070
PSA1-SB044	695871.179	13056795.071	741.246
PSA1-SB045	695861.493	13056746.084	743.143
PSA1-SB046	695823.493	13056751.323	743.749
PSA1-SB047	695778.524	13056753.335	743.996
PSA1-SB048	695730.435	13056752.818	743.347
PSA1-SB049	695685.865	13056752.782	742.435
PSA1-SB050	695640.350	13056756.669	742.728
PSA1-SB051	695592.448	13056758.502	742.105
PSA1-SB052	695545.793	13056759.646	739.005
PSA1-SB053	695498.857	13056715.506	733.251
PSA1-SB054	695589.811	13056716.276	741.245
PSA1-SB055	695683.733	13056710.775	741.113

APPENDIX B

Survey Coordinates and Elevations Measured on September 16, 2014

Velsicol Chemical Corporation Superfund Site, St. Louis, Michigan

Location	Northing[a]	Easting[b]	Ground Elevation[c]
PSA1-SB056	695774.912	13056711.503	745.021
PSA1-SB057	695853.837	13057033.851	735.270
PSA1-SB058	695952.858	13057034.689	734.207
PSA1-SB059	696051.627	13057036.414	733.114
PSA1-SB060	696052.912	13056997.710	734.178
PSA1-SB061	695953.212	13056996.487	735.279
PSA1-SB062	695853.071	13056996.640	737.436
PSA1-SB063	695945.225	13056765.780	740.846
PSA1-SB064	695682.492	13056659.502	739.049
PSA2-SB001	696014.852	13056832.273	737.520
PSA2-SB002	696016.323	13056738.709	740.694
PSA2-SB003	696019.830	13056645.315	743.559
PSA2-SB004	696020.680	13056551.095	746.046
PSA2-SB005	696022.262	13056455.648	746.790
PSA2-SB006	696026.041	13056344.545	744.508
PSA2-SB007	696050.961	13056307.618	745.113
PSA2-SB008	696050.427	13056356.015	747.047
PSA2-SB009	696051.565	13056409.689	747.535
PSA2-SB010	696052.293	13056461.120	747.071
PSA2-SB011	696053.500	13056510.741	746.237
PSA2-SB012	696055.725	13056561.262	745.063
PSA2-SB013	696057.112	13056609.472	743.691
PSA2-SB014	696058.839	13056660.413	742.370
PSA2-SB015	696060.639	13056711.237	741.130
PSA2-SB016	696062.355	13056759.144	739.536
PSA2-SB017	696063.831	13056805.553	738.183
PSA2-SB018	696116.989	13056833.727	736.428
PSA2-SB019	696120.370	13056737.436	739.505
PSA2-SB020	696119.604	13056640.004	742.381
PSA2-SB021	696141.725	13056645.785	741.982
PSA2-SB022	696104.777	13056564.667	744.874
PSA2-SB023	696103.808	13056514.306	746.328
PSA2-SB024	696102.327	13056464.334	748.056
PSA2-SB025	696100.745	13056412.644	749.839
PSA2-SB026	696099.201	13056360.779	751.417
PSA2-SB027	696110.453	13056308.014	748.279
PSA2-SB028	696115.538	13056264.079	744.265
PSA2-SB029	696145.009	13056312.533	749.372
PSA2-SB030	696148.002	13056371.331	753.114
PSA2-SB031	696147.294	13056409.636	751.636
PSA2-SB032	696149.649	13056463.211	748.767
PSA2-SB033	696154.059	13056515.064	746.437
PSA2-SB034	696154.007	13056563.679	744.800
PSA2-SB035	696156.824	13056616.482	742.964
PSA2-SB036	696216.360	13056667.508	741.458
PSA2-SB037	696205.204	13056616.326	743.281
PSA2-SB038	696202.759	13056568.812	745.099
PSA2-SB039	696205.165	13056515.828	747.303
PSA2-SB040	696198.452	13056466.138	749.850
PSA2-SB041	696195.040	13056409.481	753.137
PSA2-SB042	696195.757	13056362.597	754.025
PSA2-SB043	696204.406	13056278.733	747.070
PSA2-SB044	696245.758	13056368.086	753.332
PSA2-SB045	696243.128	13056410.493	753.539
PSA2-SB046	696248.268	13056467.869	750.456

APPENDIX B

Survey Coordinates and Elevations Measured on September 16, 2014

Velsicol Chemical Corporation Superfund Site, St. Louis, Michigan

Location	Northing[a]	Easting[b]	Ground Elevation[c]
PSA2-SB047	696253.649	13056520.722	748.167
PSA2-SB048	696252.261	13056571.173	745.866
PSA2-SB049	696248.769	13056611.649	744.041
PSA2-SB050	696324.362	13056573.002	744.022
PSA2-SB051	696312.185	13056467.750	749.610
PSA2-SB052	696312.577	13056381.991	751.015
PSA2-SB053	696346.030	13056407.998	748.753
PSA2-SB054	696381.503	13056442.014	745.922
PSA2-SB055	696381.127	13056480.234	744.638
PSA2-SB056	696384.277	13056515.443	742.553
PSA2-SB057	696416.658	13056454.586	742.216
PSA2-SB058	696067.265	13056261.485	742.856
PSA2-SB059	696110.778	13056213.916	740.249
PSA2-SB060	696202.434	13056233.236	742.949
PSA2-SB061	696257.437	13056277.036	746.001

[a] Vertical Coordinate System: North America Vertical Datum 1988 (NAVD88)

[b] Horizontal Coordinate System: Michigan State Plane, NAD83, South Zone

[c] Linear Units: International Foot

Appendix C
Photo Log

CH2MHILL

PHOTO RECORD FILE INDEX

PROJECT: Velsicol Remedial Design Investigation DATE: July – August 2014

LOCATION Potential Source Area 1 PROJECT NO: 478783

PREPARED BY: R. Vaughan

Picture Number	Photo Description/Location	Date
PSA1-SB-001-5-7	SB-001; 5 – 7 feet bgs. 	7-29-14
PSA1-SB-005-6-6.2	SB-005; 6 – 6.2 feet bgs. 	7-29-14

PSA1-SB-005-11.3-15	SB-005; 11.3 – 15 feet bgs. 	7-29-14
PSA1-SB-005-15.7-16.7B	SB-005; 15.7 – 16.7 feet bgs. 	7-29-14
PSA1-SB-006-14.5-15	SB-006; 14.5 –15 feet bgs. 	7-29-14

PSA1-SB-007-9	SB-007; 9 feet bgs. 	7-30-14
PSA1-SB-007-11.5	SB-007; 11.5 feet bgs. 	7-30-14
PSA1-SB-008-9	SB-008; 9 feet bgs. 	7-30-14

PSA1-SB-008-10.5	SB-008; 10.5 feet bgs. 	7-30-14
PSA1-SB-009-8-9	SB-009; 8 – 9 feet bgs. 	7-30-14
PSA1-SB-010-6.3	SB-010; 6.3 feet bgs. 	7-30-14

PSA1-SB-010-7	SB-010; 7 feet bgs. 	7-30-14
PSA1-SB-014-11-11.6	SB-014; 11 – 11.6 feet bgs. 	7-30-14
PSA1-SB-014-15.7	SB-014; 15.7 feet bgs. 	7-30-14

PSA1-SB-015-11A	SB-015; 11 feet bgs. 	7-30-14
PSA1-SB-015-13.5	SB-015; 13.5 feet bgs. 	7-30-14
PSA1-SB-016-8.5B	SB-016; 8.5 feet bgs. 	7-31-14

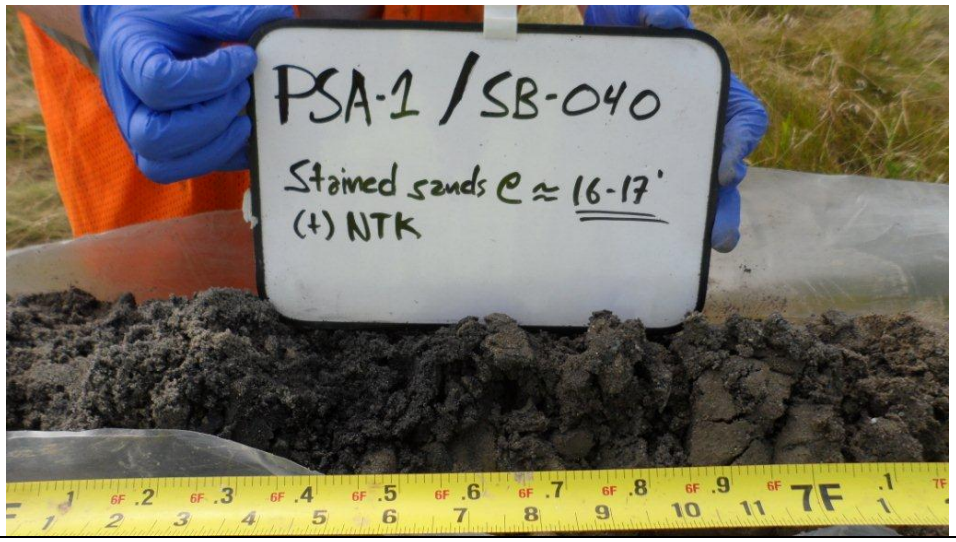
PSA1-SB-016-11	SB-016; 11 feet bgs. 	7-31-14
PSA1-SB-019-11	SB-019; 11 feet bgs. 	
PSA1-SB-020-9A	SB-020; 9 feet bgs. 	7-31-14

PSA1-SB-021-8.5-9B	SB-021; 8.5 – 9 feet bgs. 	7-31-14
PSA1-SB-022-12-13	SB-022; 12 – 13 feet bgs. 	8-1-14
PSA1-SB-022-13-14	SB-022; 13 – 14 feet bgs. 	8-1-14

PSA1-SB-024-9-10	SB-024; 9 – 10 feet bgs. 	8-1-14
PSA1-SB-024-12-13B	SB-024; 12 – 13 feet bgs. 	8-1-14
PSA1-SB-025-11-12A	SB-025; 11 – 12 feet bgs. 	8-1-14

PSA1-SB-025-14-14.5	SB-025; 14 – 14.5 feet bgs. 	8-1-14
PSA1-SB-026-11.3A	SB-026; 11.3 feet bgs. 	8-1-14
PSA1-SB-027-11.5-12.5	SB-027; 11.5 – 12.5 feet bgs. 	8-1-14

PSA1-SB-029-10	SB-029; 10 feet bgs. 	8-4-14
PSA1-SB-030-15-16	SB-030; 15 – 16 feet bgs. 	8-4-14
PSA1-SB-033-12	SB-033; 12 feet bgs. 	8-4-14

PSA1-SB-037-16.5	SB-037; 16.5 feet bgs. 	8-5-14
PSA1-SB-039-19	SB-039; 19 feet bgs. 	8-5-14
PSA1-SB-040-16-17	SB-040; 16 – 17 feet bgs. 	8-5-14

PSA1-SB-041-20-23	SB-041; 20 – 23 feet bgs. 	8-6-14
PSA1-SB-041-20-25	SB-041; 20 – 25 feet bgs. 	8-6-14

PSA1-SB-058-8.5	SB-058; 8.5 feet bgs. 	8-22-14
PSA1-SB-061-7-7.5A	SB-061; 7 – 7.5 feet bgs. 	8-25-14

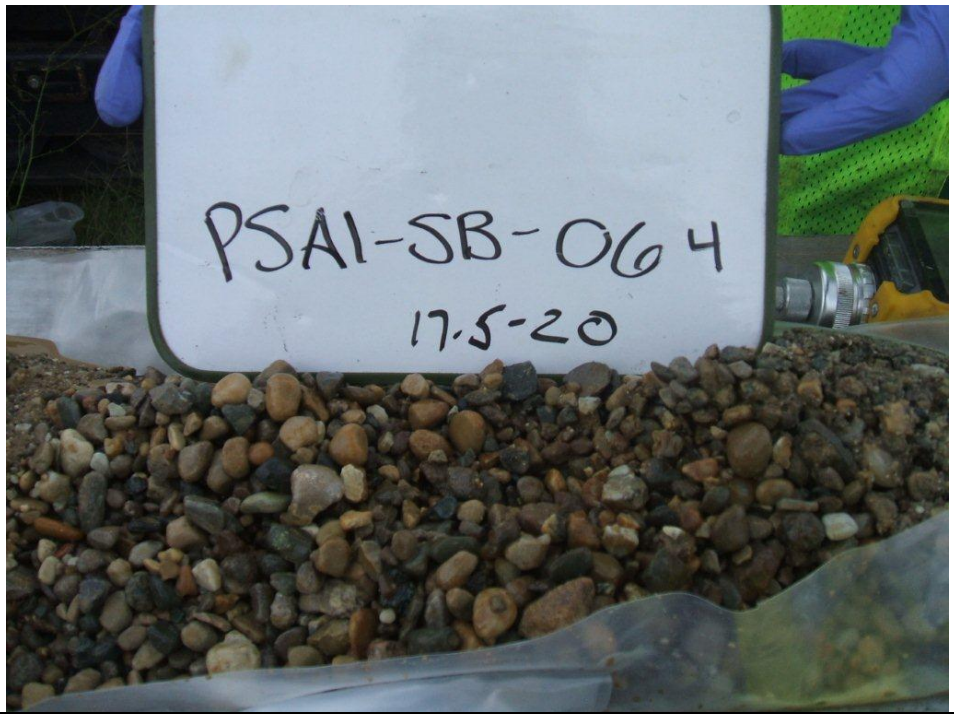
PSA1-SB-062-16-17	SB-062; 16 – 17 feet bgs. 	8-25-14
PSA1-SB-064-17-20B	SB-064; 17 – 20 feet bgs. 	8-26-14

PHOTO RECORD FILE INDEX

PROJECT: Velsicol Remedial Design Investigation DATE: August 2014

LOCATION Potential Source Area 2 PROJECT NO: 478783

PREPARED BY: R. Vaughan

Picture Number	Photo Description/Location	Date
PSA2-SB-019-18.5	SB-019; 18.5 feet bgs. 	8-13-14
PSA2-SB-023-20	SB-023; 20 feet bgs. 	8-13-14

PSA2-SB-034-21	SB-034; 21 feet bgs. 	8-15-14
PSA2-SB-036-17-19	SB-036; 17 – 19 feet bgs. 	8-15-14
PSA2-SB-037-17	SB-037; 17 feet bgs. 	8-18-14

PSA2-SB-037-19	SB-037; 19 feet bgs. 	8-18-14
PSA2-SB-042-11-11.5	SB-042; 11 – 11.5 feet bgs. 	8-20-14

Exhibit 2

FIGURE 1
Proposed Geotechnical Boring Locations
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

	PROJECT NUMBER	BORING NUMBER	
ch2m	677665.FI.01	PSA1-GT-01	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings | LOCATION : St. Louis, MI | DATE: 11/7/16

WEATHER: | DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS | START : 1325 | END : | LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
	0-2	2/2	SS-1	**1-3-9-18**	0.0'-0.8': Silty clay (CL) brown, firm, moist, little fine sand and organics 0.8'-1.0': Sand (SP) brown, fine to med., med. dense, moist 1.0'-2.0': Silt (ML) brown, very stiff, dry, trace sand and gravel	0.0 0.0
	2-5	5/5	S-1	N/A	2.0' -5.0': Clayey silt (ML), greyish brown, stiff, slightly moist, trace fine sand and gravel, cap material	0.0 0.0 0.0
5	5-7	2/2	SS-2	**2-2-2-3**	5.0'-7.0': Sandy to silty clay (CL), brownish grey to grey, firm, moist, trace gravel, faint hydrocarbon odor	0.0 0.0
	7-10	5/5	S-2	N/A	7.0'-10.0': Sandy to silty clay (CL), brownish grey, firm to stiff, moist, some intervedded sand, trace to little gravel.	0.0 0.0 0.0
10	10-12	0/2	SS-3	**weight of hammer and 1**	10'-14': Reworked sandy clay and silt (CL), greyish brown, soft, wet, trace gravel and cobbles	0.0 0.0 0.0
	12-15	5/5	S-3	N/A	14.0'-15.0': Silty clay (CL), greyish brown, stiff, moist, trace sand and gravel; till; **PP = 4.5** 15'-17': Silty clay (CL), greyish brown, hard, moist, trace gravel; till; **PP > 4.5**	0.0 Faint hydrocarbon odor 0.0
15						

	PROJECT NUMBER	BORING NUMBER	
ch2m	677665.FI.01	PSA1-GT-01	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings | LOCATION : St. Louis, MI | DATE: 11/7/16

WEATHER: | DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS | START : 1325 | END : | LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
	15-17	2/2	SS-4	**8-11-12-15**		0.0 / 0.0
	17-20	5/5	S-4	NA	15.0'-22': Silty clay (CL) greyish brown, stiff, moist, trace sand and gravel; till; **PP > 4.5**	0.0 / 0.0
20	20-22	2/2	SS-5	**5-13-21-26**		0.0 / 0.0
	22-25	5/5	S-5	NA	22'-25': Clayey silt (ML), grey, hard, moist; till - fine sand seam (<2") at 22' - moist	0.0 / 0.0
25	25-27	2/2	SS-6	**9-18-32-46**		0.0 / 0.0 — 6-inch temporary isolation casing set at 25 feet bgs
	27-30	5/5	S-6	N/A	25'-36.3': Silty clay (CL), greyish brown, hard, moist, trace sand and gravel; **PP > 4.5**	0.0 / 0.0
30						0.0

ch2m	PROJECT NUMBER 677665.FI.01	BORING NUMBER PSA1-GT-01	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings | LOCATION : St. Louis, MI | DATE: 11/7/16

WEATHER: | DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS | START : 1325 | END : | LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
	30-32	2/2	SS-7	**13-22-34-38**		0.0 / 0.0
	32-35	5/5	S-7	NA	25'-36.3': Silty clay (CL), greyish brown, hard, moist, trace sand and gravel; till; **PP > 4.5**	0.0 / 0.0
35	35-37	2/2	SS-8	**5-17-30-32**	36.3'-37': Sandy silt (ML), fine, greyish brown, dense, wet	0.0 / 0.0
	37-40	5/5	S-8	NA	37'-38': Clayey silt (ML), med. Stiff, greyish brown, moist 38'-39.6': Silty clay (CL), greyish brown, medium stiff, moist, trace sand and gravel; till; **PP=2.5** 38.6-40': Sand (SP), grey, fine to medium, medium dense, wet, little coarse sand, trace gravel and clay	0.0 / 0.0
40	40-42	2/2	SS-9	**2-1-1-1**	40'-42' No recovery	0.0 / 0.0
					EOB @ 42.0' BGS	
45						

	PROJECT NUMBER	BORING NUMBER	
ch2m.	677665.FI.01	PSA1-GT-02	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings LOCATION : St. Louis, MI DATE: 11/8/16

WEATHER: DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS START : 1300 END : 1600 LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
					0.0'-1.0': Silty clay with some fine sand and organics (grass and topsoil), brown, soft, moist to wet	0.0
	0-5	5/5	S-1	N/A		0.0
						0.0
5					1.0'-6.5': Clayey silt to silty clay (ML-CL), brown, hard, dry to moist, little gravel and sand	0.0
	5-7	2/2	SS-1	**6-7-9-10**		0.0
					6.5'-7.0': Sand and gravel (SW-GP), black stained, loose, wet, hydrocarbon odor	0.0
	7-10	5/5	S-2	N/A	7.0'-10.0' SAA grading to silty clay (CL), dark grey stained, firm, moist, trace gravel, hydrocarbon odor	8.0
10						8.0
	10-12	0/2	SS-2	**6-6-5-8**	10.0'-12.0' - Sand (SP), dark grey, fine, moist-stained with hydrocarbon odor	17.0
						40.0
	12-15	5/5	S-3	N/A	12.0'-15.0' - Sand (SP), dark grey (stained), fine to medium, loose, moist to wet, strong hydrocarbon odor	40.0
						150.0
15						150.0

	PROJECT NUMBER	BORING NUMBER	
ch2m	677665.FI.01	PSA1-GT-02	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings | LOCATION : St. Louis, MI | DATE: 11/8/16

WEATHER: | DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS | START : 1300 | END : 1600 | LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
	15-17	2/2	SS-3	**2-4-7-12**	15.0'-16.2': Sand (SP-SW), medium to coarse, dark grey, stained, wet, hydrocarbon odor; **NAPL observed**	150.0
					16.2'-17.0': Silty clay (CL), grey, medium stiff, moist, trace sand and gravel; till	110.0
	17-20	5/5	S-4	N/A	17.0'-20.0': Silty clay (CL), greyish brown, hard, moist, trace sand and gravel; till; fine, moist to wet sand seams with faint odor from 17.0'-17.4 BGS'; sand seam of less than 1" at 19.0' BGS; **PP = 3.5 to 4.5**	20.0 0.0
20						0.0
	20-22	2/2	SS-4	**9-16-17-20**	20.0'-22.0': Silty clay (CL), brownish grey, hard, moist, trace sand and gravel; **PP > 4.5**	0.0
						0.0
	22-25	5/5	S-5	N/A	22.0'-25.0': SAA, firm from 24.0-25.0', more silt from 24.0'-25.0'	0.0 0.0
25						0.0
	25-27	2/2	SS-5	**2-11-18-26**	25.0'-26.0' - SAA, firm; **PP = 1.5**	0.0
					26.0'-26.7' - Silty sand (SM), brownish grey, fine to medium, medium dense, moist to wet.	
					26.7'-27' - Silty clay (CL), greyish brown, hard, moist, trace sand and gravel, **PP > 4.5**	0.0
	27-30	5/5	S-6	N/A	27.0'-30.0' - Clayey silt (ML) becoming silty clay at 28', brownish grey, hard, dry becoming moist, trace sand and gravel; till; **PP > 4.5**	0.0 0.0
30						0.0

	PROJECT NUMBER	BORING NUMBER	
ch2m.	677665.FI.01	PSA1-GT-02	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings LOCATION : St. Louis, MI DATE: 11/8/16

WEATHER: DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS START : 1300 END : 1600 LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
	30-32	2/2	SS-6	23-27-33-95	30.0'-33.8': Clayey silt to silty clay (ML-Cl), greyish brown, hard, slightly moist, trace sand and gravel; till	0.0
						0.0
	32-35	5/5	S-7	NA		0.0
						0.0
					33.8'-35.0': Granite (boulder)	
35						0.0
					EOB @ 35' BGS	

PROJECT NUMBER	BORING NUMBER	
677665.FI.01	PSA1-GT-03	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings | LOCATION : St. Louis, MI | DATE: 11/8/16

WEATHER: | DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS | START : 945 | END : | LOGGER : E. Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
	0-2	5/5	SS-1	**1-2-9-10**	0.0'-0.6': Topsoil - silt (ML-OL), dark brown, moist, little organics 0.6'-0.7': Sand (SP), brown, fine to medium, loose, moist 0.7'-2.0': Clayey silt (ML), brown, hard, dry, trace sand and gravel; cap material	0.0 0.0
	2-5	2/2	S-1	N/A	2.0'-5.0': Clayey silt to silty clay (ML-CL), brown, stiff to hard, moist, little sand, trace gravel	0.0 0.0 0.0
5	5-7	2/2	SS-2	**6-7-4-4**	5.0'-6.2': Sandy gravel (GW), fine to medium, loose, moist 6.2'-7.0':Clayey silt to silty clay (ML-CL), grey and brown, slight staining, firm, moist, little fine sand, faint hydrocarbon odor	0.0 0.0
	7-10	5/5	S-2	N/A	7.0'-8.2': Clayey sand (SC), grey, fine, moist, medium dense, some silt, little gravel, faint hydrocarbon odor 8.2'-10.0': Sand (SP), brown, fine to medium, loose to medium dense, moist, trace gravel	0.0 0.0
10	10-12	0/2	SS-3	**10-10-11-11**	10.0'-11.0': Sandy clay to (CL), silty clay, greyish brown, moist, stiff, trace gravel; **PP= 2.5** 11.0'-11.6': Sand (SP), brown, fine to medium, loose to medium dense, moist, faint hydrocarbon 11.6'-12.0': Sandy clay to silty clay, brown, firm, moist, trace gravel	0.0 10.0
	12-15	5/5	S-3	N/A	12.0'-15.0': Silty clay (CL), grey, firm becoming stiff at 14', moist, trace gravel; till	10.0 0.0
15						0.0

ch2m	PROJECT NUMBER 677665.FI.01	BORING NUMBER PSA1-GT-03	
	SOIL BORING LOG		

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings LOCATION : St. Louis, MI DATE: 11/8/16

WEATHER: DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS START : 945 END : LOGGER : E. Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
15	15-17	1.5/2	SS-4	**3-5-6-10**	15.0'-15.5': Silty clay (CL), grey, stiff, moist, trace gravel; till 15.5'-16.0': Coarse to gravelly sand, brown to grey, loose, wet, little clay 16.0'-16.5': Silty clay (CL), grey, firm, moist, trace sand and gravel 16.5'-17.0': No recovery	0.0 0.0
	17-20	5/5	S-4	N/A		0.0 0.0
20	20-22	2/2	SS-5	**1-7-11-15**	17.0'-22.0': Silty clay (CL), grey, hard, moist, trace gravel; **PP > 4.5**	0.0 0.0 0.0
	22-25	5/5	S-5	**N/A Hard drilling**	22.0'-25.0': Silty clay *CL), grey, stiff to very stiff, moist, trace gravel; **PP = 2.0**	0.0 0.0
25	25-30	5/5	S-6	**N/A Hard drilling**	25.0'-26.0': Rock 26.0-28.5': Clayey sand interbedded with clayey silt, grey, firm, moist, little gravel and cobbles 28.5'-30.0': Clayey silt, grey, hard, moist, trace gravel	0.0 0.0 0.0 0.0
30						0.0

	PROJECT NUMBER	BORING NUMBER	
ch2m.	677665.FI.01	PSA1-GT-03	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings LOCATION : St. Louis, MI DATE: 11/8/16

WEATHER: DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS START : 945 END : LOGGER : E. Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
	30-32	2/2	SS-6	**1-11-21-16**	30.0'-30.4': Clayey silt, grey, hard, moist, trace gravel 30.0'-30.8': Clayey sand, brown, loose to medium dense, moist 30.8'-32.0': Silty clay, hard, grey, moist, trace gravel	0.0 0.0
	32-35	5/5	S-7	**N/A Hard drilling**		0.0 0.0 0.0
35	35-37	2/2	SS-7	**39-45-95-80**	32.0'-40.0': Clayey silt, hard, grey, dry, trace gravel and sand; till; pulverized	0.0 0.0
	37-40	5/5	S-8	**N/A Hard drilling; 25 min. to advance**		0.0 0.0
40					EOB @ 40.0' BGS	0.0

PROJECT NUMBER	BORING NUMBER	
677665.FI.01	PSA1-GT-04	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings | LOCATION : St. Louis, MI | DATE: 11/10/16

WEATHER: | DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS | START : 830 | END : | LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
0	0-5	5/5	S-1	PP = 2.0 PP = 3.5 PP = 4.5	0.0'-5.0': Primarily silty clay (CL), brown, firm at top becoming stiffer with depth, little sand and gravel, moist	0.0 0.0 0.0 0.0 0.0
5	5-10	5/5	S-2	PP = 2.0 PP = 1.0	5.0'-5.7': Silty clay (CL), grey to black, moist, little gravel 5.7-6.6': Silty sand (SM) brown, loose to medium dense, moist, little clay, trace gravel 6.6'-8.0': Clayey sand (SC), brown, firm, moist, trace gravel 8.0'-10.0': Fine sand (SP) brown with grey staining, loose, moist, trace gravel, faint hydrocarbon odor	0.0 0.0 0.0 0.0 0.0
10	10-15	5/5	S-3	PP = 2.0 PP = 1.5 PP = 2.5 PP = 4.0	10.0'-11.3': Gravelly coarse sand (SW), brown, moist to wet, loose, trace cobbles 11.3'-15.0': Silty clay (CL), brown, firm becoming stiff, moist, trace gravel; till	0.0 0.0 0.0 0.0 0.0
15						

	PROJECT NUMBER	BORING NUMBER	
ch2m.	677665.FI.01	PSA1-GT-04	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings | LOCATION : St. Louis, MI | DATE: 11/10/16

WEATHER: | DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS | START : 830 | END : | LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
20	15-20	5/5	S-4	PP = 2.5 PP = 1.0 PP = 1.5 PP = 4.0 PP > 4.5	15.0'-16.3': Fine sand (SP) interbedded with clayey silts to silty clays (ML-CL) brown, moist to wet, dense, trace gravel throughout	0.0 0.0 0.0 0.0 0.0
	20-22	2/2	SS-1	8-25-27-21	16.3'-25.6': Silty clay (CL) brown, firm becoming hard with depth, moist, trace gravel; till	0.0
25	22-25	5/5	S-5	PP = 3.0		0.0 0.0 0.0
	25-27	2/2	SS-2	1-16-18-20	25.6'-26.1':Gravelly coarse sand (SW) interbedded with sandy clay (CL) brown, wet, medium dense 26.1'-27.0': Silty clay (CL) brown, stiff, moist, trace gravel; till	0.0 0.0
30	27-30	5/5	S-6	N/A	27.0'-30.0': Clayey silt (ML) brown, hard, dry, little gravel, mostly pulverized	0.0 0.0 0.0

	PROJECT NUMBER	BORING NUMBER	
ch2m.	677665.FI.01	PSA1-GT-04	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings LOCATION : St. Louis, MI DATE: 11/10/16

WEATHER: DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS START : 830 END : LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
30	30-32	2/2	SS-3	30-36-100-100		0.0
				PP > 4.5		0.0
	32-35	5/5	S-7	PP > 4.5 Hard drilling		0.0
						0.0
35						0.0
	35-40	5/5	S-8	PP > 4.5 Hard drilling 25 min. to advance 35-40	30.0'-45.0': Clayey silt (ML) brown, hard, dry, little gravel, mostly pulverized	0.0
						0.0
						0.0
						0.0
40						0.0
	40-42	2/2	SS-4	94-89-98-150		0.0
						0.0
	42-45	3/3	S-9	PP = 4.5		0.0
						0.0
45						0.0

	PROJECT NUMBER	BORING NUMBER	
ch2m.	677665.FI.01	PSA1-GT-04	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings LOCATION : St. Louis, MI DATE: 11/10/16

WEATHER: DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS START : 830 END : LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
45	45-47	2/2	SS-5	39-65-70-100		0.0
	47-48	1/1	S-10	PP = 4.5	45.0'-50.0': Clayey silt (ML) brown, hard, dry, little gravel, mostly pulverized	0.0
	48-50	2/2	SS-6	25-34-26-32		0.0
50						0.0
					EOB @ 50 BGS	

	PROJECT NUMBER	BORING NUMBER	
ch2m	677665.FI.01	PSA1-GT-05	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings | LOCATION : St. Louis, MI | DATE: 11/11/16

WEATHER: | DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS | START : 1320 | END : | LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
	0-5	5/5	S-1	Soft	0.0'-1.5': Silty topsoil (OL), dark brown, soft to firm, wet, little clay and sand; grading to fine to medium fine sand (SP), brown, loose, moist	0.0
					1.5'-3.5': Clayey silt (ML), brown, hard, dry, trace sand and gravel; cap material	0.0
				PP = 4.5		0.0
					3.5'-4.3': Silty gravel and sand (GW), light brown, dry, loose, some cobbles	0.0
5					4.3'-5.0': Sand (SP), brown, fine to medium, medium dense, moist	0.2
	5-10	5/5	S-2		5.0'-5.5': Sandy silt (ML), dark brownsh grey, moist, firm, faint odor, slight staining	0.0
				PP = 1.5		0.0
					5.5'-10.0': Sandy to silty clay (CL), greyish brown, firm, moist, trace gravel	0.0
				PP = 1.25		0.0
10				PP = 1.5		0.0
	10-15	5/5	S-3	PP = 2.0	10.0'-12.7': Silty clay (CL), brown, medium stiff becoming hard, moist, trace sand and gravel; till	0.0
				PP = 4.5		0.0
					12.7'-13.1': Sand (SP), grey, fine to medium, medium dense, moist to wet.	0.0
				PP = 4.5	13.1'-15.0': Silty clay (CL), greyish brown, hard, moist, trace to little sand and gravel; till	0.0
15						0.0

ch2m	PROJECT NUMBER 677665.FI.01	BORING NUMBER PSA1-GT-05	
	SOIL BORING LOG		

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings | LOCATION : St. Louis, MI | DATE: 11/11/16

WEATHER: | DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS | START : 1320 | END : | LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
20	15-20	5/5	S-4	**PP > 4.5**	15.0'-20.0': Silt (ML), brownish grey, hard, moist, trace gravel, clayey sitl; till	0.0 / 0.0 / 0.0 / 0.0 / 0.0
	20-22	2/2	SS-1	**5-17-34-45** **PP > 4.5**	20-22': Clayey sillt (ML), grey, moist, hard; till	0.0 / 0.0
25	22-25	3/3	S-5	**PP = 1.75** **PP > 4.5**	22.0'-25.0': Silty clay (CL), grey, moist, stiff to hard, trace gravel and sand grading to little gravel and sand; till	0.0 / 0.0 / 0.0
	25-27	2/2	SS-2	**PP = 3.0** **3-7-18-28** **PP = 4.5**	25.0'-27.0': Silty clay (CL), grey, very stiff to hard, moist, little fine sand, trace gravel; till; 2' sand seam at 26' BGS	0.0 / 0.0
30	27-30	3-Mar	S-6	**PP > 4.5** **Hard drilling**	27.0'-30.0': Silt (ML), grey, hard, moist becoming dry, little fine sand, trace gravel and cobbles; pulverized till	0.0 / 0.0 / 0.0

	PROJECT NUMBER	BORING NUMBER	
ch2m	677665.FI.01	PSA1-GT-05	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings LOCATION : St. Louis, MI DATE: 11/11/16

WEATHER: DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS START : 1320 END : LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
	30-32	2/2	SS-3	PP = 4.5 42-66-72-75 PP > 4.5	30.0'-32.0': Clayey silt (ML), grey, hard, moist, little sand, trace gravel; till	0.0 0.0
	32-35	5/5	S-7	PP > 4.5 Hard drilling	32.0'-35.0': Clayey silt (ML), grey, hard, moist to dry, some fine sand, trace gravel; till; pulverized	0.0 0.0 0.0
35	35-37	2/2	SS-4	34-72-100-145		0.0 0.0
	37-40	3/3	S-8	PP > 4.5	35.0'-40.0': Clayey silt (ML), brownish grey, hard, moist, little fine sand, trace coarse sand and gravel; till	0.0 0.0 0.0
40	40-42	2/2	SS-5	24-42-100-150	40.0'-42.0': Silt (ML) brownish grey, hard, moist, some fine sand	0.0 0.0
45					EOB @ 42.0' BGS	

SECTION 31 80 00
GEOTECHNICAL INSTRUMENTATION

PART 1 GENERAL

1.01 WORK INCLUDED

A. The purpose of geotechnical instrumentation is to permit the Contractor to monitor the Subcontractor's general compliance with the requirements of the Subcontract regarding ground movement in the vicinity of excavations and protection of adjacent property. The instrumentation program specified herein is not intended to be used to ensure the safety of the Work.

B. The Subcontractor shall be responsible for monitoring ground conditions as necessary to conform to the requirements of the Subcontract. The instrumentation program required by this section does not relieve the Subcontractor of responsibility for providing additional instrumentation and monitoring if, in the Subcontractor's opinion, such additional instrumentation and monitoring are necessary to accomplish the Work.

C. The Work specified in this section includes, but is not limited to, requirements for furnishing, installing, and maintaining geotechnical instrumentation to monitor lateral and vertical movements of shoring for required excavations.

D. At a minimum, the Subcontractor shall install the instrumentation detailed in this section and at locations specified by the Contractor prior to construction. Additionally, the Subcontractor shall install instrumentation as necessary to control operations, monitor ground conditions, and ground response to achieve specified project requirements and to prevent damage to existing structures and adjacent private property.

E. The Subcontractor shall hire an independent instrumentation specialist to install instrumentation as specified. The specialist shall have documented experience as set forth in Article 1.04, Quality Assurance, of this Specification section.

F. The Subcontractor’s Instrumentation Specialist shall install the instruments as specified at the locations established by the Contractor. The Subcontractor will survey and monitor all settlement markers and furnish the Contractor with results. The Subcontractor shall provide access to the instrumentation to allow the Contractor to independently monitor the instrumentation at any time and for any reason.

G. The Subcontractor shall complete an as-installed position survey to determine the horizontal and vertical positions of settlement markers and piezometers in accordance with the requirements herein and furnish the Contractor with a copy of the results within 24 hours of field data acquisition.

H. Unless otherwise noted or instructed by the Contractor, the Subcontractor shall abandon all instruments upon completion of the Work.

1.02 SUBMITTALS

A. Action Submittals: Instrumentation shop drawings detailing locations; depths based on general information shown on the Drawings; type, details, and other pertinent information showing the installation details for the required instrumentation.

B. Informational Submittals:

1. Drawing that indicates the locations of control points and benchmarks associated with surveys for monitoring geotechnical instrumentation.
2. Description of methods for installing and protecting all instruments.
3. Schedule of instrument installation related to significant activities or milestones in the overall Project.
4. Following installation of the instruments and prior to the start of excavation, submit as-built shop drawings showing the exact installed location, the instrument identification number, the instrument type, the installation date and time, and the anchor or tip elevation and instrument length, where applicable, and installed locations of control points and benchmarks associated with surveys for monitoring geotechnical instrumentation. Include details of installed instruments, accessories, and protective measures including all dimensions and materials used.
5. Product Data: Manufacturer's literature describing installation, operation, and maintenance procedures for all instruments, materials, readout units, and accessories.
6. Reports and Records:
    a. Submit three copies of initial/baseline readings specified herein to the Contractor, on forms approved by the Contractor, at least 15 days prior to the start of any excavation activity.
    b. Submit three copies of the instrumentation data to the Contractor, on forms approved by the Contractor, within 24 hours after the observation has been made.
    c. As applicable, submit reduced data and updated data plots in ground movements within 2 working days after observations have been made.

d. Submit weekly summary of groundwater readings at each piezometer in format accepted by the Contractor with information regarding elevation or station of station of excavation progress for each reading. Provide brief narrative description on conditions in excavation, precipitation, and any changes in the vicinity of the excavation area.
e. Inform Contractor immediately when Action Limits or Displacement Limit is reached for any instrument.
f. Drilling and installation logs for instrumentation installations prepared by the instrumentation specialist.
g. Copies of abandonment forms for piezometers.

7. Permits and Consents: For drilling holes from ground surface and conducting monitoring activities and if necessary, for potholing to avoid utility interference.

C. Movement/Settlement and Support System Monitoring:

1. The professional engineer licensed in the State of Michigan who prepared the excavation support system (Section 31 41 00, Shoring) shall prepare a movement/settlement monitoring plan covering all excavation and earthwork described in the sections:
   a. Section 31 23 16, Excavation.
   b. Section 31 41 00, Shoring.
2. Submit a single monitoring plan that covers all excavations and includes the required frequency of monitoring (minimum frequency in Article 3.05, Movement/Settlement Monitoring of this section) to ensure settlement is controlled. Monitoring shall include:
   a. On-site observation of the support system performance, to be performed by the Subcontractor.
   b. Position (survey) measurement of geotechnical instrumentation, to be performed by the Subcontractor, and additional monitoring performed by the Subcontractor (see paragraph 3 below).
   c. Review of position measurements to assess ground movement, to be performed by the Subcontractor.
3. The Subcontractor shall provide a Michigan-licensed surveyor to take position measurements of the instrumentation described in this Specification section at the frequency indicated in Article 3.09, Movement/Settlement Monitoring of this section. Additional monitoring as required by the ground support engineer’s plan shall be performed by a Michigan-licensed surveyor retained by the Subcontractor. The Subcontractor’s engineer shall review all measured data as required by this Specification section.

4. The Subcontractor shall provide weekly reports from Subcontractor's ground support design engineer on performance of ground support system elements and associated adjacent ground movements and protection of adjacent property. These reports shall also provide submittal of any ground support system design modifications that are required based on field observations and support system behavior.

1.03 DEFINITIONS

A. Ground Surface Settlement Marker (GM): GMs are stakes, rods, or nails installed in unpaved or paved areas at predetermined locations to measure vertical (elevation) changes of the ground surface.

B. Open Ground: Ground without any above- or below-grade facilities, paved or unpaved roads, and utilities within a 25-foot horizontal radius.

C. Piezometer (PZ) / Observation Well: A monitoring well-constructed in a borehole using a riser pipe section near the ground surface and a specially slotted pipe section (well screen) above the bottom of the well. The well screen length and position normally extends from several feet above to several feet below the anticipated water table range.

D. Water Level Sensor (WS): A water level sensor measures the water level in a well or standpipe by sensing the level of the water when a special electrical contact tip touches the water surface. The tip is attached to the end of a specially marked graduated cable that enables the reader to measure the depth to water below the top of the well riser.

1.04 QUALITY ASSURANCE

A. Personnel Qualifications:

1. Qualified technicians with a minimum of 2 years' experience in the installation of geotechnical instrumentation similar to those specified herein.
2. Ground Support Engineer: A Michigan-licensed civil or structural engineer experienced in the design of subsurface support structures.

B. The Subcontractor shall notify the Contractor at least 24 hours prior to all instrumentation installation operations so that the Contractor may monitor the installation work.

C. Each instrument specified herein shall be the product of an acceptable manufacturer currently engaged in manufacturing geotechnical instrumentation hardware of the specified types.

D. Surveys (performed by the Subcontractor) for monitoring geotechnical instrumentation shall be referenced to the same control points and benchmarks established for setting out the work. Control points shall be tied to benchmarks and other monuments outside of the zone of ground movements that might result from underground excavations.

1.05 TOLERANCES

A. GMs and PZs shall be installed within 12 inches of the horizontal locations as agreed by the Contractor or approved shop drawings.

B. Should actual field conditions prohibit installation at the locations and elevations established by the Contractor, the Contractor shall be consulted and new instrument locations and elevations established.

1.06 PROJECT CONDITIONS

A. Obtain necessary permits for the installation of monitoring systems.

B. Provide the Contractor access to the instruments at all times.

C. All PZs shall be protected from vandalism or other accidental damage using steel locking covers or traffic-rated flush bolt-down covers.

PART 2 PRODUCTS

2.01 PIEZOMETER / OBSERVATION WELL MATERIALS

A. Coarse Sand: Sand for filter pack and sand backfill shall be clean natural silica sand; graded such that all of the material passes the No. 4 sieve and is retained on the No. 30 sieve.

B. Fine Sand: Sand for filter pack seals shall be clean natural silica sand; graded such that all the material passes the No. 10 sieve and is retained on the No. 40 sieve.

C. Bentonite Pellets: Bentonite pellets used to form bentonite seals shall be 3/8-inch-diameter compressed pellets made from high-swelling montmorillonite.

2.02 SETTLEMENT MARKERS

A. Ground surface settlement markers (GM) in unpaved areas shall consist of a 2-inch by 2-inch by 24-inch long hardwood stake or a 24-inch long, 1-inch diameter (No. 8) reinforcing bar driven approximately 10 inches below grade as directed by the Contractor. In paved areas GMs shall be hardened surveyor "PK" nails that are securely fastened by driving or epoxy grouting within a properly sized hole, flush with the pavement.

2.03 PIEZOMETER / OBSERVATION WELL (PZ)

A. Riser pipe for piezometers / observation wells shall consist of Schedule 40 or thicker PVC pipe with flush threaded couplings. All PVC pipe shall have a nominal diameter of 2 inches. A PVC cap for the riser shall be provided. Sensing tips shall consist of 2-inch ID factory-slotted PVC threaded pipe, with 0.02-inch size openings, 60 inches in length.

2.04 WATER LEVEL SENSOR (WS)

A. Water level sensors shall have electronic sensors with both a light and a buzzer indicator. The water level sensor shall have a sensitivity dial to adjust for variations in water chemistry. It shall have a minimum 50-foot-long cable on a reel with labeled foot marks and depth marks at tenths of a foot. Provide water level sensors with a carrying case.

2.05 INSTRUMENT PROTECTION AND COVERS

A. A valve box assembly or steel casing with protective cover shall be provided for each PZ. Each protective cover shall be 2 inches larger in inside diameter than the riser pipe within, or a minimum of 4 inches, whichever is greater. The valve box shall have a minimum depth below ground surface of 1.5 feet and shall have a bolted cover.

PART 3 EXECUTION

3.01 GENERAL

A. Instrumentation shall be installed at the locations established by the Contractor prior to commencement of construction activities. The number of each type of instrument for each contract is contained below:

Instrument Type	Number
Ground Surface Settlement Marker (GM)	10
Piezometers / Observation Wells (PZ)	6

B. Existing piezometers and monitoring wells will be available for Subcontractor use.

C. The GMs will typically be located within a couple of feet behind the shoring system. The PZs will typically be located near the property boundaries.

D. Locate underground utilities in all areas where borings are to be drilled and instruments installed. Instrument locations shall be modified, as approved by the Engineer, to avoid interference with the existing conduits and utilities. Repair damage to existing utilities resulting from instrument installations at no additional cost to the Contractor.

E. Contractor shall have access to marker locations and Subcontractor's cooperation is required in obtaining monitoring data, including the provision of assistance, as required.

F. All markers shall be clearly marked, permanently labeled, and protected to avoid being obstructed or otherwise damaged by construction operations or the general public.

G. Location Surveying: Promptly following installation, the Subcontractor shall survey and provide horizontal coordinates and vertical elevations of the ground surface and top of all markers.

H. Drilling from the Ground Surface: Subcontractor shall obtain any permits required for boreholes drilled from the ground surface. Obtain necessary permits for each such instrument and conform to the permit requirements during drilling and installation.

I. Initial Reading: Following marker and PZ installation and prior to the start of any construction activity within 50 feet of the edge of the excavation, the Subcontractor's surveyor, shall take a minimum of two sets of initial readings to provide baseline readings and to demonstrate the adequacy of the completed installation.

1. Installation of the instrumentation by the Subcontractor does not preclude the Owner, through an independent contractor, from installing instrumentation in, on, near, or adjacent to the construction work.
2. Elevations shall be recorded to a precision of 0.001 foot. Horizontal survey accuracy shall be 0.01 foot or less.

3. The Subcontractor shall take additional survey(s) as requested by the Contractor if in the opinion of the Contractor the two sets of initial readings do not adequately establish the baseline level. After initial readings are approved by the Contractor, the average of the two sets of initial readings shall be used to establish the baseline level of the instrument, unless otherwise directed by the Contractor.

J. Subsequent Readings: Readings shall be conducted a minimum of three times per week during excavation within 50 feet of the earth retention system. After the maximum depth of excavation has been achieved readings shall be obtained once per week until the excavation has been backfilled.

3.02 GROUND SURFACE SETTLEMENT MARKERS

A. GMs shall be installed where directed by the Contractor, and approved submittals. Markers shall be installed firmly to prevent loosening and in a manner and location that allows survey rods to be consistently placed on the high point of the marker head or point being measured.

B. GMs shall be installed at the required locations where directed by the Contractor. The method of installation shall be the Subcontractor's option; however, the marker shall be rigidly affixed so as not to move relative to the surface to which it is attached.

3.03 MARKER PROTECTION, MAINTENANCE AND REPAIR

A. Flag and protect all locations. Exercise care during construction so as to avoid damage to markers. Repair or replace markers that are damaged as a result of the contractor's operation at his expense. The Contractor will determine whether repair or replacement is required. Complete the repair or replacement as soon as practical after notification by the Contractor as to whether a repair or replacement is required.

3.04 PROTECTION OF PROPERTY AND GROUND MOVEMENT LIMITS

A. The Subcontractor shall use whatever means and methods are necessary to limit ground movements, settlements and damage of utilities, structures and other facilities. These means and methods include, but are not limited to ground support systems, underpinning of vulnerable facilities, grouting and other forms of ground improvement.

B. The ground movement limits for all instruments are established as follows:

Facility	Action Limit (inch)	Displacement Limit (inch)
Street and general roadway pavement	0.7	1.0
Open ground	0.7	1.5

C. If settlement of a GM reaches an Action Limit, the likely cause of the settlement shall be reported to the Contractor and actions shall be promptly taken to limit further settlements and to prevent Settlement Limits from being exceeded. Actions to be taken in response to measured settlements shall be reported to the Contractor before being taken, except in emergency situations. The cost of actions required to comply with settlement limits and to repair any damage to adjacent facilities shall be borne by the Subcontractor with no cost to the Owner.

3.05 SOIL DRILLING AND SAMPLING

A. Hollow stem auger methods may be used to provide a casing for temporary soil support. Boreholes shall be oversized at the ground surface as necessary to accommodate installation of protective covers.

B. Arrange ports in the drilling bit so that there is no jetting action of the drilling fluid ahead of the bit. Use the minimum amount of fluid necessary to carry away the cuttings.

C. Complete soil sampling at intervals of 2.5 feet or less using standard penetration tests that are conducted in accordance with ASTM D1586.

D. Store representative samples portions not retained for analytical laboratory testing in glass jars approximately 5 inches high and 1-3/4 inches in inside diameter at the mouth. Provide jars with metal screw caps containing a rubber or waxed paper gasket that forms an airtight seal when closed. Provide jars with labels large enough to identify the jar with the project number and name, boring number, sample number, depths at top and bottom of sample, blow count and recovery. Perform the laboratory testing on retained samples as deemed necessary.

E. Observe all soil drilling and sampling and prepare a log of the boring.

F. Upon completion of drilling, flush the boring with clear water prior to instrument installation.

3.06 PIEZOMETERS / OBSEVATION WELLS

A. Drill, sample, and log borings in soil drilled for the purpose of installing piezometers and observation wells as specified here in Soil drilling and Sampling. Drill borings using 4-inch minimum inside-diameter casing and water. If drilling fluid is necessary to stabilize the borehole, use a biodegradable organic polymeric drilling fluid. Perform a standard penetration test at 2.5-foot depth intervals.

B. Install the sensing tip, riser pipe, filter pack, filter pack seal, and annular space seal. Make pipe joints secure and watertight. Withdraw the drill casing in small increments as the backfill materials are placed, so that collapse of the borehole does not occur. Do not rotate casing during withdrawal.

C. Place filter pack material slowly so that bridging does not occur in the boring and to prevent the instrument from being lifted as the casing is withdrawn. Use a measuring rod or similar device to measure the height of the filter pack to ensure that the filter pack is installed over the proper depth interval. Carefully raise and lower the measuring rod while the filter pack is installed, to prevent bridging and to tamp the filter pack in place.

D. Place a filter pack seal above the filter pack. Place the filter pack seal in a similar manner as for filter pack material. Place a bentonite seal above the filter pack seal.

E. For observation wells, the annular space seal shall consist of crushed bentonite pellets, or powered bentonite, and shall be hydrated with water. The bentonite seal specified herein to be installed above the filter pack seal may be eliminated in this case.

F. Grout for the annular space seal for piezometers shall consist of a bentonite to cement ratio of 0.15/1 by weight, with sufficient water to allow pumping. Mix bentonite and water before placement.

G. Provide the top of each riser piper with a cap in which an air vent hole 1/8 inch in diameter has been drilled. The cap shall be easy to remove.

H. Develop each installation a minimum of 24 hours after completion. Continue development until the water becomes clear and, in the opinion of the Engineer, the material soil filter has been developed.

I. Piezometers/observation wells located within or in close proximity to excavations shall be monitored to verify sufficient lowering of the groundwater table within the limits specified in Section 31 23 19.01, Dewatering.

J. Monitoring frequency of piezometers/observation wells shall conform the water control plan and requirements in Section 31 23 19.01, Dewatering.

3.07 MOVEMENT/SETTLEMENT MONITORING

A. The Subcontractor shall develop and implement a settlement control plan to monitor existing facilities, utilities, structures, roads, streets, and other improvements from damage due to settlement resulting from installation of excavation support systems or the excavations themselves.

B. If necessary, obtain the permission of Contractor, in advance, to work outside of the work hours established for the project. The Subcontractor shall be responsible for making any necessary changes in construction methods to control loss of ground and minimize settlement to prevent damage to adjacent facilities, existing utilities, and adjacent structures.

C. Monitoring of structures and ground movement: Submit a movement / settlement monitoring plan that complies with Article 1.02C of this Specification section. Plan shall be prepared and sealed by a Civil or Structural Contractor registered with the State of Michigan. Monitoring required by this Specification section is the minimum. If, in the opinion of the Subcontractor's design support engineer, additional instrumentation is required than that required by the Subcontract Documents, Subcontractor shall install the additional instrumentation at no additional cost to the Owner.

D. Actions to Mitigate Excess Ground Movements:

1. If displacement limit of a settlement marker reaches an action limit, the likely cause of the displacement shall be promptly discussed with the Contractor. The Contractor may increase the monitoring frequency for all settlement markers within 100 feet of the location where the displacement action limit was exceeded. Review excavation and ground support operations and make operational changes or implement ground improvement or underpinning measures as appropriate to limit further displacements and to prevent displacement limits from being exceeded. Actions to be taken in response to action limits being exceeded shall be reported to the Contractor before being taken, except in emergency situations.

2. If displacement of a settlement marker reaches a displacement limit, cease excavation or other construction operations that result in further displacement until additional operational changes are made to reduce ground loss around excavation. The likely cause of the displacement shall be immediately discussed with the Contractor. The Contractor may further increase the monitoring frequency for all settlement markers and inclinometers within 100 feet of the location where the displacement limit was exceeded and may add additional settlement markers and inclinometers. Review excavation and ground support operations and make operational changes or implement ground improvement or underpinning measures as appropriate to limit further displacements and to prevent displacement limits from being exceeded. Actions to be taken in response to displacement limits being exceeded shall be discussed with and approved by the Contractor before being taken, except in emergency situations.
3. The cost of actions required for complying with displacement limits and to repair any damage to adjacent facilities shall be borne by the Subcontractor with no additional cost to the Owner.

3.08 DISCLOSURE OF DATA

A. The Subcontractor shall not disclose any data to third parties and shall not publish data without prior approval and written consent of the Owner.

3.09 ABANDONMENT OF INSTRUMENTS

A. Settlement Markers: All GMs shall be removed by the Subcontractor during the cleanup and restoration work, or sooner as allowed or required by the Contractor. Abandonment shall be documented and records submitted to the Contractor and agencies requiring abandonment records. Any resulting voids shall be filled with soil and the ground surface restored.

B. Abandon all piezometers / observation wells installed by the Subcontractor. Abandonment shall be in accordance with the requirements of local and state authorities. Submit copies of the complete state and local authorities' abandonment forms to the Contractor within 3 work days.

END OF SECTION

SECTION 32 91 13
SOIL PREPARATION

PART 1 GENERAL

1.01 GENERAL

A. This Work includes transportation and installation of topsoil to the project site.

B. Analytical testing and gradation analysis are only required for imported material from borrow source(s). Onsite material that is stockpiled for reuse will not be submitted for analytical testing or gradation analysis.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. C33/C33M, Standard Specification for Concrete Aggregates.
   b. C602, Standard Specification for Agricultural Liming Materials.
   c. D2974, Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
   d. D5268, Standard Specification for Topsoil Used for Landscaping Purposes.
   e. C117, Standard Test Method for Materials Finer Than 75-Micrometers (No. 200) Sieve in Mineral Aggregates by Washing.
   f. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).
   g. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   h. D4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
   i. D6938, Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods.
2. Michigan Department of Transportation (MDOT):
   a. MTM 108, Michigan Test Method for Materials Finer than No. 75 µm (No. 200) Sieve in Mineral Aggregates by Washing
   b. MTM 109, Michigan Test Method for Sieve Analysis of Fine, Dense Graded, Open Graded and Coarse Aggregates in the Field

1.03 DEFINITIONS

A. Optimum Moisture Content:

1. Determined in accordance with ASTM Standard specified to determine maximum dry density for relative compaction.
2. Determine field moisture content on basis of fraction passing 3/4-inch sieve.

B. Completed Course: A course or layer that is ready for next layer or next phase of Work.

C. Lift: Loose (uncompacted) layer of material.

D. Imported Material: Materials obtained from sources offsite, suitable for specific use.

1.04 SUBMITTALS

A. Action Submittals:

1. Subcontractor shall identify borrow source(s) for sampling and approval by Contractor. Borrow source samples collected by the Subcontractor will be analyzed for the following:
   a. Chemical analyses of source materials (Contamination, Fertility and Salinity).
      1) For contamination testing, test for the analyses listed in Section 31 23 23, Fill and Backfill.
   b. Gradation analyses of source materials.

B. Informational Submittals:

1. Certified Topsoil Analysis Reports:
   a. Indicate quantities of materials necessary to bring imported topsoil into compliance with textural/gradation requirements.
   b. Indicate quantity of lime, quantity and analysis of fertilizer, and quantity and type of soil additive.

1.05 SEQUENCING AND SCHEDULING

A. Perform Work specified in Section 31 23 16, Excavation, prior to performing Work specified under this section.

B. Perform post excavation and post backfill Survey in accordance with Section 01 31 13, Project Coordination prior to performing Work specified under this section.

C. Complete Work specified in this Section after receiving authorization from Contractor upon inspection of final backfill grade.

1.06 QUALITY ASSURANCE

A. Notify Contractor when:

1. Subgrade is ready for backfilling or when backfilling operations are resumed after a period of inactivity.
2. Soft or loose subgrade materials are encountered.
3. Topsoil material appears to be deviating from Specifications.

PART 2 PRODUCTS

2.01 TOPSOIL

A. General: Natural, friable, sandy loam, obtained from well-drained areas, free from objects larger than 1-1/2 inches maximum dimension, and free of subsoil, roots, grass, other foreign matter, hazardous or toxic substances, and deleterious material that may be harmful to plant growth or may hinder grading, planting, or maintenance.

B. Composition: In general accordance with ASTM D5268: Imported topsoil shall meet the requirements of Table 1 as described below:

TABLE 1
Topsoil Borrow Requirements

	Minimum	Maximum
Material Passing 2.00 mm (#10) Sieve	85%	--
Clay	5%	30%
Silt	10%	70%
Sand	10%	70%
Gravel	5%	15%

C. Organic Matter: Minimum 1.5 percent by dry weight as determined in accordance with ASTM D2974.

D. pH: Range 5.0 to 7.0.

E. Textural Amendments: Amend as necessary to conform to required composition by incorporating sand, peat, manure, or sawdust.

F. Testing of topsoil for grain-size, pH and Organic Content to be one sample per 1,000 CY of in-place topsoil.

2.02 LIME

A. Composition: Ground limestone with not less than 85 percent total carbonates, ASTM C602.

B. Gradation:

1. Minimum 50 percent passing No. 100 sieve.
2. Minimum 90 percent passing No. 20 sieve.
3. Coarser material acceptable provided rates of application are increased proportionately on basis of quantities passing No. 100 sieve.

2.03 SOIL ADDITIVES

A. Sawdust or Ground Bark:

1. Nontoxic, of uniform texture, and subject to slow decomposition when mixed with soil.
2. Nitrogen-treated, or if untreated mix with minimum 0.15 pound of ammonium nitrate or 0.25 pound of ammonium sulfate per cubic foot of loose material.

B. Peat:

1. Composition: Natural residue formed by decomposition of reeds, sedges, or mosses in a freshwater environment, free from lumps, roots, and stones.
   a. Organic Matter: Not less than 90 percent on a dry weight basis as determined by ASTM D2974.
   b. Moisture Content: Maximum 65 percent by weight at time of delivery.

C. Fertilizer: As specified in Section 32 92 00, Turf and Grasses.

D. Sand: Fine Aggregate: Clean, coarse, well-graded, ASTM C33/C33M.

2.04 SOURCE QUALITY CONTROL

A. The Subcontractor shall submit the all laboratory reports to Contractor for approval within one day of receipt from the laboratory. Subcontractor must receive approval from Contractor prior to placement of borrow source materials.

B. Perform tests necessary to locate acceptable imported source materials meeting specified physical and chemical requirements.

C. Topsoil Analysis/Testing: Performed by county or state soil testing service or approved certified independent testing laboratory.

D. Source quality control samples for contamination shall be collected and tested for the analyses listed in Section 31 23 23, Fill and Backfill.

E. The Subcontractor will collect samples of topsoil for general fertility/salinity parameters using the Ag Source Harris 'Diagnostic Test'. (http://documents.crinet.com/AgSource-Cooperative-Services/Locations/HarrisSoil-infosheet-v2-Interactive-2014.pdf) or equivalent. Collect one sample per 1,000 cubic yards of imported source material for general fertility/salinity parameters.

PART 3 EXECUTION

3.01 GENERAL

A. This work includes transportation and installation of all material to the project site.

B. Do not use sections of prepared ground surface as haul roads. Protect prepared subgrade from traffic.

3.02 SUBGRADE PREPARATION

A. If pH is determined low, apply lime to subgrade before tilling.

B. Apply lime at the rate of 50 pounds per 1,000 square feet to subgrade before tilling.

C. Remove stones over 2-1/2 inches in any dimension, sticks, roots, rubbish, and other extraneous material.

D. Limit preparation to areas which will receive topsoil within 2 days after preparation.

3.03 TOPSOIL PLACEMENT

A. Do not place topsoil when subsoil or topsoil is frozen, excessively wet, or otherwise detrimental to the Work.

B. Mix soil amendments, lime, and other soil additives, identified in analysis reports with topsoil before placement or spread on topsoil surface and mix thoroughly into entire depth of topsoil before planting or seeding. Delay mixing of fertilizer if planting or seeding will not occur within 3 days.

C. Place topsoil in maximum lift thickness of 6-inches.

D. Place remainder of topsoil to depth 6 inches where seeding and planting are scheduled.

E. Uniformly distribute to within 1/2 inch of final grades. Fine grade topsoil eliminating rough or low areas and maintaining levels, profiles, and contours of subgrade.

F. Remove stones exceeding 1-1/2-inch diameter, roots, sticks, debris, and foreign matter during and after topsoil placement.

G. Remove surplus subsoil and topsoil from Site. Grade stockpile area as necessary and place in condition acceptable for planting or seeding.

3.04 SITE TESTING

A. If test results indicate material does not meet Specification requirements, terminate material placement until corrective measures are taken.

B. Remove material placed in Work that does not meet Specification requirements.

END OF SECTION

SECTION 32 92 00
TURF AND GRASSES

PART 1 GENERAL

1.01 REFERENCES

A. Michigan Department of Transportation Standard Specifications for Construction, 2012 Version or current.

1.02 DEFINITIONS

A. Maintenance Period: Begin maintenance immediately after each area is planted (seeded) and continue for a period of 12 weeks after all planting under this section is completed.

B. Satisfactory Stand: Grass that has:

1. No bare spots larger than 3 square feet.
2. Not more than 30 percent of total area with bare spots larger than 1 square foot.

1.03 SUBMITTALS

A. Action Submittals:

1. Product labels/data sheets.
2. Seed: Mixtures: Proportions of each kind of seed.

B. Informational Submittals:

1. Seed: Certification of seed analysis, germination rate, and inoculation:
   a. Certify that each lot of seed has been tested by a testing laboratory certified in seed testing, within 6 months of date of delivery. Include with certification:
      1) Name and address of laboratory.
      2) Date of test.
      3) Lot number for each seed specified.
      4) Test Results: (i) name, (ii) percentages of purity and of germination, and (iii) weed content for each kind of seed furnished.
2. Seed Inoculant Certification: Bacteria prepared specifically for legume species to be inoculated.

3. Bag identification tags for each bag of seed used on the site, prior to installation. All seed shall be certified weed free and seeding rates will be based on pure live seed (PLS). PLS analysis results shall be provided on each seed tag.
4. Description of required maintenance activities and activity frequency.

1.04 DELIVERY, STORAGE, AND PROTECTION

A. Seed:

1. Furnish in standard containers with seed name, lot number, net weight, percentages of purity, germination, and hard seed and maximum weed seed content, clearly marked for each container of seed.
2. Keep dry during storage.

B. Hydroseeding Mulch: Mark package of wood fiber mulch to show air dry weight.

1.05 WEATHER RESTRICTIONS

A. Perform Work under favorable weather and soil moisture conditions as determined by accepted local practice.

1.06 SEQUENCING AND SCHEDULING

A. Prepare topsoil as specified in Section 32 91 13, Soil Preparation, before starting Work of this section.

B. Complete Work under this section within 3 days following completion of soil preparation.

C. Notify Contractor at least 3 days in advance of:

1. Each material delivery.
2. Start of planting activity.

D. Planting Season: The period during which soil temperatures reach 50 degrees Fahrenheit or greater in the spring with a limited possibility of frost and greater than 45 degrees Fahrenheit in the fall, typically May 1 through October 16.

1.07 MAINTENANCE SERVICE

A. Perform maintenance operations during maintenance period to include:

1. Water to support germination and sustain growth.
2. Washouts: Repair by filling with topsoil, liming, fertilizing, seeding, and mulching.
3. Mulch: Replace wherever and whenever washed or blown away.
4. Reseed unsatisfactory areas or portions thereof immediately at the end of the maintenance period if a satisfactory stand has not been produced.
5. Reseed/replant during next planting season if scheduled end of maintenance period falls after October 16.
6. Reseed/replant entire area if satisfactory stand does not develop by July 1 of the following year.

PART 2 PRODUCTS

2.01 FERTILIZER

A. Commercial, uniform in composition, free-flowing, suitable for application with equipment designed for that purpose. Minimum percentage of plant food by weight.

B. Application Mixture and Rates: Determined by soil analysis results as described in Section 32 91 13, Soil Preparation.

2.02 SEED

A. The seed mix should contain a mixture of at least 10 native species of grasses and forbs with successive blooming periods such that the site has viable cover throughout the span of the growing season.

B. The seed mix should contain species appropriate to the hydrologic regime anticipated for the planting site (i.e. dry land species for dry areas and wetland species for wet areas).

C. The seed mixture should be certified weed free and not contain any state-listed noxious, non-native, or non-native invasive species. The seed should be obtained from a supplier within 100 miles of the Project site.

2.03 STRAW MULCH

A. Threshed straw of oats, wheat, barley, or rye, free from (i) seed of noxious weeds or (ii) clean salt hay.

2.04 HYDROSEEDING MULCH

A. Wood Cellulose Fiber Mulch:

1. Specially processed wood fiber containing no growth or germination inhibiting factors.
2. Dyed a suitable color to facilitate inspection of material placement.
3. Manufactured such that after addition and agitation in slurry tanks with water, the material fibers will become uniformly suspended to form homogenous slurry.
4. When hydraulically sprayed on ground, material will allow absorption and percolation of moisture.

2.05 NETTING

A. Jute:

1. Heavy-duty, twisted, weighing 1 pound(s) per square yard.
2. Openings Between Strands: Approximately 1 inch square.

PART 3 EXECUTION

3.01 PREPARATION

A. Grade areas to smooth, even surface with loose, uniformly fine texture.

1. Roll and rake, remove ridges, fill depressions to meet finish grades.
2. Limit such Work to areas to be planted within immediate future.
3. Remove debris, and stones larger than 1-1/2-inch diameter, and other objects that may interfere with planting and maintenance operations.

B. Moisten prepared areas before planting if soil is dry. Water thoroughly and allow surface to dry off before seeding. Do not create muddy soil.

C. Restore prepared areas to specified condition if eroded or otherwise disturbed after preparation and before planting.

3.02 FERTILIZER

A. Apply evenly over area in accordance with manufacturer’s instructions. Mix into top 2 inches of topsoil, when applied by broadcast method.

3.03 SEEDING

A. Start within 2 days of preparation completion.

B. Hydroseed all areas requiring restoration.

C. Hydroseeding:

1. Application Rate: Based on manufacturer's recommendation.
2. Apply on moist soil, only after free surface water has drained away.
3. Prevent drift and displacement of mixture into other areas.
4. Upon application, allow absorption and percolation of moisture into ground.
5. Mixtures: Seed and fertilizer may be mixed together, apply within 30 minutes of mixing to prevent fertilizer from burning seed.

D. Mulching: Apply uniform cover of hydro-mulch with tackifier or straw mulch within 24 hours from the time seeding has been performed.

E. Netting: Immediately after mulching, place over mulched areas with slopes steeper than 3H:1V in accordance with manufacturer's instructions. Locate strips parallel to slope and completely cover seeded areas.

F. Water to support germination and sustain growth.

3.04 FIELD QUALITY CONTROL

A. Establishment will be measured a minimum of 1 time after the seeding is completed prior to the end of the 12 week maintenance period.

B. The Subcontractor is responsible for maintaining the seeded areas and plantings in accordance with this specification.

C. If a satisfactory stand has not been established, Engineer will make another determination after written notice from Subcontractor following the next growing season.

END OF SECTION

SECTION 33 21 13.01
GROUNDWATER ELEVATION
CONTROL TILE ABANDONMENT

PART 1 GENERAL

1.01 SCOPE

A. This section includes the Work necessary to mobilize, demobilize, set up, and move equipment related to the abandonment of a portion of the groundwater elevation control tile, as shown on Drawings.

B. Abandonment of the existing groundwater elevation control tile will be performed in-place. Abandonment activities for the groundwater elevation control tile include dewatering pipes and manholes and flowable fill installation in the pipes and manholes planned for abandonment.

1.02 SUBMITTALS

A. Informational Submittals:

1. Procedures for abandoning existing groundwater elevation control tile, including equipment and flowable fill details.
2. Controlled Low Strength Material: Certified mix design and test results. Include material types and weight per cubic yard for each component of mix.
3. Name of proposed disposal facility for water removed from groundwater elevation control tile for review and approval by Owner.

PART 2 PRODUCTS

2.01 CONTROLLED LOW STRENGTH MATERIAL (CLSM)

A. Select and proportion ingredients to obtain compressive strength between 50 psi and 150 psi at 28 days in accordance with ASTM D4832, Standard Test Method for Preparation and Testing of Controlled Low Strength Material Test Cylinders.

B. Materials:

1. Cement: ASTM C150/C150M, Type I or Type II.
2. Aggregate: ASTM C33/C33M, Size 7.

3. Fly Ash (Pozzolan): Class F fly ash in accordance with ASTM C618, except as modified herein:
   a. ASTM C618, Table 1, Loss on Ignition: Unless permitted otherwise, maximum 3 percent.
   b. Test in accordance with ASTM C1012/C1012M to verify sulfate resistance is acceptable.

C. Water: Clean, potable, containing less than 500 ppm of chlorides.

2.02 SOURCE QUALITY CONTROL

A. Certify Laboratory Performance of Mix Designs for CLSM

PART 3 EXECUTION

3.01 GENERAL

A. Dewatering activities for the groundwater elevation control tile shall be performed prior to placing flowable fill.

3.02 PLUGGING PROCEDURES

A. Controlled Low Strength Material:

1. Discharge from truck mounted drum type mixer into trench.
2. Apply in one continuous operation until the entire pipe length and manhole is filled.
3. The Subcontractor is responsible for determining, in advance, the amount of slurry required to plug the portion of the groundwater elevation control tile scheduled for abandonment.

B. Cement Slurries: Neat cement or concrete slurries shall be prepared by adding cement, or sand and cement, to the calculated required volume of clean water. The material shall be mixed in the mixing equipment until it is adequately mixed and free of lumps, then immediately pumped into the groundwater elevation control tile without delay.

C. Equipment:

1. The minimum equipment required consists of:
   a. Temporary test pump, pump service rig, and equipment capable of setting and operating pumps as specified in these Specifications.

b. Frac tank(s) with spill guard for placing water removed from groundwater elevation control tile and during dewatering activities for a minimum of three months.
c. High pressure washer and miscellaneous associated equipment for removing mud and trackable debris from trucks.

D. Superintendent shall be at the Site full time.

3.03 WORK LAYOUT

A. Set up work facilities in a neat and orderly manner within designated area at location of choice.

3.04 NOISE CONTROL

A. Monitor noise levels at least once daily during a time when onsite equipment is in use and noise levels are expected to be the highest. Measure noise levels 100 feet from work area.

B. Night time operations shall not be permitted.

C. If, at any time, the noise limits are exceeded, take immediate corrective action through drilling equipment modifications, addition of supplemental noise abatement equipment, or changes in operating procedures. Noise levels will be monitored by Contractor to assess compliance.

3.05 EQUIPMENT CLEANING

A. Downhole tools and equipment that may come in contact with tools or equipment that may be positioned directly above borehole or completed well shall arrive onsite free of surface deposits of friable solids; for example, mud, sand, grout, caked on cuttings and cleaned of grease, oils, and other petroleum products. Except that normal amounts of thread joint compound on drill pipe and tool joints, and normal amounts of lubricating grease on mechanical equipment is allowed.

B. Clean downhole equipment, tools, and equipment that may come in contact with downhole equipment that becomes soiled with petroleum products to satisfaction of Contractor before resuming work on well or groundwater elevation control tile.

C. Remove trackable mud, sand, grout and other materials from undercarriage, tires and other surfaces of equipment prior to moving equipment on or across public roads and pathways.

D. Do not empty, spill, splash, or slosh containerized fluids onto ground surface while moving containers, pipes and equipment.

E. Cleanup settled solids, and other semi-liquids and solids that spill from, or are emptied from, equipment as it is being moved.

3.06 OFFSITE DISPOSAL OF LIQUID WASTE

A. Liquid waste will include water removed from existing groundwater elevation control tile and decontamination liquids.

B. Subcontractor will be responsible for assisting CH2M with collecting and submitting waste characterization samples to a laboratory approved by Contractor.

C. Proper disposal of liquid waste will be the responsibility of the Subcontractor.

3.07 DEMOBILIZATION

A. Clean and repair damage caused by installation or removal of temporary facilities and equipment.

END OF SECTION

Appendix C
Construction Quality Control Plan

CONSTRUCTION QUALITY ASSURANCE PLAN

Velsicol Chemical Corporation Superfund Site PSA-1 and PSA-2 Excavations, Operable Unit 1

St. Louis, Michigan
Former Plant Site Remedial Design
WA No. 178-RDRD-0532/Contract No. EP-S5-06-01

Prepared for

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Acronyms and Abbreviations

3POC	Three Phases of Control
ANP	adjacent or nearby properties
BODR	basis of design report
CM	construction manager
CQAP	construction quality assurance plan
CQM	construction quality manager
COC	contaminant of concern
DDT	dichlorodiphenyl trichloroethane
DFOW	definable feature of work
FBA	Former Burn Area
EPA	U.S. Environmental Protection Agency
FIELDS	Field Environmental Decision Support
FPS	Former Plant Site
FS	feasibility study
HASP	health and safety plan
HSM	health and safety manager
HSSE	Health, Safety, Security, and Environment
MDEQ	Michigan Department of Environmental Quality
OU	operable unit
PBB	polybrominated biphenyl
PIs	project instructions
ppm	parts per million
PQMP	project quality management plan
PSA	potential source area
QA	quality assurance
QC	quality control
RA	remedial action
RAO	remedial action objective
RFI	request for information
RG	remediation goal
RI	remedial investigation
ROD	Record of Decision
SESC	Soil Erosion and Sedimentation Control
SM	site manager
SOV	schedule of values
TAL	target analyte list
TCL	target compound list
TCLP	toxicity characteristics leaching procedure
TRIS	tris(2,3-dibromopropyl) phosphate
WAM	work assignment manager

Glossary

Construction quality assurance plan (CQAP)—Establishes the guidelines and requirements to be used for project delivery to meet client objectives and achieve the standards. The primary objective of the CQAP is to document requirements, procedures, and methodology for quality assurance and quality control during construction of this project.

Quality assurance (QA)—Refers to the overall quality process. It is the assurance that the construction effort is conducted in a manner consistent with the design and meets the requirements of the project objectives.

Quality control (QC)—Refers to a planned system for monitoring, controlling, and documenting the quality of materials, supplies, and workmanship in a manner consistent with the execution plan and the drawings and specifications. Monitoring, controlling, and documenting are the active tasks associated with quality management. This document does not specifically address QC requirements.

Project instructions (PIs)—Provide management instructions for construction operations, documentation, and reporting for work to be performed. The instructions provide guidance to the project team and clarify the site manager's expectations regarding personnel assignments (including level of effort, responsibilities, accountability, project goals, direction, processes, and procedures through the construction phase of the project. The project instructions define parameters for the implementation of the CQAP.

Construction quality submittals—Refers to submittals generated during or immediately prior to construction to demonstrate compliance with the project plans, drawings, and specifications. Construction quality submittals include daily reports, shop drawings, schedules, sample documentation, calibration records, photographs, product data, samples, field change request documentation, administrative and closeout submittals, and additional technical support data presented for review and approval.

SECTION 1

Introduction

The purpose of the construction quality assurance plan (CQAP) is to provide the quality processes and procedures for work conducted at Operable Unit (OU) 1 of the Velsicol Chemical Corporation Superfund Site, St. Louis, Michigan. This CQAP specifically addresses excavation and disposal activities associated with Potential Source Area (PSA) 1 and PSA-2 in OU1 in accordance with Work Assignment No. 178-RDRD-0532 under Contract No. EP-S5-06-01, as directed by the U.S. Environmental Protection Agency (EPA). The CQAP includes processes and procedures for the following activities:

- Observing construction activities
- Sampling and testing protocol
- Documenting that construction has been completed in general accordance with the plans and specifications and with quality assurance (QA) procedures outlined in this plan

1.1 Site Description

The Velsicol Chemical Corporation River Superfund Site (National Superfund Database ID No. MID00722439) is located in St. Louis, Michigan, and occupies a 52-acre land parcel commonly referred to as the Former Plant Site (FPS) and includes the Adjacent or Nearby Properties (ANP). A chemical plant once occupied the FPS, which is located in a predominantly residential area. The Pine River flows along the western and northern boundary of the FPS into Pine River Mill Pond, where the St. Louis hydroelectric dam is located (about 0.25 mile east of the FPS). The boundary of the 52-acre FPS is fenced, and access is controlled through a main gate that remains locked at all times. Figure 1-1 shows the FPS location and the surrounding operable units.

The Velsicol Site is composed of three OUs:

- OU1 includes the FPS and ANP
- OU2 includes contaminated sediments and fish in the Pine River adjacent to the FPS and immediately downstream of the FPS (above the hydroelectric dam) for which the RA has been completed
- OU3 includes an area of the Pine River downstream of the St. Louis hydroelectric dam.

The Michigan Department of Environmental Quality (MDEQ) was the lead agency during the remedial investigation/feasibility study project phases, and EPA was the support agency. EPA Region 5 is the lead agency for the remedial design and remedial action phases, and MDEQ is the support agency.

1.1.1 Site History

The FPS was used for industrial operations beginning in the mid-1800s until 1977. Historical operations at the site included a lumber mill, oil refinery, salt-processing plant, and chemical manufacturing plant. The FPS included numerous buildings that housed manufacturing, maintenance operations, administrative functions, and laboratories for product research and development. Storage facilities for raw and finished products, including warehouses and storage tanks constructed above- and belowground, also were integrated throughout the FPS. Historical documents identify several lagoons that are either known or presumed to be associated with waste disposal practices.

In 1935, Michigan Chemical Corporation (MCC) purchased the property and operated a chemical manufacturing business. 1965, Velsicol Chemical Corporation gained a controlling interest in MCC. MCC manufactured a wide variety of products at the FPS from 1936 through 1977, including the following: various salts; magnesium oxide, rare earth chemicals; fire retardants, including polybrominated biphenyls (PBB); tris (2,3-dibromopropyl) phosphate (TRIS); and pesticides dichlorodiphenyl trichloroethane (DDT) and 1,2-dibromo-3-chloropropane (DBCP).

In 1977, production operations were terminated, and MCC initiated demolition and decommissioning of the facility in 1978. The aboveground site buildings were demolished, and some structures were buried onsite, including storage tanks and process piping. Building and tank foundations were not removed, and a significant amount of debris remains buried at the site.

1.1.2 Existing Site Conditions

1.1.2.1 Sitewide Geology

The sitewide geology was defined during the remedial investigation (RI) performed by Weston Solutions, Inc. (Weston) from 2002 through 2005. Sitewide, there are three naturally occurring unconsolidated deposits, consisting of a shallow unit, a till unit, and a lower unit. On the FPS, two manmade units are also present, including a clay cap and fill.

The clay cap was constructed as part of the 1982 Consent Judgement and varies from 2 feet to up to 10 feet in thickness. A sand layer is present directly above the clay cap, and a layer of topsoil is present above the sand layer. The thickness of these two layers has been observed to be up to 2.5 feet.

The shallow unit is composed of a variety of deposits consisting of fill, alluvium, and lacustrine deposits. Debris is also present within the shallow outwash unit (that is, concrete, metal, etc.) from the operation and demolition of the FPS. The thickness of the shallow outwash unit varies between 20 feet and 30 feet.

The till unit thickness ranges from 30 to 80 feet and is composed of sandy silt with variable amounts of sand, gravel, and cobbles. The thickness of sand and gravel seams within the till unit range from a few inches to several feet.

The lower unit extends from the base of the till unit to the top of bedrock (approximately 280 feet bgs) and consists of a series of saturated sands subdivided by the two aquitards. The lower unit is composed of the following:

- The Upper Lower Outwash, consists of the saturated sands immediately underlying the Till Unit. The Upper Lower Outwash has been observed to be up to 10 feet thick, but is typically about 2 to 4 feet thick. Immediately under the Upper Lower Outwash is a granular unit that is finer-grained and more gradational. This portion of the Lower Unit is referred to as the Lower Outwash.
- The Upper Aquitard is a cohesive unit of very stiff to hard gray to grayish brown clay or very stiff to hard gray silt approximately 10 to 30 feet thick.
- Upper City Well Intake Zone (CWIZ) consists of fine to coarse saturated sand, with gravel noted at some locations.
- The Lower Aquitard is a cohesive unit of very stiff to hard gray to grayish brown clay or very stiff to hard gray silt approximately 20 feet thick.
- Lower CWIZ consists saturated fine to coarse sand with some fine gravel.

1.1.2.2 Geology of PSA-1

During the remedial design investigation (RDI) performed by CH2M in 2014, the geology within the PSA-1 and PSA-2 boundaries was further refined. The subsurface at PSA-1 consists of the following:

- **Clay cap—**The constructed clay cap consists of approximately 1 foot of topsoil, underlain by approximately 0.5 foot of fine to medium sand, followed by approximately 4 to 10 feet of hard silty clay to clayey silt. Boring results suggest that the cap is continuous across PSA-1. Varying amounts of debris (concrete, brick, glass, wood, and metal rebar) from the plant demolition were observed during the RDI within the lower portion of the cap and in the zone from 0 to 5 feet below the cap.
- **Interbedded sand, silt, and clay—**Underlying the cap are fine to medium sands with occasional coarse sands and interbedded silts and clays. Boring results from the RDI indicate that this lithology is generally continuous

across PSA-1 and is present to depths ranging from approximately 10 to 25 feet bgs. Soil exhibiting staining and/or containing nonaqueous phase liquid (NAPL) was frequently encountered in this unit. Groundwater was typically encountered at depths ranging from approximately 10 to 20 feet bgs.

- **Glacial till—**glacial till is present at depths ranging from approximately 13 to 25 feet bgs at PSA-1. The till consists primarily of hard silty clay to clayey silt with trace to little amounts of fine sand and trace amounts of gravel. Sand and silty sand seams are occasionally encountered within the till.

Also notable within PSA-1 is a slurry wall constructed around an area of the site previously used for fuel handling and storage ("oil containment slurry wall"). Historical site documents indicate that fuel releases occurred within and adjacent to the PSA-1 boundary. The fuel release was allegedly contained by a slurry wall, which was constructed prior to the construction of the site containment slurry wall; however, construction details of the wall within PSA-1 are poorly documented. In general, the existing slurry wall within PSA-1 contains a mitten shaped area of approximately 2 acres, of which approximately three-quarters of an acre overlaps the northeast portion of PSA-1. The presence of NAPL was confirmed both inside and outside the slurry wall during the RDI.

1.1.2.3 Geology of PSA-2

The subsurface at PSA-2 consists of the following:

- **Clay cap—**The constructed clay cap is consistent with that described for PSA-1. Boring results completed as part of the RDI suggest that the cap is continuous across PSA-2.
- **Interbedded sand, silt, and clay—**Underlying the cap are interbedded layers of reworked sand, silt, and clay. Boring results from the RDI indicate that this lithology is generally continuous across PSA-2 and is present to depths ranging from approximately 12 to 25 feet bgs. Some soils exhibiting staining are present in this unit; however, staining is less frequent than at PSA-1, and the presence of NAPL is significantly less.
- **Silt—**During the RDI, soft to firm silt with grey and black laminations was observed underlying the reworked sand, silt, and clay in the southwest portion of PSA-2. Boring results indicate that this lithology is continuous across the western portion of PSA-2, with thicknesses up to 9 feet in some areas. This lithology may be related to the dredge pond that historically occupied this area of the FPS.
- **Glacial till—**Glacial till is present at depths ranging from approximately 18 to 33 feet bgs at PSA-2. The till is consistent with that described for PSA-1.

1.1.2.4 Groundwater Flow

In the shallow unit, groundwater flow is influenced by the Pine River, the St. Louis dam, the ground surface elevation, and the presence of the site perimeter slurry wall (Weston 2006). The saturated thickness of the shallow unit ranges from 0.5 foot to approximately 21.0 feet (Weston 2006). Generally, shallow unit groundwater flow below the FPS is towards the Pine River. As part of the RI completed by Weston, slug tests were performed on eight monitoring wells within the shallow unit. The hydraulic conductivity calculated from the slug test results averaged between 1.26 feet per day to 44.8 feet per day (4.46×10^{-4} centimeters per second [cm/sec] to 1.58×10^{-2} cm/sec). The geometric mean across the site was 7.31 feet per day (2.58×10^{-3} cm/sec). Additional slug testing was performed by CH2M in 2015. The mean hydraulic conductivity values derived from the 2015 slug test data test range between 0.004 foot per day to 5.65 feet per day (1.3×10^{-6} cm/sec to 1.99×10^{-3} cm/sec). The field-measured values are consistent with published values for hydraulic conductivity of similar deposits (Weston 2006).

Groundwater flow in the lower unit is influenced by regional flow conditions, local geology, and municipal well usage (Weston 2006). In October 2015, the cities of St. Louis and Alma, Michigan, formed the Gratiot Area Water Authority, which began providing potable water to the St. Louis residents from the combined system, resulting in the cessation of operation of the City of St. Louis' municipal supply wells. Previous interpretations of lower unit groundwater flow indicated that groundwater primarily flowed to the northeast in the northern portion of the FPS and southeast in the southern portion of the FPS towards the City of St. Louis municipal water supply wells. Provisions are in place to monitor groundwater elevation changes following well shutdown, and initial data indicate that groundwater elevations in the lower unit have increased approximately 10 feet with groundwater

flow in the lower unit to the east to southeast. Field measurements and observations will be integrated to revise groundwater flow directions, magnitude, and to update the site conceptual model as necessary.

1.1.2.5 Existing Site-Perimeter Slurry Wall and Clay Cap

As part of the 1982 Consent Judgment with EPA and MDEQ, a 2-foot-thick, low-permeability slurry wall was installed around the FPS. In addition, a clay cap was constructed over the entire FPS. The construction was completed in 1984.

The thickness of the clay cap ranges between 2 feet and 10 feet and extends over the entire 52-acre parcel. The cap is composed of clay with a permeability of 1×10^{-7} or less. The purpose of the clay cap is to minimize the infiltration of precipitation to the water table and enhance surface runoff.

The slurry wall runs along the entire perimeter of the FPS, over 7,200 linear feet in length. Per the Consent Judgment Technical Appendix, the slurry wall was required to be a minimum of 24 inches thick (nominal), achieve a permeability of 1×10^{-7} cm/s or less, and was to be keyed in a minimum of 36 inches (nominal) into the underlying till layer.

1.1.2.6 Existing Oil Containment Slurry Wall

In addition to the perimeter slurry wall that is part of the containment system, an oil containment slurry wall exists within part of the PSA-1 boundary. The oil containment slurry wall encompasses an area approximately 2 acres in size and resembles the shape of a mitten. This slurry wall is anticipated to be encountered during excavation of PSA-1.

1.1.2.7 Former Dredge Pond

A dredge pond was formerly located in the southwestern portion of the FPS and includes a portion of PSA-2 (and PSA-3, which will be the subject of a future RA). Operations of the former dredge pond are largely unknown; however, historical photographs and plant records suggest that the pond was approximately 5 acres in size and was used to hold dredged sediments. The former dredge pond was not lined, and it was suspected that contents from the pond were migrating back into the Pine River (Weston 2011). Therefore, the former dredge pond was filled. The date of this occurrence is unknown.

1.1.2.8 Existing Groundwater Elevation Control Tile

A non-operational groundwater elevation control tile, installed by Conestoga-Rovers and Associates (CRA), is present along the perimeter of the FPS, adjacent to the Pine River. Not much is known about the historical operations of the groundwater elevation control tile. As shown on the CRA Securement of Plant Site as-built drawings, the groundwater elevation control tile is separated into a north system and a south system at manhole sumps 6A and 6B (CRA 1984). Collectively, the groundwater elevation control tile consists of approximately 8,210 linear feet of 4-inch and 6-inch perforated clay pipe, 9 manholes, 7 manhole sumps, and 13 granular sumps.

The groundwater elevation control tile was operated from June 1994 through the end of 1996 (MEC 1997). Water was pumped from the groundwater elevation control tile at Manhole 9 and disposed offsite (MEC 1997). Through the end of 1996, at total of 4,030,000 gallons of water was removed from the FPS during three separate pumping events (MEC 1997).

1.2 Project Goals and Objectives

The Basis of Design Report (BODR; [EPA 2017]) describes the remedial design (RD) for the RA. The RA for PSA-1 and PSA-2 include confirmation sampling, construction of an excavation support wall along the east and south removal boundaries of PSA-1, excavation of PSA-1 and PSA-2, dewatering, offsite disposal of excavated material (accumulated groundwater will be treated and discharged to the Pine river), and site restoration.

The remedial action objectives (RAO) for this area of the site listed in the 2012 Record of Decision are to prevent ingestion, inhalation, and direct contact of site-related COCs in soil to human and ecological receptors and

migration of site-related COCs from unsaturated and saturated subsurface media to the groundwater or surface water beyond the point of compliance (POC), reduce the ability of DNAPL to adversely impact the aquifer by reducing DNAPL mass and mobility; and to eliminate offsite migration of DNAPL to prevent the contamination of the surface water and recontamination of sediments of the Pine River. To achieve the RAOs, excavation and offsite disposal of soils exceeding the remediation goals was selected as the treatment technology for PSA-1 and PSA-2. The major components of the selected remedy applicable to the PSA excavations include the following:

- Preconstruction meeting and submittals
- Confirmation and waste characterization sampling
- Third-party utility locate
- Mobilization
- Site Security
- Site preparation (temporary facilities, temporary fencing, protecting existing asphalt)
- Erosion control (silt fence)
- Constructing temporary roads, stockpile and laydown areas
- Abandoning and portion of the existing groundwater elevation control tile abandonment
- Abandoning monitoring wells within the removal area
- Constructing an excavation support wall along the east and south removal boundaries of PSA-1
- Excavating PSA-1 and PSA-2, including
    - Removal of the existing topsoil, sand layer, and clay cap and stockpiling for reuse
    - Removal and offsite disposal of impacted material
    - Dewatering, as needed
    - Water treatment
- Site restoration
- Surveying
- General waste disposal
- Demobilization

The overall quality control (QC) objective is to implement the final design and provide documentation that support achieving the testing, submittal, inspection and the systems' performance requirements, in such a manner that all work performed adheres to the following objectives:

- Complies with federal, state, and local regulations
- Protects human health and the environment
- Provides the client with a usable product intended to meet the project objectives (described above)
- Is cost-effective

1.3 Scope of Work

This CQAP describes the construction process, as well as the quality management process activities that will be implemented at the site during the construction activities. When this document references CH2M, it should be construed to mean CH2M and its subcontractors as their respective trade may apply to the subject being discussed. The following are major components of the construction activities:

- Mobilization
    - Mobilizing equipment, personnel, site trailers and sanitary facilities.
    - Installing erosion controls and best management practices (BMPs).
    - Limited clearing and grubbing of vegetation and implementation of erosion control measures in the disturbed areas as required.
    - Establishing physical construction limits at the site with temporary fencing.

  - Implementing stormwater and erosion control measures for the entire project area.
  - Setting up a site trailer and utility connections for the subcontractor and any lower-tiered subcontractors.
  - Conducting photographic documentation of preconstruction conditions of the site.
  - Notifying the appropriate regulatory agencies.
- Site Preparation
  - Setting up onsite construction meetings; pre-construction submittals; mobilizing equipment; setting up trailers; constructing staging areas, protecting existing asphalt surfaces not scheduled for improvements, establishing physical construction limits; and other activities.
  - Site survey
  - Construct temporary roads, stockpile, and laydown areas
  - Establish traffic controls and routes
  - Abandon existing groundwater elevation control tile in the project area
- Third-Party Utility Locate
  - Conduct utility locate and verification in the proposed work areas as shown on the design drawings
  - Ground penetrating radar and electromagnetic/magnetometer to be utilized
  - Mark underground utilities as appropriate for each utility (e.g., electrical, gas or water) with spray pain and flags capable of withstanding inclement weather and normal abuse
- PSA-1 and PSA-2 Excavation Activities
  - Characterization of imported material
  - Perimeter air monitoring
  - Constructing excavation support wall along the east and south removal area boundaries of PSA-1, and removal of excavation support wall after backfill is complete.
  - Removal of existing topsoil, sand layer, and clay cap and stockpiling for reuse
  - Removal of impacted material
  - Dewatering, as needed
  - Transportation of impacted material for offsite disposal
  - Treatment of water removed during excavation activities
- Site Restoration
  - Seeding of disturbed areas
  - Maintenance period
  - Perform erosion repairs
  - Control undesirable species growth
  - Maintain inspection logs and maintenance logs
  - Final inspections and acceptance
- Miscellaneous Construction Activities

  - Installation of high-visibility fencing around the project area
  - Handling and offsite disposal of debris
  - Air monitoring
  - Geotechnical monitoring
  - Topographic survey prior to excavation activities and during excavation activities
- Demobilization
  - Removal of all field equipment, temporary facilities, and other miscellaneous items upon completion of fieldwork and punch-list items
  - Final Acceptance

1.4 Critical Success Factors

The critical success factors for the project are:

- Implement site improvements that effectively and efficiently meet project objectives and integrate safety, environmental compliance, and cost sensitivity into the design and construction
- Maintain the integrity of existing containment features (slurry wall and clay cap)
- Complete all work safely, on time, under budget, and in compliance with the specified scope
- Identify and document value-added opportunities
- Identify and document health, safety, quality, and environment lessons learned
- Communicate effectively among CH2M project team members and with the EPA
- Follow the procedures set forth in this CQAP to ensure work is delivered with zero quality incidents

SECTION 2

Organization and Responsibilities

Responsibilities and authority are described in the following subsections.

2.1 Responsibilities

2.1.1 EPA—Superfund

EPA is responsible for the overall execution of the project. EPA will retain independent design, QA, and construction organizations to accomplish the work, and will have the authority to hire and fire these organizations. EPA has the authority to accept or reject QA plans, reports, and recommendations of EPA's contractor, and the materials and workmanship of subcontractors. Thomas Alcamo is the EPA work assignment manager (WAM) for the RA.

2.1.2 EPA Contractor

CH2M HILL, Inc. (CH2M) was contracted by EPA to manage the tasks required to complete the work assignment and to oversee the activities of the subcontractors assisting with those tasks.

An organizational chart presenting the various stakeholders and their roles and responsibilities is shown in Figure 2. Table 2-1 shows CH2M's construction team organizational structure for construction activities.

Table 2-1. Project Personnel

Velsicol Chemical Corporation Superfund Site Former Plant Site PSA-1 and PSA-2 Excavations, Operable Unit 1

Job Title	Name	Roles and Responsibilities	Contact Numbers
Site Manager	Theo von Wallmenich	• Ensures project direction and goals align with the site wide strategy • Directs contact with EPA and external stakeholders • Serves as the main interface between the project team and EPA • Represents the project team at meetings • Reviews deliverables prior to client submittal	Office: (989) 285-1515 Cell: (517) 483-3015
Project Manager	Denis Ewing	• Meets overall project objectives and goals • Acquires and applies technical and corporate resources to meet budget and schedule constraints • Effectively charters the construction team • Primary point of contact to the Site Manager • Responsible for the oversight and management of construction activities • Oversees the preparation of the deliverables • Reviews the work performed on each task against project goals and objectives for quality, responsiveness, and timeliness • Overall responsibility for project controls • Identifies and realizes remediation value-added opportunities • Conduct weekly progress meetings and weekly quantity verification meetings and prepare and distribute meeting notes discussing progress problem areas, and status of long-lead items	Office: (678) 530-4111 Cell: (678) 447 1222

Table 2-1. Project Personnel

Velsicol Chemical Corporation Superfund Site Former Plant Site PSA-1 and PSA-2 Excavations, Operable Unit 1

Job Title	Name	Roles and Responsibilities	Contact Numbers
Assistant Project Manager	Scott Pratt	• Assists PM in meeting overall project objectives and goals • Acquires and applies technical and corporate resources to meet budget and schedule constraints • Primary point of contact to the Project Manager • Assists PM with the oversight and management of construction activities • Oversees the preparation of the deliverables • Reviews noncompliance notices submitted by the Field Quality Manager and determines an appropriate action • Identifies and realizes remediation value-added opportunities	Office: (810) 360-2013 Cell: (248) 219-7146
Design Manager	Bill Andrae	• Manages design efforts • Provides design guidance during construction • Reviews noncompliance notices and assists in determining an appropriate action • Performs technical submittal reviews	Office: (414) 847-0341 Cell: (262) 366-0968
Project Engineer	Rachel Vaughan	• Provides design guidance during construction • Performs technical submittal reviews	Office: (810) 360-2021 Cell: (906) 281-3539
Construction Quality Manager	Elizabeth Markham	• Performs inspections and surveillance of project activities as necessary to ensure the quality of service, product, and workmanship meet the requirements of the project • Ensures quality planning elements are implemented as required in this CQAP • Ensures daily reports meet project requirements and correctly implement the document control/management process • Completes daily QA/QC verification forms • Ensures all delivered materials are inspected • Verifies corrective actions are taken when deemed appropriate • Participated in quality audit • Ensures required field forms and logs are completed • Advise the Project Manager of site conditions or construction conditions that may affect the accomplishment or quality of work • Reviews results of subcontractor submitted quality control tests for compliance with contract requirements • Conducts Air Monitoring in accordance with the HASP and AMP	Office: (586) 980-3355 Cell: (586) 855-4967
Senior Technical Consultant	Jason Cole	• Ensures alignment of construction tasks to site strategy and schedule • Ensures work is conducted in accordance with best practices as well as federal, state, local, and EPA requirements • Provides guidance during construction • Reviews all deliverables	Office: (617) 626-7080
Program Quality Assurance Manager	Theresa Rojas	• Ensures implementation of the Dow quality program • Performs or delegates construction audits and inspections • Participates in Operational Readiness Review meeting • Participated in quality audit	Office: (678) 530-4297 Cell: (678) 642-7030

Table 2-1. Project Personnel

Velsicol Chemical Corporation Superfund Site Former Plant Site PSA-1 and PSA-2 Excavations, Operable Unit 1

Job Title	Name	Roles and Responsibilities	Contact Numbers
Responsible Health and Safety Manager	Carl Woods	• Responsible for overall health and safety needs including audits, clearing staff to work, and developing safety plans • Reviews pre-qualifications for subcontractors • Reviews/approves subcontractor activity hazard analyses (AHA) and site specific health and safety plans prior to beginning fieldwork • Ensures the health and safety plan (HASP) is followed by all site employees	Office: (513) 889-5771 Cell: (513) 319-5771
Subcontract Manager	Lynn Roberts	• Ensures project complies with internal business group subcontracting policies • Negotiates subcontracts and issues purchase orders to subcontractors • Provides guidance to subcontractor change orders • Closes subcontracts at the end of the project	Office: (720) 286-1465
Environmental Manager	Terri Gerrish	• Ensures compliance with state and federal permitting requirements	Office: (973) 3163516 Cell: (973) 6320238
Waste Management Specialist	Lisa Schwan	• Ensures waste management complies with local, state, and federal laws • Ensures compliance with state and federal permitting requirements	Office: (770) 604-9182 Cell: (404) 414-2505
Construction Manager	Jim Eluskie	• Manages all construction activities in the field • Anticipates, understands, and implements proactive management solutions as construction work packages are assembled, procured, and awarded • Describes, quantifies, documents, and communicates change management items • Allocates construction resources • Reviews and manages construction scope, schedule, and budget • Update the project schedule for all construction tasks and identify potential scheduling conflicts or schedule creep • Reviews subcontractor's technical and cost proposals related to construction submittals • Interprets the technical content of drawings with respect to deviations or requests for clarification • Review subcontract modifications and forward modifications to the Project Manager for approval • Performs inspection and surveillance of field activities as necessary to ensure the quality of service, product, and workmanship meets project objectives, describes, quantifies, documents, and communicates potential change management items as soon as they are anticipated as potential issues • Notifies the Project Manager if a project cannot be completed with regard to quality, schedule or cost • Coordinates project activities to achieve conformance to construction specifications • Submits nonconformance reports and other QA documents to the project quality control manager	Office: (810) 229-2470 Cell: (517) 262-2283

Table 2-1. Project Personnel

Velsicol Chemical Corporation Superfund Site Former Plant Site PSA-1 and PSA-2 Excavations, Operable Unit 1

Job Title	Name	Roles and Responsibilities	Contact Numbers
		• Documents the resolution of inadequacies noted in nonconformance reports • Establishes location, time, and sampling criteria for verification testing to be performed by field staff • Reviews results of subcontractor submitted quality control tests for compliance with contract requirements • Advises the Project Manager/Construction of conditions that may affect satisfactory completion and quality of the work • Confirms that QA and support personnel are adequately trained • Performs inspection and surveillance of field activities, as necessary to ensure the quality of service, product, and workmanship meet project requirements • Review subcontractor's monthly payment requests and forward the requests to the Project Manager for approval • Provide the Project Manager with a detailed weekly construction status report, containing photographs and weekly logs	
Site Safety Coordinator	Steve Chumney	• Supervise the direct and daily activities of the field team to coordinate with the daily activities of the subcontractor • Review daily inspection reports for completeness • Track all onsite project personnel hours • Collaborate with the HSM to maintain the HASP • Provide project-specific information to the HSM needed to determine personal protective equipment (PPE) selection • Ensure CH2M staff are chartered on the HASP and other required health, environment, and safety documents • Ensure subcontractors have submitted required AHAs to the HSM for review and have received acceptance for AHAs prior to mobilization • Establish site control and appropriate decontamination processes for personnel and equipment • Ensure safety supplies and equipment required by the HASP are onsite, calibrated as appropriate, and in good working condition before initiating work in the field. • Ensure all feasible controls and safe work practices are considered before returning PPE • Ensure good housekeeping at field locations • Complete all forms necessary and specified in the HASP and ensure documents are submitted for review prior to being filed in the project binder • Conduct air monitoring, enforce HASP action levels, and maintain calibration records and record air monitoring results • Verify proper utility clearances prior to breaking ground. • Act as the project's emergency response coordinator and perform pre-emergency planning tasks as outlined in the HASP before starting field activities • Notify Project Manager and HSM of all near-misses, injuries and incidents immediately. Complete an Incident Report Form within 24 hours of an incident. Provide additional or	Office: (810) 360-2047 Cell: (734) 417-6874

Table 2-1. Project Personnel

Velsicol Chemical Corporation Superfund Site Former Plant Site PSA-1 and PSA-2 Excavations, Operable Unit 1

Job Title	Name	Roles and Responsibilities	Contact Numbers
		updated information to the HSM after submitting the initial incident report. Collaborate on incident investigations • Verify project files include safety related training and medical monitoring records, and site-specific safety procedures prior to beginning any subcontractor's field operations. Perform oversight and/or assessments of the subcontractor health and safety practices in accordance with the HASP. • Implement any noise conservation program requirements and hearing protection requirements • Prepare and conduct site orientation sessions for field personnel • Collect subcontractor timesheets and quantity verification sheets during daily safety briefings and update tracking tools	
Document Manager	Julie Clark	• Implementing the document control processes. • Implementing the document management processes. • Archiving documents and records.	Office: (810) 360-2038 Cell: (517) 896-7675

Multiple field technical staff will be employed during the execution of this project due to the planned operation schedule, which will generally be limited to 7:00 a.m. to 5:00 p.m. from Monday through Friday for an estimated one year construction period. Fewer field staff will be employed during the 12-week maintenance period.

2.1.3 Subcontractors

Construction subcontractors will be selected by CH2M to provide services during construction. Each subcontractor will work under the oversight of the Construction Manager (CM). The subcontractors are responsible to perform work in accordance with the design plans and specifications, meeting the acceptance requirements detailed in the design. The subcontractor will be responsible for construction QC CQC requirements, as appropriate.

The subcontractors are responsible for certifying that the products supplied conform to the plans and specifications. The individual subcontractors are collectively referred to as subcontractors within this CQAP.

The following type of subcontractors will be utilized to accomplish the work:

- Drilling subcontractor
- Excavation subcontractor
- Analytical laboratory subcontractor

2.1.4 Vendors, Independent Test Companies, and Third-tier Subcontractors

Vendors, independent test companies, and third-tier subcontractors are agents of the respective subcontractor by way of subcontracts, sub-subcontracts, or similar arrangements. As such, they are responsible, through the subcontractor, for maintaining QC procedures in accordance with their contractual arrangements and the subcontractor's QC plans. The agents should also provide the subcontractor with QC data and reports necessary for the agent's submittals to the PM. The following third-tier subcontractors may be used for this project:

- Borrow source provider of topsoil, general backfill, gravel and other borrow materials as necessary
- Utility locating service(s)
- Shoring/excavation support wall installation services
- Surveying services
- Transportation and disposal services
- Site restoration

SECTION 3

Quality Control Processes

Section 3 defines the reporting and documentation requirements that will be implemented during PSA-1 and PSA-2 excavation activities to ensure quality control of the work.

3.1 Construction Quality Management

An inspection system referred to as the Three Phases of Control (3POC) will be implemented as a subcontractor construction quality management process. The 3POC is a three-step inspection process that includes the Preparatory Phase, Initial Phase, and Follow-up Phase inspections. The process is designed to discuss the project requirements prior to initiating any construction work activities, assess the quality of work early in the execution of work, and monitor the work throughout the delivery until completion. The 3POC process is intended to enhance management of construction quality and formalize documentation of the quality administrators for each DFOW for the project. A DFOW is a task that is separate and distinct from other tasks and has separate control requirements. The 3POC process will be implemented for each of the following RA DFOWs:

- Mobilization and Site Preparation (DFOW 1)
  - Notifying appropriate regulatory agencies
  - Installing erosion and sediment controls
  - Constructing or establishing temporary facilities such as field trailers, material storage facilities, and sanitary facilities
  - Constructing temporary roads, stockpile, and laydown areas
  - Documenting preconstruction site conditions
  - Delivering equipment
  - Clearing and grubbing of vegetation in the removal areas as required
  - Placing temporary fencing around physical construction limits
  - Establishing traffic controls and routes
  - Site security and coordination
- Utility Locates (DFOW 2)
- Monitoring Well and Groundwater Elevation Control Tile Abandonment (DFOW 3)
  - Installing temporary isolation casing for monitoring wells set lower than bottom of excavation
  - Dewatering groundwater elevation control tile in project area
  - Installing low-strength flowable fill in groundwater elevation control tile in project area
- Sampling, Testing, and Monitoring (DFOW 4)
  - Collecting and analyzing borrow source samples – chemical and gradation
  - Geotechnical monitoring
  - Air monitoring in accordance with Air Monitoring Plan
  - Compaction testing
- Surveying (DFOW 5)
  - Pre-excavation survey
  - Post-excavation survey after removal of existing topsoil
  - Post-excavation survey after removal of existing sand layer
  - Post-excavation survey after removal of existing clay cap
  - Post-excavation survey after removal of impacted material

  - Post-backfilling survey after placement of general backfill to confirm bottom of clay cap elevation
  - Post-backfilling survey after placement of clay cap material to confirm top of clay cap elevation/bottom of sand layer elevation
  - Post-backfilling survey after placement of sand layer to confirm top of sand layer elevation/bottom of topsoil elevation
  - Post-backfilling survey after placement of topsoil to confirm pre-seeding placement grade
- Installation and Removal of Excavation Support Walls (DFOW 6)
  - Notify adjacent property owners prior to installation/removal
  - Documenting pre-installation conditions of adjacent properties and structures
  - Documenting post-removal conditions of adjacent properties and structures
- PSA-1 and PSA-2 Excavation (DFOW 7)
  - Removing existing topsoil, sand layer, and clay cap and stockpiling for reuse
  - Removing impacted material
  - Dewatering
  - Water treatment
- Waste Management (DFOW 8)
  - Stabilizing wet impacted soil, if needed
  - Transportation
  - Disposal
- Backfilling (DFOW 9)
- Site Restoration (DFOW 10)
  - Seeding
  - Watering
- Demobilization (DFOW 11)
- Maintenance Period (DFOW 12)
  - Watering
  - Seeding as needed to establish satisfactory stand

The respective inspection phases are discussed in the following subsections.

3.1.1 Preparatory Phase

The Preparatory Phase is the step in delivering the project that essentially culminates the planning and design process leading up to actual fieldwork of a specific residential property. It also serves to assure that the project delivery, QC, and safety plans have been completed and are ready to be implemented. The following events take place during the Preparatory Phase for each DFOW established by the CM:

1. Confirm that the appropriate technical specifications are incorporated into the project work plans, construction drawings and review specifications with the CM and other field team members.
2. Confirm that the appropriate contract drawings are incorporated into the project work plan and review drawings with the CM and other field team members.
3. Verify with the CQM that all shop drawings and preconstruction submittals (materials, health and safety, project plans) have been approved by the proper approving authority (including factory test results, when required).
4. Confirm with the CM and CQM that the testing plan coincides with the project plans and that adequate testing is called for to assure quality delivery.

5. Confirm definition of preliminary work required at the work site and examine the work area with the CM.
6. CM to confirm required preliminary work has been properly completed.
7. Confirm availability of required materials and equipment. Confirm with CQM and CM that materials and equipment inspected and CQM to confirm compliance with approved submittals.
8. Confirm with the HSM that the site HASP and activity hazard analyses have been reviewed and approved to verify that safety concerns are adequately addressed and applicable safety requirements have been incorporated into the plan. Confirm that the appropriate safety data sheets have been identified and properly submitted.

Discuss with the CM the construction methods to be employed during the RA. Confirm that all field team members are aware of the identified checkpoints and areas of evaluation that will allow determination that the appropriate quality of construction is being achieved. All observations will be recorded in the Preparatory Phase Report (Attachment A Form A.1).

3.1.2 Initial Phase

The Initial Phase occurs at the startup of remedial activities, or construction, associated with a specific DFOW. Essentially, the Initial Phase confirms that the CQAP is being effectively implemented and the desired results are being achieved. With the Initial Phase, notification of the CQM that the crews are ready to start a particular DFOW is required prior to their actual start.

Specific details associated with the Initial Phase are as follows:

1. Establish the quality of workmanship required to properly deliver the DFOW in accordance with project requirements. The CQM assures that the CM has made the subcontractor aware of expectations associated with the construction methods established under the Preparatory Phase. This assurance is to be achieved through observation of the initial work activities, as well as through interaction with the CM.
2. Resolve conflicts. The CQM will provide support to the CM in resolving conflicts involving quality issues. Should conflicts arise in establishing the baseline quality for the DFOW, the responsibility to resolve the conflict falls to the CQM. Should the conflict not be resolved in a manner that satisfies the contract requirements, the CQM will elevate the conflict to the PM. Should the issue jeopardize the results of the DFOW, or put the project at risk of non-compliant performance, the PM or CQM may direct a cessation of work activity.
3. Evaluate the site HASP and AHAs against actual work conditions with the CM to assure that the hazard analysis conducted to prepare the safety plan adequately addressed field conditions. Confirm applicable safety requirements are being implemented during construction activities.
4. Observe and evaluate the performance of testing technicians. Confirm with the CQM that testing is being performed in accordance with the testing plan and that required protocols are being observed. Review reports and documentation associated with extraction, packaging, transporting, and testing of samples. Note discrepancies and direct correction accordingly.

Upon completion of the Initial Phase activities, results are to be documented in initial phase checklist (Attachment A Form A.2).

3.1.3 Follow-up Phase

Completion of the Initial Phase of QC activity leads directly into the Follow-up Phase, which addresses the routine day-to-day activities on the project site. Inspection activities associated with each DFOW are to be addressed within the daily report. Specific concerns associated with the Follow-up Phase include the following:

1. Inspection of the work activity to assure work complies with the contracted project tasks.
2. Evaluation and confirmation that the quality of workmanship is being maintained at a level no less than that established during the Initial Phase.

3. Evaluation and confirmation that required testing and surveying are being performed in accordance with procedures established during the Preparatory Phase and confirmed during the Initial Phase.

Confirmation that non-conforming work is being corrected promptly (within 24-hours) and in accordance with the direction provided by the CM.

SECTION 4

Project Communications and Meetings

Section 4 discusses project communications and meetings.

4.1 Lines of Communication

Accurate and timely communication is required to avoid construction-related conflicts and potential errors and omissions.

4.1.1 External Communications

EPA, CH2M, subcontractors, and their respective employees and staff will have an established communication network, as shown in Figure 2. Establishing open lines of communication is essential for maintaining strong working relationships and producing quality work. The following communication guidelines should be adhered to throughout the project:

- The site manager (SM) should be the primary contact with the EPA's Work Assignment Manager (WAM), Thomas Alcamo.
- In person questions (if they occur) from the EPA WAM should be answered honestly and directly, but without speculation. If the answer is not known, tell the EPA WAM that you do not know, will find the answer, and someone will quickly respond. Contact the SM and PM immediately to update on conversation and unanswered questions.
- All stakeholder phone conversations must be documented. A copy of the phone memorandum should be routed to the PM, CM, and any other project team members who could be affected.
- The SM or PM will coordinate all formal client meetings. CH2M will prepare and distribute the minutes of all meetings within 5 days.

The SM and PM must review all EPA correspondence before it is sent. The key elements of the communication plan for construction include the items listed in Table 4-1.

Table 4-1. Summary of Communications and Meetings

Velsicol Chemical Corporation Superfund Site Former Plant Site PSA-1 and PSA-2 Excavations, Operable Unit 1

Type of Communication	Channel of Communication	Schedule
Communication with external stakeholders	Routine and as needed call by SM and PM with EPA.	TBD
Prebid Meeting	EPA, CH2M's SM, PM, DM, CM subcontractors and any lower-tiered subcontractors should be present.	TBD
Construction Charters	Charter Construction Team	TBD
Preconstruction meeting	CH2M's PM, CM, SM, subcontractors and any lower-tiered subcontractors should be present.	TBD
Coordination Meeting/Preconstruction Client Meeting	Meeting to discuss construction activities. EPA, stakeholders, CH2M's PM, CM/SSC/FQM, subcontractors and any lower-tiered subcontractors should be present.	TBD
Operational Readiness Review (ORR)	Checklist to prepare for mobilization	TBD

Table 4-1. Summary of Communications and Meetings

Velsicol Chemical Corporation Superfund Site Former Plant Site PSA-1 and PSA-2 Excavations, Operable Unit 1

Type of Communication	Channel of Communication	Schedule
Project status meetings	Discuss construction activities progress and status. CH2M's PM, CM/SSC/FQM, SM, and the subcontractors should be present.	TBD
Problem or work deficiency meetings	A special meeting may be held if a problem or deficiency is present or likely to occur. CH2M's PM, CM, DM, SM, QCM, FQM, and HSM, the affected subcontractor(s), and lower-tiered subcontractors involved in the problem or deficiency.	TBD
Field level communication channel	Subcontractor to CM. CM to PM/SM. PM/SM will continue the communication chain as needed.	TBD

Project-specific personnel and lines of communication will be discussed and established by all parties at the preconstruction meeting. The discussion will include the following topics:

- Communication procedures between supervisory and field staff.
- Direct communication procedures between key parties for specific issues and situations.
- Procedures and restrictions for secondary lines of communication within the project organization.
- Procedures for information transfer and confirmation between the various parties.
- Procedures for documentation of all communications.
- Format for meetings, reports, submittals, etc.

Communication will be documented with each party receiving a copy of such documentation (for example, telephone memorandums, meeting notes). Copies will be routed to other parties that should be informed of the situation (for example, problem, change, or agreement).

Document control procedures will be established for items such as subcontractor submittals, test results, and plan or specification revisions. The controls will include distribution and confirmation procedures to verify that documents are appropriately dispatched and incorporated into the project. Whenever possible, documents indicating revisions in plans, specifications, or procedures will be distributed immediately and explained to all parties at routine or special project meetings.

4.1.2 Internal Communications

The CM will communicate daily with the PM, and the PM will communicate with the SM. The SM will communicate with extended team members. All construction issues will be communicated through the CM and PM. The parties will discuss and establish the project specific personnel and lines of communication at the kickoff meeting. The discussion will include the following:

- Communication procedures between the CM and other field staff
- Direct communication procedures between key parties for specific issues and situations
- Procedures and restrictions for secondary lines of communication within the project organization
- Procedures for information transfer and confirmation between the various parties
- Procedures for documentation of communications
- Format for meetings, reports, submittals, etc.
- Format for potential change(s) that may require quantification and management

Formal communication including but not limited to weekly progress meetings, discussions with stakeholders and discussion with subcontractors that affect scope, schedule or budget will be documented, and each party will receive a copy of such documentation (e.g., telephone memorandums, meeting notes). Copies will be routed to other parties if they should be aware of the situation (e.g., problem, change, or agreement).

Document control procedures will be established for items such as subcontractor submittals, test results, and plan or specification revisions. All subcontractor submittals will be entered into the submittal log by the DM upon receipt of the deliverable. At the time of entry, the DM will document who needs to perform a detailed review of the document and notify the appropriate team members. Team members will document the completion of their reviews by indicating the approval status (e.g., approved or rejected) in the log with the date the review was completed. These controls will include distribution and confirmation procedures to verify documents are appropriately dispatched and incorporated into the project. Whenever possible, documents indicating revisions in plans, specifications, or procedures will be distributed immediately and explained at routine or special project meetings.

4.2 Project Meetings

Project meetings will be scheduled to promote communication between various personnel responsible for designing, constructing, managing, and observing the construction. The purpose of the routine project meetings is to keep all project staff members informed and to provide a forum for solving design, construction, and QA issues.

4.2.1 Prebid Meeting

A prebid meeting will be held to provide a forum for prequalified bidders to discuss the subcontract documents. At a minimum, the PM, CM, and the EPA representative should be present to meet with interested bidders. Any specific questions that are brought up will be answered in the form of an addendum to the subcontract documents.

4.2.2 Subcontractor HSSE Chartering Meeting

Prior to mobilization, all subcontractors and lower tier subcontractors that will be physically mobilizing to the FPS are required to attend a Health, Safety, Security and Environment (HSSE) chartering meeting with key CH2M representatives (PM, HSM, CQM, and CM). The purpose of the meeting is to discuss and agree on key HSSE requirements on the project and to emphasize and reinforce CH2M HILL's expectations for HSSE performance. The meeting may be held over the phone or in person, depending on project needs.

4.2.3 Preconstruction Meeting

A preconstruction meeting will be held to identify project personnel, review the project, and schedule, clarify, or resolve outstanding issues before construction startup. At a minimum, EPA, CH2M's PM, CQM, and CM, the subcontractors, and selected lower-tier subcontractors should be present. The PM, CQM, and CM will be prepared to discuss the following subjects, at a minimum:

- Required schedules
- Status of bonds and insurance
- Sequencing of critical path work items
- Progress payment procedures
- Project changes and clarification procedures
- Use of site, access, office and storage areas, security, and temporary facilities
- Subcontractor's HASP and representative
- Status of permits, license, or required approvals
- Status of submittals
- Maintenance of required records
- Activity hazard analysis
- Subcontractor's key personnel information and points of contact

- Subcontractor's QA/QC plan

The following will be performed by the CM and CQM during the preconstruction meeting:

- Provide each party with relevant construction and QA documents and supporting information. Supporting information may include construction drawings, specifications, and other applicable documents. The information transfer is not limited to documents distributed by the CM and CQM. All parties should use the opportunity to distribute relevant documents.
- Familiarize each party with his or her specific responsibilities relative to the design criteria, construction drawings, schedules, and specifications.
- Discuss the purpose of the CQAP and the documentation structure provided by the CQAP to verify that the project will be executed efficiently and in compliance with the specified design criteria and schedule.
- Review the responsibilities of each party.
- Review lines of authority and communication for each party.
- Discuss the established procedures and protocol for observations and tests, including sampling strategies.
- Discuss the established procedures and protocol for handling construction deficiencies, repairs, and retesting.
- Discuss the established procedures and protocol for handling contract modifications such as change orders and field orders.
- Review methods for documenting and reporting inspections and test data.
- Review work area security and safety protocols.
- Discuss procedures for locating and protecting construction materials and preventing damage to the materials from inclement weather or other events.
- Conduct a site walk to review construction material and equipment storage locations.
- Discuss payment for work in-place, including method of payment and unit cost work.

The preconstruction meeting will be documented by the CQM and minutes will be provided to all parties.

4.2.4 Coordination Meeting/Preconstruction Client Meeting

Prior to the start of site work, the project team will meet with EPA and stakeholders to develop a mutual understanding of the project details, including health and safety issues, communication procedures, evacuation/emergency procedures, scheduling work, security procedures, submittal reviewer/approvers, inspectors/approvers of major milestones of work performed, permits required, forms to be used, administration of onsite and offsite work, signature authorities for changes and waste documentation, schedule, and method for transmitting submittals. Minutes of the meeting will be prepared by the PM and signed by CH2M's representative, EPA's designated representative(s), and the stakeholders (MDEQ, fire marshal, representatives of local police, utilities, and health services, etc.). Meeting minutes will be distributed to the parties involved in the meeting and placed in the project files. The meeting may be held in conjunction with other meetings (for example, the preconstruction meeting).

4.2.5 Operational Readiness Review Meeting

Prior to the start of site work, the PM will complete an ORR checklist. The project team will discuss the checklist over a conference call and any noted deficiencies will be addressed prior to the start of work. Specifically, the ORR checklist covers general CH2M requirements prior to the start of work, equipment and supplies necessary to complete the work, subcontractor requirements, sampling requirements, construction procedures, waste management procedures and requirements, and environmental permits. The final, approved ORR checklist will be saved in the project folder.

4.2.6 Project Status Meetings

After the start of site work and throughout project execution, the project team will conduct project status meetings (sometimes referred to as quality meetings) at least weekly. EPA's representative(s) and stakeholders may attend any of the meetings. At a minimum, the following will be accomplished at each meeting:

1. Review the minutes of the previous meeting
2. Review the schedule
    a. Work or testing accomplished since last meeting
    b. Rework items identified since last meeting
    c. Rework items completed since last meeting
    d. Schedule delays and long lead time items
    e. Critical milestones
    f. Updated SOV
3. Review the status of submittals
    a. Submittals reviewed and approved since last meeting
    b. Request for information resolutions
    c. Submittals required in the near future
4. Review the work to be accomplished in the next 2 weeks and documentation required
    a. Completion dates for rework items
    b. Inspections required
    c. Testing required
    d. Status of offsite work or testing
    e. Documentation required
5. Discuss health and safety issues, such as near misses, incidents
6. Resolve quality issues such as nonconformance, rework, or corrective actions
7. Resolve production problems
8. Address items that may require revising the CQAP or other project plans
    a. Changes in procedures
    b. Changes in design/engineering drawings and/or specifications
    c. Changes or claims for additional compensation or time

Meetings will be recorded in project status meeting minutes, prepared by the CQM. The meetings may be held in conjunction with other meetings (such as tailgate safety meetings, progress meetings, planning meetings, etc.). Meeting minutes will be sent to all personnel attending the meeting.

4.2.7 Problem or Work Deficiency Meetings

A special meeting may be held if a problem or deficiency is present or likely to occur. The meeting should at least be attended by CH2M's CM and/or CQM, the subcontractor, and lower-tier subcontractors involved in the problem or deficiency. The purpose of the meeting is to define and resolve a problem or recurring work deficiency in the following manner:

- Define and discuss the problem or deficiency
- Review alternative solutions
- Implement a plan to resolve the problem or deficiency

The meetings will be documented by the CM, CQM, or a designated representative. Copies of the meeting minutes will be sent to all personnel attending the meeting, the PM, SM, and EPA, if not present.

4.3 Public Relations Plan

The CM may be approached by the general public during construction activities due to the proximity of the work zone to a public road. If contact occurs, the CM/SSC should direct the individual(s) to contact the EPA primary public affairs contact for the site. The CM/SSC may tell the individual(s) that EPA- and MDEQ-approved corrective measures construction activities are being conducted, however no additional project information may be shared. Once the individual(s) has left the work zone the CM/SSC shall contact the SM/PM and document the exchange in the field notes and daily report.

Primary Contact: Thomas Alcamo/U.S. Environmental Protection Agency – Project Manager, 312-886-7278, alcamo.thomas@epa.gov

Public Affairs Leader: Diane Russell/U.S. Environmental Protection Agency – Community Involvement Coordinator, 989-401-5507, russell.diane@epa.gov

4.4 Regulatory Inspections

If a local, state, or federal regulatory inspector makes an unannounced visit to the project site, the CM shall be familiar with and follow the CH2M Environmental Services Business Group guidelines and protocol as shown below:

- Occupational Safety and Health Administration (OSHA), EPA, and authorized state or local agencies have authority to inspect any facility that is subject to health, safety, and environmental legislation. Inspections may be announced or unannounced.
- Enterprise Standard Operating Procedure (SOP) HSE-201, *Agency Inspections and Communications,* describes the responsibilities, procedures, and requirements associated with inspections conducted by external regulatory agencies, as well as the methods for communicating information to key individuals. Included below is text from the Target Zero Bulletin that included a brief summary of what to do in the event of an agency inspection at your site. Clarifications have been provided when appropriate to provide project specific details. Refer to the SOP for more specific guidance.

Notification of Inspections

- If the inspection is an announced regulatory agency inspection, the PM should notify the Responsible Health and Safety Manager (RHSM) and Environmental Manager (EM) well in advance of the inspection.
- If an unannounced agency inspector visits one of our projects, field personnel must immediately notify the project Emergency Response Coordinator (ERC). For this project, the ERC will be the RHSM.
- The ERC must immediately notify the RHSM/EM, as appropriate, of unannounced inspections, or designate someone to call the RHSM/REM. The RHSM/EM can provide guidance to the field staff and PM.

Inspector Credential Verification

- Upon arrival, the ERC must request the inspector to provide official credentials. Record the inspector's name and office phone number or obtain the inspector's business card.
- The inspector shall sign the visitors log and be given a site-specific health, safety, and environmental protection briefing.
- The inspector shall meet any site access requirements associated with security clearances, specialized training, and medical monitoring. The CH2M representative shall verify the inspector possesses these requirements; access will only be granted to those areas where appropriate access requirements are met. Some inspectors have the authority to gain access to any work area at any time, such as an inspector with a search warrant. In these cases, we can stop work operations as necessary to protect the safety of the inspector(s).

Opening Conference

- The CH2M PM, RHSM, or other needed personnel and the inspector shall determine attendees for the opening conference. The RHSM (for OSHA and other worker health and safety inspections) or REM (for environmental inspections) shall join the opening conference via conference call.
- The inspector shall inform CH2M of the purpose of the inspection and provide a copy of the complaint, if applicable.
- The inspector shall outline the scope of the inspection, including employee interviews conducted in private, physical inspection of the workplace and records, possible referrals, discrimination complaints, and the closing conference(s).

Requests for OSHA Logs

- An OSHA inspector may request to review the project OSHA injury/illness log, better known as the OSHA 300 Log. Contact your RHSM for assistance in obtaining the OSHA 300 Log.
- Recordable injuries and illnesses sustained on field projects less than 1 year in duration are maintained on the CH2M office log where the injured employee is based.

The Inspection

- The scope of the inspection shall be limited to that indicated by the inspector in the opening conference. The inspector shall be escorted to relevant areas only. The ERC or other designated by the RHSM or EM must accompany the inspector during the inspection.
- Ensure the inspection is limited to the scope that the inspector disclosed during the opening conference. The ERC should always take notes that identify areas inspected, machinery or equipment and materials examined, employees or other persons interviewed, and photographs taken by the inspector.
- The inspector will observe safety, health, and environmental conditions and practices and document the inspection process. The inspector may also take photographs and instrument readings, examine records, collect air samples, measure noise levels, survey existing engineering controls, and monitor employee exposure to toxic vapors, gases, and dusts.
- CH2M should gather duplicate information (photographs, readings, samples) in the same manner and condition as the inspector. If the equipment needed to take duplicate samples is not onsite, ask the inspector if the sampling can wait until the equipment is available. If samples are taken, request a description of the tests the agency intends to perform on the samples and request results as soon as they are available.
- Employees may be questioned during the inspection tour. The employee can refuse to speak to an inspector, can speak to the inspector with a company representative (including management) present, or can speak to the inspector privately. It is CH2M policy that employees who wish to speak to the inspector are not discriminated against, intimidated, or otherwise mistreated for exercising their rights during compliance inspections.
- Copies of documents should not be provided to the inspector without the approval of the RHSM or EM or Legal Insurance Department (LID). DO NOT voluntarily release documents. Respond only to inspection team requests.
- During the course of the inspection, the inspector may point out violations. For each violation, the CH2M representative should ask the inspector to discuss possible corrective action. Where possible, violations detected by the inspector should be corrected immediately and noted by the inspector as corrected.
- For those items that cannot be corrected immediately, an action plan shall be formulated for timely correction. In any instance, employees exposed to hazards shall be removed from the area.

Closing Conference

After the inspection, a closing conference is normally held as follows:

- The CH2M PM, RHSM, or EM shall be involved via conference call in the closing conference, at a minimum.
- The inspector shall describe the apparent violations found during the inspection and other pertinent issues as deemed necessary by the inspector. CH2M shall be advised of their rights to participate in any subsequent conferences, meetings or discussions. Any unusual circumstances noted during the closing conference shall be documented by the ERC.
- The inspector shall discuss violations observed during the inspection and indicate for which violations a citation and a proposed penalty may be issued or recommended.
- The ERC shall request receipts for all samples and approved documents photocopied by the inspector, request a photocopy of the inspector's photograph log, and request a copy of the final inspection report.
- Any documentation from an agency inspection must be transmitted immediately to the RHSM or EM, and PM.

Unannounced regulatory agency inspections may happen at any time on our projects – Get the RHSM/EM and PM involved immediately if an Inspector arrives.

SECTION 5

Document Control and Management

Section 5 discusses document control and management.

5.1 General

The document manager for the project is responsible for implementing the procedures described in this section. A document control and management process will be implemented so that current and correct documents are available where the work is performed and that project records are archived after the work has been completed. Obsolete copies will be appropriately marked and/or removed from the work site and destroyed. The document manager is also responsible for providing backup of field files to the central project files as required by these procedures. Hard copies of the specifications, property drawings, HASP, and signed activity hazard analyses will be kept on file at the CH2M FPS trailer. Hard copies will include change order or RFI resolution attachments.

The document manager will be responsible to check that project personnel, subcontractors, lower-tier subcontractors, and customers use the correct version of project documents. In general, the document manager must receive all documents transmitted, either directly or copied in communications from other project team members. The document manager will save electronic documents in the respective subfolders at the following location:

\\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA.

5.2 Document Transmittals

Document transmittals between the project parties provide a record of communications that is necessary to keep appropriate construction and QA personnel informed of project requirements, progress, changes, and quality of the work. Transmittals should be formally communicated with proper documentation and confirmation of submittal and receipt to prevent misunderstandings and omissions.

5.2.1 Subcontract Clarification/Interpretation Requests

Subcontract clarification/interpretation requests and requests for information (Attachment A, Form A.4) are submitted when an explanation of the intent of specific project requirements, as presented in the subcontract documents, is required, which are generally submitted by the subcontractor to the document manager; however, the CM can submit clarification/interpretation requests to the subcontractor and should include the document manager on communications.

Subcontract clarification/interpretation requests shall be managed by the document manager. Interpretations of design or specifications by the design team will be issued in writing. In special cases, a design engineer may communicate a design interpretation or clarification verbally, followed by written confirmation. Responses to subcontract clarification/interpretation requests will be obtained in a timely manner to limit the impact on the project schedule. The PM is responsible for informing all parties of the design team's interpretations by distribution of documents to construction and QA personnel through the document manager, or by copying the document manager on communications, at a minimum.

5.2.2 Subcontract Modification Requests

A subcontract modification request is made if a change to the subcontract documents is deemed necessary for the following reasons:

- Changed site conditions
- Changed materials conditions

- Alternative design procedures proposed
- Alternative materials proposed

Subcontract modification requests (Attachment A, Form A.5 [273]) are generally prepared in response to a subcontract clarification/interpretation request submitted by the subcontractor or the document manager that has an effect on the subcontract scope, schedule, or budget. Subcontract modification requests should be submitted to the document manager for coordination with the appropriate groups. The appropriate groups will review, negotiate, and finalize all subcontract modification requests and forward modifications to the PM for approval. The CM or CQM will prepare subcontract modifications (change orders) as necessary, including the document manager on communications for submittal to the contract administrator. Responses to subcontract modification requests will be obtained in a timely manner to limit the impact on the construction schedule. The CM is responsible for transmitting all subcontract modifications to the appropriate organizations, before the change becomes part of the project record.

Likewise, the CM or CQM may issue a field order (Attachment A, Form A.6 [275]) for clarification and interpretation of drawings in cases where a subcontract modification is not suitable, including the document manager on communications. For example, a field order may be issued in response to a subcontractor-initiated subcontract clarification/interpretation request when the clarification does not affect the design intent, schedule, or cost of the work.

5.2.3 Subcontractor Submittals

Construction QC submittals are those submittals generated by the subcontractor during or immediately before construction to demonstrate compliance with the project plans. Submittal requirements for these projects are tabulated in the submittal log (Attachment B), in accordance with the requirements identified in the project plans.

The DM, with support from the PM, will log and track all submittals on the submittal log. Specific responsibilities regarding submittals include:

- Coordinating all submittal actions
- Maintaining necessary submittal records in an organized manner
- Maintaining and tracking submittals in the submittal log
- Reviewing and certifying all submittals for compliance with the project plans, drawings, and specifications
- Approving all submittals except those designated to be approved by the design manager, EPA, and/or stakeholders
- Checking all material and equipment delivered to the project for compliance with the project plans, drawings, and specifications

Certain designated technical or other submittals require approval by authorities other than the QCM, HSM or PM. In such cases, the DM will forward the submittal to the appropriate approver as specified on the Submittal Log.

The PM is responsible for coordinating the submittal transmittal and approval process and for following through to ensure the process does not affect the project schedule.

5.2.3.1 Technical Submittals

The subcontract documents require that the subcontractor (earthwork subcontractor and analytical laboratory services) submit various technical submittals. The submittals are outlined by their respective phase of work and as presented in the Submittal Register (Attachment B). Documents shall be submitted (Attachment A, Form A.7 [295]) to the document manager according to the frequency and number specified in the subcontract documents. Lower-tier subcontractor and vendor submittals shall be made through the subcontractor.

As submittals are received, the CQM will document their receipt on a submittal log. The CQM will assign the submittal to appropriate project team members for detailed review using the project SharePoint Site. Reviewers will check the submittal for general compliance with the contract documents and will note missing information or deviations in the submittal review form (Attachment A, Form A.8). The CM and/or PM will oversee the review process and help resolve questions regarding compliance with subcontract documents.

Review comments on submittals will clearly state information the reviewer considers to be lacking. Notes must be documented in the submittal quality review form (Attachment A, Form A.8) so that deficiencies can be clearly identified by the subcontractor. Notes will not be in the form of questions; rather, they must state what has been omitted or what is unacceptable.

Following the detailed review, the PM will send a marked copy of the submittal and a submittal reply form to the subcontractor. The PM will indicate on the submittal reply form whether deviations from the subcontract documents were noted, and whether additional submittals or resubmittals by the subcontractor are required. Copies of the original submittal, review copies, and submittal log and reply forms will be kept in a project submittal file.

5.2.3.2 Field Testing, QC Submittals

Submittals are administrative and technical documents such as design drawings, shop drawings, work plans, permits, certifications, schedules, air monitoring data, reports, and other types of documents and any accompanying samples that are required for the work.

Construction QC submittals are those generated by the CM, CQM or by the subcontractor prior to or during construction to demonstrate compliance with the project plans, specifications, and drawings. For materials and equipment procured directly by CH2M, the CM or CQM is responsible to check that the proper submittals are provided by the suppliers before accepting delivery. For materials and equipment supplied by the subcontractor, the CM or CQM is responsible to check that the proper submittals are provided and approved prior to delivery or installation.

The subcontract documents require that the subcontractor submit a quality control plan, materials certifications, inspection and test data, etc., for review by the CM, CQM, and staff. Documents shall be submitted to the document manager, who will forward copies to the CM, CQM, and PM for conformance evaluation and incorporation into the records. Lower-tier subcontractor vendor submittals will be made through the subcontractor. Test data and similar submittals will be submitted with a transmittal form (Attachment A, Form A.7 [295]) outlining the contents of the submittal and the date submitted.

5.2.4 Nonconformance Reports and Corrective Actions

The FQM or CM will notify the subcontractor of any detected noncompliance with the foregoing requirements. The subcontractor will take immediate corrective action after receipt of such notice. Such notice, when delivered to the subcontractor at the work site, will be deemed sufficient notification. If the subcontractor fails or refuses to comply promptly, the FQM or CM may issue an order stopping all or part of the work until satisfactory corrective action has been taken. Noncompliance notification or stop work orders will be documented in the daily report. Corrective actions will remain open, as noted in the daily reports until acceptable closure of the non-conformance. Verification of the corrective action and its results will be performed by the CM and documented in the daily report.

5.2.4.1 Initiation of Reports

When materials, methods, or work elements are not in accordance with subcontract documents and immediate resolution (within 24 hours) cannot be achieved, a nonconformance report (Attachment A, Form A.9 [442]) will be prepared. Nonconformance reports initiated by the CQM will be submitted to the CM, who will issue the nonconformance report to the subcontractor, copying the document manager, and will check that the subcontractor develops a corrective action plan.

The written nonconformance report shall be issued as soon as possible after nonconformance is detected. Each nonconformance report will be assigned a unique file number and recorded on a nonconformance report log (Attachment A, Form A.10 [444]). The log will allow the status of the nonconformance to be easily tracked.

The sole exception to this policy will be verbal notices made by the CM or CQM to the subcontractor for procedures that can be, and are, corrected immediately upon notice. Verbal notices will be recorded in the daily reports with an explanation of corrective measures taken and the time required to bring the work into conformance.

5.2.5 Resolution of Nonconformance

No payment will be issued for nonconforming work until the associated nonconformance is resolved. Each nonconformance report will remain in effect until corrective actions have been taken that meet the intent of the subcontract documents and the satisfaction of onsite QA representatives. When corrective actions are acceptable, the CM or CQM will document the corrective actions taken and results of retests, and will complete the acceptance portion of the nonconformance report. Likewise, the CM or CQM will observe and document the corrective actions and acceptability of the results on field observation forms. Whenever possible, retests shall be performed by the same CM or CQM who initially detected the nonconformance.

Full documentation is required for resolution of each nonconformance report. When a nonconformance is resolved, the following documentation procedures (Attachment A, Form A.11 [443]) will be followed:

- A copy of the observer's explanation of corrective action and acceptance will be attached to the nonconformance report for review and filing.
- Daily reports, data summaries, etc., will be updated to reflect the resolved status of the original deficiency (for example, notes of corrective action in observation reports, resubmittals, and retest results). At a minimum, the nonconformance report file number, date, or test number that identifies the initial deficiency will be included.

The corrected nonconformance will be checked off the record book, initialed, and dated by the CM or CQM, subcontractor, or designated representative.

SECTION 6

Change Management

It is critical to successfully anticipate and track change to keep on schedule and budget, or if the change will affect these things, to be fully aware of what the ramifications will be to both. Changes or clarifications may be needed during preparation of the deliverables and during field operations. All requests for change or clarification will be documented and resolved. Changes to design sketches, final project plans, field changes, and modifications to operating facilities are subject to design verification measures commensurate with those applied to the original documents (plans, design sketches, etc.).

The PM in collaboration with the DM and other appropriate team members approves design or scope changes that do not have an effect on project costs. The PM shall communicate design or scope changes to the SM that will have an effect on project costs and obtain client approval prior to proceeding. The requests for information (RFIs) will be used to communicate and document clarifications and modifications that will result in a cost or schedule change. Field orders (FOs) will be used to document changes/field agreements that do not affect cost or schedule. RFIs and FOs can be requested by any member of the project team and will be tracked and logged by the DM, PM, and contracts to ensure each RFI is fully addressed and that resolutions are documented.

All changes will be communicated to the PM as soon as the issue arises. The client should be notified of any changes to the proposed scope by the SM.

Complete documentation (Attachment C) will be maintained regarding who initiated the change, who approved the change and when, who implemented (completed) the change, and when was the change completed in the *Change Management Tracking Log* maintained in the project folder.

The following steps should be followed to manage change and potential change.

- As soon as a situation presents itself, either in the field or in the office that may affect schedule or budget, the CM needs to be notified immediately. The CM will notify the PM immediately.
- The PM and CM will determine the potential severity of the change and whether the potential change merits a budget and/or schedule estimate in order to discuss with the EPA. If an estimate is required, the PM will work with project staff to compile an idea of the likely affect(s) on both schedule and budget.
- The PM and SM will discuss the potential change with all parties concerned, the construction subcontractor, and/or the EPA WAM.

The RFI process involves either the subcontractor, FQM or CM identifying a situation in the field that requires change that will result in a change in cost or schedule. The RFI will contain the project number, an RFI identification number, and a title. This information is used for RFI tracking that will be entered by the DM. The party identifying the change prepares the RFI and forwards it to the PM and DM. If the RFI is nontechnical, the PM reviews and determines the cost implications and forwards the RFI to the SM as to discuss with the EPA WAM as required. If the RFI is of technical nature, the PM in collaboration with the QCM will forward the RFI to the appropriate project team members to address the information requested.

The response should include a narrative explanation of the resolution and attach any drawings or specifications required to complete the work. The response is returned to the PM and forwarded to the CM and subcontractor for field implementation. The RFIs are numbered sequentially for individual projects and filed electronically and at the job site.

6.1 Construction Changes

Changes to materials, supplies, work approaches, and corrective action area design during the construction effort will be documented in an overall effort to support sound engineering judgment and cost effective project delivery. Changes during construction will be documented using the RFI process.

The RFI process involves either the subcontractor or the CM identifying the situation in the field that requires change. When the subcontractor identifies a change, the subcontractor reports the concern to the CM. The CM then prepares an internal memorandum (i.e., RFI) identifying the concern and forwards it to the PM. The PM reviews and forwards to the EPA WAM as needed. The RFI will contain the project number, an RFI identification number, and a title. This information is used for RFI tracking. The PM forwards the RFI to the appropriate personnel who then are responsible to identify the appropriate design representative to evaluate the concern and prepare the appropriate response. The response should include a narrative explanation of the resolution and attach any drawings or specifications required to complete the work. The response is returned to the PM and forwarded to the CM for field implementation. The RFIs are numbered sequentially for individual projects and filed at the job site with the CM.

Note that the RFI process is a field construction tool for documenting changed field conditions or other issues that may require a deviation from project requirements identified in the specifications of the project plans. The RFI is intended to obtain input and concurrence from the management personnel responsible for developing the project plans. If issues identified in the RFI may require a change to the project scope, schedule, or budget, this should be clearly conveyed in the RFI. In such instances, it is the responsibility of the PM/CM to work closely with the contract administrator to seek and obtain proper approval from EPA (in accordance with established contract procedures) before implementing the change recommended in the RFI.

SECTION 7

Testing Requirements

The quality of materials and workmanship will be controlled by the subcontractor or supplier who furnishes the work or material involved; however, the subcontractor has the ultimate responsibility for QC of its lower-tier subcontractors and vendors.

The CM and/or CQM will observe QC testing of the construction materials, workmanship, and the subcontractor's QC activities. Specific QA requirements for observation and verification testing are detailed in the attachments. Attachment A contains samples of forms that may be used or modified to document QA activities.

QC testing, sampling, and inspecting will be conducted by the subcontractor, the subcontractor's supplier, or subcontracted independent testing companies. The subcontractor will provide to the CM or CQM, in a timely fashion or as specified, copies of QC inspection and testing reports if specified in the subcontract. The reports will include documentation of failed tests and corrective actions taken.

7.1 Observation and Verification Testing

The CM, CQM, or other designated personnel will document observations in the daily report form (Attachment A, Form A.3) and will document verification tests in the appropriate testing and field forms. Documentation will be recorded in ink. To correct an error in a testing or field form, a single line will be drawn through the error with the correct information entered next to the error. All corrections will be initialed and dated.

The field personnel will obtain, review, and become familiar with the applicable procedures, codes, standards, specifications, drawings, observation, and verification testing requirements, and accept or reject criteria.

Daily observation records and verification testing forms will contain at least the following:

- Item, condition, or activity observed or testing performed
- Location of observation or verification test
- Date of the observation or verification test
- CM's name and signature
- Type of observation or verification test
- Observation or verification test source criteria (for example, drawings and specifications)
- Results or acceptability
- Reference to corrective action taken in connection with nonconformance
- Relevant nonconformance report number

The Checklist for Michigan Permit-by-Rule for Construction Activities Requirements (Attachment A, Form A.12) will be reviewed when observing construction activities and when completing the daily inspector's report to verify soil erosion and sediment controls are in compliance.

7.2 Quality Assurance Subcontracts

The QA subcontracts include contracts for independent laboratory testing. Items or services procured for QA purposes that may affect the measurement of the quality of the construction project will meet the requirements of the contract specifications and this CQAP, as applicable.

7.3 Testing

Sampling and testing will be performed to verify that control measures are adequate to provide a product that conforms to project plans, specifications, and drawings. The Sampling and Testing Log binder will include all testing and

field forms to be used during construction to document the sampling and testing conducted. Offsite testing will be performed by laboratories and testing companies with accreditation and certifications through industry recognized organizations and standards. Onsite testing will be performed by individuals with documented training and experience to perform the testing as determined by their supervisor and accepted by the remedial program quality manager.

Testing services required for execution of the project will be contracted either directly by CH2M or by its subcontractor(s). The testing services will be procured according to a scope of work, which will be compliant with the project requirements and specifications. The scope of work will specify specific analytical and geotechnical testing methods (for example, ASTM International or similar standards), professional services, and other measurement protocols as specified in the project plans, designs, and specifications. The scope of work will also specify the nature of the report or deliverable required of the testing laboratory, including requirements for professional certification. Scheduling of site services will be the responsibility of the CM or CQM.

The following activities will be performed and documented during testing:

- Verify that testing procedures comply with contract requirements.
- Verify that facilities and testing equipment are available and comply with testing standards.
- Check test instrument calibration data against traceable certified standards.
- Verify that recording forms and the test identification system, including all test documentation requirements, have been prepared.
- Record results of all tests, both passing and failing tests, on the appropriate field form. All tests will be compiled daily by the CQM and documented in the site-specific tracking log and daily report for the date taken.
- Give the section reference, location where tests were taken, and the sequential control number identifying the test. Actual test reports may be submitted later in accordance with project specifications with a reference to the test number and the date taken.

The test results must be signed by the testing laboratory's representative authorized to sign certified test results. The signed reports, certifications, and other documentation will be submitted to EPA as part of the construction completion reports.

7.3.1 Borrow Source Sampling

The subcontractor will identify suppliers of borrow materials as part of the preconstruction activities that are necessary for site improvements to roadways and installation of the new water line. Borrow sources may include general backfill (sand), granular bedding material (for placement along the base and above the new waterline pipe), clay cap material, gravel, and topsoil.

The subcontractor will collect samples of the borrow materials (excluding gravel) at the source and submit them to the laboratory subcontractor for analysis as outlined in the specifications. Analytical results will be tracked electronically by the CQM or designee throughout the site preparation RA. The results will be made available to the CM, PM, SM, and design team for review to ensure that materials comply with project specifications and meet criteria.

Additional borrow samples will be collected during construction activities to verify continued compliance with project specifications. Additionally, a sample will be retained by CH2M for visual comparison during construction activities to confirm consistency in the materials. If inconsistencies in the materials are observed, CH2M may collect additional samples to determine continued compliance or nonconformance with project requirements.

7.3.2 Dust Monitoring and Air Sampling

All air sampling will be conducted and samples will be collected and analyzed in accordance with the site wide Air Monitoring Plan and Health and Safety Plan, both to be generated prior to beginning RA activities at the site.

7.3.3 Waste Characterization Sampling

Soil and aqueous waste sampling and characterization will be completed by CH2M and their drilling subcontractor during the RA, prior to the start of excavation. Offsite disposal of soil waste will be coordinated and arranged upon receipt waste profile approval. CH2M and the subcontractor will use the Waste Tracking Log (Attachment A, Form A.13), or similar approved version, to manage waste.

If the Subcontractor elects to treat the water collected during excavation, the Subcontractor is responsible for conducting sampling as required in the SRD.

7.3.4 Soil Compaction Testing

Soil compaction testing will be performed on borrow source materials placed during backfill. Compaction testing will be performed in accordance with Section 31 23 23, Fill and Backfill.

The subcontractor will perform in situ density testing using a nuclear density gauge or approved equivalent to demonstrate proper compaction.

7.4 Sampling and Testing Log

As tests are performed, the CQM or approved supervising field staff, will record the following information on appropriate field forms, which will be available in the Sampling and Testing Log binder:

- Field personnel observing the test
- Date the test was conducted
- Time the test was conducted
- Date the test results were received
- Results of the tests
- Whether they comply with the specifications
- Other relevant information pertaining to the test being performed
- Any remarks and acknowledgment that an accredited testing laboratory was used

Applicable project requirements, tests, or analytical procedures used must be cited on the respective field form. The CQM will obtain and compile all test results and update the site-specific electronic tracking log and field documentation binder daily, and maintain the records onsite in the project files.

Testing and inspections performed will be summarized in the daily report for the date on which the test or inspection was performed. The updated electronic tracking log will be available for review by the CM, PM, SM, and program quality manager.

7.5 Testing Companies

Independent testing companies and testing laboratories that are authorized or certified to operate in the State of Michigan will be employed on this project. Prior to the start of the work, the name(s), facility information, qualifications, and certifications of the testing companies and laboratories will be acquired and maintained in the project files.

Laboratories performing chemical analysis of samples hold current accreditation under the EPA National Environmental Laboratory Accreditation Program and hold current certification by the State of Michigan.

Laboratories performing geotechnical testing will be participating in an accreditation program and will be certified to perform the specified analytical method.

SECTION 8

Inspection

Receiving, in-process, and completion inspections will be performed during site preparation activities. An inspection is necessary for acceptance of all the items listed as DFOWs in Section 3. The DFOWs are summarized in Section 3.1. A completion inspection is required prior to final EPA acceptance.

The CQM will be responsible for verifying the in-process inspections are documented in the daily reports and verifying the site-specific electronic tracking log is completed. The CQM is also responsible for verifying that the receiving inspections are documented in the Daily Report. The CQM is responsible for maintaining the punch list during the progress of the work.

8.1 Material Inspections

The CM will verify that the material and equipment received at the project site are inspected for compliance with the project requirements and are in good working order before being accepted for use on the site. Completion of any field tests will be documented in the Test Log and Plan by the FQM. Any material or equipment not meeting the project requirements will be rejected or a written variance given by the QCM or designee. The performance and results of material and/or equipment inspections will be documented in the daily report.

8.2 Completion Inspections

8.2.1 Punch List Inspection

Punch list items should be addressed during the course of the work and the punch list inspection will occur near the completion of work for each property. The CQM will inspect the work with the CM, and develop a punch list of items that do not conform to the approved drawings and specifications. The punch list will include remaining items on the rework items list that were not corrected before the punch list inspection. The punch list will include the estimated date by which the deficiencies will be corrected. The CQM and CM will make follow-up inspections to ascertain whether deficiencies have been corrected. Once this is accomplished, CH2M will notify EPA that the feature of work is ready for prefinal inspection.

8.2.2 Prefinal Inspection before Final Client Inspection

A prefinal inspection is required to check that all aspects of the work will be acceptable to the client and that punch list work has been completed. A prefinal inspection punch list may be developed as a result of the inspection. Each deficiency noted in the punch list will be referenced (applicable specification paragraph, drawing, etc.). The CQM will check that all items on this list are corrected prior to notifying the PM/CM that a final client inspection can be scheduled.

8.2.3 Final Client Inspection

The CQM, CM, PM, SM, other project management personnel, and client representative will be in attendance at the final client inspection. Other stakeholders may be in attendance, too. The inspection will be considered closed when the work has been accepted by the client representative and acceptance has been documented and signed by all parties in a final inspection form.

SECTION 9

Project Documentation

All project quality activities and submittals pertaining to the contract and subcontract documents and the CQAP will be documented.

9.1 Calibration Documentation

The SSCs shall ensure that measuring and test equipment (M&TE) used at the site are of the proper type, range, accuracy, and tolerance to determine conformance to specified requirements. Project records must identify the M&TE used for an activity.

Normally, manufacturer's instructions are followed for calibration, calibration checks, and maintenance. The method and interval of calibration for each item is based on the type of equipment, stability characteristics, required accuracy, intended use, and other conditions affecting measurement control.

When M&TE is found to be out of calibration, an evaluation of the validity of previous inspection or test results and of the acceptability of items previously inspected or tested will be conducted and documented. Out-of-calibration devices shall be tagged or segregated and not used until they have been re-calibrated. If an item of M&TE is consistently found to be out of calibration, it will be repaired or replaced. Re-calibration will be performed whenever the accuracy of the equipment is suspect.

9.2 Photographic Record

A project photographic record will be made and kept as part of the quality records. In addition to recording construction progress and "as-constructed" installation details, the photographic record will document deviations from design and nonconformance items. Each photograph will be electronically stamped with the date the photograph was taken, and will be transferred daily to the network server for storage and viewing. Photographs will be organized folder with subfolders identified by specific construction activities (for example, specific DFOWs, pre-remediation activities, or final restoration activities).

Digital cameras will be used by the project team and photos electronically logged and filed for record purposes. The CQM, CM, or designated field personnel will save electronic photographs in the respective subfolders at the following location: \\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA\Construction\Project_Records

9.3 Field Documentation

The object of field documentation is to check that appropriate project information is documented in logbooks or on appropriate field forms during construction. Documentation is important for communicating with other staff members and other project representatives. The following regular QC observations, inspections, and records of general QC activities should be made:

- Record daily progress and associated QA and QC sampling (i.e., reference appropriate testing or inspection field form)
- Record construction operations, sequence, staging, etc.
- Maintain transportation and waste disposal records (Attachment A, Form A.14)
- Describe deviations from expected conditions, or unexpected problems and their resolution

The CQM will maintain a record of daily QC activities during construction in a field logbook, or on appropriate field forms during construction. The logbook and field forms will be available upon request for review. They will be used to record at least the following information:

- Date of entry
- Project name and location
- Time that work starts and ends every day
- Summary of weather conditions
- General description of work, size of work crew, and equipment and personnel onsite
- Duration and type of breaks
- Start time and duration of downtime resulting from equipment breakdown, weather, or emergencies
- Summaries of QC meetings and actions recommended to be performed
- Conversations with subcontractors, property owners, or residents
- QC testing equipment and personnel
- Identification of work locations
- Description of materials delivered to the site, including QC data
- Decisions made regarding defective work or corrective measures implemented, or both
- Field tests
- Sampling activities

The field forms and the bottom of the last page of the daily field logbook sentry hall be signed or initialed. Each entry will be dated to show that notes are being entered daily.

A line-out will be placed on any part of an unused page. One-line strike-throughs will be used to show corrections to entries. The strike-throughs will be initialed and dated. No correction fluid may be used.

The field documentation will also be documented in the daily report and on appropriate field forms.

9.4 Daily Report

The daily report is the daily record of operations on the job site and will be kept current (Attachment A, Form A.3). It is an essential tool for recording and reporting the daily production, safety, and quality activities of the project. The reports are the official record of work performance and compliance with project plans, drawings, and specifications. Therefore, it is important that the reports are correct and timely.

The CM is responsible for preparing the daily report and submitting the reports to the PM. The PM and CM will provide operational information, and the HSM will provide information on the health and safety activities for the daily report. The report also includes reports from subcontractor to address, at a minimum, the following:

- Quality aspects of the project that is being performed by the subcontractor
- Scheduling and resource issues
- Site safety inspections and concerns
- Environmental concerns
- Job progress
- Control inspections
- Tests performed and their results
- Personnel and equipment onsite
- Material received

The CQM will review the daily reports for accuracy and completeness because these reports are used to prepare the final reports for the project. The PM will review the reports and check that the quality process is working on the project. The project quality manager will review the reports to check that the quality processes and systems are working on the program.

The daily report template is included in Attachment A (Attachment A, Form A.3). At a minimum, the following information should be included to the daily report:

- Tailgate safety meeting minutes

- Summary of work performed that day
- Man-hours for each subcontractor
- Equipment used onsite
- Changed conditions, delays, and conflicts encountered, including QC issues
- DFOWs
- Submittal status
- Inspection conducted and findings/result of inspection
- Test conducted
- Waste disposal summary

9.4.1 Project Records

Records that are generated by the QC system must be maintained in an orderly manner. The CQM will make sure the project quality records are readily available for reference. The records should be arranged based on input from the document manager and include the following items:

- Submittals, including Submittal Register
- Daily reports
- Meeting minutes
- Inspection reports—Preparatory, Initial, and Follow-up Phases
- Punch list inspection results
- Pre-final and final inspection results
- Rework items lists
- Test results, including appropriate field forms and the site-specific electronic tracking log
- Chain of custody forms
- Construction change order and log
- Red-lined drawings/as-built drawing
- Field order and log
- RFIs arranged in numerical order and RFI log
- Nonconformance notices and corrective actions
- Certificates and qualifications
- Calibration records
- Photographs
- Correspondence (e-mails, conversation records, etc.)
- Dust/particulate readings (daily)
- DDT personal and perimeter sampling results (monthly)
- Waste tracking

Table 9-1. Reporting and Field Documentation Required

Velsicol Chemical Corporation Superfund Site Former Plant Site PSA-1 and PSA-2 Excavations, Operable Unit 1

Report or Documentation Requirement	Completed By	Delivered To	Frequency	Report Description	Server Location
Daily Report	CM	CQM	Daily	Documents daily construction and QC activity on the project site	\\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA\Construction\Project_Records
Daily Field Logbook	CM/FQM/SSC	Server Only	Daily	Upload a scanned copy of the filed logbook daily	\\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA\Construction\Project_Records
Daily Health and Safety Briefing Records	SSC	Health and Safety Manager	Daily	Documents daily health and safety "tailgate" meetings	\\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA\Construction\Project_Records
Safe Behavior Observations	SSC/CM	Health and Safety Manager	Weekly	Records observation of subcontractor work and documents whether or not work was performed in a safe manner	\\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA\Construction\Project_Records
Self-Assessment Checklists	SSC	Health and Safety Manager	Per HASP	Upload a scanned copy of the completed form at the frequency described in the HASP	\\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA\Construction\Project_Records
Project Status Meeting Minutes	PM	Project Team	Weekly	Minutes of any project status meeting held.	\\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA\Construction\Project_Meetings
Submittal Register	DM	Project Manager	As-needed	Update the submittal register to document receipt and review of subcontractor submittals	\\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA\Construction\Project_Records
Photographic Record	CM	Project Manager	Daily	Photographic record showing construction progress, special situations	\\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA\Construction\Project_Records
Daily QA/QC Verification Sheet	QCM	Construction Manager	Daily	Check list to ensure appropriate documentation and filing procedures are implemented	\\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA\Construction\Quality
Change Management Log	PM	Site Manager	As-needed	Tracking of out-of scope activities that have been completed to monitor potential budget impacts	\\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA\Construction\Administrative

Table 9-1. Reporting and Field Documentation Required

Velsicol Chemical Corporation Superfund Site Former Plant Site PSA-1 and PSA-2 Excavations, Operable Unit 1

Report or Documentation Requirement	Completed By	Delivered To	Frequency	Report Description	Server Location
HASP	HSM	Health and Safety Manager	Once	Presents health and safety procedures to be followed while onsite	\\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA\Construction\Health&Safety
Subcontractor AHAs	Sub	SSC and Health and Safety Manager	Once	Presents activity hazards and mitigation measures to be followed by the subcontractor while onsite	\\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA\Construction\Health&Safety
Subcontractor SOWs	Design Manager	Project Manager	As-Needed	Presents bid packages as well as executed subcontracts	\\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA\Construction\Procurement
Permits	Various	Project Manager	Once	Required permits that must be completed before beginning construction activities	\\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA\Construction\Permits
CQAP	QCM	Project Manager	Once – as needed for updates	Describes the quality management process activities that will be implemented at the site during the construction activities.	\\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA\Construction\Quality
Risk Management Plan and Log	PM	Project Manager	As-Needed	Presents project risks as well as mitigation measures for construction activities; will be updated as various risks are identified or removed	\\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA\Construction\Quality
Stormwater Pollution Prevention Plan	DM	E-Manager, Project Manager	Once	Provides site specific stormwater pollution prevention measures	\\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA\Construction\Permits
Waste Management/T&D Documents	Field Team	E-Manager, Project Manager	As-Needed	Presents the results of the waste characterization activities including waste profiles and waste manifests and waste tracking log	\\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA\Construction\Waste_Management
Transportation and Disposal Plan	EM	Project Manager	Once	Describes environmental and waste management requirements for construction	\\mkefpp01\proj\Velsicol_OU1\Main Plant Site\Main Plant Site RD\PSA1&2_Excavation_RA\Construction\Waste_Management

SECTION 10

Project Closeout

Project closure is to ensure all pertinent project records are identified, labeled, and properly maintained for easy retrieval at a later date. Closeout activities will be conducted throughout the progress of the project. In this way, closeout at the end of the project can be completed in an efficient and timely manner as part of budgeted activities. Closure activities to be completed for this project will include:

- Conduct closeout meeting with project team, including client (when possible), and obtain feedback
- Ensure all project documentation is filed including both electronically and hard copy
- Consolidate, purge, and archive files
- Summarize health and safety lessons learned and forward to HSM
- Summarize quality lessons learned and forward to EPA Program Construction Quality Assurance Manager
- Provide feedback and rewards/recognition to project staff throughout the delivery of this project
- Submit regular invoices, and reconcile all cost and revenue data in the financial accounting system after final payment
- Close all project tasks and subcontractor purchase orders in the financial accounting system
- Collect final payment, including outstanding accounts receivables
- Notify client that the project is complete and formally closed

SECTION 11

References

CH2M HILL. 2017. *Velsicol Chemical Corporation Superfund Site, PSA-1 and PSA-2 Excavations, Operable Unit 1—Final Basis of Design Report, St. Louis, Michigan.* January.

U.S. Environmental Protection Agency (EPA). 2012. *Velsicol Chemical Corporation Superfund Site—Proposed Plan for Operable Unit 1, St. Louis, Michigan.* February 7.

U.S. Environmental Protection Agency (EPA). 2012b. *Record of Decision—Velsicol Chemical Corporation/Pine River Superfund Site, Former Plant Site – Operable Unit 1, St. Louis, Michigan.* June 19.

Weston Solutions, Inc. 2006. *Remedial Investigation Report for Operable Unit 1—Velsicol Chemical Corporation Site, St. Louis, MI.* Prepared for the Michigan Department of Environmental Quality. November.

Weston Solutions, Inc. 2009. *Remedial Investigation Addendum Report for Operable Unit One—Velsicol Chemical Corporation Superfund Site, St. Louis, Gratiot County, Michigan.* Prepared for the Michigan Department of Environmental Quality. January.

Weston Solutions, Inc. 2011. *Feasibility Study for Operable Unit One—Velsicol Chemical Corporation Superfund Site, St. Louis, Gratiot County, Michigan.* Prepared for the Michigan Department of Environmental Quality. November.

Figures

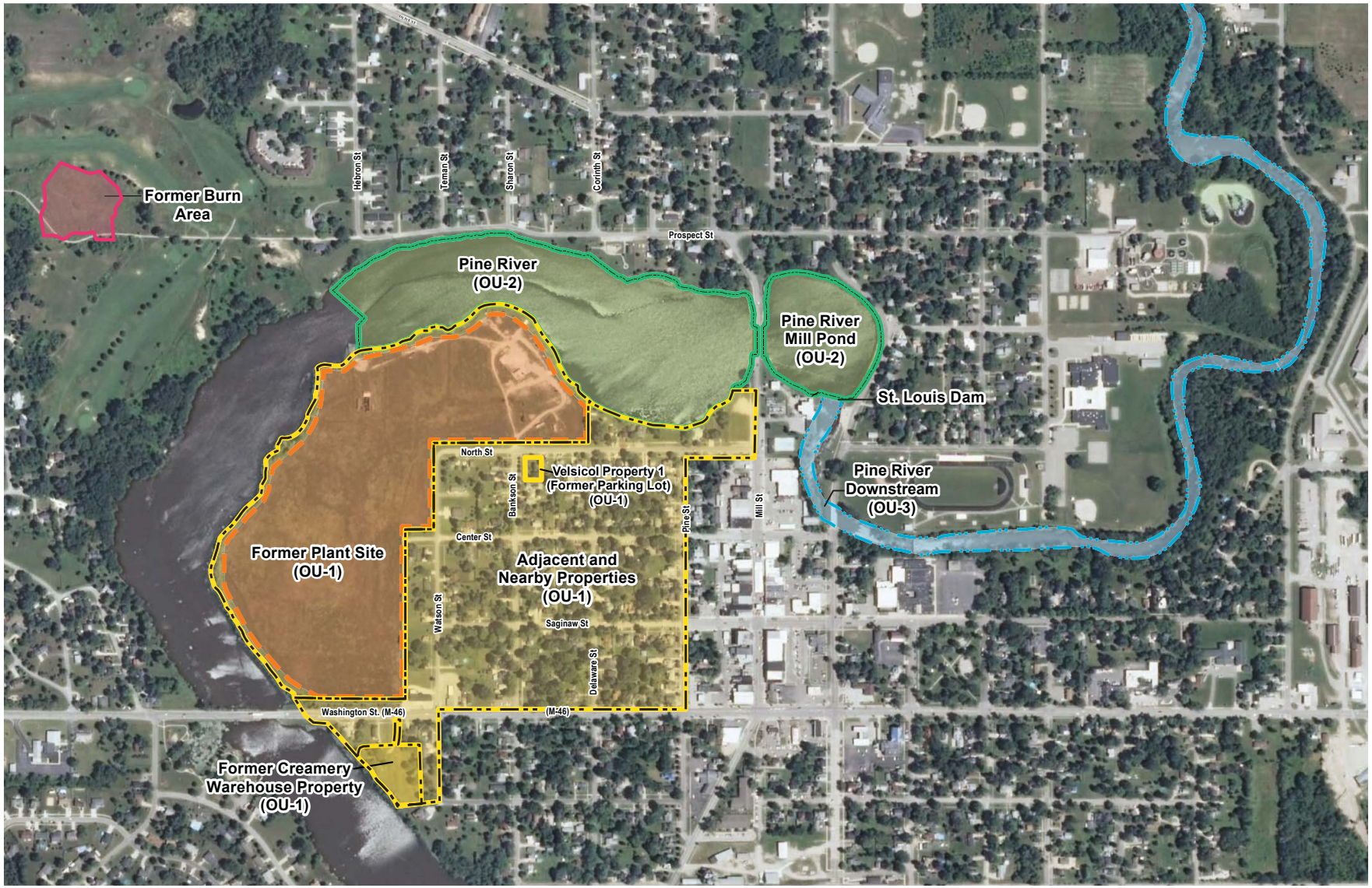

Figure 1-1
Study Areas and Operable Units
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

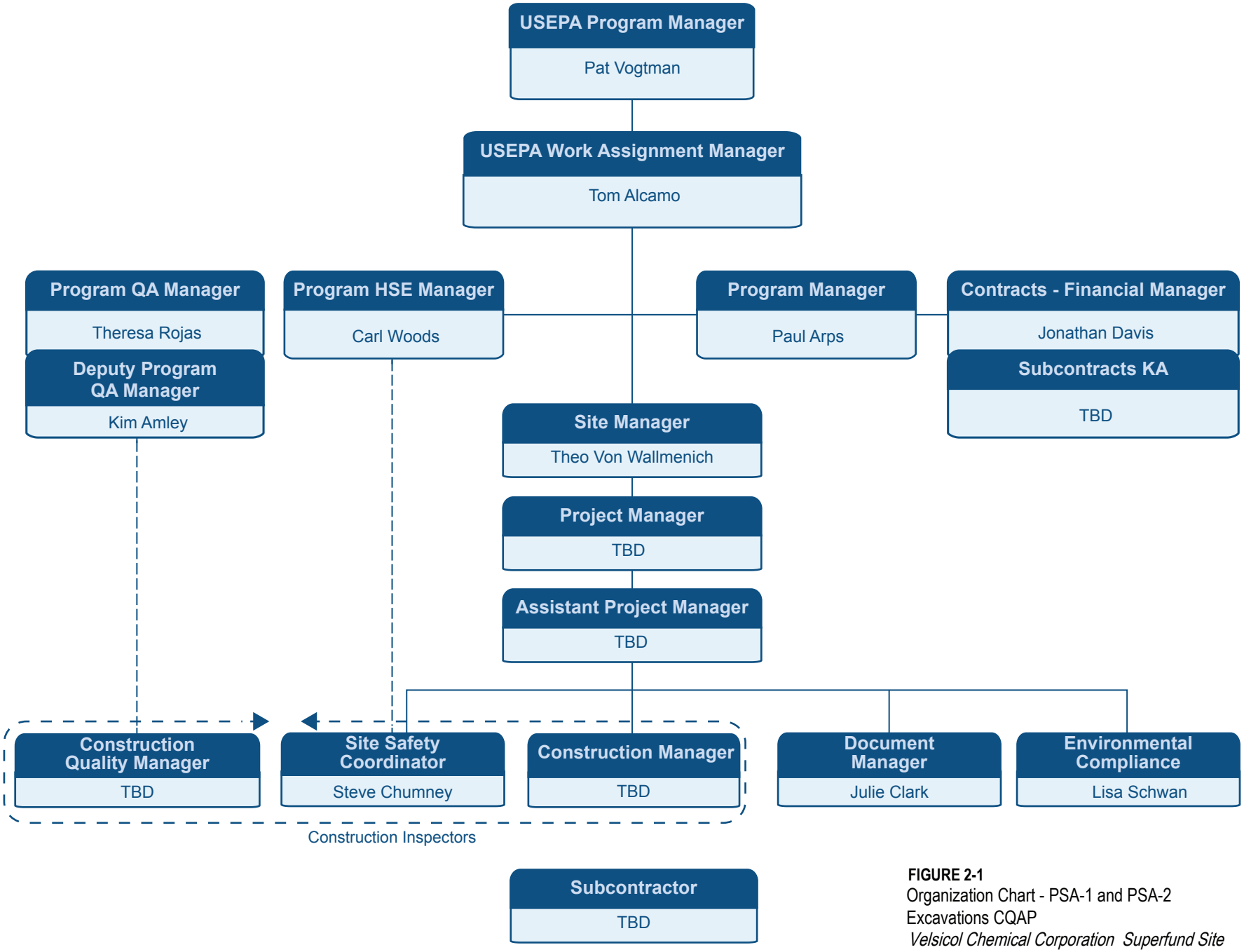

FIGURE 2-1
Organization Chart - PSA-1 and PSA-2
Excavations CQAP
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

Attachment A
Forms

ch2m Contract No:	**PREPARATORY PHASE REPORT**	REPORT NO:	REPORT DATE: REVISION NO: REVISION DATE:	TASK ORDER NO:
PROJECT NO:	DEFINABLE FEATURE OF WORK:	SITE/ACTIVITY:		

PERSONNEL PRESENT

CLIENT REP NOTIFIED _____ HOURS IN ADVANCE: YES ☐ NO ☐

NAME	POSITION	COMPANY

SUBMITTALS

REVIEW SUBMITTALS AND/OR SUBMITTAL REGISTER.

HAVE ALL SUBMITTALS BEEN APPROVED? YES ☐ NO ☐

IF NO, WHAT ITEMS HAVE NOT BEEN SUBMITTED?

ARE ALL MATERIALS ON HAND? YES ☐ NO ☐

IF NO, WHAT ITEMS ARE MISSING?

CHECK APPROVED SUBMITTALS AGAINST DELIVERED MATERIAL. (THIS SHOULD BE DONE AS MATERIAL ARRIVES).

COMMENTS:

MATERIAL STORAGE

ARE MATERIALS STORED PROPERLY? YES ☐ NO ☐

IF NO, WHAT ACTION IS TAKEN?

SPECIFICATIONS

REVIEW EACH PARAGRAPH OF SPECIFICATIONS.

DISCUSS PROCEDURE FOR ACCOMPLISHING THE WORK.

CLARIFY ANY DIFFERENCES.

PRELIMINARY WORK & PERMITS

ENSURE PRELIMINARY WORK IS CORRECT AND PERMITS ARE ON FILE.

IF NO, WHAT ACTION IS TAKEN?

CONTRACT NO:	PREPARATORY PHASE REPORT	REPORT NO:	REPORT DATE: REVISION NO: REVISION DATE:	TASK ORDER NO:
PROJECT NO:	DEFINABLE FEATURE OF WORK:	SITE/ACTIVITY:		

TESTING

IDENTIFY TEST TO BE PERFORMED, FREQUENCY, AND BY WHOM.

TEST	FREQUENCY	PERFORMER

WHEN REQUIRED?

WHERE REQUIRED?

REVIEW TESTING PLAN.

HAVE TEST FACILITIES BEEN

TEST FACILITY	APPROVED?
	YES ☐ NO ☐
	YES ☐ NO ☐

SAFETY

ACTIVITY HAZARD ANALYSIS APPROVED? YES ☐ NO ☐

REVIEW APPLICABLE PORTION OF EM 385-1-1.

MEETING COMMENTS

CLIENT/AGENCY/STAKEHOLDER COMMENTS DURING MEETING.

OTHER ITEMS OR REMARKS

OTHER ITEMS OR REMARKS:

PROJECT QC MANAGER NAME	PROJECT QC MANAGER'S SIGNATURE		DATE	

ch2m. Contract No:	**INITIAL PHASE CHECKLIST** (ATTACH ADDITIONAL SHEETS IF NECESSARY)	REPORT DATE: REVISION NO: REVISION DATE:
CTO NO:	PROJECT NAME/LOCATION:	REPORT NO:
PROJECT NO:	PROJECT QC MANAGER:	SITE H&S SPECIALIST:
SPEC SECTION:	DEFINABLE FEATURE OF WORK:	SCHEDULE ACT NO. / INDEX #

PERSONNEL PRESENT

GOVERNMENT REP NOTIFIED | HOURS IN ADVANCE: | YES ☐ NO ☐

NAME	POSITION	COMPANY/GOVERNMENT

PROCEDURE COMPLIANCE

IDENTIFY FULL COMPLIANCE WITH PROCEDURES IDENTIFIED AT PREPARATORY. COORDINATE PLANS, SPECIFICATIONS, AND SUBMITTALS

COMMENTS:

PRELIMINARY WORK

ENSURE PRELIMINARY WORK IS COMPLETE AND CORRECT. IF NOT, WHAT ACTION IS TAKEN?

WORKMANSHIP

ESTABLISH LEVEL OF WORKMANSHIP.

WHERE IS WORK LOCATED?

IS SAMPLE PANEL REQUIRED? YES ☐ NO ☐

WILL THE INITIAL WORK BE CONSIDERED AS A SAMPLE? YES ☐ NO ☐

(IF YES, MAINTAIN IN PRESENT CONDITION AS LONG AS POSSIBLE AND DESCRIBE LOCATION OF SAMPLE)

RESOLUTION

RESOLVE ANY DIFFERENCES?

COMMENTS:

CHECK SAFETY

REVIEW JOB CONDITIONS USING EM 385-1-1 AND JOB HAZARD ANALYSIS

COMMENTS:

ch2m. Contract No:	**INITIAL PHASE CHECKLIST** (ATTACH ADDITIONAL SHEETS IF NECESSARY)		REPORT DATE: REVISION NO: REVISION DATE:
CTO NO:	PROJECT NAME/LOCATION:		REPORT NO:
PROJECT NO:	PROJECT QC MANAGER:	SITE H&S SPECIALIST:	
SPEC SECTION:	DEFINABLE FEATURE OF WORK:	SCHEDULE ACT NO.	INDEX #

OTHER	OTHER ITEMS OR REMARKS

	QC MANAGER	DATE	

DAILY REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

SOP ES-P6-01, Final, Rev 1

(adapted from)

CONTRACT NAME:		REPORT NO:			
CONTRACT NUMBER:		REPORT DATE:			
TASK ORDER NUMBER:		REVISION DATE:		REV #	
PROJECT NAME:		SITE NAME:			
PROJECT NUMBER:		PROJECT DESCRIPTION:			
PROJECT MANAGER:		FIELD QUALITY MANAGER:			
CONSTRUCTION MANAGER:		H&S SAFETY Manager:			

AM WEATHER:		PM WEATHER:		MAX TEMP (F):		MIN TEMP (F):	

SUMMARY OF WORK PERFORMED

HEALTH AND SAFETY

JOB SAFETY

Was A Job Safety Meeting Held This Date?	☐ Yes	☐ No
Were there any lost-time accidents this date? (If yes, attach copy of completed OSHA report)	☐ Yes	☐ No
Was a Confined Space Entry Permit Administered This Date? (If yes, attach copy of each permit)	☐ Yes	☐ No
Was Crane/Manlift/Trenching/Scaffold/HV Elec/High Work/Hazmat Work Done?? (If yes, attach statement or checklist showing inspection performed)	☐ Yes	☐ No
Was Hazardous Material/Waste Released into the Environment? (If yes, attach description of incident and proposed action)	☐ Yes	☐ No

SAFETY ACTIONS TAKEN TODAY/SAFETY INSPECTIONS CONDUCTED (Include Observations, Safety Violations, Corrective Instructions Given, Corrective Actions Taken, and Results of Safety Inspections Conducted:

TAILGATE TOPICS:

SAFE BEHAVIOR OBSERVATIONS:

OPERATIONS / PRODUCTION REPORT

WORK FORCE – CONTRACTOR AND SUBCONTRACTOR

Company	Total Hours Today

DAILY REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

TOTAL HOURS	

EQUIPMENT ON HAND (Intial Inspection conducted to check if the Equipment is clean and in good working order/operable)

Description of Equipment	Make/Model/Manufacture	Equipment ID Number	Inspection Performed By

EQUIPMENT COMMENTS (acceptance status, inspection findings, etc.):

PLANNED WORK

Planned Work / Test for Tomorrow:

Planned Work / Test for Next Week:

CHANGED CONDITIONS/DELAY/CONFLICTS ENCOUNTERED

(List any conflicts with the project [i.e., scope of work and/or drawings], delays to the project attributable to site and weather conditions, etc.)

VISITORS AND DISCUSSIONS:

DAILY REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

SOP ES-P6-01, Final, Rev 1

(adapted from)

REGULATORY COMPLIANCE REPORT

PERMIT INSPECTIONS PERFORMED:

WASTE ACCUMULATION/STOCKPILE AREA INSPECTION

Inspection Performed By:				Signature of Inspector:			
Accumulation / Stockpile Area Inspected:		See Waste Tracking Log					
No of Containers:	Na	No of Tanks	N/A	No of Roll-Off Boxes:	N/A	No. of Drums	N/A

Inspection Results:

GENERAL COMMENTS

General Comments~ (rework, directives, etc.):

DAILY CONTRACTOR QUALITY CONTROL REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DEFINABLE FEATURES OF WORK STATUS

DFOW No.	Definable Feature Of Work	Preparatory	Initial	Follow-Up
1	Mobilization and Setup	☐	☐	☐
2	Site Preparation Work	☐	☐	☐
3	Site Restoration	☐	☐	☐
4	Demobilization	☐	☐	☐

PREPARATORY

WAS PREPARATORY PHASE WORK PERFORMED TODAY? ☐ YES ☐ NO

IF YES, FILL OUT AND ATTACH SUPPLEMENTAL PREPARATORY PHASE CHECKLIST.

DFOW No.(from list above).	Description	PREPARATORY PHASE REPORT NO. 02

INITIAL AND FOLLOW-UP FEATURE OF WORK COMMENTS

DFOW No.(from list above)	Phase	Comment/Finding/Action
	Initial ☐ Follow up ☐	
	Initial ☐ Follow up ☐	
	Initial ☐ Follow up ☐	
	Initial ☐ Follow up ☐	
	Initial ☐ Follow up ☐	
	Initial ☐ Follow up ☐	
	Initial ☐ Follow up ☐	
	Initial ☐ Follow up ☐	
	Initial ☐ Follow up ☐	
	Initial ☐ Follow up ☐	
	Initial ☐ Follow up ☐	

REWORK ITEMS

REWORK ITEMS IDENTIFIED TODAY (NOT CORRECTED BY CLOSE OF BUSINESS)			**REWORK ITEMS CORRECTED TODAY (FROM REWORK ITEMS LIST)**	
TASK/ ACTIVITY	DATE ISSUED	DESCRIPTION	TASK/ACTIVITY	CORRECTIVE ACTION(S) TAKEN

DAILY CONTRACTOR QUALITY CONTROL REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

SAMPLING/TESTING PERFORMED:

TASK/ACTIVITY TESTED	SAMPLING/TEST PERFORMED	TEST RESULTS (PASS/FAIL/CRITERIA)

MATERIALS/EQUIPMENT INSPECTION (Materials received and inspected against specifications)

DESCRIPTION/QUANTITY/VOLUME/WEIGHT	MAKE/MODEL/MANUFACTURER	MATERIAL LOT NUMBER	INSPECTION PERFORMED BY

SUBMITTALS INSPECTION / REVIEW:

SUBMITTAL NO	SUBMITTAL DESCRIPTION	SPEC/PLAN REFERENCE	SUBMITTAL APPROVED?	COMMENT/REASON/ACTION
			YES ☐ NO ☐	
			YES ☐ NO ☐	
			YES ☐ NO ☐	
			YES ☐ NO ☐	

LIST OF ATTACHMENTS (examples, as applicable: preparatory phase checklist, QC meeting minutes, safety meeting minutes, crane inspections, crane operation checklist, COCs, weight tickets, manifests, profiles, rework item list, testing plan and log, etc.):

On behalf of the contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge except as noted in this report.

PREPARER'S SIGNATURE DATE

CH2MHILL	*REQUEST FOR INFORMATION*	RFI No:	000
		Date:	

PROJECT INFORMATION					
CONTRACT No.	EP-S5-06-01			**CH2M HILL TO No:**	0000
PROJECT NAME:	PSA 1&2 Excavations Remedial Action			**CH2M HILL Project No:**	478783
SITE NAME:	Velsicol Chemical Superfund Site	**SITE LOCATION:**	St. Louis, Gratiot County, MI		
CONTRACTOR:					

REFERENCES	
Specification:	
Drawing/Plan:	
Detail/Section:	

REQUEST FOR INFORMATION DESCRIPTION	
Clarification Requested By:	
Clarification Requested Of:	

Description of Existing Condition and/or Deficiency:

Recommended Solution:

POTENTIAL IMPACT			
Cost Impact:		**Schedule Impact:**	
Activity Impacted:			
Work Days Impacted:		**Estimated Cost Impact:**	
Supporting Documentation:			

REQUESTOR INFORMATION		
Requested By:		
	Printed Name	Title
	Signature	Date

RESPONSE DISPOSITION/CONCURRENCE		
Response Disposition/Concurrence:		
Further Action Required (if any):		
Response Provided By:		
	Printed Name	Title
	Signature	Date

FORM NO.	A.5 [273]
TITLE:	Change Order
PURPOSE:	Provides contractual means for ordering modifications to the subcontract documents.
PREPARED BY:	Contractor or owner
DIRECTED TO:	Subcontractor
COPIES TO:	Contractor, owner, resident project representative
COMMENTS:	All revisions to the subcontract documents involving changes to the subcontract cost or subcontract times must be documented using this form.

CH2MHILL

CHANGE ORDER

CHANGE ORDER NO.[1]: _____

TO SUBCONTRACTOR: _____

PROJECT: _____ PROJECT NO: _____

OWNER: _____

CONTRACTOR: _____

The following modification(s) to the Subcontract are hereby ordered (use additional pages if required):

Reason for Modification(s):

Attachments (List Supporting Documents):

Subcontract Amount or Price		Subcontract Times (Calculate Days)	
Original	$ _____	Original Duration	_____ Days
Previous Change Order(s) (Add/Deduct)	$ _____	Previous Change Order(s) (Add/Deduct)	_____ Days
This Change Order (Add/Deduct)	$ _____	This Change Order (Add/Deduct)	_____ Days
Revised Subcontract Amount	$ _____	Revised Subcontract Time	_____ Days

The Revised Subcontract Completion Date is:

_____ , _____

Owner	Subcontractor	Contractor
By: _____	By: _____	By: _____
Date: _____	Date: _____	Date: _____

[1] Number all Change Orders consecutively.

Copies: Owner
Field File

FORM NO.	A.6 [275]
TITLE:	Field Order
PURPOSE:	Orders minor revisions to the subcontract documents that do not involve changes in the subcontract price or subcontract times.
PREPARED BY:	Contractor
DIRECTED TO:	Subcontractor
COPIES TO:	Owner, Resident Inspector, Document Manager, Project Field File
COMMENTS:	Use sparingly; if the revision involves changes in the subcontract price or times, either a Change Order or Written Amendment should be implemented.

CH2MHILL

FIELD ORDER

TO SUBCONTRACTOR: _____ FIELD ORDER NO: _____

PROJECT: _____ PROJECT NO: _____

OWNER: _____

CONTRACTOR: _____

The following minor changes in the work have been ordered and authorized:

Description of Changes:

Reason for Field Order:

Reference Drawing sheets and section(s) or detail(s):

Reference Specification section(s)/paragraph(s):

The intent of this Field Order is to authorize minor variations to the Subcontract Documents not involving a change in Subcontract Price or Subcontract Times and which are compatible with the design concept of the completed Project. This Field Order is binding upon OWNER and also on SUBCONTRACTOR who will perform the work promptly. If OWNER or SUBCONTRACTOR believes an adjustment to the Subcontract Price or Subcontract Times is necessary, the party may make a claim therefore in accordance with the General Conditions.

Issued by Contractor:

By: _____
Authorized Representative

Date: _____

Subcontractor Receipt Acknowledgement:

By: _____

Title: _____

Date: _____

Copy:
1. Owner
2. Resident Inspector
3. Document Manager
4. Project Field File

CH2MHILL

TRANSMITTAL OF SUB CONTRACTOR'S SUBMITTAL

(ATTACH TO EACH SUBMITTAL)

DATE: _____

TO: _____

_____

_____

_____

_____

Submittal No.: _____

☐ New Submittal ☐ Resubmittal

Project: _____

Project No.: _____

Specification Section No.: _____

(Cover only one section with each transmittal)

FROM: _____

Subcontractor

_____

_____

_____

Schedule Date of Submittal:

_____

SUBMITTAL TYPE: ☐ Shop Drawing ☐ Sample ☐ Informational

The following items are hereby submitted:

Number of Copies	Description of Item Submitted (Type, Size, Model Number, Etc.)	Spec. and Para. No.	Drawing or Brochure Number	Contains Variation to Subcontract	
				No	Yes

SUBCONTRACTOR hereby certifies that (i) SUBCONTRACTOR has complied with the requirements of Subcontract Documents in preparation, review, and submission of designated Submittal and (ii) the Submittal is complete and in accordance with the Subcontract Documents and requirements of laws and regulations and governing agencies.

By: _____

SUBCONTRACTOR (Authorized Signature)

CH2M HILL Review Form A.8

Project Name	**Velsicol Chemical Superfund Site, PSA 1&2 Excavations RA**
Document/Product Name:	
Date Comments Submitted:	

Comment Number	Reference Page or Section Number	Reviewer	CH2M HILL Review Comment	Response
1				
2				
3				
4				
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6				
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9				
10				
11				
12				
13				
14				
15				
16				
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32				
33				
34				
35				
36				
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38				
39				
40				
41				

FORM NO.	A.9 [442]
TITLE:	Defective/Rejected Work Notification
PURPOSE:	Written notice of deficiencies or rejection of work and a demand for corrective action.
PREPARED BY:	Contractor or resident project representative
DIRECTED TO:	Subcontractor
COPIES TO:	Owner, contractor, document manager, project field file
COMMENTS:	Description should contain accurate locations and specification references. The document may figure strongly in later contractor claims. EJCDC General Conditions require that “deficiencies” in the work be corrected; while “rejected” work must be removed and replaced.

CH2MHILL

DEFECTIVE/REJECTED WORK NOTIFICATION

TO SUBCONTRACTOR: _____ NOTIFICATION NO: _____

PROJECT: _____ PROJECT NO: _____

OWNER: _____ TIME: _____ AM/PM

CONTRACTOR: _____ OBSERVER: _____

Pursuant to the GENERAL CONDITIONS of the Contract, you are hereby notified of the following noncompliance violation:

Specification Section: _____ Paragraph: _____

Violation:

Subcontract Requirement:

Violation Detected by: ☐ Test ☐ Inspection ☐ Observation

Noncompliance Work is: ☐ Defective ☐ Rejected

Estimated Value of Noncomplying Work: $ _____

Defective work shall be corrected. Rejected work shall be removed and replaced. All costs shall be borne by the Subcontractor. Payment will not be made for defective or rejected work. Subcontractor shall notify Contractor when defective or rejected work is corrected.

Received by:

Contractor: _____ _____
Authorized Representative Subcontractor

Date: _____ _____
Title

_____
Date

Distribution:
1. Owner
2. Contractor
3. Document Manager
4. Field File

CH2MHILL

DEFECTIVE/REJECTED WORK NOTIFICATION LOG

PROJECT: _____ PROJECT NO: _____

SUBCONTRACTOR: _____

Notification Number	Date	Spec Section	Defective/Rejected Work	Accepted	
				By	Date

NOTIFICATION OF CORRECTION OF DEFECTIVE/REJECTED WORK

TO SUBCONTRACTOR: _____ PREVIOUS NOTIFICATION NO: _____ DATE: _____

PROJECT: _____ PROJECT NO: _____

OWNER: _____

CONTRACTOR: _____

The below listed Defective/Rejected work has been reinspected and the results of the Subcontractor's corrective actions have placed the work in compliance with the Subcontract Documents.

Description of Violation:

Description of Correction:

Contractor: _____
Authorized Representative

Date: _____

Distribution:
1. Contractor
2. Owner
3. Document Manager
4. Project Field File

Form A.12: Checklist for Michigan Permit-by-Rule for Construction Activities Requirements
PSA 1&2 Excavations Remedial Action
Velsicol Chemical Superfund Site - St. Louis, Michigan
2018

Permit Requirements	Applicable?	Notification to Agency?	Calendar-Based Action item?	Requirement Location (if applicable)
(1) (a) File with the department, on a form approved by the department, notice of coverage pursuant to the provisions of this rule before the initiation of construction activity.	No; Administrative	Yes	No	N/A
(1) (a) (i) Notice of coverage shall include a copy of the individual soil erosion and sedimentation control permit for the site as issued to the construction permittee; or if the construction activity is to be carried out by an authorized public agency, certification by the authorized public agency that an approved control plan exists; or, for part 615 or part 631 permits, a copy of the permit, along with any forms or diagrams pertaining to soil erosion and sedimentation control that were part of the permit application.	No; Administrative	Yes	No	N/A
(1) (a) (ii) Notice of coverage shall include acknowledgement by the construction permittee that any discharge that is made pursuant to the provisions of this rule shall be in compliance with part 31 of the act and the rules promulgated there under.	No; Administrative	Yes	No	N/A
(1) (a) (iii) Notice of coverage shall include a location map and a description of the nature of the construction activity.	No; Administrative	Yes	No	N/A
(1) (a) (iv) Notice of coverage shall include the location of the proposed discharge and identification of the receiving water.	No; Administrative	Yes	No	N/A
(1) (a) (v) Notice of coverage shall include the total area of the site and the area of the site that is expected to undergo construction activity during the life of the project.	No; Administrative	Yes	No	N/A
(1) (a) (vi) Notice of coverage shall include name and certification number of a certified storm water operator responsible for inspection of the construction activity in accordance with subrule (2)(e) of this rule.	No; Administrative	Yes	No	N/A
(1) (b) Provide a valid signature of the construction permittee or authorized representative on the notice of coverage. If the construction permittee is a partnership, association, corporation, industry, municipality, state agency, or interstate body, the valid signatory for the notice of coverage shall be determined in accordance with R 323.2114.	No; Administrative	Yes	No	N/A
(2) (a) A construction permittee that has authorization to discharge under a national permit pursuant to subrule (1) of this rule shall not directly or indirectly discharge wastes such as discarded building materials, concrete truck washout, chemicals, lubricants, fuels, litter, sanitary waste, or any other substance at the construction site into the waters of the state in violation of part 31 of the act or rules promulgated there under.	Yes	No	No	Prohibited in spec. section 01 50 00, 3.04 C 2.
(2) (b) A construction permittee that has authorization to discharge under a national permit pursuant to subrule (1) of this rule shall be in compliance with a soil erosion and sedimentation control permit for the site or, if the construction activity is carried out by an authorized public agency, the approved control plan, including the selected control measures that are applicable to the site.	Yes	No	No	Compliance with SESC Plan required in spec. section 01 50 00, 3.04 C 1.
(2) (c) A construction permittee that has authorization to discharge under a national permit pursuant to subrule (1) of this rule shall properly maintain and operate the soil erosion control measures.	Yes	No	No	SESC Plan - section 3.1
(2) (d) A construction permittee that has authorization to discharge under a national permit pursuant to subrule (1) of this rule shall have the soil erosion control measures under the specific supervision and control of a storm water operator who has been certified by the department as properly qualified to operate the soil erosion control measures. The certification shall be done in accordance with the requirements of R 323.1251 et seq. [For the Velsicol OU1 ANP Phase 2A RA, the certified storm water operator will be employed by the earthwork subcontractor.]	Yes	No	No	SESC Plan - section 3.3

Form A.12: Checklist for Michigan Permit-by-Rule for Construction Activities Requirements
PSA 1&2 Excavations Remedial Action
Velsicol Chemical Superfund Site - St. Louis, Michigan
2018

Permit Requirements	Applicable?	Notification to Agency?	Calendar-Based Action item?	Requirement Location (if applicable)
(2) (e) A construction permittee that has authorization to discharge under a national permit pursuant to subrule (1) of this rule shall cause the construction activity to be inspected by a certified storm water operator once per week, and within 24 hours after every precipitation event that results in a discharge from the site, and ensure that any needed corrective actions are carried out. A log of the inspections and corrective actions shall be maintained on file by the construction permittee for review and shall be retained by the construction permittee for a period of 3 years from the date of the inspection or corrective action.	Yes	No	Yes	SESC Plan - section 5.1
(2) (f) A construction permittee that has authorization to discharge under a national permit pursuant to subrule (1) of this rule shall, in accordance with the requirements for on-land facilities as set forth in spillage of oil and polluting materials, being part 5 of these rules, provide facilities and comply with reporting procedures for containment of any accidental losses of oil or other polluting materials.	Yes	No	No	Required to be addressed in site-specific HASP as described in spec. section 01 11 00 1.07 D 2 i.
(2) (g) A construction permittee that has authorization to discharge under a national permit pursuant to subrule (1) of this rule shall dispose of solids, sediment, filter backwash, or other waste that is removed from or results from the treatment or control of storm water in compliance with applicable state laws and regulations and in a manner that prevents any waste from entering waters of the state.	Yes	No	No	
(2) (h) A construction permittee that has authorization to discharge under a national permit pursuant to subrule (1) of this rule shall allow the department to enter upon the site at any reasonable time before the expiration of the authorization to discharge as set forth in subrule (5) of this rule, upon presentation of credentials and other documents as may be required by law, for the purpose of inspecting conditions relating to the pollution of any waters or determining compliance with the provisions of this rule.	Yes	No	No	CH2M HILL will maintain control of site and will permit agency access as requested.
(2) (i) A construction permittee that has authorization to discharge under a national permit pursuant to subrule (1) of this rule shall, upon request, make available for public inspection or provide to the department all reports or logs prepared pursuant to the provisions of this rule.	Yes	No	No	CH2M HILL will provide information from daily reports and earthwork subcontractor daily reports as requested.
(2) (j) A construction permittee that has authorization to discharge under a national permit pursuant to subrule (1) of this rule shall file a revised notice of coverage in compliance with the provisions of subrule (1) of this rule before any expansion of the construction activity or change in the soil erosion control measures that requires a change in the soil erosion and sedimentation control permit.	No; Administrative	No	No	N/A
(3) The department may require that discharges from a construction activity be authorized by an individual national permit if it has been determined by the department that unlawful pollution cannot be adequately guarded against, and there is or may be water quality degradation that will violate the commission act unless requirements in addition to those in the soil erosion and sedimentation control permit are imposed. A determination by the department for an individual national permit or other additional control constitutes grounds for revocation of the authorization to discharge pursuant to the provisions of this rule.	No; Administrative	No	No	N/A
(4) The department may require that discharges from a construction activity be authorized by an individual national permit if it has been determined by the department that the responsible part 91 permitting entity or authorized public agency is not carrying out a program that is adequate to ensure that the requirements of part 91 of the act are complied with.	No; Administrative	No	No	N/A

Form A.12: Checklist for Michigan Permit-by-Rule for Construction Activities Requirements
PSA 1&2 Excavations Remedial Action
Velsicol Chemical Superfund Site - St. Louis, Michigan
2018

Permit Requirements	Applicable?	Notification to Agency?	Calendar-Based Action item?	Requirement Location (if applicable)
(5) (a) The authorization to discharge pursuant to the provisions of this rule expires when the soil erosion and sedimentation control permit expires, or is revoked or terminated by the part 91 permitting entity in accordance with the provisions of part 91 of the act and 1969 PA 306, MCL 24.201 et seq., or when the authorized public agency determines that the project has been completed by the stabilization of earth change activity.	No; Administrative	No	No	N/A
(5) (b) The authorization to discharge pursuant to the provisions of this rule expires five years from the date of the notice that is filed pursuant to the provisions of subrule (1)(a) of this rule, if the authorization to discharge has not previously expired pursuant to subdivision (a) of this subrule. This authorization may be extended by filing a new notice in compliance with the provisions of subrule (1)(a) of this rule. The construction permittee shall file a notice of termination with the department, on a form approved by the department, when authorization to discharge expires as set forth in accordance with subdivision (a) of this subrule. The notice of termination shall include the name and address of the construction permittee, the location of the construction site, and the mailing address, if available, and certification that stabilization of earth change activity has been completed or, if the certification cannot be made, the reason why the authorization to discharge has expired.	No; Administrative	No	No	N/A
(6) The department may revoke authorization to discharge pursuant to the provisions of this rule if an individual national permit is required pursuant to the provisions of subrule (3) of this rule or in compliance with R 323.2159.	No; Administrative	No	No	N/A
(7) Nothing in this rule shall be construed to preclude the institution of any legal action or relieve the construction permittee from any responsibilities, liabilities, or penalties to which the construction permittee may be subject pursuant to part 31 of the act or rules promulgated there under.	No; Administrative	No	No	N/A
(8) The provisions of this rule are severable, and if any provision of this rule or the application of any provisions of this rule to any circumstances is held invalid, the application of the provisions of this rule to other circumstances and the remainder of this rule shall not be affected by the invalidity.	No; Administrative	No	No	N/A
(9) The construction permittee shall take all reasonable steps to minimize any adverse impact to the surface or groundwaters of the state that result from noncompliance with any of the conditions specified in this rule.	Yes	No	No	
(10) If, for any reason, the construction permittee does not comply with, or will be unable to comply with, any of the conditions that are specified in this rule, the construction permittee shall provide the department with the following information, in writing, within 5 days of becoming aware of the noncompliance or inability to comply: (a) A description of the noncompliance and its cause; (b) The period of noncompliance, including exact dates and times, or, if the noncompliance is not corrected, the anticipated time that the noncompliance is expected to continue and the steps taken to reduce, eliminate, and prevent recurrence of the noncompliance.	Yes	Yes	No	
(11) The provisions of this rule do not convey any property rights in either real or personal property, or any exclusive privileges, authorize any pollution, impairment, or destruction of the natural resources of the state, or the violation of any federal, state, or local laws or regulations, or obviate the necessity of obtaining permits or approvals from other units of government as may be required by law.	No; Administrative	No	No	N/A
(12) The provisions of this rule do not exempt the construction permittee from giving notice to public utilities and complying with each of the requirements of 1974 PA 53, MCL 460.701 et seq.	Yes	No	No	Required in spec. section 01 31 13 1.02
(13) This rule shall not provide authorization to discharge storm water from construction activity which is mixed with non-storm water, or which is subject to an existing national permit or general permit.	Yes	No	No	Water discharge requirements in spec. section 01 50 00 3.06

Form A.13 Waste Tracking Log

TO No	Project No	Project Name	Site Description	Container Type	Container Desig.	Waste Profile Sample No	Sub-contractor	Transporter	Date Transported	Transporter EPA ID	Load ID	Disposal Facility	Disp Fac EPA ID	Media	Waste Type (Haz, Nonhaz, TSCA)	Waste Code/ Haz Waste No	Disposal Date	Manifest Number	Disposal Treatment Method (Enter disposal quantity under appropriate method)					Certif of Disp/ Destruc Date	Comments/ Notes	File Status (see note)
																			Incineration	Recycle	Landfill	Other	Unit			

ch2m.

Testing Plan and Log

Project Name:				Project No:		Task Order No:		Contract Name:		Contract No:					Test Reports File Location		
Item No	Spec Section and Paragraph	Test Required	Test Method	Frequency	Criteria	Proposed Testing Company/Facility	Sampled By	Tested By	Test Location	Date Test Done	Test Results	Pass / Fail?	Retest? (Yes/No)	Results Forwarded To	Date Results Forwarded	Approved By	Comments / Notes
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
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27																	
28																	
29																	
30																	
31																	
32																	
33																	

Photo Log

Contract Name:		Project Name:		Project No:	
Contract No:		Project Description:		Task Order No:	
Project		Project QC Manager:			

Site	File Name	Photo ID	Date	Time	Task and Description	View Direction	Taken By

ch2m

PRE-FINAL and FINAL INSPECTION

PUNCH LIST

DATE: _____

PAGE: 1 OF 1

PROJECT: _____ PROJECT NO: _____

CONTRACTOR: _____

INSPECTED _____

Item	Location	Action Required	Accepted	
			By	Date

ch2m. Contract No:	**REWORK ITEMS LIST / PUNCH LIST** (ATTACH ADDITIONAL SHEETS IF NECESSARY)	REPORT DATE: REVISION NO: REVISION DATE:
TASK ORDER NO:	PROJECT NAME/LOCATION:	REPORT NO:
PROJECT NO:	PROJECT QC MANAGER:	SITE H&S SPECIALIST:

ITEM NUMBER	DATE IDENTIFIED	DESCRIPTION	CONTRACT REQUIREMENT (Spec Section and Paragraph No., Drawing No., and Detail No, etc.)	ACTION TAKEN BY QC MANAGER	RESOLUTION	DATE COMPLETED

Attachment B
Submittal Register

Submittal Register

PROJECT NO:		**PROJECT NAME:**		**TASK ORDER NO:**		**CONTRACT NO:**			**CONTRACT NAME:**			
ITEM NO	**TYPE OF SUBMITTAL**	**DESCRIPTION OF SUBMITTAL**	**REFERENCE: Spec / Drawing**	**APPROVING REQUIREMENT: Approval (A) or Information (I)**	**APPROVING AUTHORITY: (CH or Client)**	**SUBMITTAL FREQUENCY: (One time, weekly, etc.)**	**DATE SUBMITTED TO APPROVER**	**APPROVIING AUTHORITY NAME**	**TITLE / COMPANY OR AGENCY**	**STATUS: -Approved -Rejected**	**DATE APPROVED**	**REMARKS**

Attachment C
Change Management Tracking Log

Change Management Tracking Workbook

Velsicol Main Plant Site

USEPA - Region 5

Task		Scope Change		Cost	Estimated Budget Impacts (Revenue)				Schedule Impacts	Communicated (date)	
Date	WBS #	Scope Change	Initiator	Description	Labor	Expense	Total	Resource(s) Required	Description	Team	Client
					$0.00	$0.00	$0.00				

Appendix D
Geotechnical Borings

0 140 280
Feet

N

FIGURE X
Proposed Geotechnical Boring Locations
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

MKE \\HERCULES\PROJ\GIS\EPA\VELSICOL_SUPERFUNDSITE\REPORTS\478783_VELSICOL_MAIN_PLANTSITE_GEOSURVEY\MAPFILES\GEOSURVEYFIGURES\LM_REQUESTS\02_VELSICOL_PSA BOUNDARIES AND PROPOSED BORING LOCATIONS.MXD MPETERSH 9/21/2016 9:32:19 AM

ch2m

	PROJECT NUMBER	BORING NUMBER	
ch2m	677665.FI.01	PSA1-GT-01	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings | LOCATION : St. Louis, MI | DATE: 11/7/16

WEATHER: | DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS | START : 1325 | END : | LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
	0-2	2/2	SS-1	**1-3-9-18**	0.0'-0.8': Silty clay (CL) brown, firm, moist, little fine sand and organics 0.8'-1.0': Sand (SP) brown, fine to med., med. dense, moist 1.0'-2.0': Silt (ML) brown, very stiff, dry, trace sand and gravel	0.0 0.0
	2-5	5/5	S-1	N/A	2.0' -5.0': Clayey silt (ML), greyish brown, stiff, slightly moist, trace fine sand and gravel, cap material	0.0 0.0 0.0
5	5-7	2/2	SS-2	**2-2-2-3**	5.0'-7.0': Sandy to silty clay (CL), brownish grey to grey, firm, moist, trace gravel, faint hydrocarbon odor	0.0 0.0
	7-10	5/5	S-2	N/A	7.0'-10.0': Sandy to silty clay (CL), brownish grey, firm to stiff, moist, some intervedded sand, trace to little gravel.	0.0 0.0 0.0
10	10-12	0/2	SS-3	**weight of hammer and 1**	10'-14': Reworked sandy clay and silt (CL), greyish brown, soft, wet, trace gravel and cobbles	0.0 0.0 0.0
	12-15	5/5	S-3	N/A	14.0'-15.0': Silty clay (CL), greyish brown, stiff, moist, trace sand and gravel; till; **PP = 4.5** 15'-17': Silty clay (CL), greyish brown, hard, moist, trace gravel; till; **PP > 4.5**	0.0 Faint hydrocarbon odor 0.0
15						

	PROJECT NUMBER	BORING NUMBER	
ch2m	677665.FI.01	PSA1-GT-01	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings | LOCATION : St. Louis, MI | DATE: 11/7/16

WEATHER: | DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS | START : 1325 | END : | LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
	15-17	2/2	SS-4	**8-11-12-15**		0.0 / 0.0
	17-20	5/5	S-4	NA	15.0'-22': Silty clay (CL) greyish brown, stiff, moist, trace sand and gravel; till; **PP > 4.5**	0.0 / 0.0
20	20-22	2/2	SS-5	**5-13-21-26**		0.0 / 0.0
	22-25	5/5	S-5	NA	22'-25': Clayey silt (ML), grey, hard, moist; till - fine sand seam (<2") at 22' - moist	0.0 / 0.0
25	25-27	2/2	SS-6	**9-18-32-46**		0.0 / 0.0 — 6-inch temporary isolation casing set at 25 feet bgs
	27-30	5/5	S-6	N/A	25'-36.3': Silty clay (CL), greyish brown, hard, moist, trace sand and gravel; **PP > 4.5**	0.0 / 0.0
30						0.0

ch2m	PROJECT NUMBER 677665.FI.01	BORING NUMBER PSA1-GT-01	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings | LOCATION : St. Louis, MI | DATE: 11/7/16

WEATHER: | DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS | START : 1325 | END : | LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
	30-32	2/2	SS-7	**13-22-34-38**		0.0 / 0.0
	32-35	5/5	S-7	NA	25'-36.3': Silty clay (CL), greyish brown, hard, moist, trace sand and gravel; till; **PP > 4.5**	0.0 / 0.0
35	35-37	2/2	SS-8	**5-17-30-32**	36.3'-37': Sandy silt (ML), fine, greyish brown, dense, wet	0.0 / 0.0
	37-40	5/5	S-8	NA	37'-38': Clayey silt (ML), med. Stiff, greyish brown, moist 38'-39.6': Silty clay (CL), greyish brown, medium stiff, moist, trace sand and gravel; till; **PP=2.5** 38.6-40': Sand (SP), grey, fine to medium, medium dense, wet, little coarse sand, trace gravel and clay	0.0 / 0.0
40	40-42	2/2	SS-9	**2-1-1-1**	40'-42' No recovery	0.0 / 0.0
					EOB @ 42.0' BGS	
45						

	PROJECT NUMBER	BORING NUMBER	
ch2m.	677665.FI.01	PSA1-GT-02	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings LOCATION : St. Louis, MI DATE: 11/8/16

WEATHER: DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS START : 1300 END : 1600 LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
					0.0'-1.0': Silty clay with some fine sand and organics (grass and topsoil), brown, soft, moist to wet	0.0
	0-5	5/5	S-1	N/A		0.0
						0.0
5					1.0'-6.5': Clayey silt to silty clay (ML-CL), brown, hard, dry to moist, little gravel and sand	0.0
	5-7	2/2	SS-1	**6-7-9-10**		0.0
					6.5'-7.0': Sand and gravel (SW-GP), black stained, loose, wet, hydrocarbon odor	0.0
	7-10	5/5	S-2	N/A	7.0'-10.0' SAA grading to silty clay (CL), dark grey stained, firm, moist, trace gravel, hydrocarbon odor	8.0
10						8.0
	10-12	0/2	SS-2	**6-6-5-8**	10.0'-12.0' - Sand (SP), dark grey, fine, moist-stained with hydrocarbon odor	17.0
						40.0
	12-15	5/5	S-3	N/A	12.0'-15.0' - Sand (SP), dark grey (stained), fine to medium, loose, moist to wet, strong hydrocarbon odor	40.0
						150.0
15						150.0

	PROJECT NUMBER	BORING NUMBER	
ch2m	677665.FI.01	PSA1-GT-02	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings | LOCATION : St. Louis, MI | DATE: 11/8/16

WEATHER: | DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS | START : 1300 | END : 1600 | LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
	15-17	2/2	SS-3	**2-4-7-12**	15.0'-16.2': Sand (SP-SW), medium to coarse, dark grey, stained, wet, hydrocarbon odor; **NAPL observed**	150.0
					16.2'-17.0': Silty clay (CL), grey, medium stiff, moist, trace sand and gravel; till	110.0
	17-20	5/5	S-4	N/A	17.0'-20.0': Silty clay (CL), greyish brown, hard, moist, trace sand and gravel; till; fine, moist to wet sand seams with faint odor from 17.0'-17.4 BGS'; sand seam of less than 1" at 19.0' BGS; **PP = 3.5 to 4.5**	20.0 0.0
20						0.0
	20-22	2/2	SS-4	**9-16-17-20**	20.0'-22.0': Silty clay (CL), brownish grey, hard, moist, trace sand and gravel; **PP > 4.5**	0.0
						0.0
	22-25	5/5	S-5	N/A	22.0'-25.0': SAA, firm from 24.0-25.0', more silt from 24.0'-25.0'	0.0 0.0
25						0.0
	25-27	2/2	SS-5	**2-11-18-26**	25.0'-26.0' - SAA, firm; **PP = 1.5**	0.0
					26.0'-26.7' - Silty sand (SM), brownish grey, fine to medium, medium dense, moist to wet.	
					26.7'-27' - Silty clay (CL), greyish brown, hard, moist, trace sand and gravel, **PP > 4.5**	0.0
	27-30	5/5	S-6	N/A	27.0'-30.0' - Clayey silt (ML) becoming silty clay at 28', brownish grey, hard, dry becoming moist, trace sand and gravel; till; **PP > 4.5**	0.0 0.0
30						0.0

	PROJECT NUMBER	BORING NUMBER	
ch2m.	677665.FI.01	PSA1-GT-02	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings LOCATION : St. Louis, MI DATE: 11/8/16

WEATHER: DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS START : 1300 END : 1600 LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
	30-32	2/2	SS-6	23-27-33-95	30.0'-33.8': Clayey silt to silty clay (ML-Cl), greyish brown, hard, slightly moist, trace sand and gravel; till	0.0
						0.0
	32-35	5/5	S-7	NA		0.0
						0.0
					33.8'-35.0': Granite (boulder)	
35						0.0
					EOB @ 35' BGS	

PROJECT NUMBER	BORING NUMBER	
677665.FI.01	PSA1-GT-03	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings | LOCATION : St. Louis, MI | DATE: 11/8/16

WEATHER: | DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS | START : 945 | END : | LOGGER : E. Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
	0-2	5/5	SS-1	**1-2-9-10**	0.0'-0.6': Topsoil - silt (ML-OL), dark brown, moist, little organics 0.6'-0.7': Sand (SP), brown, fine to medium, loose, moist 0.7'-2.0': Clayey silt (ML), brown, hard, dry, trace sand and gravel; cap material	0.0 0.0
	2-5	2/2	S-1	N/A	2.0'-5.0': Clayey silt to silty clay (ML-CL), brown, stiff to hard, moist, little sand, trace gravel	0.0 0.0 0.0
5	5-7	2/2	SS-2	**6-7-4-4**	5.0'-6.2': Sandy gravel (GW), fine to medium, loose, moist 6.2'-7.0':Clayey silt to silty clay (ML-CL), grey and brown, slight staining, firm, moist, little fine sand, faint hydrocarbon odor	0.0 0.0
	7-10	5/5	S-2	N/A	7.0'-8.2': Clayey sand (SC), grey, fine, moist, medium dense, some silt, little gravel, faint hydrocarbon odor 8.2'-10.0': Sand (SP), brown, fine to medium, loose to medium dense, moist, trace gravel	0.0 0.0
10	10-12	0/2	SS-3	**10-10-11-11**	10.0'-11.0': Sandy clay to (CL), silty clay, greyish brown, moist, stiff, trace gravel; **PP= 2.5** 11.0'-11.6': Sand (SP), brown, fine to medium, loose to medium dense, moist, faint hydrocarbon 11.6'-12.0': Sandy clay to silty clay, brown, firm, moist, trace gravel	0.0 10.0
	12-15	5/5	S-3	N/A	12.0'-15.0': Silty clay (CL), grey, firm becoming stiff at 14', moist, trace gravel; till	10.0 0.0
15						0.0

ch2m	PROJECT NUMBER 677665.FI.01	BORING NUMBER PSA1-GT-03	
	SOIL BORING LOG		

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings LOCATION : St. Louis, MI DATE: 11/8/16

WEATHER: DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS START : 945 END : LOGGER : E. Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
15	15-17	1.5/2	SS-4	**3-5-6-10**	15.0'-15.5': Silty clay (CL), grey, stiff, moist, trace gravel; till 15.5'-16.0': Coarse to gravelly sand, brown to grey, loose, wet, little clay 16.0'-16.5': Silty clay (CL), grey, firm, moist, trace sand and gravel 16.5'-17.0': No recovery	0.0 0.0
	17-20	5/5	S-4	N/A		0.0 0.0
20	20-22	2/2	SS-5	**1-7-11-15**	17.0'-22.0': Silty clay (CL), grey, hard, moist, trace gravel; **PP > 4.5**	0.0 0.0 0.0
	22-25	5/5	S-5	**N/A Hard drilling**	22.0'-25.0': Silty clay *CL), grey, stiff to very stiff, moist, trace gravel; **PP = 2.0**	0.0 0.0
25	25-30	5/5	S-6	**N/A Hard drilling**	25.0'-26.0': Rock 26.0-28.5': Clayey sand interbedded with clayey silt, grey, firm, moist, little gravel and cobbles 28.5'-30.0': Clayey silt, grey, hard, moist, trace gravel	0.0 0.0 0.0 0.0
30						0.0

	PROJECT NUMBER	BORING NUMBER	
ch2m.	677665.FI.01	PSA1-GT-03	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings LOCATION : St. Louis, MI DATE: 11/8/16

WEATHER: DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS START : 945 END : LOGGER : E. Pasek

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
	30-32	2/2	SS-6	**1-11-21-16**	30.0'-30.4': Clayey silt, grey, hard, moist, trace gravel 30.0'-30.8': Clayey sand, brown, loose to medium dense, moist 30.8'-32.0': Silty clay, hard, grey, moist, trace gravel	0.0 0.0
	32-35	5/5	S-7	**N/A Hard drilling**		0.0 0.0 0.0
35	35-37	2/2	SS-7	**39-45-95-80**	32.0'-40.0': Clayey silt, hard, grey, dry, trace gravel and sand; till; pulverized	0.0 0.0
	37-40	5/5	S-8	**N/A Hard drilling; 25 min. to advance**		0.0 0.0
40					EOB @ 40.0' BGS	0.0

PROJECT NUMBER	BORING NUMBER	
677665.FI.01	PSA1-GT-04	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings | LOCATION : St. Louis, MI | DATE: 11/10/16

WEATHER: | DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS | START : 830 | END : | LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
0	0-5	5/5	S-1	PP = 2.0 PP = 3.5 PP = 4.5	0.0'-5.0': Primarily silty clay (CL), brown, firm at top becoming stiffer with depth, little sand and gravel, moist	0.0 0.0 0.0 0.0 0.0
5	5-10	5/5	S-2	PP = 2.0 PP = 1.0	5.0'-5.7': Silty clay (CL), grey to black, moist, little gravel 5.7-6.6': Silty sand (SM) brown, loose to medium dense, moist, little clay, trace gravel 6.6'-8.0': Clayey sand (SC), brown, firm, moist, trace gravel 8.0'-10.0': Fine sand (SP) brown with grey staining, loose, moist, trace gravel, faint hydrocarbon odor	0.0 0.0 0.0 0.0 0.0
10	10-15	5/5	S-3	PP = 2.0 PP = 1.5 PP = 2.5 PP = 4.0	10.0'-11.3': Gravelly coarse sand (SW), brown, moist to wet, loose, trace cobbles 11.3'-15.0': Silty clay (CL), brown, firm becoming stiff, moist, trace gravel; till	0.0 0.0 0.0 0.0 0.0
15						

	PROJECT NUMBER	BORING NUMBER	
ch2m.	677665.FI.01	PSA1-GT-04	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings | LOCATION : St. Louis, MI | DATE: 11/10/16

WEATHER: | DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS | START : 830 | END : | LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
20	15-20	5/5	S-4	PP = 2.5 PP = 1.0 PP = 1.5 PP = 4.0 PP > 4.5	15.0'-16.3': Fine sand (SP) interbedded with clayey silts to silty clays (ML-CL) brown, moist to wet, dense, trace gravel throughout	0.0 0.0 0.0 0.0 0.0
	20-22	2/2	SS-1	8-25-27-21	16.3'-25.6': Silty clay (CL) brown, firm becoming hard with depth, moist, trace gravel; till	0.0
25	22-25	5/5	S-5	PP = 3.0		0.0 0.0 0.0
	25-27	2/2	SS-2	1-16-18-20	25.6'-26.1':Gravelly coarse sand (SW) interbedded with sandy clay (CL) brown, wet, medium dense 26.1'-27.0': Silty clay (CL) brown, stiff, moist, trace gravel; till	0.0 0.0
30	27-30	5/5	S-6	N/A	27.0'-30.0': Clayey silt (ML) brown, hard, dry, little gravel, mostly pulverized	0.0 0.0 0.0

	PROJECT NUMBER	BORING NUMBER	
ch2m.	677665.FI.01	PSA1-GT-04	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings LOCATION : St. Louis, MI DATE: 11/10/16

WEATHER: DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS START : 830 END : LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
30	30-32	2/2	SS-3	30-36-100-100		0.0
				PP > 4.5		0.0
	32-35	5/5	S-7	PP > 4.5 Hard drilling		0.0
						0.0
35						0.0
	35-40	5/5	S-8	PP > 4.5 Hard drilling 25 min. to advance 35-40	30.0'-45.0': Clayey silt (ML) brown, hard, dry, little gravel, mostly pulverized	0.0
						0.0
						0.0
						0.0
40						0.0
	40-42	2/2	SS-4	94-89-98-150		0.0
						0.0
	42-45	3/3	S-9	PP = 4.5		0.0
						0.0
45						0.0

	PROJECT NUMBER	BORING NUMBER	
ch2m.	677665.FI.01	PSA1-GT-04	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings LOCATION : St. Louis, MI DATE: 11/10/16

WEATHER: DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS START : 830 END : LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
45	45-47	2/2	SS-5	39-65-70-100		0.0
	47-48	1/1	S-10	PP = 4.5	45.0'-50.0': Clayey silt (ML) brown, hard, dry, little gravel, mostly pulverized	0.0
	48-50	2/2	SS-6	25-34-26-32		0.0
50						0.0
					EOB @ 50 BGS	

	PROJECT NUMBER	BORING NUMBER	
ch2m	677665.FI.01	PSA1-GT-05	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings | LOCATION : St. Louis, MI | DATE: 11/11/16

WEATHER: | DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS | START : 1320 | END : | LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
	0-5	5/5	S-1	Soft	0.0'-1.5': Silty topsoil (OL), dark brown, soft to firm, wet, little clay and sand; grading to fine to medium fine sand (SP), brown, loose, moist	0.0
					1.5'-3.5': Clayey silt (ML), brown, hard, dry, trace sand and gravel; cap material	0.0
				PP = 4.5		0.0
					3.5'-4.3': Silty gravel and sand (GW), light brown, dry, loose, some cobbles	0.0
5					4.3'-5.0': Sand (SP), brown, fine to medium, medium dense, moist	0.2
	5-10	5/5	S-2		5.0'-5.5': Sandy silt (ML), dark brownsh grey, moist, firm, faint odor, slight staining	0.0
				PP = 1.5		0.0
					5.5'-10.0': Sandy to silty clay (CL), greyish brown, firm, moist, trace gravel	0.0
				PP = 1.25		0.0
10				PP = 1.5		0.0
	10-15	5/5	S-3	PP = 2.0	10.0'-12.7': Silty clay (CL), brown, medium stiff becoming hard, moist, trace sand and gravel; till	0.0
				PP = 4.5		0.0
					12.7'-13.1': Sand (SP), grey, fine to medium, medium dense, moist to wet.	0.0
				PP = 4.5	13.1'-15.0': Silty clay (CL), greyish brown, hard, moist, trace to little sand and gravel; till	0.0
15						0.0

ch2m	PROJECT NUMBER 677665.FI.01	BORING NUMBER PSA1-GT-05	
	SOIL BORING LOG		

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings | LOCATION : St. Louis, MI | DATE: 11/11/16

WEATHER: | DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS | START : 1320 | END : | LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
20	15-20	5/5	S-4	**PP > 4.5**	15.0'-20.0': Silt (ML), brownish grey, hard, moist, trace gravel, clayey sitl; till	0.0 / 0.0 / 0.0 / 0.0 / 0.0
	20-22	2/2	SS-1	**5-17-34-45** **PP > 4.5**	20-22': Clayey sillt (ML), grey, moist, hard; till	0.0 / 0.0
25	22-25	3/3	S-5	**PP = 1.75** **PP > 4.5**	22.0'-25.0': Silty clay (CL), grey, moist, stiff to hard, trace gravel and sand grading to little gravel and sand; till	0.0 / 0.0 / 0.0
	25-27	2/2	SS-2	**PP = 3.0** **3-7-18-28** **PP = 4.5**	25.0'-27.0': Silty clay (CL), grey, very stiff to hard, moist, little fine sand, trace gravel; till; 2' sand seam at 26' BGS	0.0 / 0.0
30	27-30	3-Mar	S-6	**PP > 4.5** **Hard drilling**	27.0'-30.0': Silt (ML), grey, hard, moist becoming dry, little fine sand, trace gravel and cobbles; pulverized till	0.0 / 0.0 / 0.0

	PROJECT NUMBER	BORING NUMBER	
ch2m	677665.FI.01	PSA1-GT-05	

SOIL BORING LOG

PROJECT : Velsicol WA201 - PSA1 Geotechnical Borings LOCATION : St. Louis, MI DATE: 11/11/16

WEATHER: DRILLING CONTRACTOR : Cascade Drilling (3rd tier to Coleman Engineering)

DRILLING METHOD AND EQUIPMENT USED : Mini Rotosonic track mount

WATER LEVELS START : 1320 END : LOGGER : S. Chumney

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. OVM (ppm): Breathing Zone / Above Hole
	30-32	2/2	SS-3	PP = 4.5 42-66-72-75 PP > 4.5	30.0'-32.0': Clayey silt (ML), grey, hard, moist, little sand, trace gravel; till	0.0 0.0
	32-35	5/5	S-7	PP > 4.5 Hard drilling	32.0'-35.0': Clayey silt (ML), grey, hard, moist to dry, some fine sand, trace gravel; till; pulverized	0.0 0.0 0.0
35	35-37	2/2	SS-4	34-72-100-145		0.0 0.0
	37-40	3/3	S-8	PP > 4.5	35.0'-40.0': Clayey silt (ML), brownish grey, hard, moist, little fine sand, trace coarse sand and gravel; till	0.0 0.0 0.0
40	40-42	2/2	SS-5	24-42-100-150	40.0'-42.0': Silt (ML) brownish grey, hard, moist, some fine sand	0.0 0.0
45					EOB @ 42.0' BGS	

Appendix E
Dewatering Calculations

PSA-1

Project Name/Title:	Velsicol PSA-1	Project Number:	478783
Document Name:	Velsicol Chemical Corporation Superfund Site, PSA-1 and PSA-2 Excavations, Operable Unit 1, St. Louis, Michigan Preliminary Basis of Design Report, October 2015	Preparer Name:	Dan Plomb/MKE
Project Manager:	Scott Pratt/DET	Design Manager:	Bill Andrae/MKE
Calculation Title:	Dewatering Calculation for PSA-1		

Purpose: Calculate the amount of water that will seep into excavation during removal.

Assumptions:

Work will be perofrmed in this sequence, or similar:

1) installation of sheet pile wall along the east and southboundaries as shown in the attached figure

2) Removal of the 5 foot clay cap, in the area of proposed excavation

3) Excavation of the removal area will advance from west to east. Excavation will be performed maintaining a 2:1 slope on the outer edges to minimize sloughing and provide a safe work area. Depending on the material encountered, the excavation will be modified to a 3:1 slope to maintain the sidewalls from sloughing. The depth of the excavation will vary depending on the depth of the impacted soils, but will generally be to the top of the silty clay layer.

4) Backfilling will lag behind the excavation, but backfilling and excavation will primarily occur concurrently. Backfilling will proceed from west to east, and begin after the excavation has advanced enough to limit any comingling of the clean backfill with the removal area soils. Backfilling in this manner will help stabilize the excavation, and prevent further sloughing. Backfill with be performed using a self-compacting, medium to coarse, well graded stone.

5) At any one time, as the exacavtion moves from west to east, and the backfill follows in suit, upto 50 feet of open exacavation my exist, along with an influx of water.

6) water level in PSA-1 is at around elev. 725, as measured in GMW-2 in June 2015.

7) top of till ranges from elev. 718 to 726, with an average around 722.

8) perimeter slurry wall is impermeable

9) During the RI in 2002, Weston performed slug tests on 8 monitoring wells in the shallow outwash unit, and the hydraulic conductivity ranged from an average of 1.26 ft/day to 44.8 ft/day (4.46x10-4 cm/s to 1.58x10-2 cm/s). The geometric mean across the site was 7.31 ft/day (2.58x10-3 cm/s). The field

10) Specific Yield, S, is equal to the porosity, which is estimated at 0.2 for the type of material present.

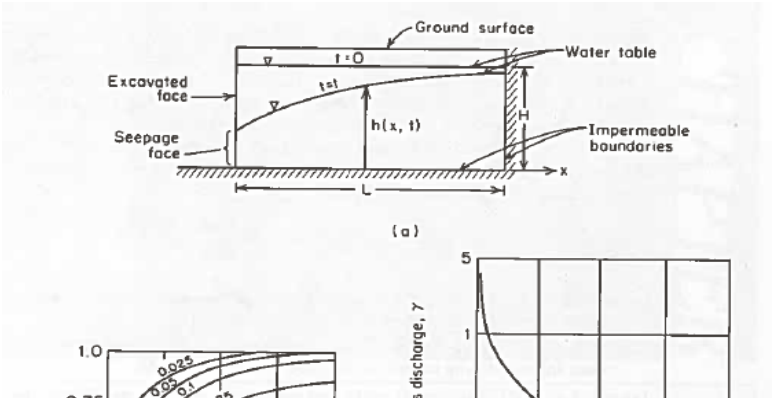
Calculation

Once steps 1, 2 and 3 (above) are performed water coming into the excavation will be mainly from the exposed sides of the trench, with the trench ranging in length 280 to 420 feet long.

48,200 CY, assuming a production of 1100 CY /day gives a duration of 44 days.
The excavation is 420 feet across, west to east. So per every 5 days, 46.6 feet (west to east) is exacavated.
At time 0 - distance to west barrier is 350 feet, and distance to east barrier is 420 feet

At time 44, distance to the west barrier is 770 feet, and distance to the east barrier is 0

Groundwater flow into an excavation, some distance from an impermeable boundary can be calculated from Freeze and Cherry, Pg.495:



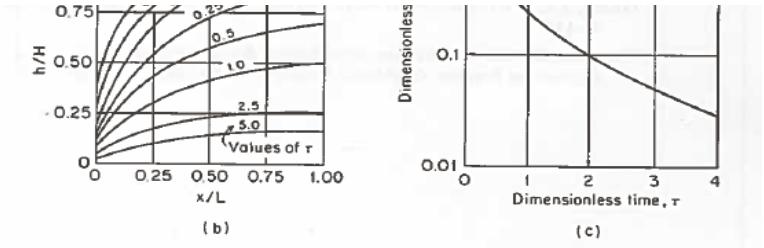


Figure 10.18 *Prediction of groundwater inflows into an excavation (after Ibrahim and Brutsaert, 1965).*

where:

$$\tau = \frac{KH}{S_y L^2} t$$ and $$\gamma = \frac{S_y L}{KH^2} q$$

t = time (days)
K = Hydrualic conductivity (ft/day)
H = Head (feet)
S_y = Specific yeild
L = Distance from imperable boundary to excavation
q = flow (CF/day) per foot of trench

τ can then be calculated from the above equation, graph "c" used to derive a value of γ , and then γ , was used to calculate q.

Excavation was broken up into five day increments, advancing the excavation west to east, and backfilling along the way.

Groundwater flow into the trench from the west:

t (days)	L (feet)	S	K (ft/day)	H (feet)	τ	γ	q (CF/day)	TRENCH LENGTH (feet)	Gallons
5	397	0.20	7.31	3	0.003	5	4.1429471	350	54231
10	444	0.20	7.31	3	0.003	5	3.70723076	350	48528
15	490	0.20	7.31	3	0.002	5	3.354442	350	43910
20	537	0.20	7.31	3	0.002	5	3.06296324	350	40094
25	584	0.20	7.31	3	0.002	5	2.81808992	350	36889
30	630	0.20	7.31	3	0.001	5	2.60947168	350	34158
35	677	0.20	7.31	3	0.001	5	2.42961179	350	31804
40	724	0.20	7.31	3	0.001	5	2.27294713	350	29753
45	770	0.20	7.31	3	0.001	5	2.1352625	350	27951

Groundwater flow into the trench from the east:

t (days)	L (feet)	S	K (ft/day)	H (feet)	τ	γ	q (CF/day)	TRENCH LENGTH (feet)	Gallons
5	373	0.20	7.31	3	0.004	4.8	4.22939491	350	55363
10	327	0.20	7.31	3	0.005	4	4.02791808	350	52725
15	280	0.20	7.31	3	0.007	3.2	3.75929431	350	49209
20	233	0.20	7.31	3	0.010	2.6	3.66518106	350	47977
25	187	0.20	7.31	3	0.016	1.8	3.1716214	350	41517
30	140	0.20	7.31	3	0.028	1.2	2.81896736	350	36900
35	93	0.20	7.31	3	0.063	0.8	2.81846417	350	36894
40	47	0.20	7.31	3	0.251	0.4	2.81695568	350	36874
45	1	0.20	7.31	3	548.250	0.001	0.32895	350	4306

total 709082 gallons
16115 GPD

In addition - contact water from rain, over the area of the exacavtion would need to be handled.
Average rainfall for St. Loius Mi is 31 inches/year, which would equate to 3.75 inches during the 44 day excavation.
This equates to 10.2 inches x 2.5 acres x 43560 SF/acre x 1 ft/12 inches x 7.48 gallons/CF = 254553.75 gallons
5785 gpd

Total = 963635 gallons
21901 gpd

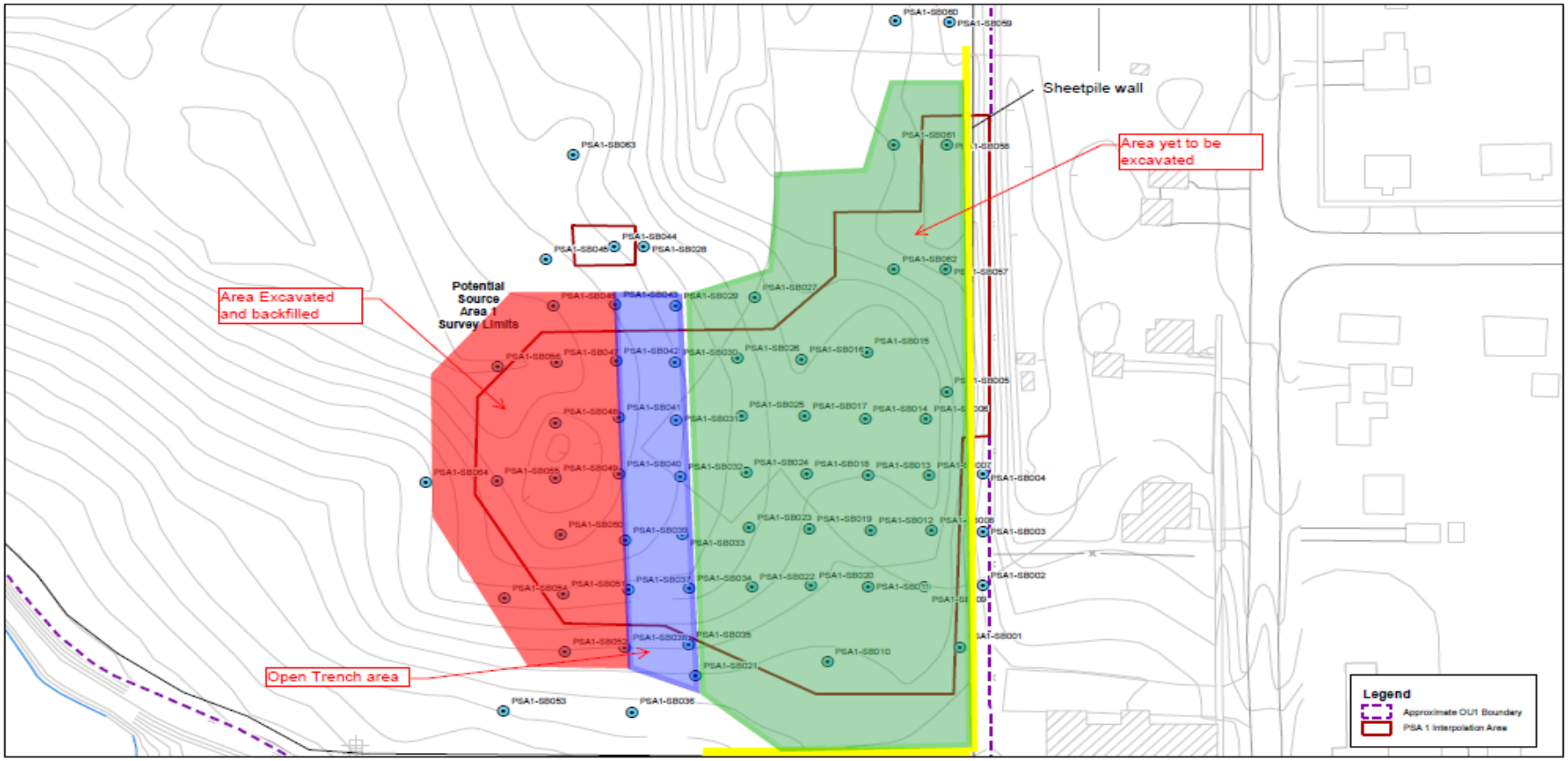


FIGURE 1
PSA 1 Interpolation Areas
Velsicol Chemical Corporation Superfund Site
St. Louis, Michigan

CH2MHILL

PSA-2

Project Name/Title:	Velsicol PSA-2	Project Number:	478783
Document Name:	Velsicol Chemical Corporation Superfund Site, PSA-1 and PSA-2 Excavations, Operable Unit 1, St. Louis, Michigan Preliminary Basis of Design Report, October 2015	Preparer Name:	Dan Plomb/MKE
Project Manager:	Scott Pratt/DET	Design Manager:	Bill Andrae/MKE
Calculation Title:	Dewatering Calculation for PSA-2		

Purpose: Calculate the amount of water that will seep into excavation during removal.

Assumptions:

Work will be perofrmed in this sequence, or similar:

1) Removal of the 5 foot clay cap, in the area of proposed excavation

2) Excavation of the removal area will at 3 "pits", to depths below the water table. Excavation will be performed maintaining a 2:1 slope on the outer edges to minimize sloughing and provide a safe work area. Depending on the material encountered, the excavation will be modified to a 3:1 slope to maintain the sidewalls from sloughing. The depth of the excavation will vary depending on the depth of the impacted soils, but will generally be to the top of the silty clay layer.

3)Average rainfall for St. Loius Mi is 31 inches/year, which would equate to .007 ft/day.

4) Area B4 is approximatetly 60'x55', for an area of 3300 ft2. Area C1 is 90'x50' for an area of4500 ft2; and Area C2 is 72'x72' for an area of 5184 ft2

5) Flow into these excavations can be estimated by assuming the pit is circular, of equal area to the proposed rectangle

6) water level in PSA-2 is at around elev. 724. for areas C1 and C2, and 730 for area B4.

7) top of till ranges from elev. 721 in areas 2 and 3, and 725 in area 1.

8) During the RI in 2002, Weston performed slug tests on 8 monitoring wells in the shallow outwash unit, and the hydraulic conductivity ranged from an average of 1.26 ft/day to 44.8 ft/day (4.46x10-4 cm/s to 1.58x10-2 cm/s). The geometric mean across the site was 7.31 ft/day (2.58x10-3 cm/s). The field measured values are consistent with published values for hydraulic conductivity of similar deposits.

9) Specific Yield, S, is equal to the porosity, which is estimated at 0.2 for the type of material present.

Calculation

Once the excavation is complete, water coming into the excavation will be mainly from the exposed sides of the trench. Following:

Simple Analytical Equations for Estimating Ground Water Inflow to a Mine Pit

by Fred Marinelli[a,b] and Walter L. Niccoli[a]

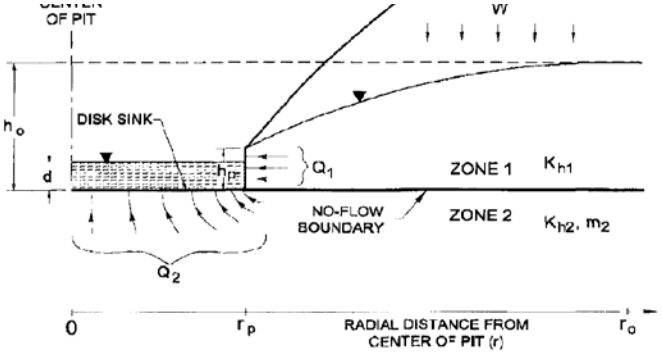


Figure 2. Pit inflow analytical model.

The calculation for flow into the excavation from Zone 1=

$$Q_1 = W \pi (r_o^2 - r_p^2)$$

Where:

$$(1)\ h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}}\left[r_o^2 \ln\left(\frac{r_o}{r_p}\right) - \frac{(r_o^2 - r_p^2)}{2}\right]}$$

Knowing ho, hp, W, K, and rp: ro can be solved iteratively

	Area	Ft2	Equivalent circle radius (r_p)	h_p	h_o	r_o
B4		3300	32	0	2	87
C1		4500	38	0	2	93
C2		5184	41	0	2	96

	Area	Q (FT3/DAY)	Excavation volume yds3	Excavation rate (yds3/day)	Volume of water (gallons)
B4		143.2666	1656	1000	1774.6262
C1		158.605	2321	1000	2753.5541
C2		166.2797	2184	1000	2716.3984
			total		7244.5787

solve ro iteratively until ho=2; where rp = 32

h_o	h_p	W	K	r_o	r_p
0	0	0.007	7.31	32	32
0.1586	0	0.007	7.31	37	32
0.3241	0	0.007	7.31	42	32
0.4958	0	0.007	7.31	47	32
0.6729	0	0.007	7.31	52	32
0.8549	0	0.007	7.31	57	32
1.0413	0	0.007	7.31	62	32
1.2319	0	0.007	7.31	67	32
1.4261	0	0.007	7.31	72	32
1.6238	0	0.007	7.31	77	32
1.8248	0	0.007	7.31	82	32
2.0287	0	0.007	7.31	87	32
3.0006	0	0.007	7.31	110	32

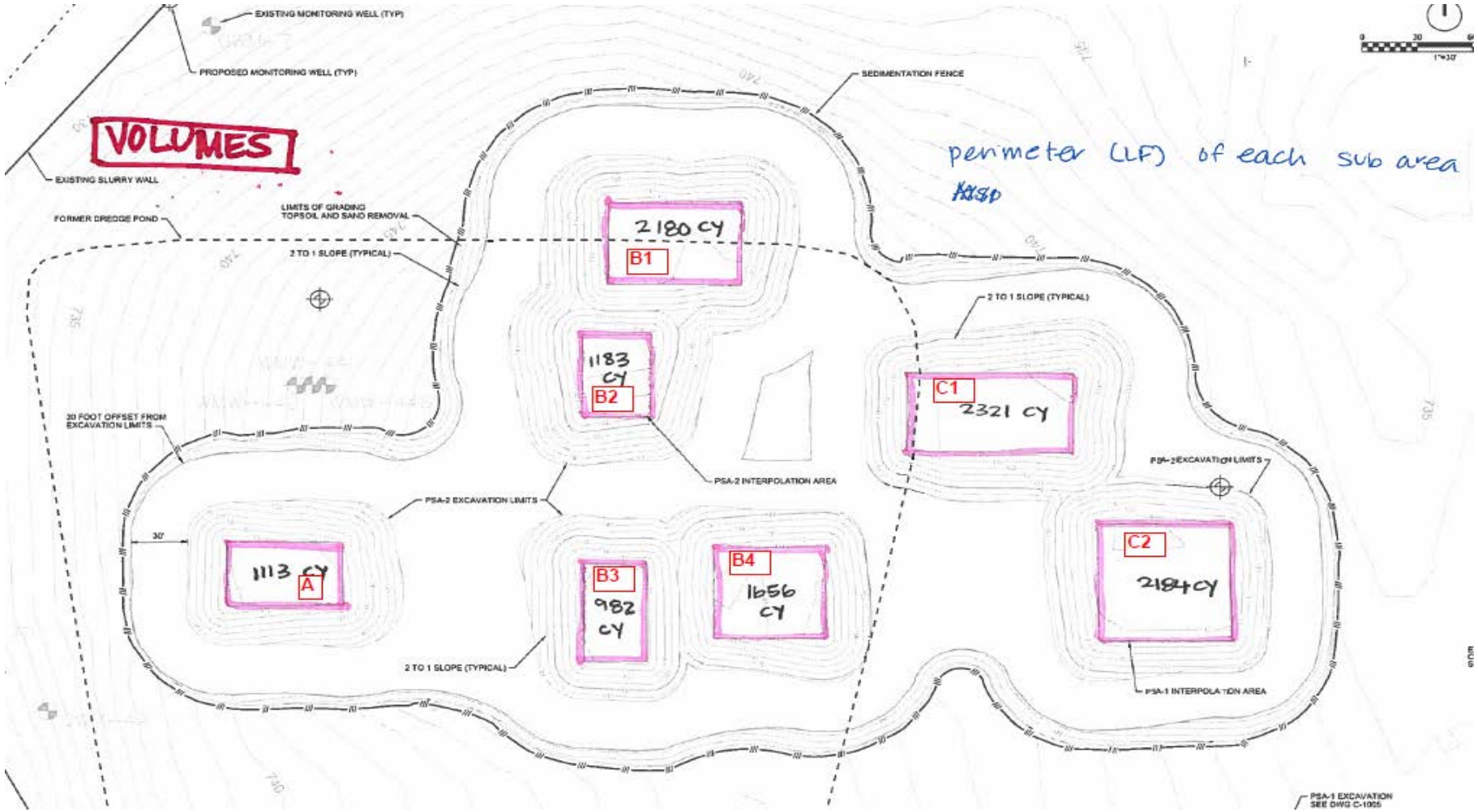
solve ro iteratively until ho=2; were rp = 38

h_o	h_p	W	K	r_o	r_p
0	0	0.007	7.31	38	38
0.158	0	0.007	7.31	43	38
0.322	0	0.007	7.31	48	38
0.4913	0	0.007	7.31	53	38
0.6655	0	0.007	7.31	58	38
0.8441	0	0.007	7.31	63	38
1.0267	0	0.007	7.31	68	38
1.2131	0	0.007	7.31	73	38

1.4029	0	0.007	7.31	78	38
1.5959	0	0.007	7.31	83	38
1.7919	0	0.007	7.31	88	38
1.9907	0	0.007	7.31	93	38

solve ro iteratively until ho=2; were rp = 41

h_o	h_p	w	K	r_o	r_p
0	0	0.007	7.31	41	41
0.1577	0	0.007	7.31	46	41
0.3211	0	0.007	7.31	51	41
0.4895	0	0.007	7.31	56	41
0.6625	0	0.007	7.31	61	41
0.8397	0	0.007	7.31	66	41
1.0207	0	0.007	7.31	71	41
1.2054	0	0.007	7.31	76	41
1.3933	0	0.007	7.31	81	41
1.5843	0	0.007	7.31	86	41
1.7783	0	0.007	7.31	91	41
1.975	0	0.007	7.31	96	41


EXISTING MONITORING WELL (TYP)
PROPOSED MONITORING WELL (TYP)
VOLUMES
EXISTING SLURRY WALL
FORMER DREDGE POND
LIMITS OF GRADING TOPSOIL AND SAND REMOVAL
2 TO 1 SLOPE (TYPICAL)
SEDIMENTATION FENCE
perimeter (LF) of each sub area
2180 CY
B1
1183 CY
B2
2 TO 1 SLOPE (TYPICAL)
C1
2321 CY
30 FOOT OFFSET FROM EXCAVATION LIMITS
PSA-2 INTERPOLATION AREA
PSA-2 EXCAVATION LIMITS
PSA-2 EXCAVATION LIMITS
30'
1113 CY
A
B3
982 CY
B4
1656 CY
C2
2184 CY
2 TO 1 SLOPE (TYPICAL)
PSA-1 INTERPOLATION AREA
PSA-1 EXCAVATION
SEE DWG C-1005

Appendix F
Green Remediation
Best Management Practices

APPENDIX F

Green Remediation Best Management Practices for PSA-1 and PSA-2 Excavations

Velsicol Chemical Corporation Superfund Site PSA-1 and PSA-2 Excavations, Operable Unit 1

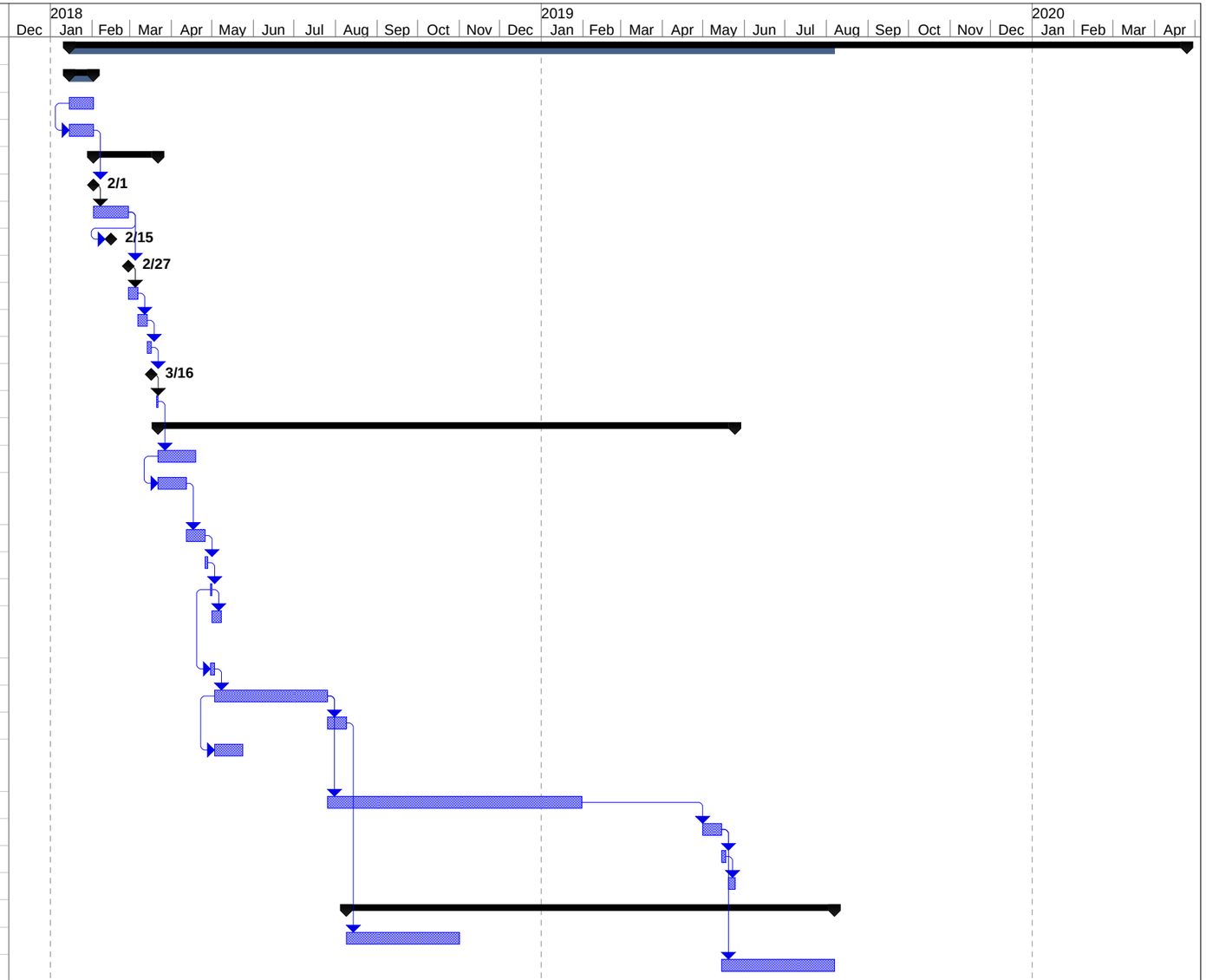
SITE INVESTIGATION/EPA-542-F-09-004, December 2009
Planning for Site Investigation
Scheduling activities for appropriate seasons to reduce delays caused by weather conditions and fuel needed for heating or cooling
Establishing electronic networks for data transfers and deliverables, team decisions, and document preparation, and selecting electronic products on the basis of comparisons available in the Electronic Product Environmental Assessment Tool (EPEAT®)
Reducing travel through increased teleconferencing, compressed work hours, and flexible work locations
Procurement
Select service providers, product suppliers, and analytical laboratories from the local area and coordinate service and delivery schedules, to reduce fuel consumption and associated air emissions
Energy Use & Renewable Energy
Limiting the number of vehicles deployed onsite, and renting electric, hybrid, or hydrogen fuel cell vehicles
Instituting idle reduction plans, such as machinery shutdown after three minutes of non-use
Compressing shipments to offsite laboratories whenever feasible
Using rechargeable batteries for handheld data loggers and other field instruments
Disposing IDW at the nearest permitted facility
Water Use & Impacts on Water Resources
Steam-cleaning or using phosphate-free detergents instead of organic solvents or acids to decontaminate sampling equipment
Containing decontamination fluids and preventing their entrance into storm drains or the ground surface
Using biodegradable hydraulic fluids on hydraulic equipment such as drill rigs
Quickly restoring any vegetated areas disrupted by equipment or vehicles, to control stormwater runoff and avoid soil transport to surface water bodies
Materials Management & Waste Reduction
Consider products, packing material, and disposable equipment with reuse or recycling potential
Recycling cardboard boxes and beverage bottles
Reducing the number of sampling days
CLEAN FUEL EMISSIONS/EPA 542-F-10-008, April 2010
Operations and Maintenance
Implement an idle reduction plan
Assure proper tune-ups of vehicles and equipment and maintenance of fuel storage tanks
Establish routines for daily activities such as using biodegradable lubricants, closely managing petroleum-product waste materials, driving efficiently, and inflating tires properly
Track fuel consumption and associated emission of GHG and air toxics and set reduction goals
EXCAVATION AND SURFACE RESTORATION/EPA 542-F-08-12
Planning for Excavation and Surface
Incorporation of green requirements into product and service procurements
Early and continuous scouting for onsite or nearby sources of backfill material for excavated areas
Integrated schedules allowing for resource sharing and fewer days of field mobilization
Energy Requirements
Green Procurement
Purchase materials from one supplier of locally produced products to reduce need for delivery fuels

Select local providers for field operations
Fuels utilized in transfer of materials and wastes
Select the closest waste receiver
Fuel consumption by heavy construction machinery and equipment
Selecting suitably sized and typed equipment for tasks
Instructing workers to avoid engine idle and using machinery with automatic idle-shutdown devices
Performing routine, on-time maintenance such as oil changes to improve fuel efficiency
Air Emissions
Securing and covering material in open trucks while hauling excavated material, and reusing the covers
Revegetating excavated areas as quickly as possible
Limiting onsite vehicle speeds to 10 miles per hour
Impacts to Water
Cover soils with biodegradable tarps and mats, rather than spraying with water, to suppress dust while potentially enhancing soil fertility
Use phosphate-free detergents instead of organic solvents or acids to decontaminate sampling equipment (if not required for some contaminants)
Overlay synthetic barriers and fluid collection systems on ground surfaces of staging areas and where excavated material is dewatered
Use dewatering processes that maximize water recycling, and consider automated systems to account for sediment variability
Material Consumption and Waste Generation
Green purchasing considers product life cycles and gives preference to
Products, packing material, and disposable equipment with reuse or recycling potential
BMPs for waste management include
Establishing staging areas prior to any digging
Salvaging uncontaminated and pest- or disease-free organic debris for use as infill, mulch, or compost
Reclaiming and stockpiling uncontaminated soil for use as fill or other purposes such as habitat creation
Impacts to Land and Ecosystems
Establishment of minimally intrusive and well-designed traffic patterns for onsite activities and plans to reduce off-site traffic congestion
Installation of silt fences and basins to capture sediment runoff along sloped areas
PUMP AND TREAT TECHNOLOGIES/EPA-542-F-09-005, Dec 2009
Stormwater Discharge Controls
Maximum vegetative cover across the site
Use of gravel roads, porous pavement and separated impervious surfaces
Materials and Waste Management/EPA 542-F-13-003, December 2013
Purchase of Greener Material
Select products that are environmentally preferable (when compared to other products serving the same purpose) with respect to raw materials consumption, manufacturing processes and locations, packaging, distribution, recycled content and recycling capability, maintenance needs, and disposal procedures
Choose vendors with production and distribution centers near the site, to minimize fuel consumption associated with delivery
Choose suppliers that will take back scraps or unused materials
Material Reuse or Recycling Versus Disposal
Screen local recyclers and waste haulers to identify organizations that will handle materials in an environmentally responsible manner, including suitable transportation methods and waste destinations

Evaluate environmental or other trade-offs involved in onsite reuse of materials versus shipment offsite for reuse and/or recycling; evaluations can range in level of effort from qualitative comparisons of options to more rigorous quantification of alternative outcomes.
Procurement
Develop a plan and reporting format to routinely track materials reuse/recycling and disposal
Integrating Renewable Energy into Site Cleanup/EPA 542-F-11-006, April 2011
Track Energy Use
Online calculators or software available from government or non-profit organizations at no cost, such as the NOx and Energy Assessment Tool (NxEAT); EPA offers an online compendium of such tools
Incorporating additional security measures to prevent damage or theft of system components
Renewable Energy Assessments
General analysis of the energy demand and additional recommendations for energy efficiency
Preliminary evaluation of the site's renewable energy resources, which may include multiple sources
A list of pertinent federal, state, and public utility incentives applying to the site.
Landfill Cover Systems and Energy Production/EPA 542-F-11-024, December 2011
Designing and Installing a Cover System
Design in ways that mimic rather than alter the site's natural setting, to improve the cover's long-term performance and protect ecosystem services such as potable water, wildlife habitat, and carbon storage
Use uncontaminated soil or sediment from onsite excavation instead of imported soil/sediment for the cover's frost prevention and erosion control layers; similarly, uncontaminated sand, gravel, and rocks from onsite instead of offsite areas may be used for drainage
Choose geotextile fabric or drainage tubing composed of 100% recycled materials rather than virgin materials for lining, erosion control, and drainage

Appendix G
Final Construction Schedule

ID	Task Name	Duration	Start	Finish	Predecessors
1	**Remedial Action**	**595 days**	**Mon 1/15/18**	**Fri 4/24/20**	
2	**Pre-Bid Activities**	**14 days**	**Mon 1/15/18**	**Thu 2/1/18**	
3	Prepare Subcontractor SOW	14 days	Mon 1/15/18	Thu 2/1/18	
4	Prepare Subcontract Bid Documents	14 days	Mon 1/15/18	Thu 2/1/18	3SS
5	**Bidding Activities**	**34 days**	**Thu 2/1/18**	**Wed 3/21/18**	
6	Issue Bid Documents	0 days	Thu 2/1/18	Thu 2/1/18	4
7	Bid Process	18 days	Fri 2/2/18	Tue 2/27/18	6
8	Pre-Bid Meeting	0 days	Thu 2/15/18	Thu 2/15/18	7FS-9 days
9	Bids Due	0 days	Tue 2/27/18	Tue 2/27/18	7
10	Evaluate Bids/Fact Finding	5 days	Wed 2/28/18	Tue 3/6/18	9
11	Prepare Consent Package for USEPA	5 days	Wed 3/7/18	Tue 3/13/18	10
12	USEPA Review Consent Package	3 days	Wed 3/14/18	Fri 3/16/18	11
13	Obtain Consent from USEPA	0 days	Fri 3/16/18	Fri 3/16/18	12
14	Issue Notice of Award	1 day	Wed 3/21/18	Wed 3/21/18	13FS+2 days
15	**PSA-1 and PSA-2 Excavations**	**307 days**	**Thu 3/22/18**	**Fri 5/24/19**	
16	Subcontractor Develops Pre-Mobilization Submittals	20 days	Thu 3/22/18	Wed 4/18/18	14
17	Preconstruction Confirmation Sampling and Waste Characterization Sampling	15 days	Thu 3/22/18	Wed 4/11/18	16SS
18	Mobilization and Site Control	10 days	Thu 4/12/18	Wed 4/25/18	17
19	Utility Locates	2 days	Thu 4/26/18	Fri 4/27/18	18
20	Abandon Monitoring Wells	1 day	Mon 4/30/18	Mon 4/30/18	19
21	Dewater and Demolish Existing Groundwater Elevation Control Tile	5 days	Tue 5/1/18	Mon 5/7/18	20
22	Initial Site Survey	3 days	Mon 4/30/18	Wed 5/2/18	20SS
23	Potential Source Area 2 Excavation & Backfill	60 days	Thu 5/3/18	Wed 7/25/18	22
24	PSA-2 Restoration	10 days	Thu 7/26/18	Wed 8/8/18	23
25	Construct Excavation Support Wall Along Eastern and Southern Excavation Boundaries of PSA-1	15 days	Thu 5/3/18	Wed 5/23/18	23SS
26	Potential Source Area 1 Excavation & Backfill	135 days	Thu 7/26/18	Wed 1/30/19	23
27	PSA-1 Site Restoration	10 days	Wed 5/1/19	Tue 5/14/19	26
28	Final Site Survey	3 days	Wed 5/15/19	Fri 5/17/19	27
29	Demobilization	5 days	Mon 5/20/19	Fri 5/24/19	28
30	**Restoration Maintenance Periods**	**259 days**	**Thu 8/9/18**	**Tue 8/6/19**	
31	PSA-2	60 days	Thu 8/9/18	Wed 10/31/18	24
32	PSA-1	60 days	Wed 5/15/19	Tue 8/6/19	27



Project: PSA-1 & PSA-2 Excavations
Date: Mon 1/9/17

Task	External Milestone	External Milestone	Manual Summary Rollup	Progress
Split	External Milestone	External Milestone	Manual Summary	Deadline
Milestone	External Milestone	Inactive Milestone	Start-only	
Summary	External Milestone	Inactive Summary	Finish-only	
Project Summary	External Milestone	Manual Task	External Tasks	
External Tasks	External Milestone	Duration-only	External Milestone	

Appendix H
Final Engineer's Estimate of Construction Cost

Redacted