GEOTECHNICAL MONITORING PLAN

VELSICOL CHEMICAL CORPORATION SUPERFUND SITE

DOWNGRADIENT VERTICAL BARRIER WALL

St. Louis, Gratiot County, Michigan

January 2025

Prepared for:

United States
Environmental Protection
Agency
Region 5

Prepared by:

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Contract No. 68HER19D0001
Task Order No. 68HE0521F0122

Geotechnical Monitoring Plan

SIGNATURE PAGE

Velsicol Chemical Corporation Superfund Site
DGVBW Construction & UGSW Repair

USEPA Contract No.: 68HER19D0001
Task Order No.: 68HE0521F0122

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Acronyms and Abbreviations

AECOM	AECOM Technical Services, Inc.
AMSL	Above Mean Sea Level
ANP	adjacent and nearby properties
ASTM	American Society for Testing and Materials
bgs	below ground surface
BODR	Basis of Design Report
CQC	Contractor Quality Control
DGVBW	Downgradient Vertical Barrier Wall
EPA	U.S. Environmental Protection Agency
FM	Facility Settlement Marker
FPS	Former Plant Site
Hardman	Hardman Construction
INC	Inclinometers
ips	inches/second
JSS	Job Site Services, Inc.
LF	linear feet
MCC	Michigan Chemical Corporation
OU	Operable Unit
PPV	peak particle velocity
Site	Velsicol Chemical Corporation Superfund Site
SME	Soil and Materials Engineers
Spicer	Spicer Group, Inc.
SPT	standard penetration testing
TOCOR	Task Order Contracting Officer's Representative
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
VM	Vibration Monitoring

1.0 Introduction

This Geotechnical Monitoring Plan is valid for the Downgradient Vertical Barrier Wall (DGVBW) Construction and associated activities in Operable Unit (OU) 1 at the former Velsicol Chemical Corporation Superfund Site (Site) in Saint Louis, Gratiot County, Michigan only. A copy of this plan is to be always maintained at the Site during the performance of field activities. The work being done will be performed by AECOM Technical Services, Inc. (AECOM), Job Site Services, Inc. (JSS), Hardman Construction (Hardman), and Spicer Group (Spicer), collectively the AECOM Team, as well as lower tier subcontractors. Remedial actions described herein will be performed in accordance with Contract No. 68HERH19D0001, Task Order (TO) No. 68HE0522F0086, as directed by the United States Environmental Protection Agency (EPA) and United State Army Corps of Engineers (USACE) Task Order Contracting Officer's Representative (TOCOR).

1.1 Site History

Velsicol Chemical Corporation (formerly Michigan Chemical Corporation [MCC]) once produced a variety of chemical compounds and products at their main plant site in St. Louis, Michigan. Industrial operations took place from the mid-1800s until 1977. Historical operations included a lumber mill, oil refinery, salt-processing plant, and chemical manufacturing plant. MCC manufactured products including various salts, magnesium oxide, rare earth chemicals, fire retardants, and pesticides. The building and facilities have now been demolished and the 54-acre parcel of land has been divided into sections. Each section has been investigated by EPA for contamination attributed to manufacturing activities. The focus of this Geotechnical Monitoring Plan is the installation of a DGVBW along the Pine River to prevent leeching of Site contaminants into the river.

1.2 Site Description

The Site is on a 52-acre plot of land which is referred to as the Former Plant Site (FPS). It includes the adjacent and nearby properties (ANP). Pine River is located along the western and northern Site boundaries and leads into Mill Pond, which contains a hydroelectric dam. The boundary of the FPS is fenced, and access is controlled through the main gate, which can be locked. The site contains four operable units:

- OU1 – FPS and ANP;
- OU2 – Contaminated sediments in the Pine River and Mill Pond downstream until the St. Louis Hydroelectric Dam;
- OU3 – Pine River sediments stretching from the St. Louis hydroelectric dam to approximately 1.25 miles downstream of the dam, for which RI activities are ongoing; and
- OU4 – Pine River sediments stretching from approximately 1.25 miles downstream of the St. Louis hydroelectric dam to the confluence of the Pine, Chippewa, and Tittabawassee rivers, for which remedial investigation activities are ongoing.

The specific area addressed by this project and monitoring plan is OU2.

1.3 Purpose

The purpose of this Geotechnical Monitoring Plan is to monitor:

1. Settlement of the DGVBW.
2. Lateral movement of the DGVBW.
3. Peak particle velocity (PPV) via vibration monitoring to protect the residential parcels east of the north/east terminus of the DGVBW and State Highway 46 on the south terminus.

Geotechnical monitoring will allow EPA and AECOM to protect properties adjacent to the Site and monitor compliance with the requirements of the Contract regarding ground movement in the vicinity of DGVBW installation, and deformation of the DGVBW itself.

1.4 Subsurface Information

Based on the current and historical soil borings, the soil profile along the DGVBW generally consists of very soft riverine/alluvial sediments overlying very dense glacial till.

The depth of the sediment shown in the historical river borings ranged from approximately 8 to 15-feet. In OU2, most of the sediment was dredged in the early 2000s, except for the area close to shore (inner bend of the river), where sediment has reaccumulated from ongoing water movement. Material in this layer was weak and consisted of granular alluvium with organic matter. Most standard penetration test N-values in the alluvial sediment ranged from 0 to 10 blows per foot. A dense, compacted clay cap was placed in portions of the northern alignment after sediment removal in OU2.

Very dense glacial till lies below the sediment, where standard penetration testing (SPT) typically encountered refusal in the historical borings. The design drawings in the September 2023 Basis of Design Report (BODR) prepared by Jacobs show the top of till elevations along the DGVBW based on the river soil borings advanced during the 2002 NAPL investigation.

Bedrock was not encountered in any of the borings. Borings extended to termination elevations ranging from 683.9 to 687.2-feet Above Mean Sea Level (AMSL). All borings were terminated at 40-feet bgs, as specified in the Perimeter Drain and Geotechnical Predesign Investigation Work Plan, Velsicol Chemical Corporation Superfund Site, Remedial Design (CH2M, 2022).

1.5 Definition of Terms

The following are definitions of terms used for this Geotechnical Monitoring Plan:

1. Facility Settlement Markers (FM): Reflective prisms, steel rods, punch marks, or survey nails which are visible and installed on a fixed structure at predetermined locations to monitor the vertical and horizontal displacement from baseline values.
2. Inclinometers (INC): Vertical inclinometers are instruments for measuring relative horizontal displacements affecting the shape of a guide casing embedded in the ground or structure. Inclinometer probes will measure displacement in two perpendicular planes; therefore, displacement magnitudes and directions (vectors) can be calculated. Measurements taken will be used to monitor displacement from baseline values.
3. Vibration Monitors (VM): Vibration monitoring involves installing seismographs that continuously measures the incoming vibrations from construction activities and calculates the maximum PPV for each 10-second time interval.
4. Threshold: The threshold is a predefined level for an instrument. Exceeding the threshold will trigger an alarm, which might indicate a potential structural failure, an

unsafe working condition, or other event that requires corrective action. Specific thresholds discussed in this document will be tied to specific alarms (discussed below and later in text).

5. Threshold Level: A specific measurement for displacement or peak particle velocity that if not exceeded will result in a Green condition and if exceeded will result in a Yellow Alarm condition.
6. Yellow Alarm: The alarm refers to a signal that is designed to alert the project personnel when the instrumentation reading exceeds the Green condition Threshold Level. The Yellow Alarm condition is intended to capture a developing trend of the monitored data and to notify Site personnel that working condition may need to be paused, monitored closely, or adjusted to avoid a Red Alarm condition being reached.
7. Red Alarm: A specific measurement for displacement or peak particle velocity that if exceeded will result in a Red Alarm condition. If a Red Alarm is exceeded construction activities potentially causing the exceedance will stop, work will be assessed, and an approach forward will be established to bring the construction activities into compliance with Yellow and Green conditions. Actual field construction conditions may vary, and it may not always be possible to rely only on analyses-based levels to verify safety and stability.

2.0 Geotechnical Monitoring Roles and Responsibilities

The following sections describe the roles and responsibilities for AECOM, Spicer, and Soil and Materials Engineers, Inc. (SME) personnel involved in performing Geotechnical Monitoring as detailed in Specification Sections 31 80 00 (GEOTECHNICAL INSTRUMENTATION).

2.1 Site History

AECOM is the Prime Contractor for the Site. AECOM will have Site safety and health oversight and coordination responsibilities for AECOM workers, including AECOM contractors and their subcontractors. AECOM will coordinate with Spicer to document and prepare reports for the installation, baseline surveying, and monitoring of FMs, INCs, and VMs as specified in the Contract Documents to monitor ground and structure movements throughout the Site construction activities.

The Contractor Quality Control (CQC) System Manager will review and report geotechnical monitoring activities in the Daily Reports. A tracking spreadsheet will be kept including a summary for all geotechnical monitoring data, details of Yellow or Red Alarm conditions exceeded, and details of any corrective actions taken.

Throughout Site construction activities AECOM will provide EPA/USACE TOCOR access to observe monitoring of the geotechnical instruments when requested.

2.2 Spicer Group Inc. (Spicer)

Spicer is contracted to AECOM and will provide the Michigan-licensed surveyor to perform initial location surveys of the geotechnical instruments and the Instrumentation Specialist to supervise installation of the geotechnical instruments as required in Specification Section 31 80 00 (Geotechnical Instrumentation). Spicer will obtain the materials and equipment needed for installation, monitoring, and maintaining the geotechnical instrumentations outlined in this Geotechnical Monitoring Plan to monitor ground and structure movements during the installation of the DGVBW. See the Site Work Plan for Spicer's qualifications.

2.2.1 Soil and Materials Engineers, Inc. (SME)

Chris Naida of SME will be the Instrumentation Specialist (see **Appendix A** for resumes of SME personnel). The Instrumentation Specialist will prepare instrumentation shop drawings, supervise, and direct SME field staff and be responsible for instrument installation required. The Instrumentation Specialist's designated representative will be present to supervise installation of VMs and INCs. The Instrumentation Specialist will be available by cellular phone during INC and VM installation activities. After initial installation of the instruments, SME will perform monitoring of INCs and VMs per this plan.

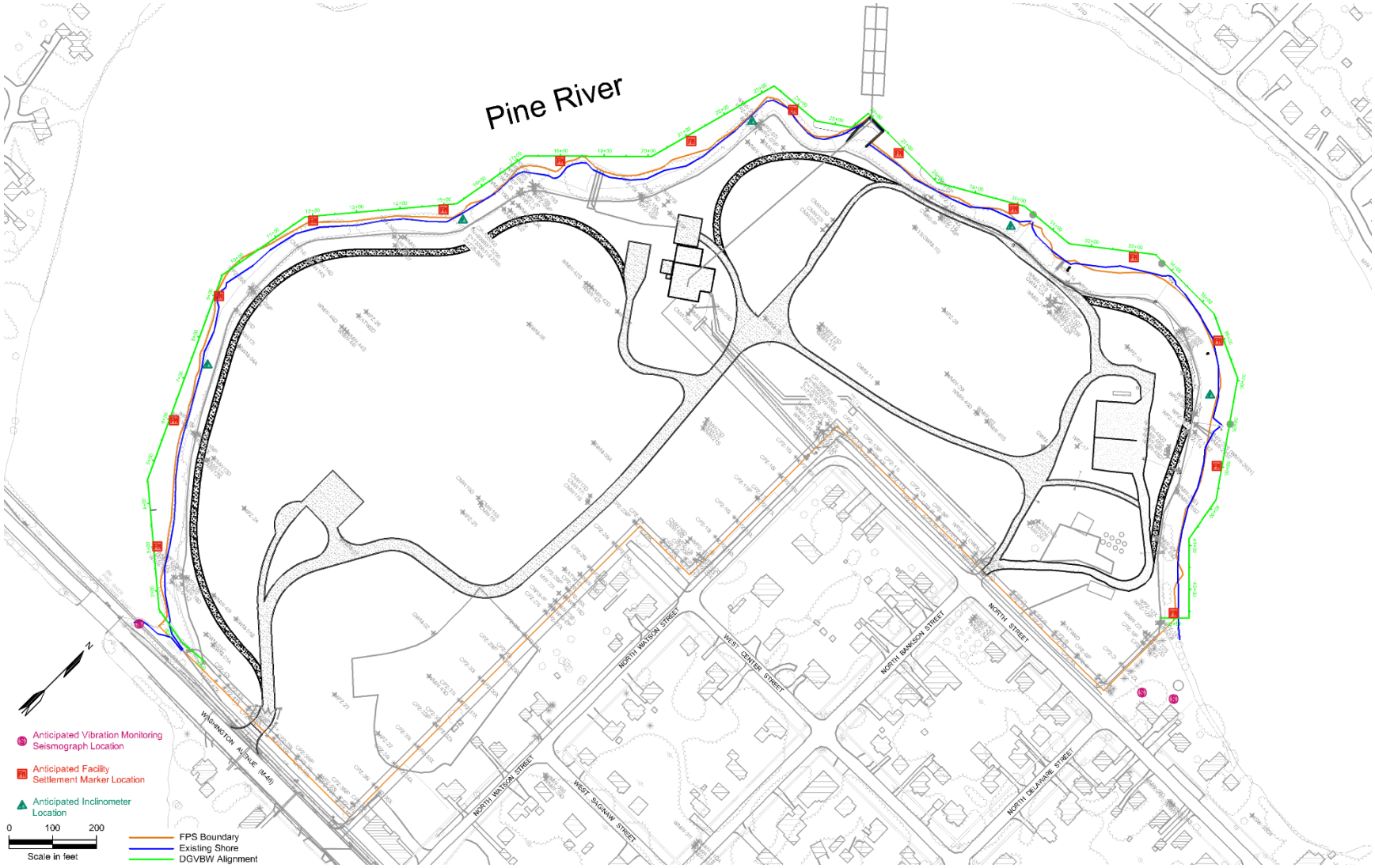
3.0 Geotechnical Monitoring

The following sections contain the types, location and configuration, installation, baseline surveying, monitoring frequency, exceedance protocol, and abandonment procedures for the FMs, INCs, and VMs.

3.1 General

The instrumentation layout is shown on **Figure 3-1 – Geotechnical Monitoring Instrumentation Location Map**. The instrumentation locations provided are approximate locations and were selected by AECOM's Senior Geotechnical Engineer and the Site Instrumentation Specialist. Offsets or modifications due to field conditions and/or homeowner input may be required. AECOM will notify EPA/USACE TOCOR at minimum of 24 hours in advance of the planned instrumentation installation.

Figure 3-1. Geotechnical Monitoring Instrumentation Location Map



3.2 Monitoring Instruments, Installation, and Collecting Baseline Data

The following list provides a summary of the types and numbers of monitoring instruments proposed to be utilized for this Geotechnical Monitoring Plan:

- FMs (total of 14):
    - Installed approximately every 300 linear feet (LF) on the DGVBW six (6) inches below the final design top elevation.
- INCs (total of 5):
    - Installed approximately every 860 LF of the DGVBW alignment adjacent to the edge of the Pine Riverbank.
- VMs (total 3):
    - One (1) installed on the southern side of the FPS property in close proximity to the State Highway 46 bridge.
    - One (1) installed adjacent to the residential structures at 322 North Street.
    - One (1) installed adjacent to the residential structures at 320 North Street.

Prior to the installation of INCs, Miss DIG and a third-party utility locating service will be contacted to locate and identify utilities at the proposed locations of the INCs, see the Work Plan for additional details on utility locating. INCs and VMs will be installed under the direct supervision of the Site Instrumentation Specialist's designated representative. If a proposed location of a monitoring instrument requires relocation AECOM will request approval from the USACE/EPA TOCOR.

The AECOM Team will acquire, install, and commission all monitoring instruments described in this Geotechnical Monitoring Plan. Information on the specific instrumentation equipment (manufacturer, model number, calibration procedures, leading sensitivity/range/frequency, etc.) vibration instruments, locations of data loggers and base stations, commissioning procedures and results, and other relevant information on the installation, construction, and maintenance of equipment will be established as directed by the manufacturers.

The AECOM Team will provide all goods and services needed to complete installation, connect to data acquisition, and assure proper and calibrated reporting of results in accordance with the manufacturer's recommendations and this Geotechnical Monitoring Plan.

Monitoring instrument installations will satisfy the following constraints:

- Instrumentation location is cleared of known utilities prior to installation activities.
- Satisfy requirements as defined within this plan, including requirements for setting up alarms when thresholds are reached.
- At the conclusion of commissioning activities, field instrumentation installation activities are to be documented in a report to the CQC System Manager that includes, at minimum, the following information:
    - Actual instrumentation locations and installation depths for INCs.
    - Instrument supplier certification, calibration, and serial number as applicable.
    - Photographic documentation.
    - Boring Log, Driller's Log, and Grout specifications for INCs.

- Baseline survey data.
- Data acquisition equipment installed, supplier certifications, and serial numbers.

FMs are discussed further in **Section 3.2.1**, INCs are further discussed in **Section 3.2.2**, and VMs are further discussed in **Section 3.2.3**.

3.2.1 Facility Settlement Markers

FMs on the DGVBW will consist of reflective prisms, steel rods, punch marks, or survey nails which are visibly installed on the DGVBW, and which can be easily measured via surveying techniques to obtain vertical and horizontal displacement values. The 14 FM locations will be spread approximately uniformly across the length of the wall, starting near Sta. 0+00 of the wall, and spaced at approximately every 300 LF. FMs will be physically located approximately six inches below the final design elevation for the top of wall. Each FM will be installed and baseline established once pile driving operation reach 100 LF beyond the proposed FM location (to avoid false readings created by pile driving operations). After installation of each FM, Spicer will survey the FM to determine its horizontal and vertical position as a baseline reading. Spicer will conduct these surveys utilizing a Leica TS 16 Robotic Total Station that is with accuracy between 1- and 2-mm in conjunction with a Lecia Viva GS16 GNSS – Rover Unit. Horizontal survey accuracy will be 0.01-foot or less. A minimum of two sets of initial readings will be taken at the time of the baseline. Once accepted by the EPA, the average of the two sets of initial readings will be used to establish the baseline. Surveys will be referenced to the same control points and benchmarks established for the Site.

3.2.2 Inclinometers

SME will perform inclinometer installation and monitoring, with assistance from Spicer's Site personnel. SME will drill five (5) test borings to about 10 feet into the dense glacial till stratum (anticipated to be encountered near 10 to 30 feet below ground surface). SME will install an inclinometer casing for the full boring depth at each location. Drilling of test borings and installation of INCs will be performed under the supervision of SME's Instrumentation Specialist and AECOM's Geotechnical Specialist, and/or their designated representatives. Each INC will be installed adjacent to the edge of the Pine Riverbank starting near the start of the DGVBW and spaced approximately every 860 LF of the DGVBW alignment. The inclinometer casing will be grooved plastic with a 2.75-inch outer diameter and rigid self-aligning couplings and end plugs. Each casing's "A" axis will be oriented perpendicular to the riverbank slope.

During drilling the casings will be staged close to the installation location and appropriate safety slinging and lifting techniques as outline in the Accident Prevention Plan/Health and Safety Plan will be followed. The assembled inclinometer will be carefully lowered and centered in the borehole so that it is true, straight, and vertical throughout. The top of the inclinometer casings will extend out of the ground approximately 3 to 4 feet, and will be protected with a steel, stick-up well cover. Decontamination of equipment used for INC installation will be conducted prior to and between drilling locations to prevent any cross contamination.

SME will classify subsoil strata, prepare logs for the test borings, and revise drilling procedures as necessary, to characterize subsurface conditions at the INC locations (throughout the explored test boring depth). Test borings will be advanced with continuous flight, hollow-stem augers. Samples will be collected from each inclinometer boring with a split-barrel sampler using the Standard Penetration Test Method (SPT) in accordance with American Society for Testing and Materials (ASTM) D1586. Samples will be obtained at 2.5-foot intervals within the upper 20 ft of each boring and then at 5 ft intervals thereafter to the boring termination depth. Each sample obtained will be logged in accordance with ASTM D2487 to classify soils in accordance with Unified Soil Classification System (USCS). Representative sample of each 2.5-

foot interval retained for analytical laboratory testing will be stored in glass jars approximately 5 inches high and 1-3/4 inches in inside diameter at the mouth. Sample jars will be labeled with the project number and name, boring number, sample number, depths at top and bottom of sample, blow count and recovery.

After each inclinometer casing is placed to the target depth at each location, the borehole will be backfilled with sodium bentonite and Portland cement-based grout, and any excess soil cuttings will be collected for disposition with other Site wastes. The casing will then be hand checked to ensure the inclinometer is level prior to completion. The grout proposed for backfilling the boreholes will have a 1: 2.5: 0.3 ratio (cement: water: bentonite). The water and cement will be mixed first and bentonite will be added to produce a flowable grout. After the installation has been completed a groove tracking test will be performed to ensure that the inclinometer casing has been properly installed. The inclinometer sensor will be lowered to the bottom of the casing in all four possible orientations, verifying that on raising to the top of the casing the inclinometer orientation is unchanged.

The INC monitoring system will include probe, an appropriate length of cable, cable relief, pulley assembly, cable hole, and readout box. The INC readout will measure inclinations at any depth selected by the operator and will digitally store, process, and report the data (by display and downloadable digital files) as lateral movements from the stored baseline reading. The cable connecting the sensor and indicator will have a stranded steel core to take the stress of pulling so as not to break any connectors or wires. The cable will be jacketed with a waterproof material and marked externally at 1-foot intervals for accurate depth determination. The cable guide pulley shall mount to the top of the inclinometer casing.

Spicer will survey the location of the inclinometer and after the grout has set, SME will take initial readings of the inclinometers to obtain baseline data from each. SME will perform all reading and include results in the Daily Reports.

INC monitoring will be performed with a GEOKON GK-604D digital inclinometer system. SME will process INC data with the computer program GTILT (equivalent or better) and Microsoft Excel.

3.2.3 Vibration Monitors

SME will install three (3) seismograph units, one on the southern side of the FPS property in close proximity to the State Highway 46 bridge, one adjacent to the residential structures at 322 North Street, and one adjacent to the residential structures at 320 North Street to measure vibration levels prior to construction to establish baseline data and concurrently during construction to ensure thresholds for vibration are not exceeded.

Seismographs to be used are Nomis Model Mini Supergraph II 8100 to measure and record vibration levels during ambient conditions (i.e., no construction) and during remedial activities. The portable seismograph consists of a tri-axial geophone sensor, which connects to a main data processing and storage unit. The geophones will be installed 1-foot bgs as close to as reasonably possible to the structures being monitored. Each tri-axial geophone measures the incoming vibrations in three mutually perpendicular directions (radial, transverse, and vertical). For this project the seismograph will be set for continuous reading of the incoming vibrations to record and save the maximum PPV occurring during 10-second time intervals. SME will set up the units and monitoring system in a way that any exceedance of Alarm Thresholds will generate an alert delivered via e-mail (notification time based on internet/cellular service) to the designated AECOM supervisor(s) with the authority to stop work in the vicinity of the exceedance and coordinate/execute the protocols.

Prior to initiating pile driving or other vibration-causing work SME will conduct background vibration monitoring for a period of up to three days to establish a baseline to compare to PPV data recorded during remedial activities. AECOM will notify EPA/USACE prior to conducting baseline monitoring. If requested by EPA/USACE a new baseline will be established if in the opinion of EPA/USACE the initial data collected doesn't adequately establish a baseline.

3.3 Instrumentation Protection and Repair

Throughout remedial activities all instruments will be clearly marked, permanently labeled, and protected to avoid being obstructed or otherwise damaged by construction operations or the public. To the extent practical INCs and VMs will be protected from vandalism or other accidental damage using steel locking covers or traffic-rated flush bolt-down covers. Padlocks will be furnished for each lockable protective housing. All padlocks will be brass and keyed the same, five keys for padlocks will be provided to EPA/USACE. VMs will be reasonably protected from vandalism or other accidental damage; however, the VMs will be powered by solar panels that cannot be covered. EPA/USACE will be notified in the event a geotechnical instrument is damaged. AECOM will follow EPA/USACE direction on repair or replacing any damaged instruments. Any repairs or replacements of geotechnical instruments will occur as soon as practical after notification by EPA/USACE as to whether a repair or replacement is required.

3.4 Geotechnical Monitoring Frequency and Alarm Thresholds

The following Sections detail the monitoring frequency and Alarm Thresholds for the geotechnical instruments. AECOM set up an alarm system with 3 color-coded Alarm Thresholds for the instrumentation described in this Geotechnical Monitoring Plan. **Table 3-1** provides Alarm Thresholds and protocol associated with each color-coded alarm.

Table 3-1. Alarm Thresholds for Instruments

Alarm	Corrective Action to be taken by AECOM
Green	All work may proceed.
Yellow	AECOM's Superintendent may make a recommendation to EPA/USACE TOCOR to pause construction and perform internal evaluation. AECOM will identify potential issues and prepare potential corrective measures for discussion with EPA/USACE TOCOR before resuming construction under caution.
Red	All work must be stopped for further safety evaluation and development of a corrective action. Work must not resume without the approval from EPA/USACE TOCOR, AECOM's Superintendent, and the SSHO.

The AECOM Team is responsible for appropriate evaluations and for giving the recommendation to EPA/USACE TOCOR to continue work if a Yellow or Red Alarm is triggered. When data indicates that a Yellow or Red Alarm has been exceeded, the AECOM Project Manager, Superintendent, Site Safety and Health Officer (SSHO), and CQC System Manger will be notified immediately, and appropriate actions will be taken per this plan. Specific monitoring frequencies and Alarm Thresholds for the FMs, INCs, and VMs are detailed in the following sections.

3.4.1 Facility Settlement Markers

Measurements for FMs will be taken via conventional survey techniques as described in **Section 3.2.1** Facility Settlement Markers of this plan. All FMs will be surveyed at least once a month. An FM will be surveyed daily when remedial construction is taking place within 200 LF of the FMs. If a Yellow Alarm or Red Alarm is triggered, survey event frequency will increase as directed by AECOM's Geotechnical Lead and as agreed with USACE.

Surveys will record the northing, easting, and elevation in U.S. feet for each FM surveyed. Survey data will be tracked and will include graphical plots of movement (both vertical and lateral) vs. time, along with the complete raw survey data. FM Alarm Thresholds are provided in **Table 3-2** below.

Table 3-2. Alarm Thresholds for Facility Settlement Markers

Delta Displacement	Alarm Threshold	Description
Cumulative Total Lateral Displacement	**Green**	≤ 1.0 inches
	Yellow	> 1.0 and ≤ 2.0 inches
	Red	> 2.0 inches
Cumulative Total Vertical Displacement	**Green**	≤ 1 inches
	Yellow	> 1.0 and ≤ 2.0 inches
	Red	> 2.0 inches

If Yellow or Red Alarm Thresholds are exceeded at any FM during the DGVBW installation, the expected cause of the settlement will be reported to EPA/USACE TOCOR, and corrective actions will be undertaken in accordance with **Section 3.5 Alarm Threshold Exceedance Protocol** to limit and/or prevent further settlements from occurring. If a Yellow Alarm is triggered at an FM located beyond 200 LF from the work, survey event frequency will increase to at least once per week until tolerance for green is achieved. If a Red Alarm is triggered, survey event frequency will increase to at least 2 times per week until tolerance for green is repeated twice.

3.4.2 Inclinometers

Inclinometer monitoring will be a stepped approach, SME will take inclinometer readings at the following frequency:

- 2 readings per week following installation for a period of 1 month or following significant movement (i.e. a Yellow or Red Alarm).
- After the above 1-month period and if movement is insignificant (i.e. a Green Threshold condition is maintained); 2 readings per month for a period of 6 months.
- After the above 6-month period and if movement is insignificant (i.e. a Green Threshold condition is maintained); 1 reading per month for the duration of the project.

Furthermore, reading event frequencies will be increased at the locations where a Yellow or Red Alarm has been triggered, as follows:

- Yellow Alarm Threshold: Minimum of one reading per week.
- Red Alarm Threshold: Minimum of two readings per week.

A spreadsheet tracking file will provide INC graphs showing ground movement parallel and transverse to the DGVBW. a Daily Report will include test boring logs and Inclinometer installation details. INC Alarm Thresholds are provided in **Table 3-3** below.

Table 3-3. Alarm Thresholds for Inclinometers

Inclinometer Displacement	Alarm Threshold	Description
Cumulative Total Displacement	**Green**	≤ 1.0 inches
	Yellow	> 1.0 and ≤ 1.5 inches
	Red	> 1.5 inches

If INC Alarm Thresholds are exceeded during the DGVBW installation, the expected causes of the exceedance will be reported to EPA/USACE TOCOR, and corrective actions will be determined to limit and/or prevent further displacement from occurring (as/if applicable). See **Section 3.5** and **4.0** for additional information on exceedance protocol, documentation, and reporting.

3.4.3 Vibration Monitors

SME will maintain and troubleshoot the VMs, with the assistance of Spicer. In addition, SME staff will visit the Site periodically to perform routine maintenance of the seismographs. SME will provide remote monitoring and web services for the seismograph units post the vibration data daily. The VM located near the State Highway 46 bridge will be installed and monitored continuously by SME until sheet/king piling installation reaches station 10+00. When sheet/king piling installation reaches station 10+00 the VM will be shut down and removed. VMs located at 320 and 322 North Street will be installed, and baseline monitoring conducted prior to sheet/king piling installation reaches station 30+00. VMs at 320 and 322 North Street will be monitored continuously by SME until sheet/king pile installation is completed through station 43+00. SME will set the units to prepare a vibration report for each seismograph, which will be downloaded the subsequent day after monitoring by Spicer and the AECOM CQC Systems Manager or designee and included in the applicable tracking spreadsheet.

Table 3-4. Alarm Thresholds for Vibration Monitors

Alarm Threshold	Description - State Highway 46 Bridge	Description - Residential Properties
Green	0.8 inches/second (ips)	0.4 inches/second (ips)
Yellow	> 0.8 ips and ≤ 2.0 ips	> 0.4 ips and ≤ 1.0 ips
Red	> 2.0 ips	> 1.0 ips

SME will set up the units and monitoring system in a way that any exceedance of vibration Alarm Thresholds provided in **Table 3-4** will generate an alert delivered via e-mail to the designated on-site AECOM supervisor(s) with the authority to stop work in the vicinity of the exceedance and coordinate/execute the exceedance protocols detailed here and in **Section 3.5** and **4.0**. Spicer staff will be at the Site during all remedial activities, whenever vibration generating activities are taking place. AECOM will include all compiled data in a tracking

spreadsheet which will be available for review by the USACE/EPA TOCOR and the accumulated data will be provided in the Remedial Action Report (RAR).

3.5 Alarm Threshold Exceedance Protocol

Instrumentation Alarm Thresholds and routine instrumentation data review will not be relied upon as the only means of detecting or determining potential/developing instabilities. AECOM personnel will be responsible for performing daily inspections and being aware of other indicators of potential/developing instabilities and to communicate the instabilities with others. This includes formal documentation in writing that describes and provides photo documentation of visual observations such as ground cracking, sloughing, structural cracking or tilting/leaning, etc.

For VMs if Site activities exceed 80% of the ground vibration limit or a Yellow Alarm is exceeded a report will be submitted to EPA/USACE and work causing the exceedance will stop. Work will not resume without permission from EPA/USACE. The report will give the construction parameter data and include a proposal for corrective action necessary to ensure that the specified limit is not exceeded for future activities.

If Yellow Alarm condition is reached for the INCs and FMs, the AECOM Team will internally review the instrument data and Site conditions leading to this exceedance after immediately notifying EPA/USACE TOCOR. Site operations expected of causing the exceedance may continue under close observation unless otherwise directed by the Site Superintendent or EPA/USACE TOCOR to avoid a Red Alarm exceedance. The AECOM Team will determine if the Yellow Alarm exceedance is cause for corrective actions to be implemented. If such conditions occur and the Red Alarm is exceeded, the Site operations expected of causing the exceeded will stop and the AECOM Superintendent, EPA/USACE TOCOR, AECOM CQC System Manager, and applicable subcontractors will review the instrument data and provide input on corrective actions to be implemented. The Site operations expected of causing the exceeded will resume when a path forward to bring the operation back into compliance with the Yellow and Green conditions is established.

4.0 Data Collection and Documentation

Throughout remedial activities, the AECOM Team will be responsible for the collection, documentation, calibration, reporting, and explanation of Thresholds being exceeded.

AECOM's data collection and reporting will consist of the following:

1. **Data Collection Protocols:** Collect, download, collate, and organize all data coming from the instrumentation at the frequencies identified in **Sections 3.4.1, 3.4.2,** and **3.4.3**.
2. **Exceedance Protocols:** See **Section 3.5.**
3. **Daily Reports:** While the standard reporting period will be monthly, a summary of daily geotechnical monitoring conducted, and results will be provided in the Daily Report. Daily Reports will include the following information:
    a. A summary of which geotechnical instruments were monitored.
    b. A summary of any Yellow or Red Alarms reached including the expected cause of the exceedance and corrective actions taken.
    c. Initial installation information/details of equipment.
    d. Summary of instrumentation checks/maintenance performed, and evidence that the instruments are functioning correctly.
4. **Tracking Spreadsheet:** A spreadsheet summarizing and organizing all geotechnical instrumentation data collected and tracked. The spreadsheet will be available to review to the AECOM Project Manager and EPA/USACE TOCOR. Spreadsheet s will include the following information:
    a. Summary of additional instrumentation installed during the reporting period, if applicable, and instrument, serial numbers, calibration records, and evidence that the instrument is functioning correctly.
    b. Plots of instrumentation data vs. time.
    c. A detailed summary of any Yellow or Red Alarms reached that occurred during the monitoring period including the expected cause of the exceedance and corrective actions taken.
    d. Comments on data or abnormalities.

5.0 Abandonment of Instruments

After completion of remedial activities or sooner if allowed by EPA/USACE, Spicer and SME will remove the FMs and VMs. SME will abandon INCs in accordance with Specification Section 31 80 00 (GEOTECHNICAL INSTRUMENTATION). Tremie method will be used to pour grout into each INC to the full depth of instrument casings. The grout will consist of cement, bentonite, and water of the same proportions and consistency discussed in **Section 3.2.2**. Guard casings and valve boxes will be removed and holes will be patched with materials and to a durability consistent with the surrounding ground surface. Abandonment documentation will be submitted to EPA/USACE and agencies requiring abandonment records.

6.0 References

CH2M Hill Inc., 2022. Geotechnical Predesign Investigation Work Plan, Velsicol Chemical Corporation Superfund Site, Remedial Design. 2020.

CH2M Hill Inc., 2023. Final Basis of Design Report, Remedial Design of the Velsicol Chemical Corporation Superfund Site Downgradient Vertical Barrier Wall, St. Louis, Michigan. September 2023.

Appendix A
SME Resumes

CHRISTOPHER G. NAIDA, PE

SENIOR CONSULTANT

(734) 637-0122 chris.naida@sme-usa.com

- Geotechnical Engineering
- Geodynamic Services
- Forensic Evaluations
- Earth Retention Systems

BACKGROUND

Chris is a Senior Consultant with more than 15 years of experience. He works with many clients such as developers, private and commercial owners, universities, construction, managers, designers, and specialty contractors. He specializes in the evaluation of slopes, permanent and temporary earth-retention/shoring design, deep foundation systems, geodynamic services, and forensic evaluations of geotechnical and structural related distress to structures. He is proficient in a variety of field related testing including pile dynamic analysis testing, deep foundation load tests, seismic testing, and infiltration testing. Chris has performed numerous geotechnical evaluations and designed various types of earth retention systems and underpinning including sheet pile, soldier pile and lagging walls, tangential augercast pile walls, tiebacks, shotcrete and soil nails, soil grouting, geogrid and geotextiles.

RELATED PROJECT EXPERIENCE

Assistant Project Manager for **University of Michigan (U-M) Science Building Addition** at the Dearborn Campus. SME saved U-M more than $150,000 in foundation costs by working with the structural engineer to recommend a shallow foundation system, in lieu of the previous deep foundation system, to support the new building addition. We also performed seismic testing and site-specific analysis using refined data collected, which allowed an upgrade of the seismic design category resulting in a cost savings of about $100,000.

Provided pile dynamic analysis (PDA) testing, static load tests and observations for driven H-piles and drilled augercast in-place (ACIP) piles for **Ford Motor Campus** Upgrades in Dearborn, various MDOT bridge structures across Michigan and Great Lakes Water Authority facilities in Southeast Michigan.

Provided **forensic geotechnical services** for a 50-year-old building where four of the apartments suddenly experienced up to 1-inch wide cracking in the exterior brick and interior drywall. Found the site soils were mostly highly plastic with a propensity for large volume changes with moisture, and concluded that two large trees nearby removed water through their root systems, resulting in non-uniform settlement that caused cracking in the building. Trees were removed and building movement was monitored, observing that the cracks in the exterior brick closed up some, and the foundation rebounded.

Provided geotechnical design and construction materials services (CMS) with geotechnical related field testing for the **U-M Alice Lloyd and East Quadrangle Dormitory** in Ann Arbor, Michigan. Services included design of temporary earth retention systems such as shotcrete walls, push pier and concrete mini-piles; concrete underpinning, tiebacks, soil nails, and soil grouting.

RELATED PROJECT EXPERIENCE CONT.

Project Engineer for several geotechnical evaluations for new **10 plus-story multi-use buildings** including 413 East Huron, Ann Arbor City Apartments, 116 West Huron, and Pizza House. The projects also included specialty subgrade preparation for 10,000 psf or greater allowable soil bearing pressures and temporary earth-retention design services.

Developed and implemented instrumentation plan for inclinometer measurements to monitor lateral sloughing and bottom heave and/or soil rebound along edge of nearly vertical 15 to 35-foot feet excavation 9.5-foot diameter **City of Dearborn** CSO pipe replacement.

Performed geodynamic services for proposed **vibration sensitive hospital equipment** (MRI units). Evaluated proposed location for equipment in relation to expected onsite typical daily vibrations such as vehicle and pedestrian traffic, air-borne vibrations (sound), mechanical equipment, underground infrastructure and other related activities.

Managed geotechnical and material related services for a 90,000 square-foot high bay freezer storage building with over 18-inches of slab heave and 6 inches of foundation heave. Developed building enclosure assessment, slab and roof survey, subsurface remote temperature monitoring, and subgrade warming plan in collaboration with mechanical engineer, contractor, and owner.

Prepared geotechnical evaluation reports for proposed 3.5 million gallon elevated water storage tanks in Farmington Hills, Michigan. Assisted in design of 100+ foot diameter mat foundation which included imbedded sensors for temperature monitoring during concrete placement in the winter.

Performed geotechnical forensic services for existing structures in Michigan related to concrete slab curling, settlement, and excessive frost heave from lime stabilization.

Prepared a work plan, established vibration measurement criteria, and performed vibration monitoring with remote alert capabilities during near sensitive historical building structures and museum artifacts using a combination of geophones installed on walls, floors, artifact cases, and foundations.

EDUCATION

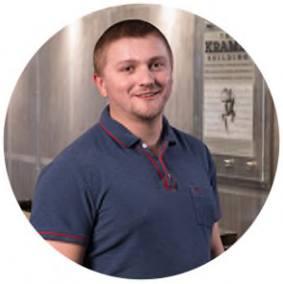
B.A., Civil Engineering, Lawrence Technological University
M.A., Geotechnical Engineering, University of Michigan

REGISTRATIONS AND CERTIFICATIONS

Registered Professional Engineer – Michigan, Ohio, and Indiana
MUST Safety Program
Marathon Safety Program
Achieved Intermediate Rank on Dynamic Measurement and Analysis Proficiency Test and CAPWAP – Pile Driving Contractors Association (PDCA)

AFFILIATIONS

American Society of Civil Engineers (ASCE)
Chi Epsilon – National Civil Engineering Honor Society



CAMERON R. PLACE, PE

PROJECT ENGINEER

(989) 284-4321 cam.place@sme-usa.com

- Geotechnical Engineering
- Environmental Engineering
- Construction Materials Services

BACKGROUND

Cam is a Project Engineer who provides geotechnical engineering, environmental engineering, and construction materials services related to soils, shallow and deep foundations, earthwork and subgrade preparation, pavement design, and agricultural waste storage structures. Cam specializes in complex drilling projects with challenging access requirements that require significant coordination between property owners, field crews, land agents, and clients. Additionally, Cam has provided engineering oversight for a variety of contaminated sites ranging from former manufactured gas plant (MGP) sites to bulk petroleum storage sites. He is skilled at performing construction materials services such as subgrade evaluations, field density verification of fill, re-steel placement observation, and Portland cement and asphalt concrete testing. He also performs laboratory testing of soil, aggregates and concrete materials. Cam has seven years of experience including an internship and co-op with SME.

RELATED PROJECT EXPERIENCE

Project engineer / manager providing field and consulting engineering services for multiple high-tension **electrical transmission line** and **electrical substation projects** throughout lower Michigan. Projects typically include site visits for accessibility and boring layout, collaborating with land owners and land agents regarding drill rig access, geotechnical drilling and sampling, standard penetration testing (SPT), vane shear testing, cone penetration testing (CPT), infiltration testing, electrical resistivity testing, waste characterization testing, and geotechnical laboratory testing. Project Manager for two projects that required over 60 soil borings each across 20+ miles of electrical transmission line. Provide geotechnical recommendations for both shallow and deep foundations for substation and electrical transmission line structures related to new builds, sag remediation, and upgrades.

Project engineer / manager providing geotechnical engineering services for a new **Public Safety and Fire Station** building along the Saginaw River in Bay City, Michigan. The site soils consisted of over 20 feet of undocumented fill and/or organic soils over soft clays to about 100 feet. The site also had shallow groundwater controlled by the Saginaw River and environmental petroleum impact. Cam provided recommendations for deep foundations including auger cast-in-place (ACIP) piles and a rigid inclusion ground improvement system for support of the proposed structure.

Project engineer / manager for multiple **void investigation** and **remediation projects** within 100+ year old factories for a confidential client. Projects typically included visual review of structural distresses and site conditions, review of historical plans and information, coordinating non-destructive testing such as ground-penetrating radar and slab impulse response surveys, performing soil borings, and providing remediation recommendations such as compaction grouting.

RELATED PROJECT EXPERIENCE CONT.

Field engineer responsible for coordinating drilling and environmental waste management for over 80 soil borings at the **Former Buick City site** in Flint, Michigan as part of brownfield redevelopment efforts. Project included performing training on skid-steer operation and maintenance for other field staff, coordinating drill rig access around 5,000 plus vehicles stored on site, coordinating with multiple tenants, and managing and coordination related to storage and disposal of environmentally impacted soil boring cuttings.

Field engineer for remediation of soil and groundwater impacted with coal tar and other coal gas manufacturing waste products at a **former MGP site** in Bay City, Michigan. Provided environmental and geotechnical engineering oversight for the owner regarding the installation and removal of over 900 lineal feet of 60 feet long steel sheet pile, stability monitoring with inclinometers, excavation and disposal of 20,400 tons of impacted soil, in-situ soil stabilization of 3,600 cubic yards of impacted soil, and treatment and disposal of over 5 million gallons of impacted groundwater, and placement and compaction of sand backfill.

Staff engineer responsible for the preparation of bid specifications/cost estimate and oversight of field staff for remediation of impacted soil and groundwater at a **former MGP site** in Mount Clemens, Michigan. The project consisted of asbestos abatement and demolition of an existing 12,000 square foot building, excavation, and disposal of 31,000 tons of impacted soil, treatment and disposal of over 90,000 gallons of impacted groundwater, and placement and compaction of sand and clay backfill.

Staff engineer responsible for preparation of bid specifications, cost estimates, field engineering services, and oversight of field staff for multiple **Michigan Department of Environment, Great Lakes, and Energy (EGLE)** excavation projects at petroleum impacted sites throughout mid and southeast Michigan.

Lead design engineer / project manager responsible for subsurface evaluations, design, construction oversight, and as-built reporting for more than 10 multi-million-gallon agricultural liquid waste storage structures. Provides engineering services related to solid waste stacking facilities and runoff control and collection.

EDUCATION

M.S., Civil Engineering – Geotechnical Focus, Missouri University of Science and Technology, 2023

Graduate Geoenvironmental Engineering Certificate, Missouri University of Science and Technology, 2021

B.S., Civil Engineering, Michigan Technological University, 2017

REGISTRATIONS AND CERTIFICATIONS

Professional Engineer (PE) – Michigan
OSHA 40-Hour HAZWOPER
OSHA 10-Hour Construction Safety
Nuclear Density Gauge Operator – Troxler
American Red Cross First Aid

DUSTIN R. KERN

OPERATIONS MANAGER

(989) 205-2889 dustin.kern@sme-usa.com

- Construction Materials Services
- Project Manager
- Laboratory Testing
- MDOT Region Mix Inspector
- Lead Engineering Technician

BACKGROUND

Dustin manages construction material services (CMS) projects for SME's Bay Region office in Saginaw, Michigan. He prepares proposals, provides project set-up and management, technical support, and conducts reviews of field and laboratory test reports for CMS projects. These services include caisson observation, masonry observation, verification of micropile installation, foundation subgrade observation, field density testing, compaction verification testing of fill/backfill, and concrete and bituminous concrete testing. With 24 years of experience, Dustin provides coordination of field personnel and the resources to complete projects efficiently and on time. He also serves as Team Leader for SME's Co-op and Intern Program in Bay Region. Additionally, Dustin serves as Region Mix Inspector (RMI) and reviews Quality Assurance (QA) testing and documentation in the Michigan Department of Transportation (MDOT) Bay Region Central Lab provided by SME.

RELATED PROJECT EXPERIENCE

Dustin has been the Project Manager for more than 1,200 CMS projects throughout Michigan including:

- MDOT Bay Region HMA Testing (2022-present)
- FLTF Dam Restorations (Smallwood, Secord, Edenville, and Sanford)
- Bavarian Inn Lodge Water Park
- City of Bay City Streets Projects (2017-present)
- Caro Center – State Psychiatric Hospital
- Saginaw United High School – Tower
- Mersen USA Expansion
- HSC NextGen Building
- Pincanna – Compassionate Advisors
- Meijer – West Branch and Bad Axe Stores
- ITC/METC Bay Region Transmission Projects (2017-present)
- Consumers Energy Bay Region Transmission Projects (2017-present)
- Costco – Midland Store
- Uptown Bay City Infrastructure
- SCIT Governmental Operations Center
- Soo Locks Boiler Replacement
- McLaren Central Michigan Emergency Department Addition
- Comfort Inn & Suites – Clarkston
- Ascension St. Mary's ED Addition
- Dow Customer Innovation R&D Center

RELATED PROJECT EXPERIENCE CONT.

Dustin assists engineers in setting up and adjusting bituminous mixtures, troubleshooting and correcting mixture problems at the plant and street, and interpreting testing results and specifications. He also provides Quality Assurance testing and coordinates sampling behind paver activities of hot mix asphalt (HMA) in the Central Lab of the **Michigan Department of Transportation (MDOT) Bay Region**. Dustin provided Region Mix Inspector (RMI) services for various projects throughout the **MDOT Bay Region**. Services included setting up and adjusting bituminous mixtures, and troubleshooting and correcting mixture problems at the plant and project sites. Assisted engineers in understanding the bituminous mixtures and specifications.

Provided CMS for the **Dow Kokam** expansion in Midland, Michigan. Services included verification of the design soil bearing capacity within existing fill materials, proofroll observations, fill/backfill and concrete testing, and concrete floor flatness/levelness evaluations.

Lead Engineering Technician for CMS at the multi-faceted $2 Billion **Hemlock Semiconductor Corporation** Solar – Phase I, II, III and IV expansion projects in Hemlock, Michigan. Services included subgrade verification, deep foundation evaluations, proofroll observations, fill/backfill, concrete testing, masonry inspection and floor flatness/ levelness evaluations.

Lead Engineering Technician for an approximately $500,000 pavement reconstruction project at **Consumers Energy Karn-Weadock Generating Complex** in Essexville, Michigan. Provided CMS testing for concrete, soil and HMA. Verified construction quantities and acted as liaison between contractors, engineers, and Consumers Energy. SME also provided Full Depth Reclamation (FDR) mix designs.

Engineering Technician for **Consumers Energy West Branch Service Center** in West Branch, Michigan. Performed test pits, subgrade proofrolls, masonry inspections, field density and concrete testing, and laboratory soil, concrete and HMA testing.

Observed the removal of distressed asphalt and underlying cement kiln dust base for **Delta College**. Provided daily repair quantities of pavement and unsuitable base materials removed.

Provided observation and CMS for **Marlette Community Hospital** in Marlette, Michigan. Services included foundation subgrade verification, proofroll observations, fill/backfill, concrete and bituminous concrete testing and observing placement of sprayed-on fireproofing.

Performed bituminous concrete plant inspection for several **MDOT** projects, including Pine Street and Scheurman Street in Essexville; Old M-76 in Sterling; and James Clements Airport in Bay City, Michigan.

EDUCATION

Civil Engineering Courses, Michigan State University

REGISTRATIONS AND CERTIFICATIONS

Certified Nuclear Density Meter Operator – Troxler
Certified Superpave Hot Mix Asphalt Mix Design – Michigan Department of Transportation (MDOT)
Qualified Masonry Inspector – ICC

TRAVIS R. BRUSKI

SENIOR STAFF SPECIALIST

(989) 529-0153 travis.bruski@sme-usa.com

- Construction Materials Services
- Laboratory Testing
- Michigan Department of Transportation Certified

BACKGROUND

Travis provides construction materials services (CMS) including foundation subgrade evaluations, masonry inspections, floor flatness and levelness, field density verification of fill/backfill, re-steel placement observation, and concrete and bituminous concrete testing. He also performs laboratory testing of soil, concrete and asphalt. Travis has 16 years of experience with SME.

RELATED PROJECT EXPERIENCE

As the Lab Supervisor, Travis performs quality assurance lab testing of hot mix asphalt (HMA) and cores as part of SME's team providing services to the **Michigan Department of Transportation** (MDOT) Bay Region HMA Quality Initiative Program.

Provided lab and field testing, and managed multiple **Hot Mix Asphalt Local Agency** projects throughout mid-Michigan, the Thumb, and the Upper Peninsula.

Clare Municipal Airport project in Clare, Michigan. Performed QA plant inspection testing of Hot Mix Asphalt.

Engineering Technician for the **DN Tanks 7.00 Million Gallon Water Storage Tank** project in Brown City, Michigan. Performed testing of concrete using shrinkage beam test specimens at the Homer Concrete batch plant in Imlay City, Michigan. Provided recommendations to help achieve acceptable mix designs required for the project.

Engineering Technician for the **Ford DDC Wet Pad Replacement** project in Dearborn, Michigan. Performed hot mix asphalt (HMA) batch plant testing at the Ajax Materials Inkster Plant in Romulus, Michigan.

Engineering Technician for the new 184,380 SF **Dow Corporate Center** in Midland, Michigan. Services included concrete testing, re-steel inspection and verification of backfill.

Provided field density testing and concrete testing on numerous streets throughout the **City of Bay City**, Michigan.

Lead Technician for **MBS Airport Terminal Development Phase 10** project in Auburn, Michigan. Services included concrete testing, beam strength test specimens, sand moisture testing, aggregate sampling and moisture testing, and concrete coring.

Provided concrete testing for **Midwest Water Treatment Plants** in Caro, Essexville and Saginaw, Michigan. Also performed nondestructive testing of concrete at the **Saginaw Water Treatment Plant** in Saginaw, Michigan.

RELATED PROJECT EXPERIENCE CONT.

Provided CMS for **Consumers Energy Karn Power Plant** including concrete, re-steel, backfill and grout testing.

Lead Technician for the **Michigan Wind 2** project in Minden City, Michigan. Services included density testing, proofroll observation and undercut monitoring.

Performed CMS for the **Hemlock Semiconductor Corporation** expansion projects in Hemlock, Michigan. Services included fill/backfill observation, concrete testing, re-steel, floor flatness verification, and masonry inspection.

Performs concrete, field density, foundation subgrade evaluations, and soil resistivity testing for various **ITC**, **METC**, **Consumers Energy**, and **Wolverine Power** substations and transmission lines throughout Michigan.

Performed CMS for **ARAUCO** Grayling MDP Plant Phase II. Services included concrete, nuclear density tests for backfill, foundation subgrade evaluations.

Performed concrete testing for the **I-75 Reconstruction** project in Bay County, Michigan as well as additional roadway reconstruction projects in Millington, Mount Pleasant, and Bay City, Michigan.

Lead Technician for **Lowe's** Pavement Rehabilitation Projects in Midland and Flint Townships, Michigan. Services included hot mix asphalt (HMA) density testing and sampling, concrete testing, construction monitoring, and as-built verification for concrete and asphalt repairs.

EDUCATION

Associate of Applied Science, Concrete Technology, Alpena Community College

REGISTRATIONS AND CERTIFICATIONS

Concrete Field Testing Technician, Grade I – American Concrete Institute (ACI)
Concrete Strength Testing Technician – American Concrete Institute (ACI)
Concrete Field Testing Technician, Level I – Michigan Concrete Association (MCA)
Advanced Concrete Technician, Level II – Michigan Concrete Association (MCA)
Certified Density Technician – Michigan Department of Transportation (MDOT)
Michigan Qualified Bituminous QC/QA Technician – Michigan Department of Transportation (MDOT)
Michigan Certified Aggregate Technician, Level II – Michigan Department of Transportation (MDOT)
Certified Nuclear Density Meter Operator – Troxler
Restricted Zone Training – Construction Safety Standard Part 2, Masonry Wall Bracing
OSHA 10-Hour Construction Safety Training