SUPPLEMENTAL PHASE III EOC WORK PLAN - ADDENDUM NO. 2 COMPANY VEHICLE OPERATIONS PROPERTY YPSILANTI, MICHIGAN

GENERAL MOTORS
YPSILANTI, MICHIGAN

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AIAC	Acceptable Indoor Air Concentrations
bgs	below ground surface
CAEPA	California Environmental Protection Agency
CRA	Conestoga-Rovers & Associates
CVO	Company Vehicle Operations
CVOC	Chlorinated Volatile Organic Compound
DCE	Dichloroethylene
DNAPL	Dense Non-Aqueous Phase Liquid
EM	Electromagnetic
ENCORE	Environmental Corporate Remediation
EOC	Extent of Contamination
FMG	Field Method Guidelines
HSA	Hollow Stem Augers
ID	Inner Diameter
GM	General Motors
GSI	Groundwater/Surface Water Interface
MIP	Membrane Interface Probe
NAPL	Non-Aqueous Phase Liquid
PAOC	Potential Area of Concern
PCBs	Polychlorinated Biphenyls
PCE	Tetrachloroethylene
PID	Photoionization Detector
SVOC	Semi Volatile Organic Compound
TAL	Target Analyte List
TCE	Trichloroethylene
TCL	Target Compound List
VOC	Volatile Organic Compound
WRBC	Willow Run Business Center

1.0 INTRODUCTION

Conestoga-Rovers & Associates, Inc. (CRA) was retained by Environmental Corporate Remediation (ENCORE), a wholly owned subsidiary of General Motors (GM), to prepare this Supplemental Phase III Extent of Contamination (EOC) Work Plan, Addendum No. 2 (Work Plan Addendum 2) for the Company Vehicle Operations (CVO) Area (Site) at the former Willow Run Assembly Plant located in Ypsilanti, Michigan. Figure 1.1 presents the Site location. CRA prepared a Supplemental Phase III EOC Work Plan (EOC Work Plan) in October 2003 and a Supplemental Phase III EOC Work Plan, Addendum No. 1 (Work Plan Addendum 1) in April 2004. This Work Plan Addendum 2 was prepared to further investigate and delineate impacts identified during the ongoing EOC work completed at the Site in 2003 and 2004.

The Site is located on the former Willow Run Assembly Plant property, which currently houses the Willow Run Business Center (WRBC), as well as the GM CVO facility. Prior to 1940 the Ford Motor Company owned a large section of undeveloped land including the Site of the current Willow Run facility. In 1941 the United States Defense Plant Corporation of America purchased the Willow Run facility and directed Ford to construct and operate a bomber production plant. The Kaiser-Frazer Company (Kaiser-Frazer) leased the bomber plant and CVO area from the War Asset Administration in November 1945 and purchased the facility in December 1948. Kaiser-Frazer owned the property until its sale to GM in December 1954.

This Work Plan Addendum 2 addresses issues identified at the CVO area only. The CVO area is bordered on the north and east by Tyler Pond, which influences groundwater flow at the property. The WRBC exists to the west, and Tyler Road abuts the southern Site boundary.

Specifically, this Work Plan Addendum 2 presents additional investigative activities that will be conducted to:

- Further evaluate volatilization to indoor air as a pathway near the Haulaway Building (Potential Area of Concern (PAOC) 19);
- Investigate soil impacts and monitor for the presence of dense non-aqueous phase liquid (DNAPL) in Injection Area 1, outside the northeast corner of the Haulaway Building;
- Determine the sources of anomalies detected by electromagnetic surveys conducted in the fall of 2004;
- Continue delineating the extent of buried waste material and debris at the Site;

- Investigate the areas where pits and burial areas were observed in historical aerial photographs;
- Provide additional groundwater monitoring points in the vicinity of the sheet pile wall in PAOC 18;
- Investigate groundwater flow along the southern property boundary; and
- Further characterize and delineate non-aqueous phase liquid (NAPL) observed in PAOC 18.

2.0 BACKGROUND

2.1 INDOOR AIR PATHWAY- PAOC 19

During the Phase III EOC Supplemental Investigation completed in May 2004, soil gas samples were collected from temporary soil gas probes beneath the northeast corner of the Haulaway Building. These samples were collected to investigate the potential for vinyl chloride to volatilize to indoor air from impacted groundwater beneath the building.

Two soil borings were completed within the northeast corner of the Haulaway Building (SB19-19 and SB19-18). Both soil borings were advanced to approximately 5 feet below the building floor. Soil boring SB19-19 was completed from the first floor of the Haulaway building, while SB19-18 was completed in a maintenance pit with a depth of 4.9 feet below the first floor elevation. The millpoint screen used to collect samples was driven and exposed to the subsurface 3 to 5 feet below ground surface (bgs) at the respective locations. Therefore, the soil gas samples collected from SB19-19 and SB19-18 were collected from approximately 5 feet and 10 feet bgs (first floor of building), respectively. The locations of soil borings SB19-19 and SB19-18 are presented on Figure 2.1.

A Gilian Pump was used to purge the millpoint screen for three minutes at a flowrate of 1 liter/minute (5 well volumes) prior to sampling. Samples were collected using laboratory supplied Summa Canisters. The boreholes were filled with bentonite chips and a cement patch was applied at the surface following sampling. The two soil gas samples were submitted to the laboratory for target compound list (TCL) volatile organic compounds (VOCs) analysis.

The criteria used to evaluate the soil gas samples collected from these two locations were the Part 201/213 Acceptable Indoor Air Concentrations (AIAC) multiplied by 100,000 for non-chlorinated VOCs and multiplied by 10 for chlorinated VOCs (CVOCs). AIACs are indoor air concentrations that are protective of occupant exposures for generic residential or generic industrial uses.

Seven VOCs were detected in the soil gas samples above the laboratory reporting limits. Five of the seven constituents detected (1,1-dichloroethylene (DCE), cis-1,2-DCE, trans-1,2-DCE, tetrachloroethylene (PCE) and trichloroethylene (TCE)) were above the industrial AIACs multiplied by a factor of 10 for chlorinated VOCs.

Although the two samples collected have VOC concentrations greater than the applicable criteria, this does not necessarily indicate that a risk to occupants is present. Additional investigations to determine the source (groundwater, soil, and/or DNAPL) are required and are discussed in subsequent sections.

2.2 BURIED WASTE MATERIAL AND DEBRIS

During the Phase III EOC and Supplemental Investigations at the Site, buried historical waste material and debris was observed at several locations. The delineation of the buried debris specifically in the area of PAOC 18 was initiated to aid in the evaluation of a potential source for DNAPL, and was completed using the following methods:

- Review of historical aerial photos;
- Geophysical surveys; and
- Soil boring investigation.

2.2.1 HISTORICAL AERIAL PHOTOS REVIEW – PAOCS 23 & 24

Several aerial photos of the CVO property from 1940 to the present were reviewed to look for visible evidence of potential sources of contamination. A review of the photos from 1940, 1949, 1952, 1955, 1956, 1963, 1969, 1978, 1980, 1985, 1990, 1994, 1995, and 1998 was conducted by CRA in 2004. Information relevant to the delineation of debris material at the Site is described below.

The 1949 photo shows Tyler Pond in place. The area south of Tyler Pond appears undeveloped although there is evidence of activity. A series of vehicle paths appear in the CVO area. An excavated pit and some piles of material are apparent at a location just northeast of where the Haulaway Building is now located. The pit is dark in color indicating that it may contain liquid. The location is consistent with Injection Area 1. The area of the 1949 pit will be referred to as PAOC 23, 1949 Pit. There is also evidence of filling activities along the south shore of Tyler Pond from the Outfall #11 area to the east. The evidence of filling activities stops approximately 150 feet east of where Outfall #12 is located. The eastern most portion of this area is where Injection Area 2 is located.

The 1952 photo shows that the area south and west of Tyler pond was being used as a construction materials storage area. This photo also indicates there is substantial soil disturbance activities along the south shore of Tyler Pond from the Outfall #11 area to just east of the Outfall #12 area at the same location as identified in the 1949 photo. While remnants of the excavated pit identified in the 1949 photo are present, there is evidence of two additional pits directly west of the pit identified in the 1949 photo. The east end of the pits was located at the northwest corner of where the Haulaway Building is located and extends approximately 150′ directly west. These pits are dark in color indicating that they may contain liquid. These new ponds were constructed between 1949 and 1952. The area of the 1952 pits will be referred to as PAOC 24, 1952 Pits.

GM purchased the property in December 1954.

The 1955 photo indicates that the land use south of Tyler Pond remains unchanged from the 1952 photo. The land south of Tyler Pond remains undeveloped but significant fill activities are continuing northwest of Outfall #11 where an apparent tributary/drain enters Tyler Pond. This photo does not indicate evidence of recent significant excavation or fill activities near Outfall #11 and to the east of that location along Tyler Pond. It appears that vegetation has covered most of the area between Outfall #11 and Outfall #12 indicating that minimal disturbance of the soils has occurred recently to 1955. Some remnants of fill or excavation activities are noticeable to the south and southwest of Outfall #12, which is consistent with where the top of the hill/fence line is located today. Remnants of the "pit" identified in the 1949 drawing are still noticeable in the 1955 photo. It appears the pit is being filled in from the sides of the pit or the liquid level in the pit is dropping. This is based on the observation of the pit appearing to cover less surface area and the appearance of more "beach" area around the rim of pit. It is possible this area may have been used to dump liquids. The pits located to the west of previously identified "pit" are still present but it appears the liquid levels have decreased based on more shoreline being present on the south side of the pits.

Figure 2.2, presents the approximate locations of these activities on a current Site drawing. Copies of the 1949, 1952 and 1955 aerials are presented in Appendix A. Copies of the additional aerial photos are available upon request.

2.2.2 GEOPHYSICAL SURVEYS

Geophysical surveys was completed in two areas of the Site during the late summer and early fall of 2004. The surveys including Electromagnetic (EM) surveys and electrical resistivity surveys were completed to locate buried metal objects and to determine the top of clay, respectively. The two areas that were investigated consisted of portions of the parking lot immediately adjacent to the north perimeter fence, and any accessible green space areas beyond the fence (further north), which slopes towards Tyler Pond (Figure 2.3). The eastern area corresponds to the vicinity of Outfall #12 and the PAOC 18 sheet pile wall, while the western area corresponds to the area located south and east of Outfall #11.

The EM results for this area indicate that numerous weak to strong intensity metal detection anomalies were noted within the survey coverage area. Some of these anomalous responses were attributed to surficial metal objects that were noted in a field book as the survey was being conducted. These included parked vehicles, former metal fence posts, catch basins, injection well metal flush mounts, and the metal fence along the western and northern survey perimeter. However, at several locations there were no metal objects on the surface, which could be identified as the source(s) of the anomalous responses observed. These anomalies, which are labeled A to N, are shown on Figures 2.4 and 2.5. Anomalies A, B, and N were identified and marked in the field as the EM survey was being conducted based on a preliminary review of the data. Subsequent test pitting activities conducted in early September 2004 yielded two drums from anomalies A and B respectively. At least one refuse layer was observed in each of the test pits. The refuse layers included stained soils, solidified paint sludge, ash, plastic and wood debris. The remaining anomalies require additional investigation to determine the source of the metal detection.

The electrical resistivity survey was conducted over the eastern area only, near Outfall #12 and PAOC 18. The survey results indicate that the interpreted top surface of the clay is undulating, and generally is found at depths varying from 15 to 25 feet bgs. The top of the clay surface is interpreted to correspond with areas where the lowest resistivity (i.e. highest conductivity) was measured. The interpreted top of clay surface also takes into account the electrode spacing (3.3 feet) that was employed as the survey was being conducted. Based on the information provided on the modeled sections, a 3-D visualization was completed (Figures 2.6 and 2.7). The 3-D visualization has incorporated the surveyed ground surface, interpreted top of clay surface, intrusive investigation locations (PZs, MWs) and services (sewers and outfalls), to provide some insight as to potential migration pathways of DNAPL from the parking lot to the bank of the pond. The visualization indicates that several "bowls" are present in the top of clay surface that may be collecting DNAPL. This information will be used to place additional DNAPL monitoring points in PAOC 18 (see Section 3.3).

2.2.3 SOIL BORING INVESTIGATION

Several boreholes and monitoring wells have been completed and installed by CRA as a part of the EOC investigations at the Site. Borehole logs completed during investigations at the Site over the past few years were reviewed for observations of debris. The locations of soil borings and monitoring wells, east of the catwalks, in which the debris was observed are presented on Figure 2.4, and west of the catwalks on Figure 2.5. The buried waste material and debris observed included stained soils, paint sludge, ash, plastic, concrete cinders, glass, brick, metal shavings and wood. Based on the observations of the refuse layer made during test pitting activities, black stained soils, noted in borehole logs, were considered debris for the purpose of this delineation.

2.3 NAPL DELINEATION

2.3.1 DNAPL

During the initial EOC investigation completed in November 2003, a brown liquid was observed directly above the clay-confining unit in soil borings SB18-63 and SB18-64. Two monitoring wells were installed at the location of the two soil borings in May 2004. These monitoring wells, MW18-01 and MW18-02, were constructed with 6-inches of polyvinyl chloride (PVC) riser sunken into the clay to create a sump to collect potential DNAPL. Initial DNAPL measurements, obtained on May 26, 2004 indicated approximately 1 and 2.1 feet of DNAPL was present in MW18-01 and MW18-02, respectively.

The delineation of DNAPL (CRA, November 2004) was required to complete the design and placement of a sheet pile wall to prevent DNAPL migration into Tyler Pond (CRA, January 2005). The investigation mainly concentrated on the PAOC 18 area east of the catwalks and west of Outfall #13.

Soil borings were completed along the bank to define the extent of the DNAPL. The presence or absence of DNAPL was determined by visual observations of the soil directly above the clay-confining layer, and through the use of Sudan IV (a NAPL detection product). A photoionization detector (PID) was also used to aid the delineation. Figure 2.8 shows the extent of DNAPL observed in soil borings. Several soil borings identified in Figure 2.8 were completed to delineate the buried refuse and were not advanced to the confining clay unit, therefore no DNAPL information is available from these locations.

A storm sewer line runs east-west through PAOC 18, just north of the CVO fence. Due to the proximity of the sewer to the DNAPL, the potential for both the sewer and the bedding to act as a conduit for DNAPL migration was investigated. Each manhole was evaluated for the presence of DNAPL. DNAPL was not observed in the sediment pulled from the manholes. To investigate the sewer bedding, two test pits (TP18-01 and TP18-02) were completed along the storm sewer that runs between the catwalks and Outfall #12. No DNAPL was observed in the bedding material.

As discussed in Section 2.2.2 geophysical surveys were completed to locate buried metal objects and to determine the top of clay. The EM survey indicated the presence of several anomalies just south of the fence line in the PAOC 18 area. Four 55-gallon steel drums were found at the locations where anomalies were observed. Among these drums, one drum was approximately 25% filled with a solvent (TP18-06), one drum was approximately 75% filled with an oily wastewater (TP18-05) and two drums contained soil and sludge (TP18-04 and TP18-06).

2.3.2 LNAPL

Several 1-inch diameter piezometers and 2- and 4-inch diameter monitoring wells were installed in the vicinity of the sheet pile wall to monitor groundwater levels and DNAPL thickness. During groundwater level monitoring activities, LNAPL was detected once in each of PZ18-96, PZ18-126, PZ18-143, and MW18-04. LNAPL has not been consistently present in any of these wells to date.

2.4 GROUNDWATER MONITORING

Elevated concentrations of VOCs are present in groundwater at the Site. Quarterly groundwater monitoring is being conducted which include a full round of groundwater levels and VOC sampling from several perimeter wells. Following the installation of the sheet pile wall in PAOC 18, additional groundwater monitoring wells are required to monitor levels around the wall and replace the groundwater-surface water interface (GSI) well, GS-5, which is now located inside the sheet pile wall and thus is not a GSI well.

2.5 BASIS FOR INVESTIGATION

Based on the results of the field activities associated with the EOC Work Plan and Work Plan Addendum 1, additional investigative activities are required at the Site. This Work Plan Addendum 2 is designed to collect subsurface information for the following purposes:

- Further evaluate volatilization to indoor air as a pathway near the Haulaway Building (PAOC 19);
- Investigate soil impacts and monitor for the presence of DNAPL in Injection Area 1, just outside the Haulaway Building;
- Determine the sources of anomalies detected by electromagnetic surveys conducted in the fall of 2004;
- Continue delineating the extent of buried waste material and debris at the Site;
- Investigate the areas where pits and burial areas were observed in historical aerial photographs;
- Provide additional groundwater monitoring points in the vicinity of the sheet pile wall in PAOC 22;
- Investigate groundwater flow along the southern property boundary; and
- Further characterize and delineate NAPL observed in PAOC 18.

Additional investigation will be needed to address other PAOCs at the Site and will be discussed under separate cover.

3.0 INVESTIGATION PROGRAM

Except as otherwise noted in this Work Plan, all sampling methodologies and analytical procedures will be in accordance with those presented in the EOC Work Plan and EOC Work Plan Addendum 1. Detailed stratigraphy logs will be completed for each borehole and monitoring well installed. Permanent monitoring wells will be installed using 4-¼ inch inside diameter (ID) hollow stem augers (HSA). Temporary wells and soil borings will be completed using a GeoProbe direct push rig. Continuous soil samples will be collected from each location to record soil stratigraphy and to screen for organic vapors using a PID.

Field related activities (borings, well development, groundwater sampling, etc.) will be conducted following ENCORE Field Method Guidelines (FMG). Applicable ENCORE FMGs (Soil Borings, Well Construction Materials, Well Development and Groundwater Sampling, Soil Gas Surveys) can be found in Appendix A of the EOC Work Plan and Work Plan Addendum 1. All soil borings and monitoring well locations are approximate and will be located based on actual field conditions.

3.1 INDOOR AIR PATHWAY- PAOC 19

3.1.1 SOIL GAS EVALUATION

To investigate the potential for VOCs to volatilize from groundwater to soil gas within the unsaturated overburden, the installation of eight permanent soil gas probes beneath the northeast corner of the Haulaway Building will be completed (Figure 3.1). The probes will be installed at two depths, 5 to 6 ft bgs (GP19-01D through GP19-04D) and directly below the concrete slab (GP19-01S through GP19-04S).

The deeper soil gas probes (5 to 6 feet bgs) will be installed using the Geoprobe dual tube sampling system (a direct push method) to advance a borehole six-inches into the clay-confining unit. The dual tube sampling system consists of first advancing a 2½-inch ID inner sampling casing followed by advancing a 3½-inch ID outer casing. The outer casing will cut away disturbed soil immediately surrounding the borehole left by the inner probe. The outer casing will create reduced soil disturbance itself due to the inner probe having already been advanced. The inner casing will be advanced six-inches into the confining unit to evaluate the presence of free product above the clay unit and to collect soil samples above the water table. This borehole will be filled with cement grout to an approximately depth of 6 feet bgs. The outer casing will then be used to cut away the disturbed soil to a depth of 6 feet bgs, where the soil probe will be installed. It is anticipated that using the dual tube system will result in a minimum amount of soil disturbance around the borehole annulus. The soil gas probes will be constructed of ½-inch ID polyethylene tubing. The screened interval for each soil gas probe will be 1 foot in length and will be set at the approximately 5 to 6 feet bgs. A typical soil gas probe construction detail is presented on Figure 3.2.

The shallow or sub-slab probes will be installed using a rotary hammer drill (or other appropriate portable drill). A shallow outer hole, approximately 7/8-inch inches diameter, will be created using the drill. A smaller diameter inner hole (5/16-inches in diameter) will be drilled within the outer hole through the concrete slab and approximately 3-inches into the sub-slab material. The sub-slab probes will be constructed from small diameter brass or stainless steel tubing and compression fittings. A cement grout that expands upon drying will be used to seal between the probe and the outer hole. A typical sub-slab probe construction is presented on Figure 3.3.

A monitoring well will be installed adjacent to soil gas probe GP19-04 to correlate groundwater and soil gas concentrations. The remaining three soil gas probes will be installed adjacent to existing monitoring wells. Soil samples will be collected from each three foot interval from ground surface to the water table at the boreholes used to install the soil gas probes (or adjacent monitoring well) to evaluate soil impacts. These samples will be analyzed for TCL VOCs, TCL semi volatile organic compounds (SVOCs), and Site target analyte list (TAL) metals. An additional TCL VOC soil sample will be collected from the 5 to 6 foot bgs interval, as this is where the screen will be installed for the soil gas probes. These results will be used to correlate soil and soil gas concentrations.

Soil samples will be collected at each soil gas probe location for the analyses of the soil physical properties of moisture content, dry bulk density, grain size analyses, and fraction of organic carbon content. Where more than one overburden soil type is observed at a specific location, a soil sample will be collected from each soil type. The soil physical properties will be applied in a Site-specific modeling analysis of the vapor intrusion pathway.

The soil gas probe sampling will be completed one week following the installation of the soil gas probes. Following soil gas probe installation, one week is considered to provide sufficient time for any formation disturbances created by drilling activities to dissipate and for equilibrium conditions to be reestablished in the unsaturated zone.

The soil gas samples will be collected using 6-liter capacity Summa™ canisters fitted with a laboratory calibrated critical orifice flow regulation device sized to allow the collection of the soil gas sample over a 1-hour sample collection time. The 1-hour sample collection time for a 6-litre capacity Summa™ canister corresponds to a maximum soil gas sample collection flow rate of approximately 200 milliliters per minute (ml/min). This soil gas sample collection flow rate corresponds to the maximum flow rate recommended in the soil gas sampling protocol recently developed by the California Environmental Protection Agency (CAEPA) (CAEPA, 2003). A maximum flow rate of 200 ml/min is recommended to limit VOC stripping from soil, prevent the short-circuiting of ambient air from ground surface that would dilute the soil gas sample, and increase confidence regarding the location from which the soil gas sample is obtained. The low flow rate of 200 ml/min provides the most representative sample of in-situ conditions. Prior to sample collection, soil gas probe purging will be conducted at a maximum flow rate of 200 ml/min. Two soil gas probe volumes (calculated based on casing and sand pack volume) will be purged to remove potentially stagnant air from the internal volume of the soil gas probe and ensure that soil gas representative of the formation is drawn into the soil gas probe.

Quality control/quality assurance (QA/QC) measures implemented during the soil gas sampling event will include maintaining a minimum negative pressure in the Summa™ canisters following sample collection, collection of one field duplicate sample, collection of an ambient air sample (outside), and the analysis of a trip blank Summa™ canister.

The barometric pressure will be documented at the time of sampling. Appendix B presents additional soil gas sampling protocol.

Groundwater samples will be collected from the monitoring wells adjacent to the soil gas probes each time a soil gas sample is collected from the probes. It is currently estimated that two rounds of sampling will be required. The first round of groundwater samples will be analyzed for TCL VOCs, TCL SVOCs, and Site TAL metals. Subsequent rounds of samples will only be analyzed for TCL VOCs, unless the previous analytical results indicate that other constituents are a concern.

3.1.2 ADDITIONAL SOURCE IDENTIFICATION

Based on preliminary soil gas results previously collected at the Site, additional impacts including soil and/or DNAPL may also be present in this area causing the elevated soil gas VOC concentrations. Regular groundwater monitoring in Injection Area 1 has shown elevated levels of CVOCs in groundwater including concentrations of vinyl chloride, cis-1,2-DCE and TCE at concentrations greater than 1% of their solubility in water. At these concentrations the presence of DNAPL is a possibility, but does not definitively indicate that DNAPL is present.

To evaluate the presence of free product and soil impacts in this area a membrane interface probe (MIP) will be used. The MIP is a screening tool with semi-quantitative capabilities that acts as in interface between volatile contaminants in the subsurface and gas-phase detectors at the surface. The block at the leading edge of the probe is heated to approximately 100-120 degrees C to accelerate diffusion of the contaminates through the membrane, where a carrier gas transports the contaminants to the detectors at ground surface. An electron capture detector (ECD) will be used to detect chlorinated contaminants (TCE, PCE). The detector information and the electrical conductivity of the soil are graphed by field instrumentation, which allows determination of depth and relative concentration of the contaminants. A Geoprobe advances the MIP at approximately 1-foot per minute to the desired depth (6 to 12-inches into the clay confining unit). Figure 3.1 presents the proposed MIP soil boring locations.

Soil borings will be advanced with the GeoProbe adjacent to the MIP borings to visually evaluate the material placed in the historical pits. The soil borings will be completed at least 6 inches in the sand clay interface and this interface will be visually examined for the presence of DNAPL (with the use of Sudan IV or other shake tests). Soil samples will be collected for laboratory analysis for TCL VOCs, TCL SVOCs, Site TAL metals and total polychlorinated biphenyls (PCBs) from the soil boring completed adjacent to the MIP boring with the highest detections of VOCs. Samples will be collected from each three-foot interval from ground surface to the water table.

Soil borings completed for the installation of the PAOC 19 gas probes (Section 3.1.1) and for the PAOC 23 investigation (Section 3.2.2) will be used to evaluate the presence of additional sources.

If the presence of DNAPL is detected using the MIP or visual examination of the sand-clay interface, the closest injection well will be checked for DNAPL. The injection wells were not constructed for the purpose of evaluating the presence of DNAPL; therefore, the sand pack around and below the screen may contain DNAPL but it may not enter the well. If these depths (DNAPL observed in borehole and bottom of injection well) do not correspond, then the borehole will be completed as a monitoring well with a 6-inch sump installed into the clay to allow DNAPL to accumulate, if present. If DNAPL is encountered, a sample will be collected for chemical analysis (TCL VOCs, TCL SVOCs, Site TAL metals and total PCBs), fingerprinting and physical properties analysis (specific gravity, viscosity, and flashpoint).

Table 3.1 summarizes the soil analyses to be conducted on samples from each location. Table 3.2 summarizes the soil gas analysis to be conducted from each location. Table 3.3 summarizes the NAPL analysis to be completed if NAPL is encountered. Table 3.4 summarizes the groundwater analyses to be conducted on samples from each location.

3.2 BURIED WASTE MATERIAL AND DEBRIS

3.2.1 ADDITIONAL GEOPHYSICAL SURVEYS

Additional geophysical surveys (EM and electrical resistivity) will be conducted in several areas to determine if buried metal objects are present. Figure 2.3 summarizes where geophysical surveys have been completed on-Site and where the additional surveys are proposed. The EM surveys will be conducted over the pits identified in the 1949 (PAOC 23) and 1952 (PAOC 24) aerial photographs, the area south of the PAOC 18 sheet pile wall that was not previously completed and additional areas west of the catwalks along the northern fence line. An electrical resistivity survey will be conducted along the southern property boundary outside the property fence to evaluate potential groundwater migration pathways to the south.

3.2.2 SOIL BORING INVESTIGATION ACTIVITIES

Four soil borings will be advanced in each of the two areas where pits were identified in the 1949 and 1952 aerial photograph review, PAOCs 23 and 24, respectively. The borings will be completed to evaluate soil conditions within this area. Figure 3.1 presents the approximate locations of the soil borings.

At each of the proposed soil boring locations in PAOC 23 (SB23-01 through SB23-04) and PAOC 24 (SB24-01 through SB24-04), two borings will be completed. In one boring MIP will be used to collect VOC data, while the second will be used to determine what if any buried debris is present.

Based on the results of the MIP, soil samples will be collected from the borehole adjacent to the MIP boring in each PAOC with the highest detections of VOCs. The soil boring will be completed at least 6 inches in the sand clay interface and this interface will be visually examined for the presence of DNAPL. Soil samples will be collected and analyzed for TCL VOCs, TCL SVOCs, Site TAL metals and total PCBs from each three-foot interval from ground surface to the water table.

If the presence of NAPL is detected in the PAOC 23 borings, the procedure described in Section 3.1.2 involving checking the closest injection well for DNAPL will be followed. If DNAPL or LNAPL is encountered in PAOC 24 borings, a well will be installed to define thickness and confirm the presence of NAPL. If NAPL is encountered, a sample will be collected for chemical analysis (TCL VOCs, TCL SVOCs, Site TAL metals and total PCBs), fingerprinting and physical properties analysis (specific gravity, viscosity, flashpoint, and/or heating value).

Table 3.1 summarizes the environmental analyses to be conducted on samples from each soil boring. Table 3.3 summarizes the NAPL analysis to be completed if NAPL is encountered.

3.2.3 TEST PITTING ACTIVITES

Several weak to strong metal detection responses were observed during the EM surveys both east and west of the catwalks (Figure 2.3). Test pits will be conducted in these areas to determine what produced the metal detection response.

If required, following the test pits conducted to evaluate the metal detection responses, additional test pits will be completed to delineate the buried refuse and debris surrounding PAOC 18. The test pit locations will be selected following the observations of buried debris made during the test pits completed at the EM survey locations. The additional test pits will be initiated in areas believed to be free of buried debris and refuse and move towards the refuse to see where the refuse ends.

Soil will be stockpiled on visqueen as it is removed from the test pit. Visually clean soils will be used to backfill the test pits. Debris and stained soils will be transferred to roll off boxes. Excavated soils from different areas (i.e. PAOC 18 vs. west of the catwalks) will be segregated into different roll off boxes. Any excavated drums will be placed in over packs and their contents sampled for disposal.

If the EM surveys proposed in Section 2.3.1 indicate additional anomalies, test pits will be conducted in these areas to determine the cause of the metal detection.

3.3 NAPL DELINEATION

As discussed in Section 2.2.2, DNAPL may be collecting in low spots or bowls in the top of clay surface. Five soil borings (SB18-199 through SB18-203) will be completed to evaluate the presence of DNAPL using MIP. If the MIP indicates a significant amount of elevated VOCs above the clay layer a monitoring well will be installed to evaluate DNAPL thickness and characteristics. Figure 3.4 presents the locations where additional MIP soil borings will be installed to evaluate the presence of DNAPL in PAOC 18.

If DNAPL is observed in a new well not located directly adjacent to the wells that DNAPL has been previously observed in (MW18-01 through MW18-04, and PZ-130) or the DNAPL is visually different, a sample of the DNAPL will be collected for fingerprint and chemical analysis. If LNAPL is encountered in new or existing wells in sufficient volume to collect a sample a sample will be collected for laboratory analysis.

Table 3.3 summarizes the NAPL analysis to be conducted if encountered.

3.4 GROUNDWATER MONITORING

The groundwater at the Site is impacted with VOCs. Additional groundwater monitoring points will be installed to monitor groundwater levels and concentrations at the Site. Figure 3.4 presents the locations of damaged wells and proposed sampling locations in PAOC 18. Table 3.4 summarizes the groundwater analyses to be conducted on samples from each location.

3.4.1 PAOC 18 GROUNDWATER

Several piezometers were unavoidably damaged during the installation of the sheet pile wall in PAOC 18. If the existing piezometers cannot be repaired they will be abandoned and replacement piezometers will be installed to monitor groundwater levels within and around the sheet pile wall.

Well GS-5 is located within the sheet pile wall and no longer reflects groundwater venting to surface water conditions. Accordingly, groundwater VOC concentrations reflecting GSI conditions will be assessed by two new wells, GS-6, which will be installed on the west side of the sheet pile wall, and PZ18-195, which is located on the east side. In addition IW-45 and PZ18-131, located at the end of each wing wall will be used to monitor ground water levels inside and around the sheet pile wall so groundwater flow can be determined.

Select wells within PAOC 18 will be sampled to evaluate groundwater conditions inside the sheet pile wall. These samples will be analyzed for TCL VOCs, TCL SVOCs, Site TAL metals, and total PCBs. If a well has a detectable layer of NAPL, a groundwater sample will not be collected.

Table 3.4 summarizes the groundwater analyses to be conducted on samples from each location.

3.4.2 PAOC 19 GROUNDWATER – SOUTHERN BOUNDARY

Groundwater concentrations of VOCs along the southern property boundary of the Site exceed generic Part 201 criteria including GSI criteria. The Fons landfill, located directly south of the Site, has a clay wall surrounding the landfill. Based on groundwater flow observations, it appears groundwater along the southern portion of the Site flows south towards the Fons Landfill and is anticipated to then flow east along the clay wall towards Willow Run Creek downstream of the Tyler Pond dam. To evaluate compliance with Part 201 GSI criteria a GSI well (GS-7) will be installed south of the Tyler Pond dam, east of the Fons landfill. Figure 3.5 presents the location of GS-7.

Groundwater elevation monitoring completed bimonthly during the 2004 calendar year indicated that groundwater flows northeast towards Tyler Pond and south to southeast towards Tyler Road. Groundwater concentrations also indicate that there may be a preferential pathway along the southern property boundary. An electrical resistivity survey will be conducted along the outside of the CVO fence line to evaluate the conductivity of the subsurface along the southern boundary (Figure 2.3).

Table 3.4 summarizes the groundwater analyses to be conducted on samples from each location.

4.0 SCHEDULE

The work described in this Work Plan Addendum 2 will be completed by the end of the third quarter of 2005.

5.0 REFERENCES

BBL. October 1997. Description of Existing Conditions Report, Former Willow Run Assembly Plant Property, Ypsilanti, Michigan.

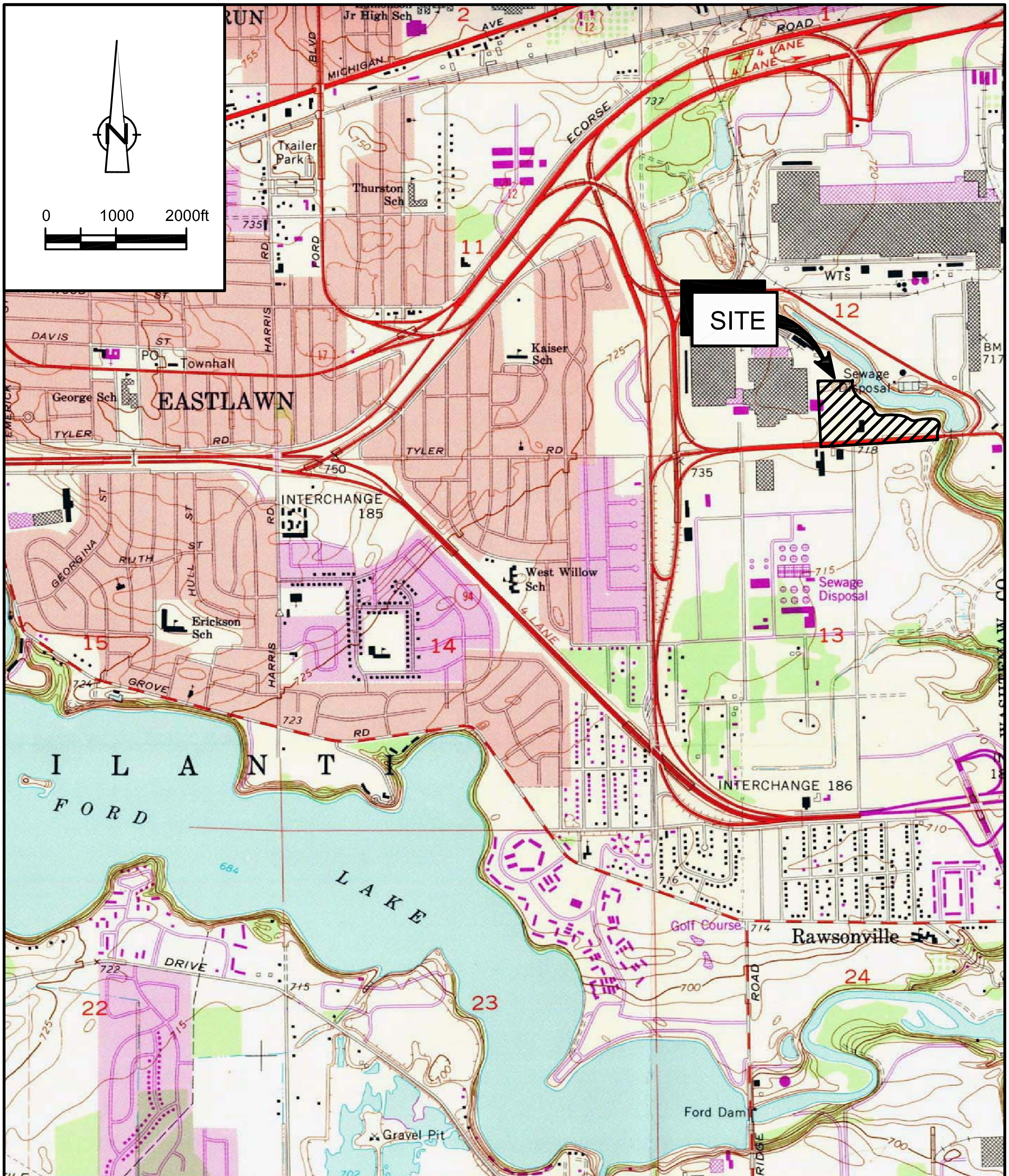
CAEPA, 2003. Advisory – Active Soil Gas Investigations, Department of Toxic Substances Control, January 28, 2003.

CRA. October 2003. Supplemental Phase III Extent of Contamination (EOC) Work Plan, Former Willow Run Assembly Plant Property, Ypsilanti, Michigan.

CRA. April 2004. Supplemental Phase III EOC Work Plan, Addendum No. 1, Former Willow Run Assembly Plant Property, Ypsilanti, Michigan.

CRA. November 8, 2004. DNAPL Delineation at PAOC 18 Memorandum.

CRA. January 2005. Construction Completion Report, PAOC 18 Interim Response Actions, Company Vehicle Operations Area, Ypsilanti, Michigan.

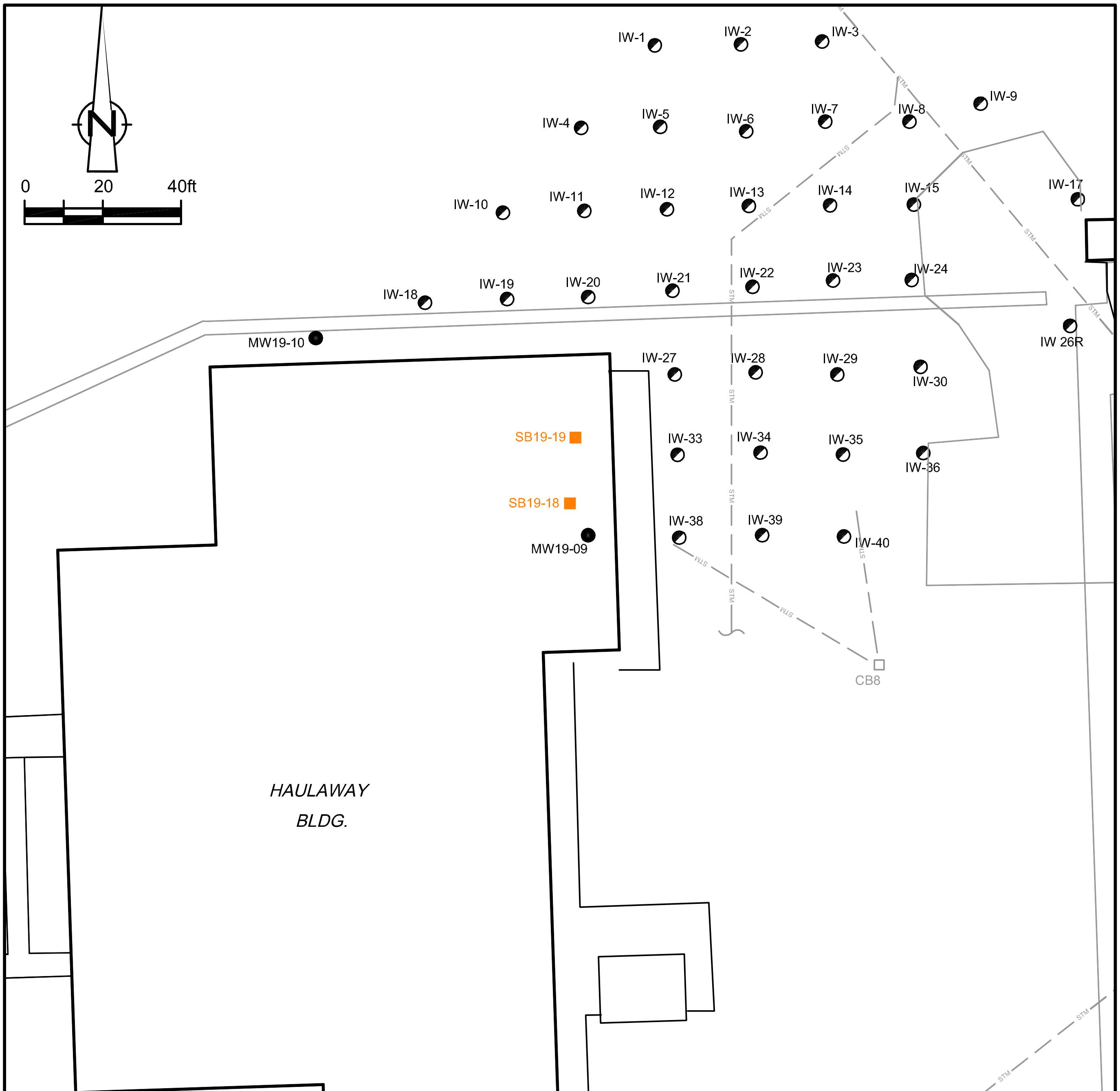


SOURCE: USGS QUADRANGLE MAP;
YPSILANTI EAST, MICHIGAN

figure 1.1

SITE LOCATION
EOC WORK PLAN - ADDENDUM NO. 2
COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan

17303-04(010)GN-WA009 FEB 08/2005



LEGEND

FENCE LINE

SB19-18 SOIL GAS SAMPLING LOCATION

MW19-18 PHASE III EOC MONITORING WELL

IW-52 INJECTION WELL LOCATION

STORM SEWER

CB8 CATCH BASIN

PAVEMENT VARIATION

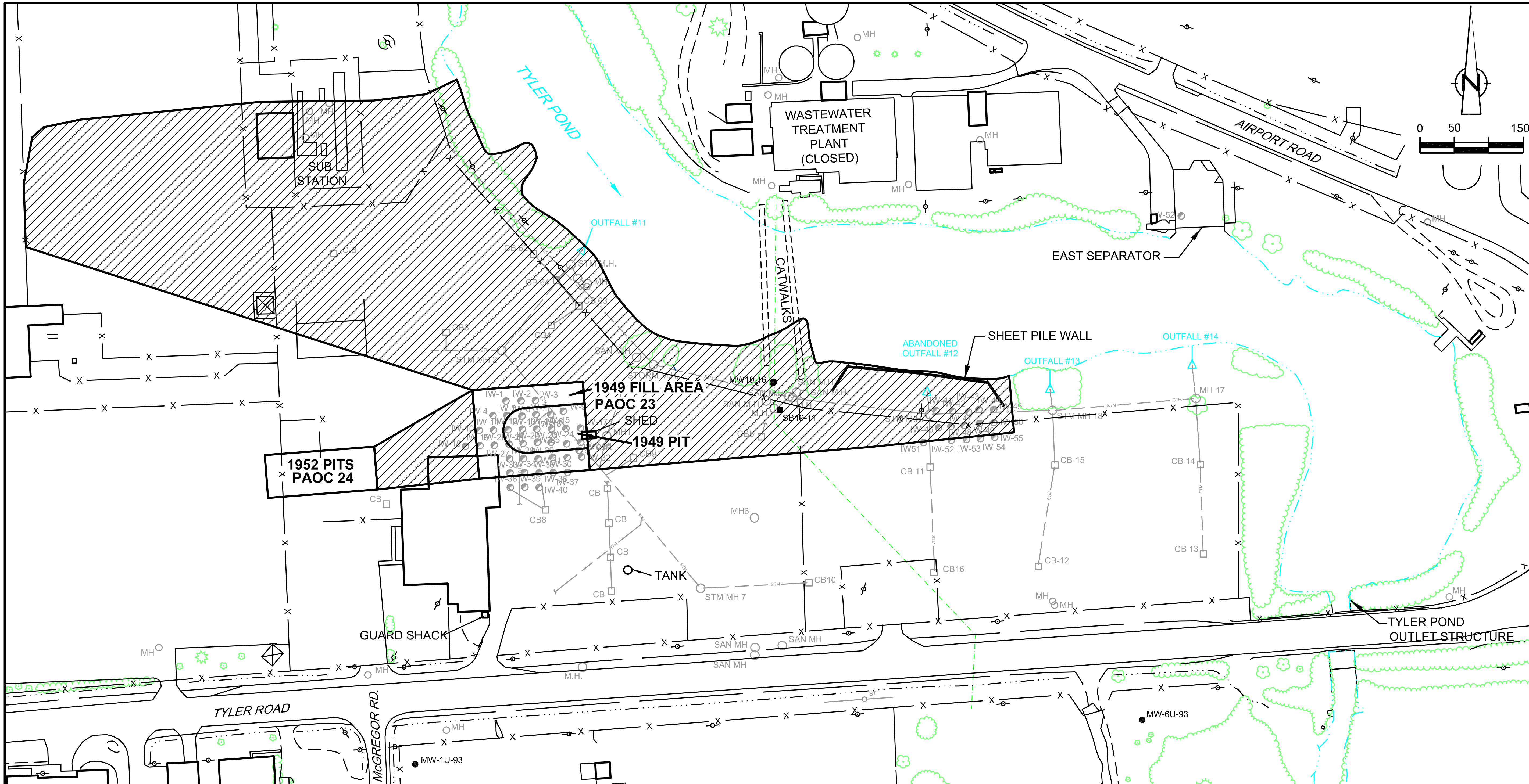
R.S. FENCE GATE POST

LOCATION UNKNOWN BEYOND THIS POINT

figure 2.1

PAOC 19 SOIL GAS SAMPLING LOCATIONS
EOC WORK PLAN - ADDENDUM No. 2
COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan

17303-04(010)GN-WA016 FEB 08/2005



LEGEND

- DITCH, STREAM OR RIVER
- FENCE LINE (SURVEYED)
- FORMER SLUDGE LINE
- STORM SEWER
- PERMANENT SEWER PLUG
- FILLING ACTIVITIES/SOIL DISTURBANCES
- MANHOLE
- CATCHBASIN
- POWER POLE
- INJECTION WELL LOCATION
- VEGETATION
- TREE

figure 2.2

HISTORICAL FILL ACTIVITIES
EOC WORK PLAN - ADDENDUM No. 2
COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan

17303-04(010)GN-WA011 MAR 31/2005

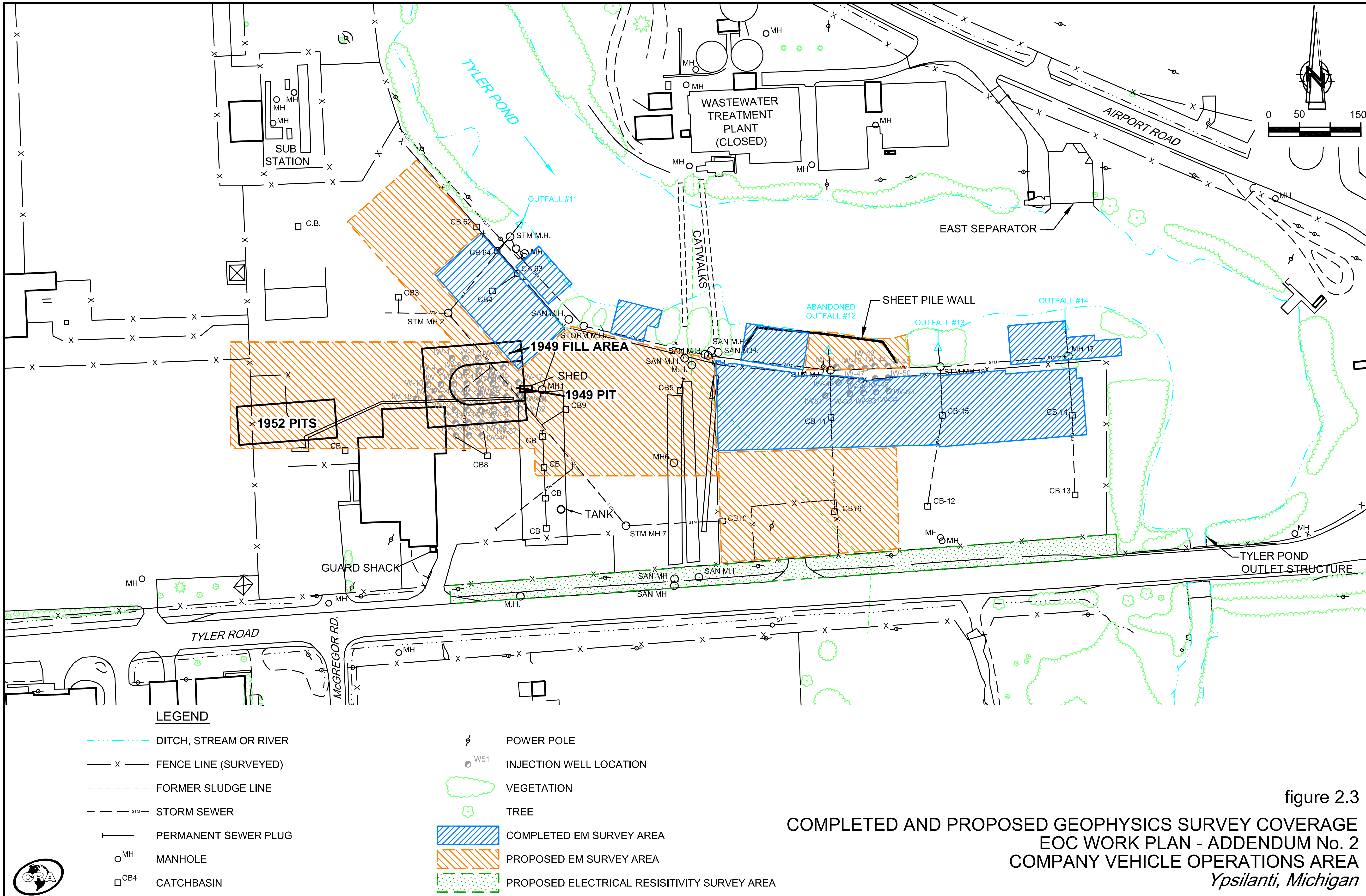
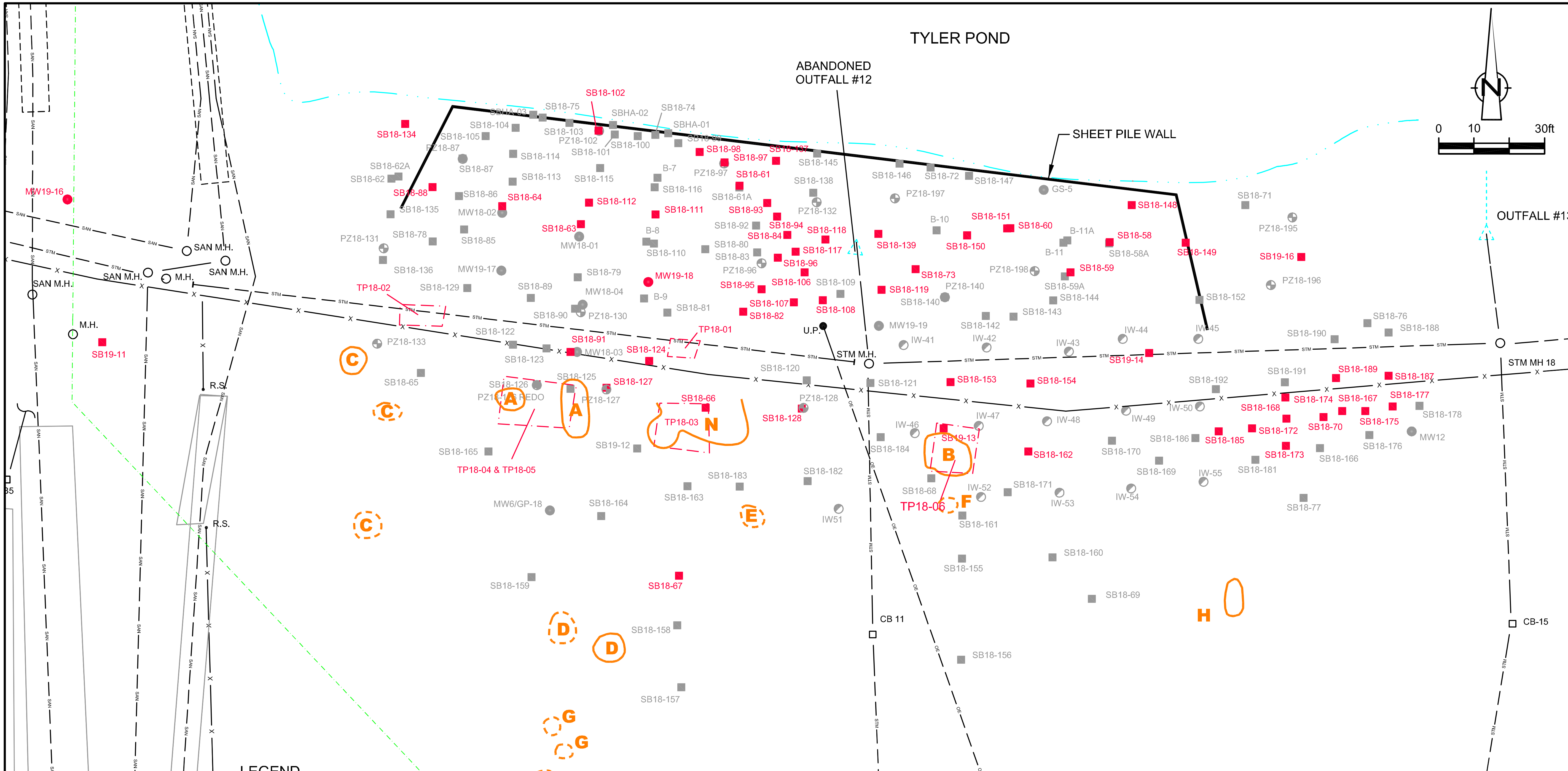


figure 2.3

COMPLETED AND PROPOSED GEOPHYSICS SURVEY COVERAGE
EOC WORK PLAN - ADDENDUM No. 2
COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan

17303-04(010)GN-WA013 MAR 31/2005



LEGEND

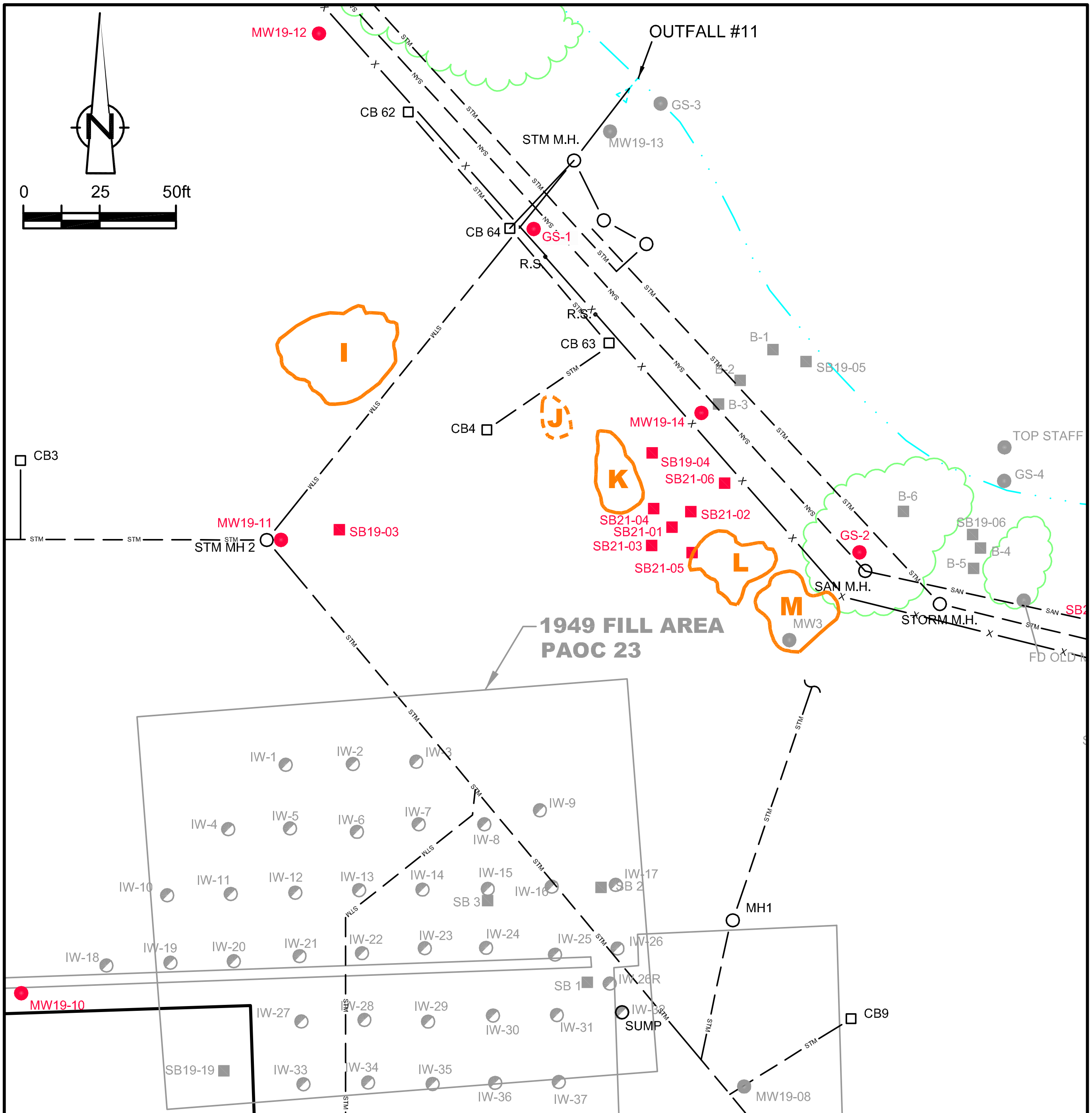
— · · —	DITCH, STREAM OR RIVER
——— x ———	FENCE LINE (SURVEYED)
- - - - -	FORMER SLUDGE LINE
— — — STM —	STORM SEWER
⊢———	PERMANENT SEWER PLUG
— — — SAN —	SANITARY SEWER
— — — OE —	OVERHEAD ELECTRICAL LINE
TP18-01	TEST PIT LOCATION DEBRIS OBSERVED
• R.S.	FENCE GATE POST (SURVEYED)
◯	STRONG METAL DETECTION RESPONSE
◌	WEAK TO MODERATE METAL DETECTION RESPONSE
N	METAL DETECTION ANOMALY IDENTIFIER
SB18-79 ■	SOIL BORINGS - DEBRIS OBSERVED
□ CB15	CATCH BASIN (SURVEYED)
○ MH18	MANHOLE (SURVEYED)
SB18-157 ■	DEBRIS NOT OBSERVED
MW19-19 ●	MONITORING WELL LOCATION
PZ18-128 ⊕	PIEZOMETER LOCATION
IW51 ⊘	INJECTION WELL LOCATION

CRA

figure 2.4

BURIED DEBRIS INVESTIGATION - PAOC 18
EOC WORK PLAN - ADDENDUM No. 2
COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan

17303-04(010)GN-WA012 APR 01/2005



LEGEND

DITCH, STREAM OR RIVER

FENCE LINE (SURVEYED)

TREE LINE

SB19-08 SOIL BORINGS WITH DEBRIS PRESENCE

SB1,B1 SOIL BORINGS WITH NO DEBRIS OBSERVED

MW8 MONITORING WELL LOCATION

GS-2 GROUNDWATER SURFACE WATER INTERFACE WELL

IW-52 INJECTION WELL LOCATION

SAN SANITARY SEWER

STM STORM SEWER SHOWN AS PER INVERTS FOUND BY FIELD OBSERVATIONS

CB15 CATCH BASIN

MH18 MANHOLE

R.S. FENCE GATE POST

LOCATION UNKNOWN BEYOND THIS POINT

STRONG METAL DETECTION RESPONSE

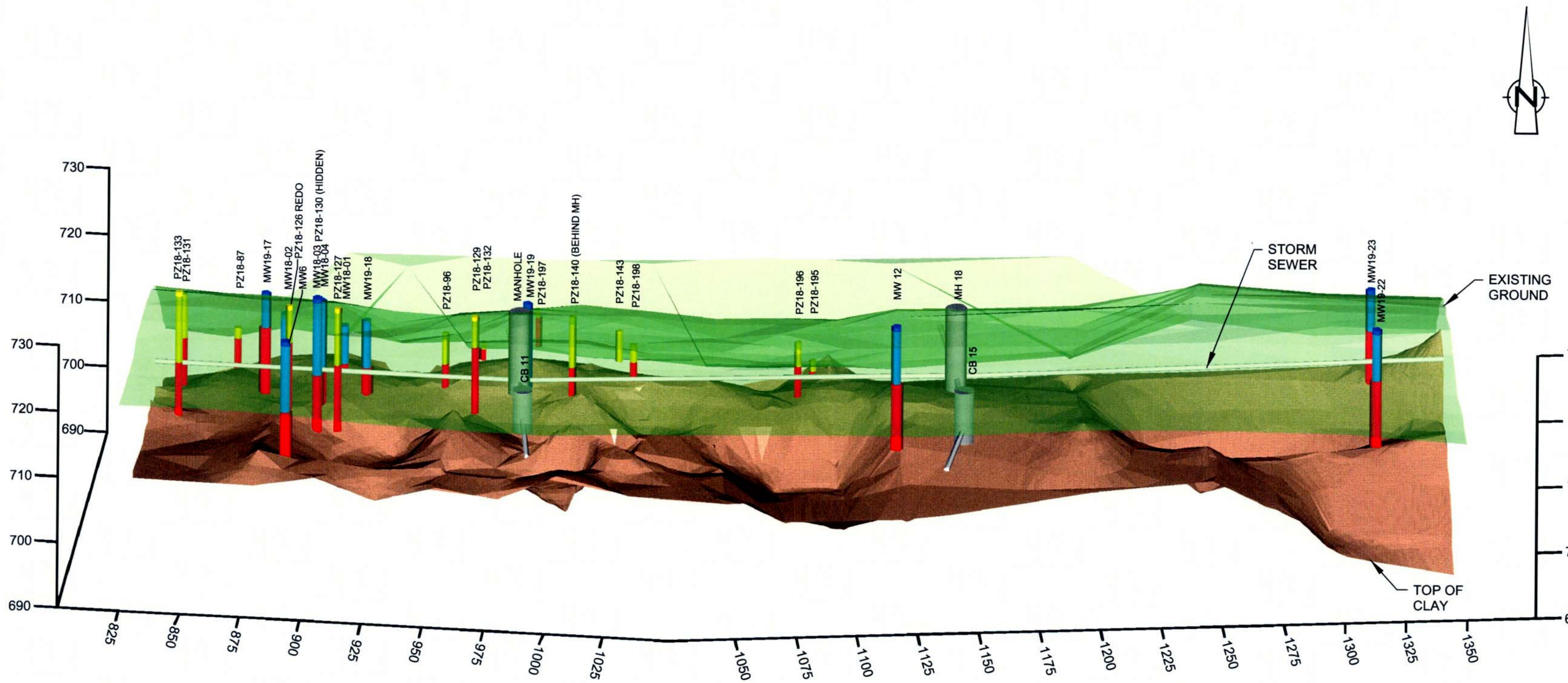
WEAK TO MODERATE METAL DETECTION RESPONSE

M METAL DETECTION ANOMALY IDENTIFIER

figure 2.5

BURIED DEBRIS INVESTIGATION - WEST
EOC WORK PLAN - ADDENDUM No. 2
COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan

17303-04(010)GN-WA014 MAR 31/2005



LEGEND

MONITORING WELL

PIZEOMETER

CATCHBASIN

STORM SEWER

EXISTING GROUND

TOP OF CLAY

figure 2.6

PAOC 18 3-D VISUALIZATION - VIEW 1
EOC WORK PLAN - ADDENDUM No. 2
COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan

17303-04(010)GN-WA018 MAR 29/2005

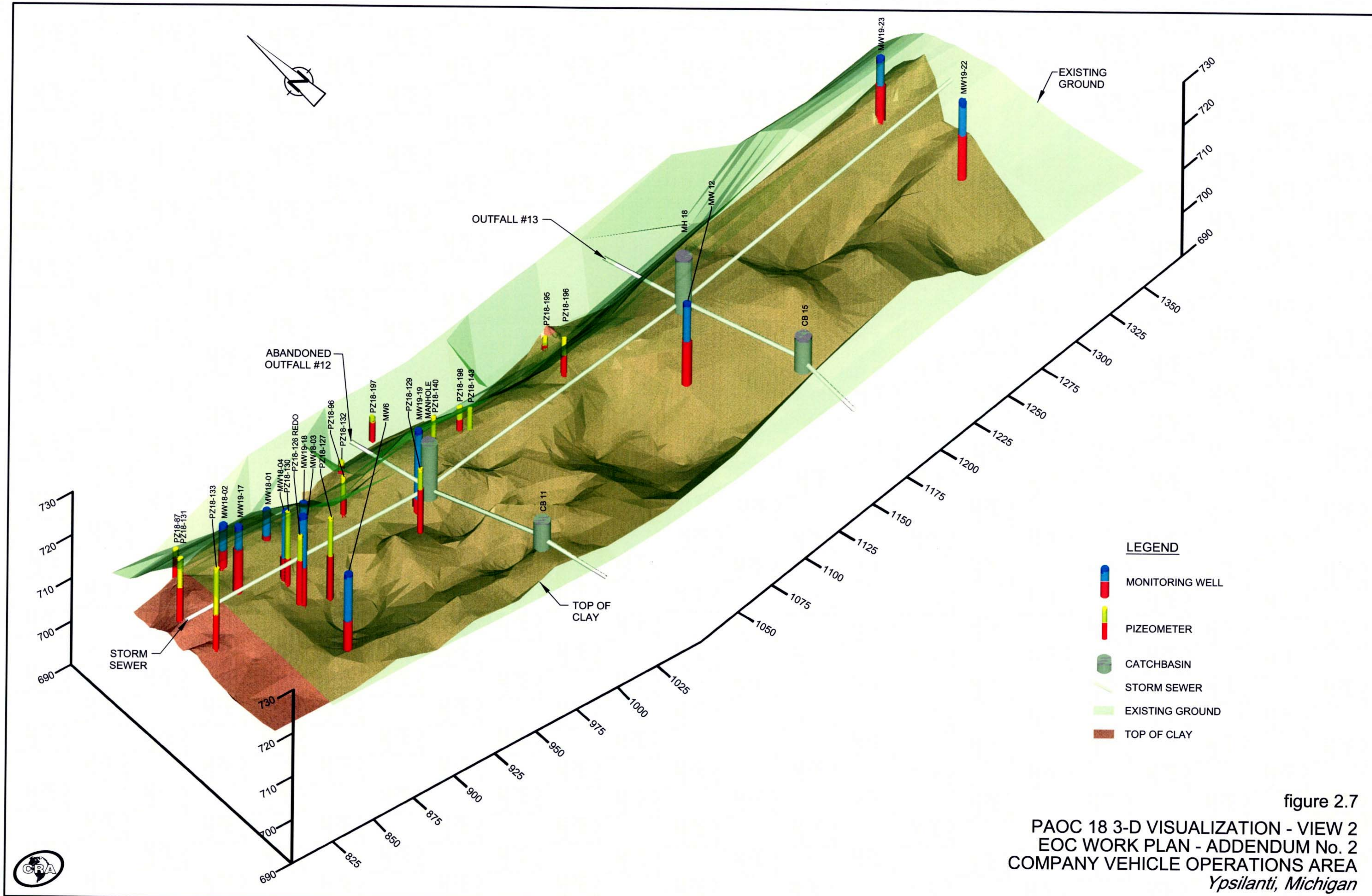
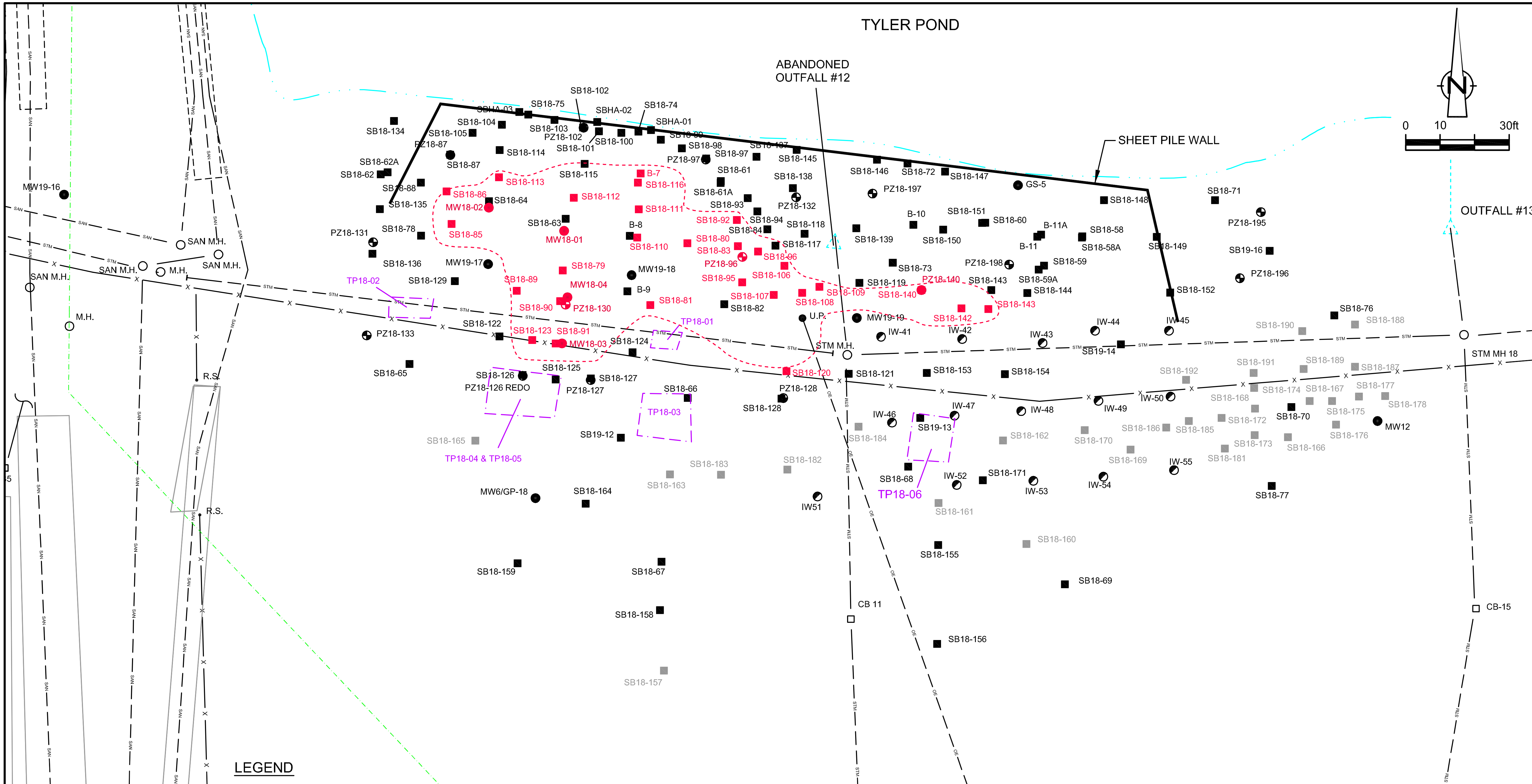


figure 2.7

PAOC 18 3-D VISUALIZATION - VIEW 2
EOC WORK PLAN - ADDENDUM No. 2
COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan

17303-04(010)GN-WA019 MAR 31/2005



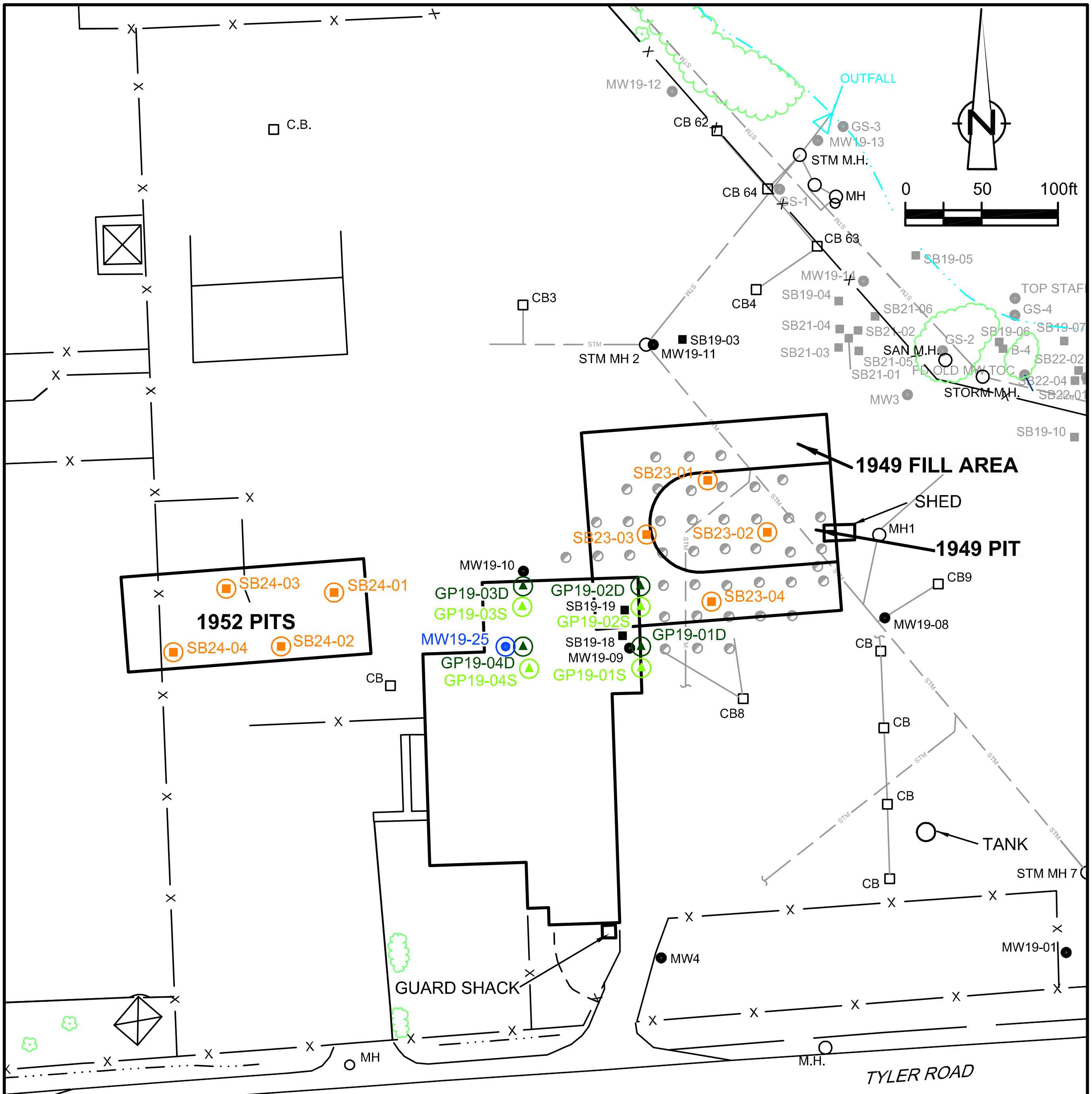
LEGEND

	DITCH, STREAM OR RIVER	TP18-01	TEST PIT LOCATION	SB18-79	SOIL BORINGS - DNAPL OBSERVED
X	FENCE LINE (SURVEYED)	CB15	CATCH BASIN (SURVEYED)	SB18-157	SOIL BORINGS - DNAPL INFORMATION UNAVAILABLE
	FORMER SLUDGE LINE	MH18	MANHOLE (SURVEYED)	SB18-158	SOIL BORINGS - NO DNAPL OBSERVED
STM	STORM SEWER	R.S.	FENCE GATE POST (SURVEYED)		
	PERMANENT SEWER PLUG	SB18-157	BOREHOLE LOCATION		
SAN	SANITARY SEWER	MW19-19	MONITORING WELL LOCATION		
OE	OVERHEAD ELECTRICAL LINE	PZ18-128	PIEZOMETER LOCATION		
	EXTENT OF DNAPL (DELINEATED BY SOIL BORINGS)	IW51	INJECTION WELL LOCATION		

figure 2.8

PAOC 18 DNAPL DELINEATION
EOC WORK PLAN - ADDENDUM No. 2
COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan

17303-04(010)GN-WA020 APR 01/2005



LEGEND

	DITCH, STREAM OR RIVER	MH	MANHOLE	MW19-25	PROPOSED MONITORING WELL LOCATION
X	FENCE LINE (SURVEYED)	CB4	CATCHBASIN	SB23-02	PROPOSED MIP BOREHOLE LOCATION
STM	STORM SEWER		INJECTION WELL LOCATION	GP19-01D	PROPOSED DEEP SOIL GAS PROBE LOCATION
	VEGETATION	SB19-18	BOREHOLE LOCATION	GP19-01S	PROPOSED SUB-SLAB VAPOR PROBE LOCATION
	TREE	MW19-09	MONITORING WELL LOCATION		

figure 3.1

PAOC 19, 23 and 24 SAMPLING LOCATIONS
EOC WORK PLAN - ADDENDUM No. 2
COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan

17303-04(010)GN-WA015 APR 08/2005

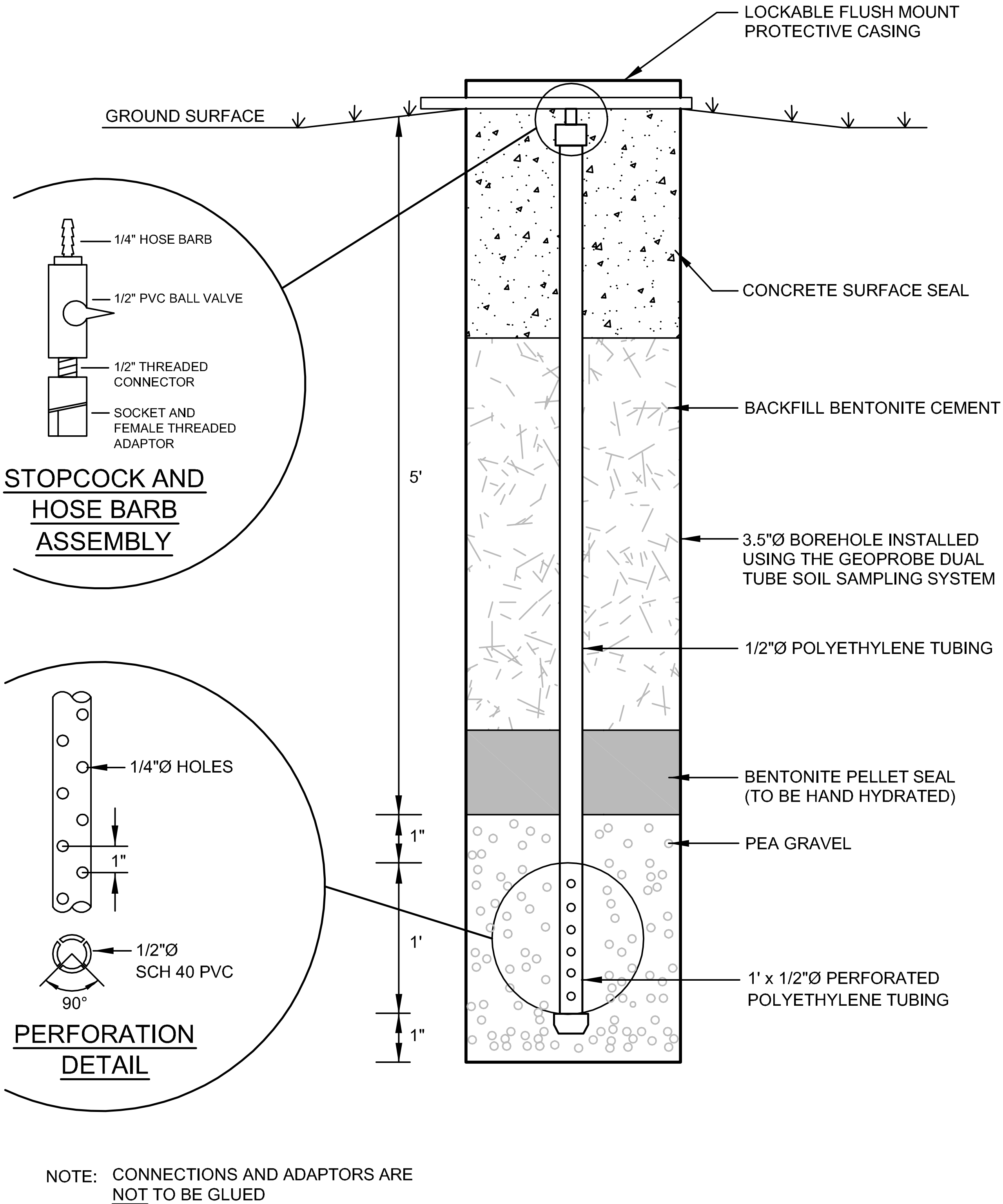


figure 3.2

TYPICAL SOIL VAPOR PROBE DETAIL
EOC WORK PLAN - ADDENDUM No. 2
COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan

17303-04(010)GN-WA010 FEB 08/2005

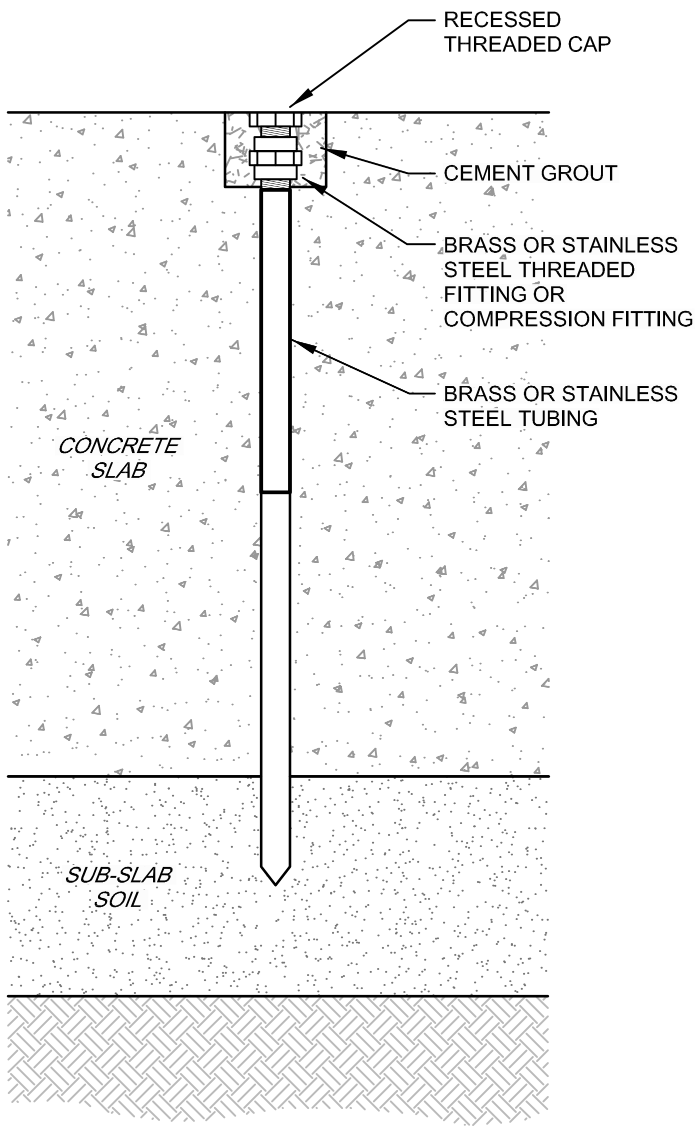
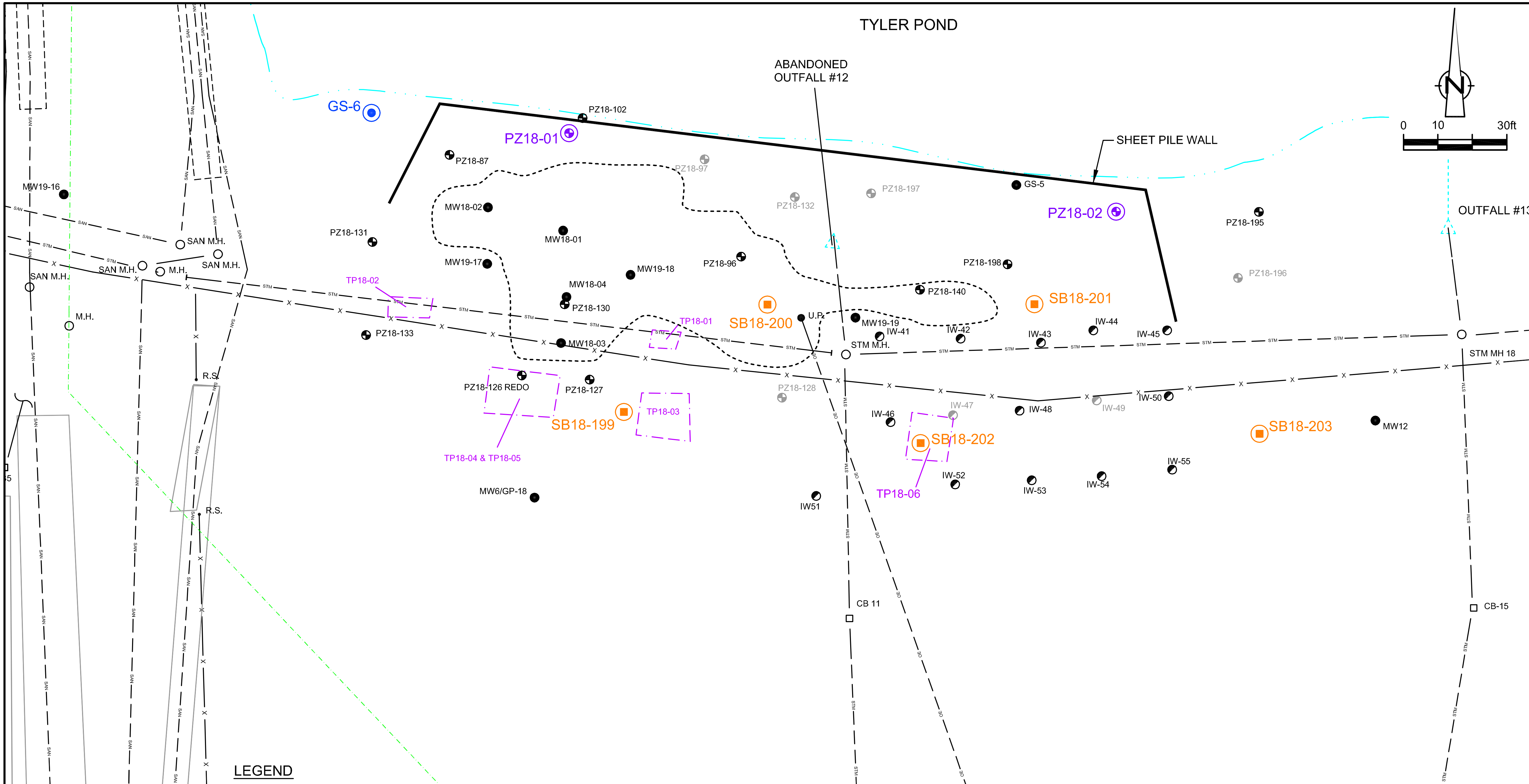


figure 3.3

TYPICAL SUB-SLAB VAPOR PROBE DETAIL
EOC WORK PLAN - ADDENDUM No. 2
COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan

CRA

17303-04(010)GN-WA022 APR 08/2005



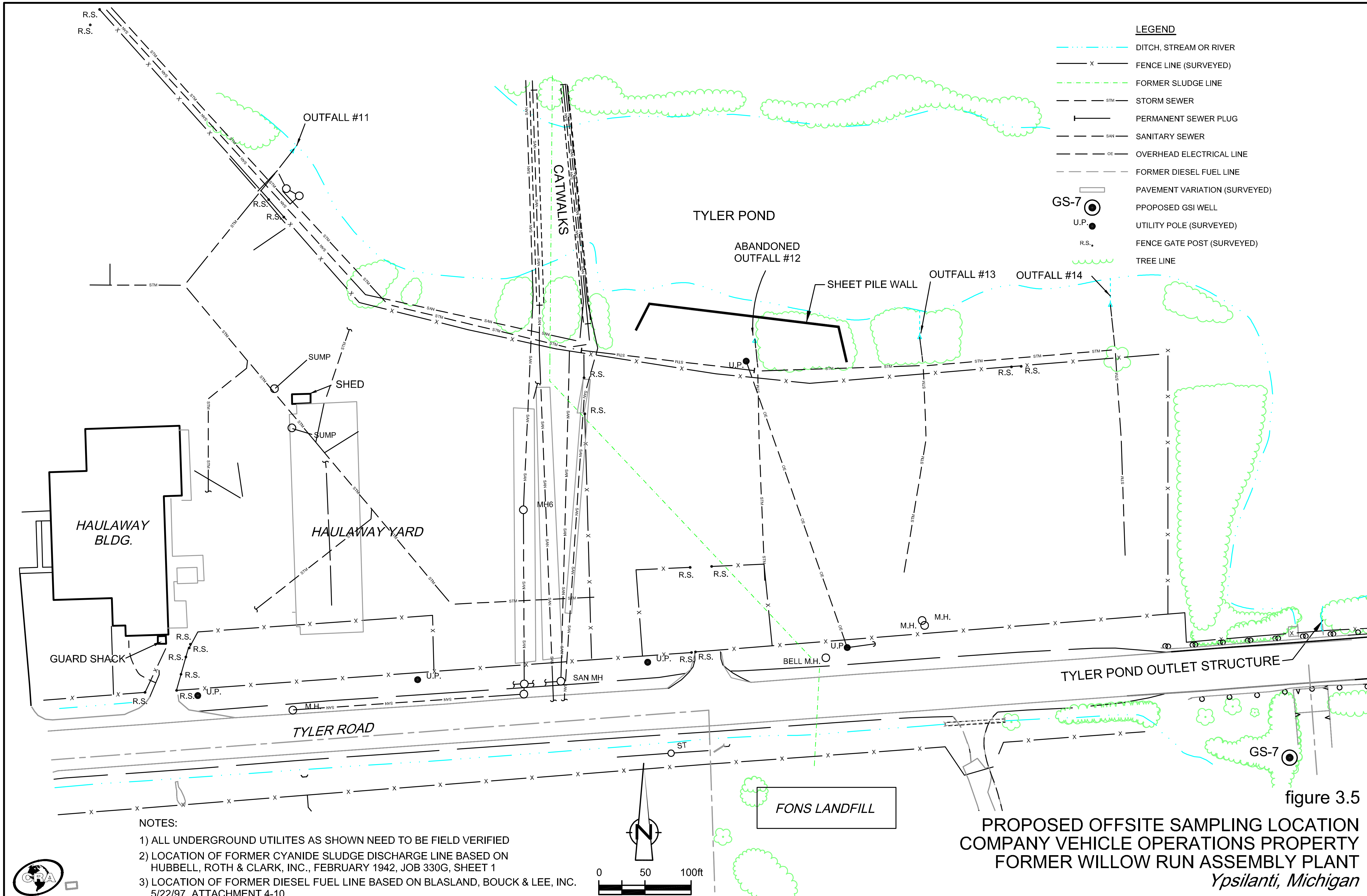
LEGEND

	DITCH, STREAM OR RIVER	TP18-01	TEST PIT LOCATION	PZ18-131	DAMAGED WELLS (MW/PW/IW/GS)
X	FENCE LINE (SURVEYED)	CB15	CATCH BASIN (SURVEYED)		PROPOSED MONITORING WELL LOCATION
	FORMER SLUDGE LINE	MH18	MANHOLE (SURVEYED)		PROPOSED MIP BORING LOCATION
STM	STORM SEWER	R.S.	FENCE GATE POST (SURVEYED)		PROPOSED PIEZOMETER LOCATION
	PERMANENT SEWER PLUG	MW19-19	MONITORING WELL LOCATION		
SAN	SANITARY SEWER	PZ18-128	PIEZOMETER LOCATION		
OE	OVERHEAD ELECTRICAL LINE	IW51	INJECTION LOCATION		
	EXTENT OF DNAPL (DELINEATED BY SOIL BORINGS)				

figure 3.4

PAOC 18 SAMPLING LOCATIONS
EOC WORK PLAN - ADDENDUM No. 2
COMPANY VEHICLE OPERATIONS AREA
Ypsilanti, Michigan

17303-04(010)GN-WA017 APR 11/2005



NOTES:

1) ALL UNDERGROUND UTILITES AS SHOWN NEED TO BE FIELD VERIFIED
2) LOCATION OF FORMER CYANIDE SLUDGE DISCHARGE LINE BASED ON HUBBELL, ROTH & CLARK, INC., FEBRUARY 1942, JOB 330G, SHEET 1
3) LOCATION OF FORMER DIESEL FUEL LINE BASED ON BLASLAND, BOUCK & LEE, INC. 5/22/97, ATTACHMENT 4-10

figure 3.5

PROPOSED OFFSITE SAMPLING LOCATION
COMPANY VEHICLE OPERATIONS PROPERTY
FORMER WILLOW RUN ASSEMBLY PLANT
Ypsilanti, Michigan

17303-04(010)GN-WA021 APR 08/2005

TABLE 3.1

SOIL SAMPLING PROGRAM
SUPPLEMENTAL PHASE III EOC WORK PLAN - ADDENDUM NO. 2
CVO AREA
YPSILANTI, MICHIGAN

Boring/Well Number	Target Depth	Environmental Parameters		Other Parameters		
		Sample Intervals[1] (feet bgs)	Chemical Analysis[2]	Sample Intervals (feet bgs)	Analysis	Sampling Reason
GP19-01	6" into clay	3-foot intervals to WT 5-6 feet bgs (screened zone)	TCL VOCs	One from each overburden soil type[3]	Moisture Content, dry bulk density, grain size analyses, and FOC	Indoor Air Evaluation
GP19-02	6" into clay	3-foot intervals to WT 5-6 feet bgs (screened zone)	TCL VOCs	One from each overburden soil type[3]	Moisture Content, dry bulk density, grain size analyses, and FOC	Indoor Air Evaluation
GP19-03	6" into clay	3-foot intervals to WT 5-6 feet bgs (screened zone)	TCL VOCs	One from each overburden soil type[3]	Moisture Content, dry bulk density, grain size analyses, and FOC	Indoor Air Evaluation
GP19-04	6" into clay	5-6 feet bgs (screened zone)	TCL VOCs	--	--	Indoor Air Evaluation
MW19-25	6" into clay	3-foot intervals to WT	TCL VOCs	One from each overburden soil type[3]	Moisture Content, dry bulk density, grain size analyses, and FOC	Indoor Air Evaluation
SB23-01	6" into clay	Continuous with MIP 3-foot intervals to WT[4]	MIP - VOCs [4]TCL VOCs, TCL SVOCs, Site TAL Metals, PCBs	--	--	PAOC 23 Investigation/ Add. PAOC 19 Source Identification
SB23-02	6" into clay	Continuous with MIP 3-foot intervals to WT[4]	MIP - VOCs [4]TCL VOCs, TCL SVOCs, Site TAL Metals, PCBs	--	--	PAOC 23 Investigation/ Add. PAOC 19 Source Identification
SB23-03	6" into clay	Continuous with MIP 3-foot intervals to WT[4]	MIP - VOCs [4]TCL VOCs, TCL SVOCs, Site TAL Metals, PCBs	--	--	PAOC 23 Investigation/ Add. PAOC 19 Source Identification
SB23-04	6" into clay	Continuous with MIP 3-foot intervals to WT[4]	MIP - VOCs [4]TCL VOCs, TCL SVOCs, Site TAL Metals, PCBs	--	--	PAOC 23 Investigation/ Add. PAOC 19 Source Identification
SB24-01	6" into clay	Continuous with MIP 3-foot intervals to WT[4]	MIP - VOCs [4]TCL VOCs, TCL SVOCs, Site TAL Metals, PCBs	--	--	PAOC 24 Investigation
SB24-02	6" into clay	Continuous with MIP 3-foot intervals to WT[4]	MIP - VOCs [4]TCL VOCs, TCL SVOCs, Site TAL Metals, PCBs	--	--	PAOC 24 Investigation
SB24-03	6" into clay	Continuous with MIP 3-foot intervals to WT[4]	MIP - VOCs [4]TCL VOCs, TCL SVOCs, Site TAL Metals, PCBs	--	--	PAOC 24 Investigation

TABLE 3.1

SOIL SAMPLING PROGRAM
SUPPLEMENTAL PHASE III EOC WORK PLAN - ADDENDUM NO. 2
CVO AREA
YPSILANTI, MICHIGAN

Boring/Well Number	Target Depth	Environmental Parameters		Other Parameters		
		Sample Intervals[1] (feet bgs)	Chemical Analysis[2]	Sample Intervals (feet bgs)	Analysis	Sampling Reason
SB24-04	6" into clay	Continuous with MIP 3-foot intervals to WT[4]	MIP - VOCs [4]TCL VOCs, TCL SVOCs, Site TAL Metals, PCBs	--	--	PAOC 24 Investigation
SB18-199	6" into clay	Continuous with MIP	MIP - VOCs	--	--	PAOC 18 DNAPL Investigation
SB18-200	6" into clay	Continuous with MIP	MIP - VOCs	--	--	PAOC 18 DNAPL Investigation
SB18-201	6" into clay	Continuous with MIP	MIP - VOCs	--	--	PAOC 18 DNAPL Investigation
SB18-202	6" into clay	Continuous with MIP	MIP - VOCs	--	--	PAOC 18 DNAPL Investigation
SB18-203	6" into clay	Continuous with MIP	MIP - VOCs	--	--	PAOC 18 DNAPL Investigation
PZ18-01	6" into clay	--	--	--	--	PAOC 18 GW Monitoring
PZ18-02	6" into clay	--	--	--	--	PAOC 18 GW Monitoring
GS-6	5' bgs	Field Observations[5]	TCL VOCs, TCL SVOCs, Site TAL Metals, PCBs	--	--	GSI Monitoring
GS-7	5' bgs	--	--	--	--	GSI Monitoring

Notes
bgs - below ground surface
WT - water table
FOC - fraction of organic carbon content
MIP - Membrane Interface Probe
[1] Additional samples may be collected at intervals where field observations indicate impacts (i.e. odours, staining, elevated PID readings).
[2] "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" SW846, 3rd Edition, updated November 1986

VOCs	U.S. EPA Method SW846-8260
SVOCs	U.S. EPA Method SW846-8270
PCBs	U.S. EPA Method SW846-8082
Site TAL Metals	U.S. EPA Method SW846-6000/7000 series

[3] Overburden Soil Types - sands, silts, gravel - all units greater than 1 foot thick
[4] Samples to be collected at boring adjacent to the MIP boring that indicated the highest detections for VOCs.
[5] Sample to be collected if field observations indicated impacts (i.e. staining, odours, elevated PID readings).

TABLE 3.2

SOIL GAS SAMPLING PROGRAM
SUPPLEMENTAL PHASE III EOC WORK PLAN - ADDENDUM NO. 2
CVO AREA
YPSILANTI, MICHIGAN

Boring/Well Number	Target Depth	Environmental Parameters		Sampling Frequency
		Sample Intervals (feet bgs)	Chemical Analysis[1]	
GP19-01S	3-inches below concrete	sub-slab	TCL VOCs	Twice[2]
GP19-02S	3-inches below concrete	sub-slab	TCL VOCs	Twice[2]
GP19-03S	3-inches below concrete	sub-slab	TCL VOCs	Twice[2]
GP19-04S	3-inches below concrete	sub-slab	TCL VOCs	Twice[2]
GP19-01D	6 feet beneath concrete	5-6 feet bgs	TCL VOCs	Twice[2]
GP19-02D	6 feet beneath concrete	5-6 feet bgs	TCL VOCs	Twice[2]
GP19-03D	6 feet beneath concrete	5-6 feet bgs	TCL VOCs	Twice[2]
GP19-04D	6 feet beneath concrete	5-6 feet bgs	TCL VOCs	Twice[2]

Notes
bgs - below ground surface
[1] "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" SW846, 3rd Edition, updated November 1986
VOCs U.S. EPA Method SW846-8260
[2] Samples will be collected at least one month apart and in conjunction with groundwater samples from adjacent wells.
QA/QC Samples will include the collection and analysis of one duplicate sample, one ambient air sample and one trip blank Summa™ canister.

TABLE 3.3

NAPL SAMPLING PROGRAM
SUPPLEMENTAL PHASE III EOC WORK PLAN - ADDENDUM NO. 2
CVO AREA
YPSILANTI, MICHIGAN

Area	NAPL Analysis[1]
PAOC 19/23	TCL VOCs, TCL SVOCs, Site TAL metals, Total PCBs; Fingerprinting; and Specific gravity, viscosity, and flashpoint.
PAOC 24 - DNAPL	TCL VOCs, TCL SVOCs, Site TAL metals, Total PCBs; Fingerprinting; and Specific gravity, viscosity, and flashpoint.
PAOC 24 - LNAPL	TCL VOCs, TCL SVOCs, Site TAL metals, Total PCBs; Fingerprinting; and Specific gravity, viscosity, and flashpoint.
PAOC 18 - DNAPL	TCL VOCs, TCL SVOCs, Site TAL metals, Total PCBs; Fingerprinting; and Specific gravity, viscosity, and flashpoint.
PAOC 18 - LNAPL	TCL VOCs, TCL SVOCs, Site TAL metals, Total PCBs; Fingerprinting; and Specific gravity, viscosity, and flashpoint.

Notes

[1] "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"
SW846, 3rd Edition, updated November 1986

VOCs	U.S. EPA Method SW846-8260
SVOCs	U.S. EPA Method SW846-8270
Site TAL Metals	U.S. EPA Method SW846-6000/7000 series

TABLE 3.4

GROUNDWATER SAMPLING PROGRAM
SUPPLEMENTAL PHASE III EOC WORK PLAN - ADDENDUM NO. 2
CVO AREA
YPSILANTI, MICHIGAN

Well Number	Groundwater Analysis[1]	Sampling Frequency	Sampling Reason
MW19-09	TCL VOCs, TCL SVOCs, Site TAL Metals, total PCBs	Initial with GP19-01	Indoor Air Evaluation
IW-20, 21 or 27[2]	TCL VOCs, TCL SVOCs, Site TAL Metals, total PCBs	Initial with GP19-02	Indoor Air Evaluation
MW19-10	TCL VOCs, TCL SVOCs, Site TAL Metals, total PCBs	Initial with GP19-03	Indoor Air Evaluation
MW19-25	TCL VOCs, TCL SVOCs, Site TAL Metals, total PCBs	Initial with GP19-04	Indoor Air Evaluation
MW19-09	TCL VOCs	Subsequent with GP19-01	Indoor Air Evaluation
IW-20, 21 or 27[2]	TCL VOCs	Subsequent with GP19-02	Indoor Air Evaluation
MW19-10	TCL VOCs	Subsequent with GP19-03	Indoor Air Evaluation
MW19-25	TCL VOCs	Subsequent with GP19-04	Indoor Air Evaluation
GS-6	TCL VOCs	Quarterly	GSI Monitoring
PZ18-195	TCL VOCs	Quarterly	GSI Monitoring
PZ18-131	TCL VOCs	Quarterly	PAOC 18 GW Monitoring
IW-45	TCL VOCs	Quarterly	PAOC 18 GW Monitoring
GS-7	TCL VOCs	Quarterly	GSI Monitoring

Notes

[1] "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"
SW846, 3rd Edition, updated November 1986

VOCs	U.S. EPA Method SW846-8260
SVOCs	U.S. EPA Method SW846-8270
Site TAL Metals	U.S. EPA Method SW846-6000/7000 series
PCBs	U.S. EPA Method SW846-8082

[2] The closest injection well to GP19-02 will be sampled. This will be determined once the probe is installed.
The exact location may change due to field conditions and underground utilities.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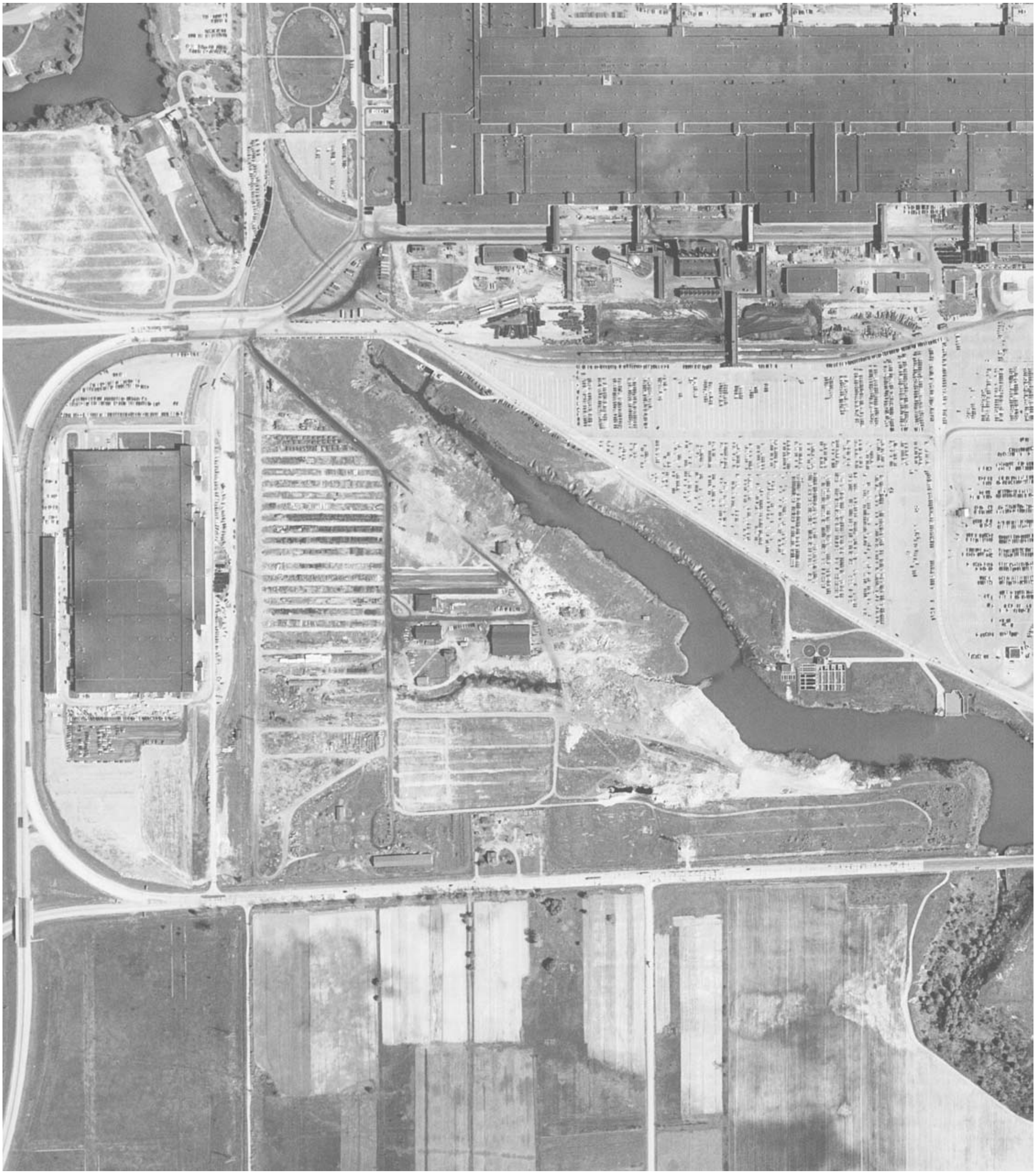

HISTORICAL INFORMATION GATHERERS, INC.

Ypsilanti, Michigan

1952	
HIG Project Number: MAE-2191	
Client Project Number: 17303	
Approximate Scale 1:6000 (1"=500')	

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1.0 INTRODUCTION

This attachment presents the soil gas sampling protocol to be implemented at the Company Vehicle Operations Area (Site) in Ypsilanti, Michigan. The Quality Assurance/Quality control (QA/QC) measures to be applied during the soil gas sampling are outlined. The soil gas sampling protocol outlined herein is based on the soil gas sampling protocol recently developed by the California Environmental Protection Agency (CAEPA) (CAEPA, 2003).

2.0 SOIL GAS PROBE SAMPLING PROTOCOL

A summary of the steps involved in the sampling protocol is presented below:

- Soil gas samples will be collected using 6-liter capacity Summa™ canisters to ensure that soil gas is drawn from the formation during sampling.
- The soil gas probes will be purged prior to sampling using personnel sampling pump complete with low flow valves calibrated using Buck flow calibrator (primary standard calibration method). The sampling system will be set for a flow rate slightly less than 200 millilitres per minute (mL/min) [at approximately the maximum soil gas sampling rate recommended by CAEPA (2003)].
- The purging will be conducted to remove minimum of two probe volumes (calculated considering the volume of the screened interval filter pack, with assumed sand porosity of 30 percent, and the probe casing volume).
- At the start and the end of the purging period, the total concentration of VOCs of the personnel sampling pump exhaust gas will be recorded with a portable photoionization detector (PID) to screen for the presence of volatile organic compounds (VOCs). After sample collection, the gas probe will be monitored for total VOC concentrations using the PID instrument. Typical PID instrument flow rates vary from approximately 300 mL/min to 500 mL/min (depending on manufacture and model), and as such, monitoring from gas probes will be minimized prior to sampling activities to reduce soil gas disturbances. PID readings will be recorded and entered in the field logbook and chain of custody as appropriate.
- Following purging, a 6-liter capacity Summa™ canister will be connected to the soil gas probe and opened to draw in a soil gas sample. At each gas probe, the Summa™ canister will be connected to the gas probe using Teflon tubing and gas tight fittings. New Teflon tubing will be used at each probe location.
- The 6-litre capacity Summa™ canisters will be fitted with a laboratory calibrated critical orifice flow regulation device sized to allow the collection of the soil gas sample over a 1-hour sample collection time. The 1-hour sample collection time for a 6-litre capacity Summa™ canister corresponds to a maximum soil gas sample collection flow rate of approximately 200 mL/min. This soil gas sample collection flow rate corresponds to the maximum flow rate recommended in the soil gas sampling protocol recently developed by the CAEPA (2003). A maximum flow rate of 200 mL/min is recommended to limit VOC stripping from soil, prevent the short-circuiting of ambient air from ground surface that would dilute the soil gas sample, and increase confidence regarding the location from which the soil gas sample is obtained. The low flow rate of 200 mL/min provides the most representative sample of in-situ conditions.

- To ensure some residual vacuum in each canister following sample collection, the canister pressure will be measured at approximately 50 minutes after start of sample collection using a vacuum gauge provided by the laboratory. A maximum residual vacuum of 10-inch mercury (Hg) is allowed. A canister residual vacuum above this value will require continued sampling until vacuum reading is below the threshold.
- The residual Summa™ canister vacuum will be measured and recorded. A minimum 1-inch Hg vacuum will be required for the sample to be considered valid, or the sampling will be repeated using a fresh Summa™ canister. Once the vacuum is measured, the safety cap will be securely tightened on the inlet of the Summa™ canister prior to shipment to the laboratory under chain of custody procedures.
- Vacuum gauge provided by laboratory will be returned with the canister samples to check residual vacuum in the laboratory prior to sample analysis and recorded on the analytical data report. This check will ensure sample integrity prior to laboratory analysis.
- All canisters will be pre-cleaned at the laboratory in accordance with the TO-14 method and documentation of the cleaning activities will be provided.
- The critical orifice flow regulation devices to be re-used during sampling will be cleaned in accordance with laboratory requirements by purging orifice with zero air (provided by laboratory) for minimum 45 seconds at minimum 75 psi.
- The canisters will be labeled noting the unique sample designation number, date, time, and sampler's initials. A bound field log book will be maintained to record all soil gas and air sample data.
- The canisters will be listed on the chain-of-custody in order of suspected highest to lowest impact and recorded PID readings. The laboratory analyzed the canisters Indicate on the chain-of-custody to the canisters in this order.

3.0 AMBIENT AIR SAMPLING

An ambient air sample will be collected from an upwind location outside the Haulaway Building away from any obvious potential emission sources such as automobiles, sewer vents, furnace vents, etc., to the extent practical. The ambient air sample will be collected as a grab sample with Summa™ canister intake valve opened slightly for a period of approximately 10 minutes to ensure canister sample is at atmospheric pressure at end of sampling period. Sample container will then be closed and canisters will be labeled noting the unique sample designation number, date, time, and sampler's initials. A bound field logbook will be maintained to record all sampling data.

4.0 QA/QC ACTIVITIES

The level of the quality assurance/quality control (QA/QC) effort will include:

- a field duplicate;
- a background ambient air sample; and
- a field blank.

Field blank and field duplicate samples will be analyzed to assess the quality of the data resulting from the field sampling program. Field blank will consist of unused Summa™ canister will be submitted to the analytical laboratory to provide the means to assess the quality of the data resulting from the field sampling program. Field blank sample will be analyzed to check for procedural contamination at the Site, which may cause sample contamination. Field duplicate sample will be analyzed to check for sampling and analytical reproducibility.

The level of QA/QC effort provided by the project laboratory for the samples analyses will correspond to the level of QA/QC effort specified in "The Determination of Volatile Organic Compounds in Ambient Air Using Summa™ Passivated Canister Sampling and Gas Chromatographic Analysis" (USEPA, 1988).

5.0 FIELD INSTRUMENTATION CALIBRATION

Sampling or monitoring equipment used in the soil gas sampling program to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specification and requirements. Field calibration of PID instrument will be carried out prior to sampling activities.

6.0 REFERENCES

CAEPA, 2003. Advisory – Active Soil Gas Investigations, Department of Toxic Substances Control, January 28.

USEPA, 1988. The Determination of Volatile Organic Compounds in Ambient Air Using Summa™ Passivated Canister Sampling and Gas Chromatographic Analysis, May.