AIR SPARGING AND SOIL VAPOR EXTRACTION SYSTEM DESIGN AND INSTALLATION WORK PLAN

FORMER HUCK MANUFACTURING FACILITY

KINGSTON, NEW YORK

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1 Introduction

1.1 GENERAL

On behalf of Federal-Mogul Corporation, WSP Engineering of New York, P.C. [1] (WSP Engineering) has prepared the following Air Sparging and Soil Vapor Extraction (AS/SVE) System Design and Installation Work Plan for the former Huck manufacturing facility (Site) in Kingston, New York. Figures 1 and 2 illustrate the site location and site layout, respectively. The proposed system design is based on the results of the AS/SVE pilot test performed in the Former Degreaser Area, which are summarized in the AS/SVE Pilot Test Report, dated July 23, 2010. In accordance with the pilot test report, the proposed system is designed to reduce volatile organic compound (VOC) mass in groundwater in the Former Degreaser Area, while addressing VOCs that may be present in overburden soils in this area. Furthermore, the SVE portion of the system will create a negative pressure below the building slab, which will mitigate the potential for vapor intrusion within the treatment area and, thus, improve indoor air quality. The Former Degreaser Area is one of two onsite source areas for VOCs in groundwater and is designated Area 1. The second groundwater source area is in the Former Metal Finish and Chemical Storage Area and is associated with affected soil in Area 7. Refer to Figure 2 for the locations of these areas at the site.

In addition to the Former Degreaser Area, WSP Engineering proposes to extend the AS/SVE system into four additional areas of the site where VOCs are present in soil at concentrations above the recommended soil cleanup objectives (SCOs), as presented in the New York State Department of Environmental Conservation's (NYSDEC) Technical and Administrative Guidance Memorandum (TAGM) 4046, dated January 1994. These areas are illustrated on Figure 2 and listed below:

- Area 2 – the Southern Parking Lot Area
- Area 3 – the Former 10,000-Gallon Fuel Oil Underground Storage Tank Area
- Area 4 – the southern portion of the Suspected Disposal Area
- Area 5 – the northern portion of the Suspected Disposal Area

The estimated horizontal extent of affected soil in Areas 1 and 2 is illustrated in Figure 3 and the estimated horizontal extent of affected soil in Areas 3, 4, and 5 is illustrated in Figure 4. In Areas 1, 3, and 4, where elevated VOC concentrations are present in soil near, or below, the groundwater surface, the proposed system includes the installation of AS wells to address VOCs that may be present in saturated soils and in groundwater in these areas.

The remaining two areas identified at the site, Area 6 and Area 7, are currently being addressed by other remedies. As illustrated in Figure 5, Area 6 consists of VOCs in shallow soil in the parking lot east of the main manufacturing building and Area 7 comprises two areas of deeper VOC-affected soil near soil borings SB-1 and SB-14. The soils in Area 7 are associated with the second onsite groundwater source area below the Former Metal Finish and Chemical Storage Area. In March 2004, a SVE system was installed primarily along the eastern and southern property lines as an interim remedial measure to address elevated VOC concentrations within Area 6 from 1 to 3 feet below ground surface (bgs) and to prevent the offsite migration of VOCs in soil gas (ESC Engineering 2004). The SVE system operated continuously until June 2008, when WSP Engineering began pulsing the system with approval from the NYSDEC. Treatment of soils in the eastern parking lot is ongoing. The VOC-affected soil in Area 7 is normally located several feet below the groundwater table and information collected to date

[1] WSP Engineering of New York, P.C. is an affiliate of WSP Environment & Energy LLC that is licensed to perform engineering in New York.

demonstrates that VOCs in groundwater below the Former Metal Finish and Chemical Storage Area are attenuating naturally; presumably in the form of biodegradation (WSP 2007; WSP Engineering 2009). Therefore, the Area 7 soils will be addressed by the ongoing biodegradation as VOCs partition from the soil into groundwater. The estimated horizontal extent of affected soil in Areas 6 and 7 is illustrated in Figure 5.

As described above, the installation and operation of the proposed AS/SVE system will address the groundwater source below the Former Degreaser Area (Area 1) in addition to all remaining areas of the site where VOCs have been detected in soil at concentrations above the SCOs.

1.2 PLAN ORGANIZATION

The remainder of this work plan consists of five sections: Section 2.0 presents a summary of investigation results for VOCs in soil and groundwater; Section 3.0 discusses the design criteria for the AS/SVE system and outlines the key elements of the AS/SVE system installation; Section 4.0 presents the requirements for system startup, operation, maintenance and monitoring; and Section 5.0 provides the proposed schedule for system installation and startup.

2 Investigation Summary for VOCs

This section presents a brief summary of the VOC results for soil and groundwater in areas of the site that will be addressed by the proposed AS/SVE system. Detailed results of site investigation activities conducted by WSP Engineering and others from 1993 to 2008 are provided in the Final Site Investigation Report, dated December 14, 2007, and the Combined Additional Pre-Design Investigation Report, Remedial Action Selection Report, and AS/SVE Pilot Test Work Plan, dated December 7, 2009.

2.1 SUMMARY OF VOCS IN ONSITE SOIL

From 2002 to 2008, WSP Engineering collected soil samples from approximately 140 soil borings to delineate the horizontal and vertical extent of VOCs in soil. The primary VOCs detected in soil were trichloroethene (TCE), tetrachloroethene (PCE), and cis-1,2-dichloroethene (cis-1,2-DCE). Based on the results of the soil investigations, soils containing VOCs at concentrations above the SCOs have been identified in the following areas of the site: Former Degreaser Area (Area 1), Southern Parking Lot Area (Area 2), Former 10,000-Gallon Fuel Oil Underground Storage Tank Area (Area 3), the southern portion of the Suspected Disposal Area (Area 4), the northern portion of the Suspected Disposal Area (Area 5), the parking lot east of the main building (Area 6), and in two isolated areas below the Former Metal Finish and Chemical Storage Area (Area 7; Figures 3 through 5). As mentioned above, Area 6 is undergoing treatment by an existing SVE system and affected soils in Area 7 will be addressed by the ongoing biodegradation of VOCs in groundwater below the Former Metal Finish and Chemical Storage Area.

Area 1 (Figure 3) contains soils with elevated VOC concentrations that are normally well-below the water table. As illustrated in Figure 3, the area is being targeted for remediation based on the sample results from soil boring SB-33. The sample collected from 17.5 to 19.5 feet bgs contained 93,000 micrograms per kilogram (µg/kg) of PCE and 65,000 µg/kg TCE. These soils are presumed to be associated with the groundwater source area below the Former Degreaser Area and will be addressed by the AS and SVE wells proposed for this area.

Area 2 (Figure 3) is characterized by elevated concentrations of PCE (6,800 µg/kg) and TCE (95,000 µg/kg) detected at surface soil sample location SS-1. Similarly, Area 5 (Figure 4) is characterized by elevated concentrations of PCE (140,000 µg/kg), TCE (170,000 µg/kg) and trans-1,2-DCE (9,000 µg/kg) detected in surface soil sample SS-12. Since these constituents were detected within the 1 to 3 foot depth interval only, it is unlikely that groundwater quality has been affected in these areas. Therefore, the proposed system includes only the installation of SVE wells in these areas.

Areas 3 and 4 (Figure 4) contain both shallow and deeper soils with VOCs above the SCOs. Area 3 contained elevated levels of acetone (260 µg/kg), methylene chloride (MC; 130 µg/kg) and TCE (3,900 µg/kg) in shallow soils at location SB-45. Elevated levels of acetone (210 µg/kg) and MC (250 µg/kg) were also detected at this location at 6 to 8 feet bgs. MC (110 µg/kg) was also detected in SB-44 at a depth of 15.5 to 17.5 feet bgs. Surface soil samples (1 to 3 feet bgs) from Area 4 contained trans-1,2-DCE at concentrations from 400 to 130,000 µg/kg, TCE at concentrations from 76,000 to 130,000 µg/kg, and PCE at concentrations from 1,300 to 3,900 µg/kg. A subsurface sample collected from 6 to 8 feet bgs at SB-131 contained elevated levels of the following VOCs: trans-1,2-DCE (4,300 µg/kg); MC (140 µg/kg); TCE (4,400 µg/kg); vinyl chloride (380 µg/kg); and xylenes (2,000 µg/kg). Also, a subsurface soil sample collected from 15 to 17 feet bgs at SB-27 contained elevated levels of MC (850 mg/kg), toluene (5,200 µg/kg), TCE (720 µg/kg) and xylene (11,600 µg/kg). The presence of VOCs in both vadose and saturated zone soils suggests that VOCs may be present in groundwater in these areas. Therefore, WSP Engineering is proposing to install AS and SVE wells in Areas 3 and 4.

2.2 SUMMARY OF VOCS IN GROUNDWATER

Based on groundwater investigations performed from 2002 through 2008, two onsite source areas for VOCs in groundwater have been identified. These source areas are located in the Former Degreaser Area and in the Former Metal Finish and Chemical Storage Area. Figure 6 illustrates the results from the low flow groundwater-sampling event conducted in July 2008 in support of the pre-design investigation. The results indicate that groundwater samples from wells MW-14 and MW-15 in the Former Degreaser Area and wells MW-4, MW-16, and MW-17 in the Former Metal Finish and Chemical Storage Area contained cis-1,2-DCE, PCE, and TCE at concentrations above the evaluation criteria. The maximum concentrations of these VOCs detected in the Former Degreaser Area were 6,800 micrograms per liter (µg/l) of TCE at MW-14, 1,400 µg/l of PCE at MW-15, and 1,000 µg/l of cis-1,2-DCE at MW-14. The maximum concentrations of these compounds detected in the Former Metal Finish and Chemical Storage Area were 52 µg/l of TCE at MW-17, 22 µg/l of PCE in MW-16, and 3,700 µg/l of 1,2-DCE at MW-16. In addition, vinyl chloride was detected in a groundwater sample from MW-9 at a concentration above the evaluation criterion. The ambient water quality standard (class GA groundwater) for both cis-1,2-DCE and TCE is 5 µg/l. The ambient water quality standard for vinyl chloride is 2 µg/l. A guidance value of 0.7 µg/l was used to evaluate the groundwater results for PCE.

During the 2004 pre-design investigations, in situ groundwater samples were collected at three separate depth intervals within the two-onsite source areas to evaluate the vertical extent of VOCs in groundwater (WSP 2007). The results of this vertical profiling indicated that VOCs at concentrations above the evaluation criteria were restricted primarily to the upper 10 feet of the saturated zone.

Based on the July 2008 groundwater data, Figure 7 was generated to depict the areas targeted for groundwater remediation. The isoconcentration contours illustrated in this figure represent the sum of all VOCs detected in each monitoring well.

3 Full-Scale Air Sparging and Soil Vapor Extraction System Design and Installation

3.1 DESIGN CONSIDERATIONS

3.1.1 Design Criteria

This section describes the design for the proposed AS/SVE system to be installed at the Site. The proposed system consists of an AS component designed to target VOC-affected groundwater and a SVE component designed to remove VOCs from the vadose zone, as well as VOCs released from the groundwater due to the AS component operation. The AS/SVE design is based largely on the results of the pilot test that was conducted at the Site by WSP Engineering between March 14 and March 21, 2010. The AS/SVE pilot test report was submitted to NYSDEC on July 23, 2010 (WSP Engineering 2010). The two key pilot test results that were used to design the full-scale system were:

- The maximum effective radius of influence (ROI) for the SVE well was found to be 28 feet, using a design SVE flow rate of approximately 157 standard cubic feet per minute (scfm) and a vacuum of approximately 46 inches water column (WC).
- The maximum effective ROI for the AS well was found to be approximately 20 feet, using a design air injection rate of 12 to 13 scfm and pressure of 4.2 to 4.8 pounds per square inch (psi), and the recommended depth for the AS well screens was recommended to be 29 feet bgs.

3.1.2 SVE System Layout

The layout of the SVE System in Area 1 is designed to complement the AS System in the area. That is, the pattern of SVE wells is arranged to both encompass the estimated ROI of each of the AS wells and extend outward to the 1,500 µg/l groundwater VOC contour. These considerations resulted in a total of six SVE wells (SV-1 to SV-6) within Area 1 at an approximate spacing of 40 feet. Based on this spacing and considering the 28-foot ROI estimated from the pilot test (WSP Engineering 2010), WSP Engineering has arranged the SVE wells in a triangular array to maximize the SVE well efficiency. Figures 3, 4, and 8 provides the layout and the ROI of the SVE wells in Areas 1 through 5. Based on the same design considerations, two SVE wells will be installed in Area 4 (SV-9, SV-10) and Area 5 (SV-11, SV-12) with an approximate spacing of 40 feet. One SVE well will be installed in Area 2 (SV-7) and Area 3 (SV-8).

The extracted vapor stream will be treated with one of the existing 2,000-pound vapor phase granular activated carbon (GAC) units prior to discharge to the atmosphere through the existing SVE system discharge stack. Vapor phase GAC was selected as the most appropriate control technology based on the VOC concentrations detected at the Site during the AS/SVE pilot test and successful use of this treatment technology with the existing SVE trench system. The 2,000-pound GAC unit was sized to treat an influent VOC mass loading of 60 parts per million by volume (ppmv) from the SVE trench system installed in March 2004. During the three days of AS/SVE pilot test activities, VOC concentrations from the SVE pilot test well, SV-1, dropped from a maximum concentration of approximately 15 ppmv down to 8 ppmv. Therefore, WSP Engineering anticipates that the mass loading from the proposed AS/SVE system will be below the existing SVE system design criterion of 60 ppmv, assuming a total flow of 750 scfm at 7.4 inches of mercury (inches Hg) and the simultaneous operation of up to six SVE wells. As discussed in Section 3.2.5, WSP Engineering intends to “cycle” the SVE wells in two groups.

3.1.3 AS System Layout

The AS well layout for the Former Degreaser Area (Area 1) is designed to address the highest concentrations of VOCs in groundwater in this source area. In Area 1, the AS design involves the operation of 8 AS wells (AS-1 through AS-8). The AS wells will be spaced approximately 30 feet apart, which will provide the appropriate overlap between sparge wells based on the 20-foot ROI. Figures 3, 4, and 8 provides the layout and the ROI of the AS wells in Areas 1 through 5.

A single AS well will also be operated in Areas 3 (AS-9) and 4 (AS-10) to address the potential presence of VOCs in groundwater in these areas. The design air injection rate is anticipated to be 12 scfm at an applied pressure of approximately 4.2 psi.

3.2 FULL-SCALE AIR SPARGING AND SOIL VAPOR EXTRACTION SYSTEM INSTALLATION

3.2.1 Proposed Onsite System Configuration and Equipment

This section conceptually describes WSP Engineering's process design and mechanical components for the system. Detailed depiction of the system's design and configuration is provided in the drawing package included in Appendix A:

- Drawing Sheet 1 – Title Sheet
- Drawing Sheet 2 – System Layout
- Drawing Sheet 3 – Process and Instrumentation Diagram
- Drawing Sheet 4 – Well Locations and Piping Routes – Cycle Group 1
- Drawing Sheet 5 – Well Locations and Piping Routes – Cycle Group 2
- Drawing Sheet 6 – Soil Vapor Extraction and Air Sparging Equipment Layout And Manifold Connection Details
- Drawing Sheet 7 – Soil Vapor Extraction System and Air Sparging Manifold Details
- Drawing Sheet 8 – Air Sparging Wellhead Completion Details
- Drawing Sheet 9 – Soil Vapor Extraction Wellhead Completion and Pipe Hanger Details

The system will use an extraction well network and sparging well network, air moving equipment, overhead and underground piping for vapor/air transfer, and existing vapor treatment equipment. The well configuration of the proposed system is shown on Appendix A, Sheet 2. The air moving and treatment equipment will be housed in the existing SVE equipment room on the east side of the facility (Appendix A, Sheets 2 and 6). Approximate routes for air/vapor transfer piping are provided on Appendix A, Sheets 4 and 5. Details of the designs for the wells, transfer piping, air moving equipment, and the treatment equipment are described in the following sections. A process and instrumentation diagram of the system is provided on Appendix A, Sheet 3.

3.2.2 Soil Vapor Extraction Wells

To induce vapor flow across the vadose zone, the SVE wells will be installed to an approximate depth of 11 feet bgs (approximately 1 to 2 feet above the seasonal high water table elevation, as determined from groundwater elevations collected between November 2004 and July 2008) with 8 feet of well screen. Existing pilot test well SV-1 will be used as an extraction well (Appendix A, Sheet 2) and will be renamed SV-3. The vacuum is anticipated to propagate from the top of the well screen to the ground surface, pulling air through shallow soil affected by VOCs. To ensure short-circuiting does not occur along the bedding material, WSP Engineering will use flowable fill, or similar, in place of highly permeable backfill. WSP Engineering may elect to install the piping without bedding material if the native fill does not contain large aggregate.

Consistent with the pilot test, each extraction well will be 2-inch-diameter and installed with a portable direct-push drill rig (Geoprobe® 540MT, or similar). Each well will be comprised of Schedule 80 black iron pipe well riser and stainless steel well screen, or similar. Because the proposed SVE well locations outside the facility are accessible with a truck-mounted drilling rig, WSP Engineering may elect to install Schedule 40 polyvinyl chloride (PVC) wells outside the facility using hollow-stem auger drilling methods. Construction details for the extraction wells are provided on Appendix A, Sheet 9.

3.2.3 Air Sparging Wells

The AS wells will be installed to an approximate depth of 29 feet bgs, or five feet below the estimated vertical extent of the affected groundwater, with four feet of well screen. The AS wells will be 2-inch-diameter and installed with a portable direct-push drill rig (Geoprobe® 540MT, or similar). Each well will be comprised of Schedule 80 black iron pipe well riser and stainless steel well screen, or similar. Because the proposed AS well locations outside the facility are accessible with a truck-mounted drilling rig, WSP Engineering may elect to install Schedule 40 PVC wells outside the facility using hollow-stem auger drilling methods. Construction details for the AS wells are provided on Appendix A, Sheet 8.

3.2.4 Monitoring Points

WSP Engineering will install three vacuum monitoring points, in addition to the existing four monitoring points installed during the pilot test activities, to monitor subsurface vacuum during operation of the AS/SVE system. The proposed monitoring points are designated MP-5 through MP-7 on Appendix A Sheet 2. The monitoring points will be used solely to monitor vacuum in the vadose zone; therefore, the monitoring point will be installed with the same construction as the SVE wells.

3.2.5 Soil Vapor Extraction Equipment

WSP Engineering will use the existing SVE equipment at the Site to operate the full-scale system. Vacuum-induced vapor flow will be produced by the existing 40 horsepower, positive displacement Roots® RAI Series Model 615 blower capable of approximately 900 scfm at 9 inches Hg vacuum. The existing system is equipped with an air inlet filter and a 120-gallon vapor liquid separator with a float switch-operated discharge pump. The blower is powered by the existing 480-volt, 3-phase electrical service provided inside the SVE equipment room.

A new 6-inch, Schedule 40 PVC manifold header pipe will convey the vapor flow from the SVE piping manifold, containing 12 SVE wells, to the SVE blower. A new 6-inch, Schedule 40 PVC tee will be installed within the existing 6-inch PVC system piping in the SVE equipment room, prior to the inlet filter, to create a permanent connection point for the 6-inch manifold header pipe. This new connection will allow for continued operation of the existing SVE trench system in Area 6. The 6-inch manifold header pipe will be equipped with a 6-inch butterfly valve that can be closed to enable pulsing of the existing SVE trench system. The header pipe will be routed through the west wall of the SVE equipment room into an adjacent storage locker. A SVE piping manifold will be housed within the storage locker and will allow for the control of vacuum levels and vapor flow for each SVE well (Appendix A, Sheet 7).

During operation of the existing Area 6 SVE trench system, WSP Engineering has found that in order to optimize VOC removal efficiency, the system should be operated using a pulsing or cyclical mode of operation. Specifically, WSP Engineering found that the highest concentrations of VOC were removed during the first 20 minutes of SVE operation, followed by a sharp decline and asymptotic long term removal. Based on these observations, WSP Engineering is proposing to use cyclical operation of the SVE well network using two groups of six SVE wells. Cycle Group 1 will address Area 1 and Cycle Group 2 will address Areas 2, 3, 4, and 5. During operation of each SVE well cycle group, only the corresponding AS wells will be operated. The SVE cycle groups are displayed on Appendix A, Sheets 4 and 5. Cycling of grouped SVE wells will be achieved manually using ball valves at the SVE manifold, to be housed within the storage locker adjacent to the SVE equipment room.

3.2.6 Air Sparging Equipment

The onsite AS equipment will consist of an air compressor, which will be pre-manufactured on a skid to be housed within the northern portion of the existing SVE equipment room (Appendix A, Sheet 6). The compressor will be sized to generate at least 96 scfm at 6 psi to allow for the operation of up to eight AS wells simultaneously. Again, as discussed in Section 3.2.5, the AS wells will be cycled in two cycle groups. Cycle Group 1 will encompass eight AS wells (AS-1 through AS-8) and Cycle Group 2 will include AS-9 and AS-10. To eliminate the potential for indoor vapor intrusion, WSP Engineering will not operate any of the AS wells inside or outside the facility without operating the corresponding SVE cycle group.

Cycling of grouped AS wells will be achieved manually using ball valves at the AS manifold, to be installed within the same storage locker as the SVE manifold (Appendix A, Sheet 6). The cycle groups of AS wells are displayed on Sheets 4 (Cycle Group 1) and 5 (Cycle Group 2) of Appendix A. The 3-inch Schedule 40 steel AS header pipe will be routed from the AS manifold to the air compressor, which will be housed in the eastern portion of the SVE equipment room.

To prevent excessive buildup of condensate in the AS piping network, a self-activating condensate drain valve will be installed on the 3-inch AS header piping before the AS manifold (Appendix A, Sheet 7).

3.2.7 Equipment Area

The air-moving and treatment equipment is housed on the east side of the facility in the SVE equipment room (Appendix A, Sheet 6). Interior air transfer piping will be hung from the facility roof trusses and will be supported in accordance with the manufacturer’s instructions to prevent excessive sag. Air transfer piping for exterior wells will exit the building through the concrete block walls and will then be placed below grade in a trench located directly outside the building (Appendix A, Sheets 8 and 9). The AS and SVE piping manifolds will be secured to the facility roof support structure, the concrete floor, and the storage locker wall.

3.2.8 Transfer Pipe Network

Transfer of vapor from the SVE wells and transfer of air to the AS wells will require a transfer piping network dedicated to each system component. WSP Engineering configured the transfer piping network to conform to site conditions and space constraints. Proposed piping routes for the AS and SVE systems are depicted on Appendix A, Sheets 4 and 5.

The SVE transfer piping will consist of 4-inch-diameter Schedule 40 PVC piping dedicated to each SVE well (SV-1 through SV-12). The SVE transfer piping will connect to the SVE manifold, which will consist of dedicated 4-inch-diameter PVC legs connected to a 6-inch PVC header (Appendix A, Sheet 7). Balancing of vapor flow to the SVE wells will be accomplished using butterfly valves. Vapor flow will be measured using instrumentation mounted on the SVE manifold piping, including a differential pressure flow sensor equipped with a differential pressure gauge, a vacuum gauge, and a temperature gauge. SVE piping routed outside to Areas 2, 3, 4, and 5 will transition from above ground piping to below grade piping immediately after exiting the facility (Appendix A, Sheet 9). Buried SVE piping will be trenched to a depth of 16 inches below grade and piping within the building will be hung from the facility roof trusses (Appendix A, Sheet 9). Pipe will be supported in accordance with the manufacturer’s instruction to prevent excessive sag. SVE wellhead piping details are provided on Appendix A, Sheet 9.

The AS piping network (AS-1 through AS-10) inside the facility will consist of 1.5-inch-diameter schedule 80 PVC piping dedicated to each well. AS transfer piping located inside the facility will be hung from roof trusses, routed to the nearest storage locker or facility wall, and trenched from the storage locker or facility wall to the respective AS well (see detail, Appendix A, Sheet 8). AS piping routed outside to Areas 2, 3, 4, and 5 will transition to 1.5-inch diameter Schedule 40 high-density polyethylene (HDPE) after exiting the building and will transition back to 1.5-inch diameter Schedule 80 PVC prior to connection to the AS wellhead (Appendix A, Sheet 8). HDPE was selected to minimize the chance of pipe breakage if excessive condensation buildup occurs during a period of extreme cold. Transfer piping located outside the facility will be trenched underground to an approximate depth of 16 inches (see detail, Appendix A, Sheet 8). Balancing of compressed air flow to the AS wells will be accomplished using butterfly valves. Air flow will be measured using instrumentation mounted on the manifold piping, including a pressure gauge, temperature gauge, and a differential pressure flow sensor equipped with a portable differential pressure gauge. AS wellhead piping and AS manifold details are provided on Appendix A, Sheets 7 and 8.

3.2.9 Waste Management

Waste generated during installation of the AS/SVE wells and system, including, but not limited to, concrete debris, soil, purge water, and decontamination rinsate, will be placed in Department of Transportation-approved 55-gallon steel drums (or other appropriate approved waste containers) and staged onsite for later disposal. WSP Engineering will arrange for transportation and disposal of the wastes in accordance with all federal and state requirements.

3.2.10 Soil Vapor Treatment System

The existing SVE system is equipped with an air inlet filter and a 120-gallon vapor liquid separator (VLS) with discharge pump. Condensate in the extracted vapor will be removed and collected in the VLS. Liquid collected in the VLS will be pumped to the existing 400-gallon poly tank and then containerized for proper offsite disposal. An in-line filter located before the VLS will collect particulates from the extracted vapor. After the condensate and particulates are removed, the vapor stream will pass through a 2,000-pound GAC unit, where VOCs will be removed from the extracted vapor. Routine vapor sampling will be used to calculate VOC mass removal by the GAC unit and to estimate the time to depletion of the GAC sorptive capacity. The GAC will be replaced when VOC mass removal has approached the sorptive capacity of the GAC (as specified by the manufacturer). Routine vapor sampling will also be used to verify that breakthrough of the GAC unit has not occurred.

3.2.11 Electrical Service

The 480-volt/3-phase electrical power service required to operate the system will be provided by existing service inside the SVE equipment room. The electrical feed to the system is fitted with a separate dedicated meter to track electricity consumption for the system. The electrical service is also equipped with a primary shutoff switch.

3.2.12 Programmable Logic Control

The AS/SVE system equipment will be controlled using a computerized programmable logic control (PLC) system, centralized in a master control panel. The existing master control panel inside the SVE equipment room will be upgraded or replaced. The PLC will be programmed to deactivate the entire system in the event of an alarm condition.

Alarm conditions will be incorporated into the system and controlled by the PLC. Three alarms will exist within the system that will trigger the immediate shutdown of the entire system. A liquid switch high (LSH) in the VLS will be activated to shut down the system in the event that a VLS tank fills with condensate water. A temperature switch high (TSH), located on the discharge stack inside the equipment room, will protect the SVE blower from overheating. The AS header piping exiting the AS compressor skid will be equipped with a pressure switch high (PSH) to safeguard against damage to air transfer piping, due to excessive line pressure, caused by malfunction of the system equipment.

3.2.13 Remote Monitoring

The system will be equipped with a wireless remote monitoring package using an internet connection. The remote capabilities include starting and stopping the system and monitoring system component operation and logs of shutdown conditions. Other system functions, such as manipulating control and isolation valves for AS/SVE cycling, may also be automated in the future, if remote operations are determined to be more economical.

4 System Startup and Operations and Maintenance Activities

Startup of the AS/SVE system will be completed as soon as the AS/SVE system installation is complete. The AS/SVE startup will follow procedures outlined in Section 4.1. After all tasks are complete the system will be considered operational and WSP Engineering or its subcontractor will conduct operation and maintenance (O&M) site visits on a periodic basis to ensure optimal operation of the AS/SVE system. The periodic O&M activities to be performed are described in detail below.

4.1 SYSTEM STARTUP

Before startup of the system, WSP Engineering will collect groundwater samples from MW-7, MW-9, MW-14, and MW-15 to serve as a baseline to which subsequent groundwater sample results can be compared under the groundwater performance monitoring described in Section 4.4.

During start-up, the AS compressor and SVE blower will be energized and set at minimum operating levels to verify that the equipment is functioning in accordance with the design and manufacturer's specifications. The SVE system will be periodically checked for leaks and inspected to ensure proper performance as the vacuum levels are increased incrementally. Once the system is operating at or close to the expected operating specifications, air flow, vacuum, and temperature for each well will be monitored at the SVE manifold. The air flow to SVE Cycle Group 1 and Cycle Group 2 will be balanced (equal air flow from each well in each Cycle Group) independently during the initial startup.

After both SVE cycle groups are balanced, the AS startup will be initiated. The AS system will be periodically checked for leaks and inspected to ensure proper performance as the pressure levels are increased incrementally. During the startup, the pressure, temperature, and flow for each well will be monitored at the AS manifold. The air flow for each cycle group will be balanced independently. During the balancing process, the corresponding SVE cycle group will be operated to eliminate the potential for vapor intrusion.

Following the balancing of both the AS and SVE cycle groups, Cycle Group 1 will be put into operation. Separate startups will be completed for Cycle Groups 1 and 2. The startup for each cycle group will include, at a minimum, the procedures outlined below and will last a minimum of 24 hours.

The initial mass removal rates will be monitored during the start-up sequence at the influent of the SVE system and at the SVE manifold using a photoionization detector (PID). The measurements will be collected every hour for the first 8 hours of operation and then periodically thereafter. Analytical samples will also be collected from the SVE system influent to verify the field readings and provide data on the baseline recovery of the system. The analytical samples will be collected from the SVE system using an evacuated 1-liter Entech Instruments, Inc. (Entech), sample canister (or equivalent) at intervals of approximately 2, 4, 8, and 24 hours after the system has reached the projected operating specifications. The samples will be shipped to a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified laboratory for analysis of TCE, PCE, and cis-1,2-DCE by U.S. Environmental Protection Agency (EPA) Method TO-15.

4.2 VAPOR TREATMENT MONITORING

WSP Engineering will collect periodic vapor samples from the SVE system to monitor VOC mass removal from the SVE system. Vapor samples will be collected using Entech canisters, or similar, connected to a sample port on the manifold header piping upstream of the GAC units. Vapor samples will also be collected downstream of the GAC units to confirm adequate treatment for discharge to the atmosphere. All vapor samples will be analyzed using EPA Method TO-15.

4.3 AS/SVE SYSTEM PERFORMANCE MONITORING

WSP Engineering, or its O&M subcontractor, will collect and record AS and SVE system flow and pressure/vacuum measurements to confirm proper operation. Tasks and measurements to be performed during monthly O&M visits include, but are not limited to, the following:

- check for alarm conditions and verify proper operation of all equipment
- inspect all valve positions to verify none of the devices have been misadjusted or vary from their original position
- inspect filters and replace, as necessary
- check all aboveground transfer piping for leaks
- SVE manifold line differential pressure, temperature, vacuum, and VOC concentrations (using a PID)
- line vacuum upstream and downstream of GAC treatment units
- AS heat exchanger inlet line pressure and temperature
- AS heat exchanger outlet line pressure, temperature, and differential pressure
- AS primary manifold line temperature
- AS secondary manifold line pressure, temperature, and differential pressure
- check breakthrough pressure is maintained at operating AS wells, and adjust AS manifold valves, as necessary, to maintain positive air flow
- rebalance air flow for the AS and SVE wells, as necessary

4.4 GROUNDWATER PERFORMANCE MONITORING

Groundwater samples will be collected from monitoring wells MW-7, MW-9, MW-14, and MW-15 on a quarterly basis to evaluate changes in dissolved VOC concentrations as a result of AS operation (Appendix A, Sheet 2). WSP Engineering will use this data to evaluate the progress of treatment and determine when shut-down of the system is justified. All groundwater samples will be collected using low-flow purging and sampling techniques, and will be analyzed for VOCs by a NYSDOH ELAP- certified laboratory using EPA Method 8260B.

4.5 SUBSURFACE VACUUM MONITORING

Subsurface vacuum/pressure measurements will be collected from the existing pilot test monitoring points (MP-1 through MP-4) and proposed monitoring points (MP-5 through MP-7; Appendix A, Sheet 2). The vacuum monitoring will be done on an as-needed basis during startup to ensure design criteria are being met and will continue on a quarterly basis to confirm subsurface vacuum influence.

5 Project Schedule and Reporting

WSP Engineering will begin soliciting proposals for the procurement of equipment for the AS/SVE system and the installation of AS/SVE wells and piping once written approval of this work plan is received from the NYSDEC. Drilling activities are anticipated to begin in April 2011 and take two to three weeks to complete. The AS/SVE system installation will likely take place in May 2011. The AS/SVE System Construction Completion Report will be submitted to the NYSDEC within 8 weeks of completing the system installation and start-up activities.

6 References

ESC Engineering of New York, P.C. 2004. Interim Remedial Measures Summary Report, Huck Manufacturing Facility, Kingston, New York. August 6.

WSP Engineering of New York, P.C. 2010. Air Sparge and Soil Vapor Extraction Pilot Test Report, Former Huck Manufacturing Facility, Kingston, New York. July 30.

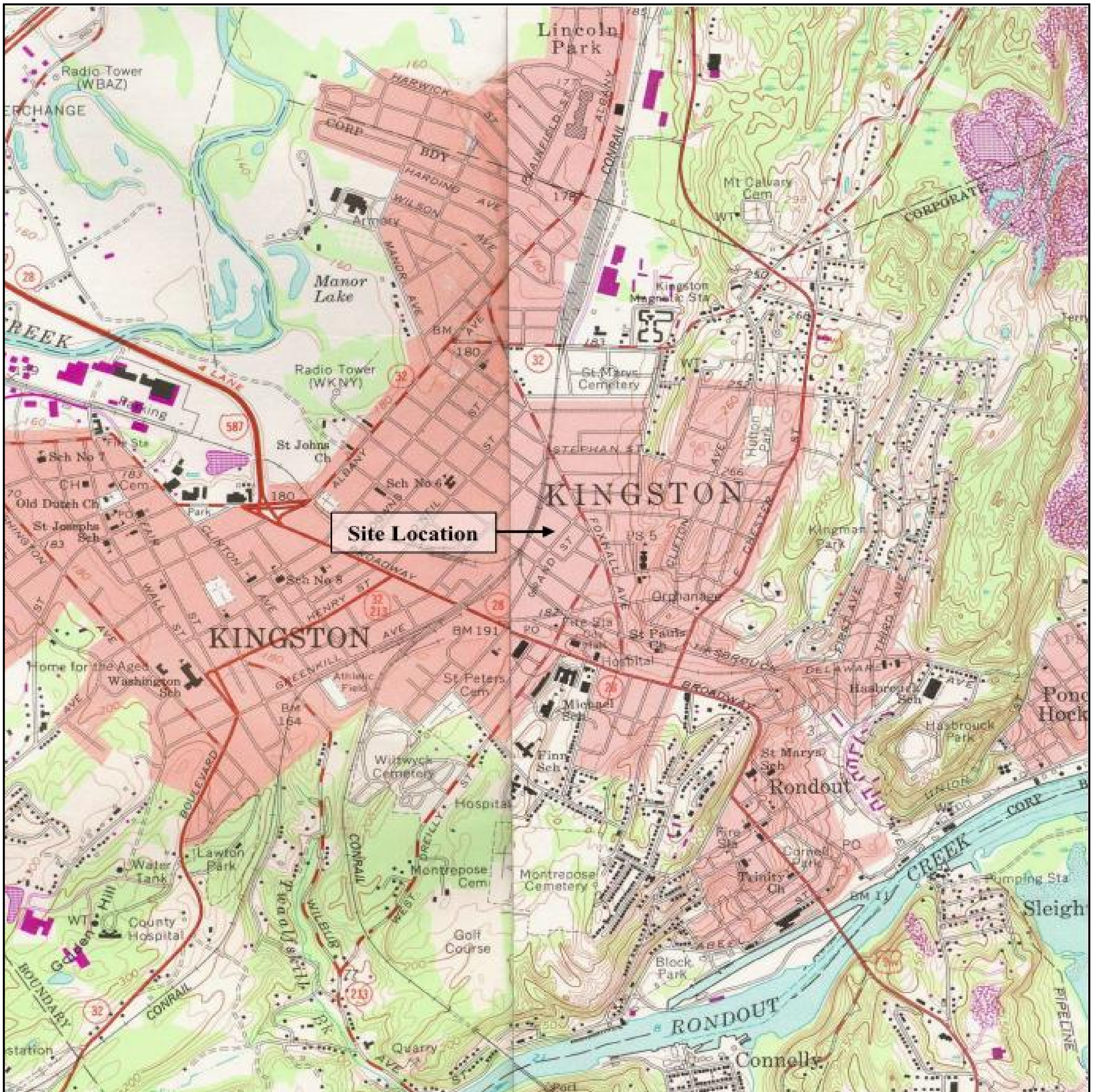
WSP Engineering of New York, P.C. 2009. Combined Additional Pre-Design Investigation Report, Remedial Action Selection Report, and Air Sparge/Soil Vapor Extraction Pilot Test Work Plan, Former Huck Manufacturing Facility, Kingston, New York. December 7.

WSP Environmental Strategies. 2007. Final Site Investigation and Pre-Design Report, Huck Manufacturing Facility, Kingston, NY. December 14.

7 Acronym List

µg/kg	micrograms per kilograms
µg/l	micrograms per liter
AS	air sparging
bgs	below ground surface
DCE	dichloroethene
ELAP	Environmental Laboratory Approval Program
EPA	Environmental Protection Agency
GAC	granular activated carbon
HDPE	high-density polyethylene
HG	mercury
LSH	liquid switch high
MC	methylene chloride
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	operations and maintenance
PCE	tetrachloroethene
PID	photoionization detector
PLC	programmable logic control
ppmv	part per million by volume
PSH	pressure switch high
psi	pounds per square inch
PVC	polyvinyl chloride
ROI	radius of influence
scfm	standard cubic feet per minute
SCO	soil cleanup objectives
SVE	soil vapor extraction
TAGM	Technical and Administrative Guidance Memorandum
TCE	trichloroethene
TSH	temperature switch high
VLS	vapor liquid separator
VOC	volatile organic compound
WC	water column

Figures



Reference
7.5 Minute Series Topographic Quadrangle
Kingston East, New York
Photorevised 1980 Scale 1:24,000

N

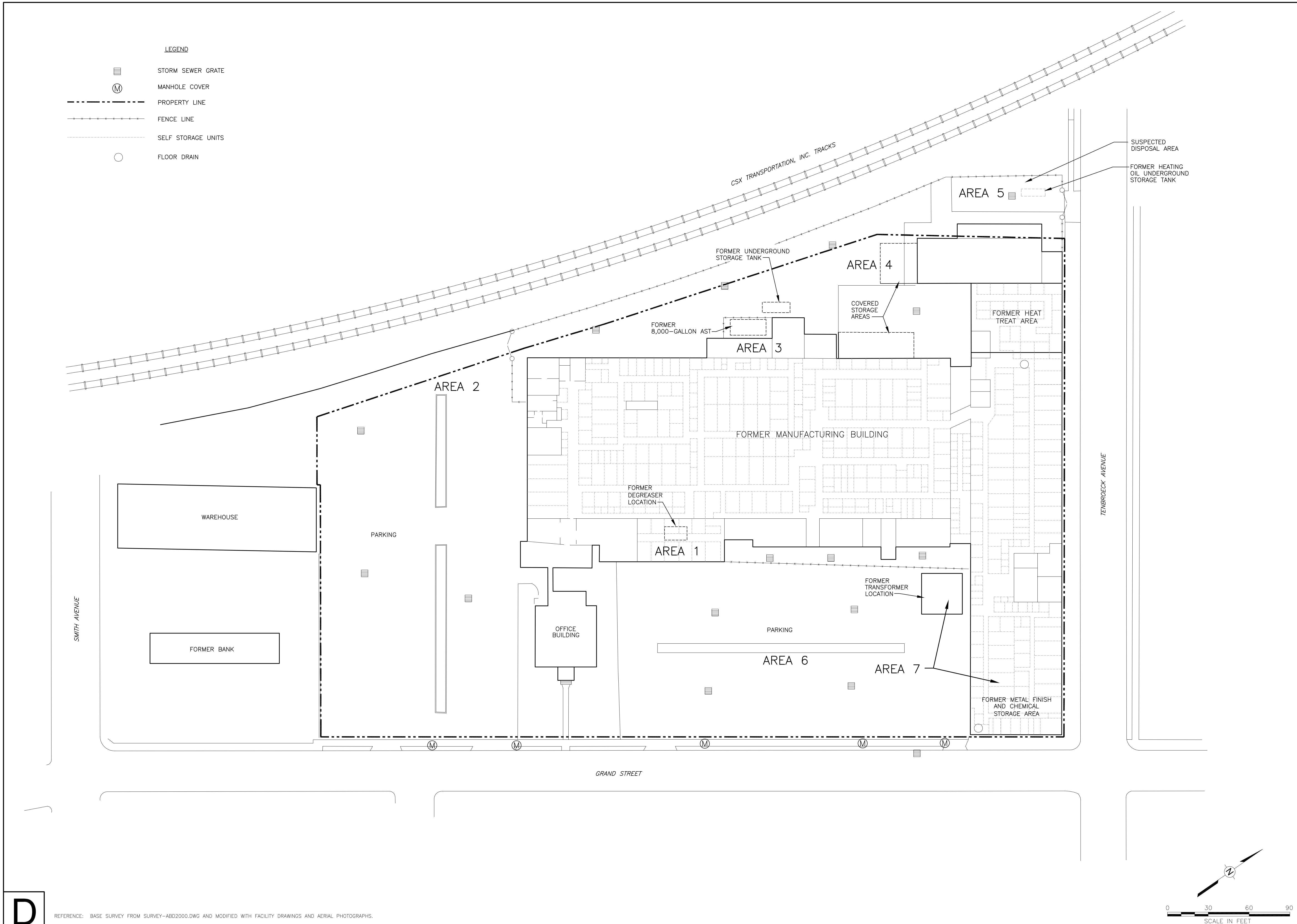
Quadrangle Location

1000 0 2000 4000

Scale in Feet

WSP Engineering of New York, P.C.
2360 Sweet Home Road
Suite 3
Amherst, New York 14228
716-691-5232

Figure 1
Site Location
Huck Manufacturing Facility
Kingston, New York



REFERENCE: BASE SURVEY FROM SURVEY-ABD2000.DWG AND MODIFIED WITH FACILITY DRAWINGS AND AERIAL PHOTOGRAPHS.

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FIGURE 2

Drawing Number
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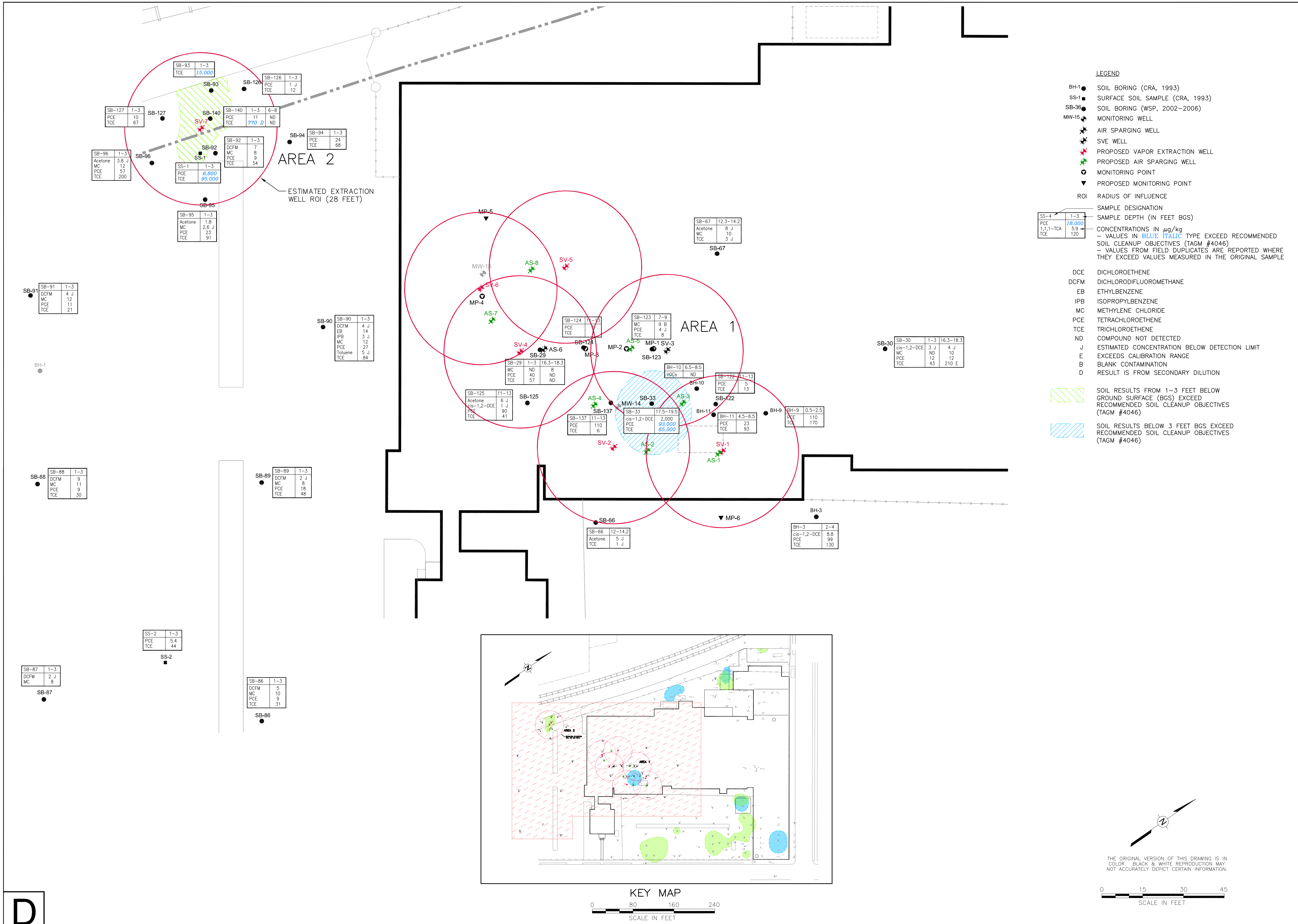

REVISIONS

PROPOSED AREAS 1 AND 2 AS/SVE WELL LOCATIONS

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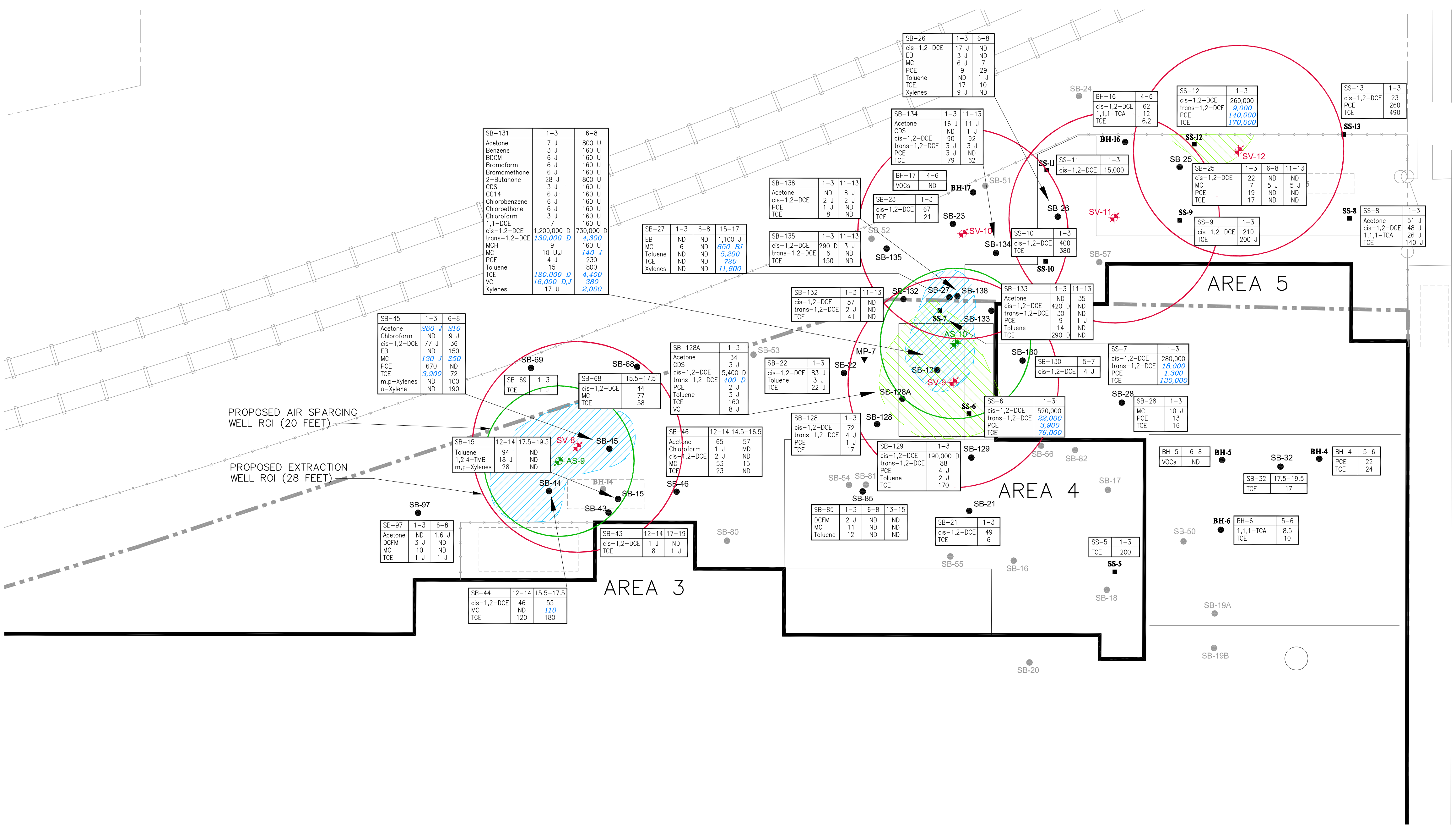
FIGURE 3

Drawing Number 00005609–003



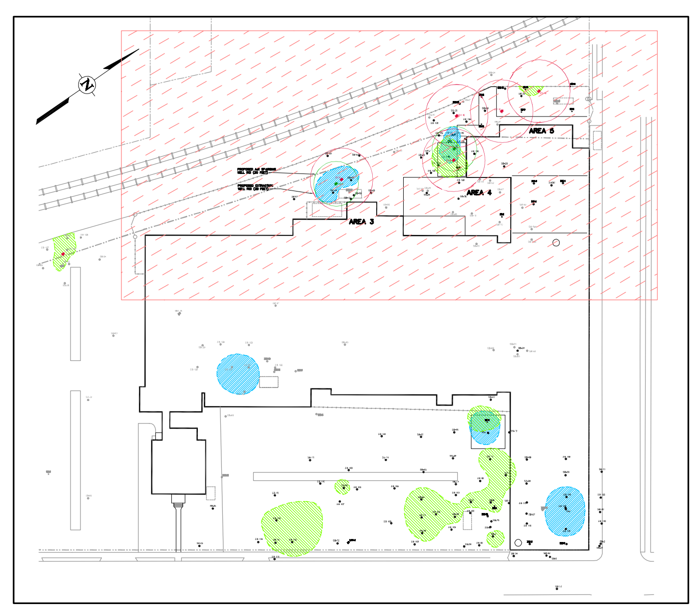
LEGEND

- BH-1 ● SOIL BORING (CRA, 1993)
- SS-1 ■ SURFACE SOIL SAMPLE (CRA, 1993)
- SB-36 ● SOIL BORING (WSPES, 2002–2006)
- MW-6 MONITORING WELL (CRA)
- PROPOSED VAPOR EXTRACTION WELL
- PROPOSED AIR SPARGING WELL
- ▼ PROPOSED MONITORING POINT
- ROI RADIUS OF INFLUENCE
- SAMPLE DESIGNATION
- SAMPLE DEPTH (IN FEET BGS)
- CONCENTRATIONS IN µg/kg
  - VALUES IN BLUE ITALIC TYPE EXCEED RECOMMENDED SOIL CLEANUP OBJECTIVES (TAGM #4046)
  - VALUES FROM FIELD DUPLICATES ARE REPORTED WHERE THEY EXCEED VALUES MEASURED IN THE ORIGINAL SAMPLE

BDCM	BROMODICHLOROMETHANE
CDS	CARBON DISULFIDE
DCE	DICHLOROETHENE
DCFM	DICHLORODIFLUOROMETHANE
EB	ETHYLBENZENE
MC	METHYLENE CHLORIDE
PCE	TETRACHLOROETHENE
TCE	TRICHLOROETHENE
ND	COMPOUND NOT DETECTED
J	ESTIMATED CONCENTRATION BELOW DETECTION LIMIT
D	RESULT IS FROM SECONDARY DILUTION

SOIL RESULTS FROM 1–3 FEET BELOW GROUND SURFACE (BGS) EXCEED RECOMMENDED SOIL CLEANUP OBJECTIVES (TAGM #4046)

SOIL RESULTS BELOW 3 FEET BGS EXCEED RECOMMENDED SOIL CLEANUP OBJECTIVES (TAGM #4046)



KEY MAP

0 80 160 240

SCALE IN FEET

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PROPOSED AREAS 3, 4, AND 5 AS/SVE WELL LOCATIONS

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FIGURE 4

Drawing Number
00005609–004

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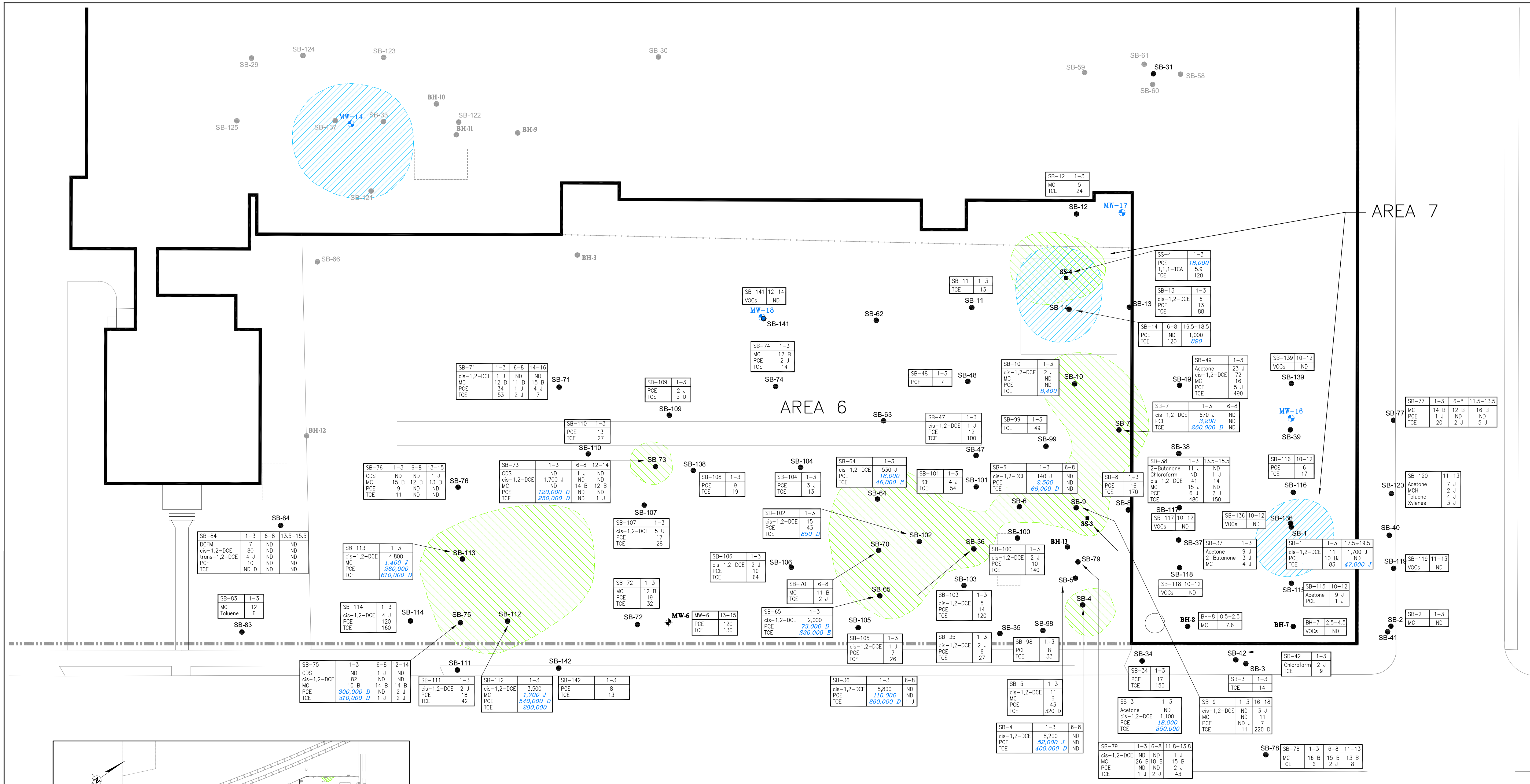

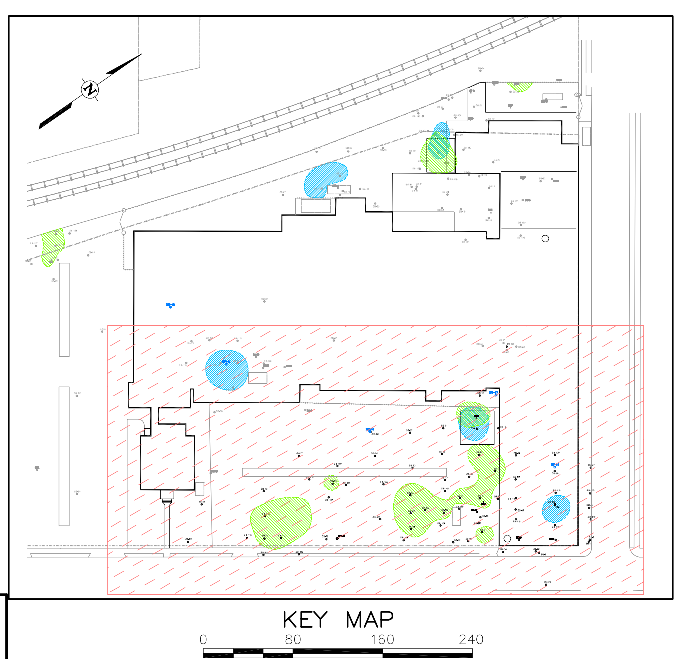

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LEGEND

MW-16	MONITORING WELL (WSP, JULY 2008)
MW-6	MONITORING WELL
BH-1	SOIL BORING (CRA, 1993)
SS-1	SURFACE SOIL SAMPLE (CRA, 1993)
SB-36	SOIL BORING (WSP, 2002–2008)

SS-4 — SAMPLE DESIGNATION
1–3 — SAMPLE DEPTH (IN FEET BGS)
PCE 18,000 / 1,1,1-TCA 5.9 / TCE 120 — CONCENTRATIONS IN µg/kg
– VALUES IN BLUE ITALIC TYPE EXCEED RECOMMENDED SOIL CLEANUP OBJECTIVES (TAGM #4046)
– VALUES FROM FIELD DUPLICATES ARE REPORTED WHERE THEY EXCEED VALUES MEASURED IN THE ORIGINAL SAMPLE

CDS	CARBON DISULFIDE
DCE	DICHLOROETHENE
DCFM	DICHLORODIFLUOROMETHANE
MC	METHYLENE CHLORIDE
MCH	METHYLCYCLOHEXANE
PCE	TETRACHLOROETHENE
TCA	TRICHLOROETHANE
TCE	TRICHLOROETHENE

LEGEND

ND	COMPOUND NOT DETECTED
J	ESTIMATED CONCENTRATION BELOW DETECTION LIMIT
E	EXCEEDS CALIBRATION RANGE
B	BLANK CONTAMINATION
D	RESULT IS FROM SECONDARY DILUTION

SOIL RESULTS FROM 1–3 FEET BELOW GROUND SURFACE (BGS) EXCEED RECOMMENDED SOIL CLEANUP OBJECTIVES (TAGM #4046)

SOIL RESULTS BELOW 3 FEET BGS EXCEED RECOMMENDED SOIL CLEANUP OBJECTIVES (TAGM #4046)

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0 15 30 45
SCALE IN FEET

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VOC RESULTS IN SOIL – AREAS 6 AND 7

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FIGURE 5

Drawing Number
00005609–005

VOCs (ug/l)	MW-12
cis-1,2-DCE	ND
PCE	**6.0**
TCE	**33**
VC	ND

VOCs (ug/l)	MW-13
cis-1,2-DCE	ND
PCE	ND
TCE	ND
VC	ND

VOCs (ug/l)	MW-11
cis-1,2-DCE	**7.1**
PCE	**78**
TCE	**66**
VC	ND

VOCs (ug/l)	MW-10
cis-1,2-DCE	**69**
PCE	**160 D**
TCE	**190 D**
VC	ND

VOCs (ug/l)	MW-9
cis-1,2-DCE	**21**
PCE	ND
TCE	**78**
VC	**24**

VOCs (ug/l)	MW-3
cis-1,2-DCE	**18**
PCE	**35**
TCE	**50**
VC	ND

VOCs (ug/l)	MW-1
cis-1,2-DCE	ND
PCE	**17**
TCE	**31**
VC	ND

VOCs (ug/l)	MW-7
cis-1,2-DCE	**5.3**
PCE	**13**
TCE	**160 D**
VC	ND

VOCs (ug/l)	MW-15
cis-1,2-DCE	**170 D**
PCE	**1,400 D**
TCE	**620 D**
VC	ND

VOCs (ug/l)	MW-8
cis-1,2-DCE	1.0
PCE	**6.1**
TCE	**35**
VC	ND

VOCs (ug/l)	MW-17
cis-1,2-DCE	**300 D**
PCE	**6.3**
TCE	**52**
VC	ND

VOCs (ug/l)	MW-16
cis-1,2-DCE	**3,700 D**
PCE	**22**
TCE	**27**
VC	**1.6**

VOCs (ug/l)	MW-2
cis-1,2-DCE	ND
PCE	**1.7**
TCE	**22**
VC	ND

VOCs (ug/l)	MW-5
cis-1,2-DCE	ND
PCE	**2.9**
TCE	3.3
VC	ND

VOCs (ug/l)	MW-14
cis-1,2-DCE	**1,000 D**
PCE	**1,100 D**
TCE	**6,800 D**
VC	ND

VOCs (ug/l)	MW-6
cis-1,2-DCE	ND
PCE	**5.8**
TCE	**8.2**
VC	ND

VOCs (ug/l)	MW-18
cis-1,2-DCE	3.5
PCE	**20**
TCE	**490 D**
VC	ND

VOCs (ug/l)	MW-4
cis-1,2-DCE	**500**
PCE	ND
TCE	**22**
VC	ND

LEGEND

- STORM SEWER GRATE
- MANHOLE COVER
- PROPERTY LINE
- FENCE LINE
- MW-2 MONITORING WELL
- ug/l MICROGRAMS PER LITER
- ND NON-DETECT
- D CONCENTRATION IS FROM A SECONDARY DILUTION ANALYSIS
- CIS-1,2-DCE CIS-1,2-DICHLOROETHENE
- PCE TETRACHLORETHENE
- TCE TRICHLOROETHENE
- VC VINYL CHLORIDE

NOTE:
CONCENTRATIONS IN BOLD EXCEED THE NEW YORK STATE AMBIENT WATER QUALITY STANDARDS OR GUIDANCE VALUES FOR CLASS GA GROUNDWATER PROVIDED IN THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION DIVISION OF WATER TECHNICAL AND OPERATIONAL GUIDANCE SERIES (1.1.1), DATED JUNE 1998, AND THE APRIL 2000 ADDENDUM.

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LOW FLOW GROUNDWATER SAMPLING RESULTS PRIMARY VOCs (JULY 2008)

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FIGURE 6

Drawing Number
00005609-007

D

Legend

MW-12 ⊕	Groundwater Monitoring Well Location
ND	VOCs Not Detected
448	Total VOC Concentration (Measured in ug/L)
168.5 --------	Groundwater Elevation Contour (Measured in Feet Above Mean Sea Level)

Notes:

1. Groundwater monitoring wells MW-1 through MW-15 were sampled on July 21 through 23, 2008. Groundwater elevations measured on July 21, 2008.
2. Isoconcentration contour interval is 500 ug/L.

Total VOC Isoconcentration Contour Color Scale
(Measured in ug/L)

3,000	5,000	7,000
2,500	4,500	6,500
2,000	4,000	6,000
1,500	3,500	5,500

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TOTAL VOCs IN GROUNDWATER (JULY 2008)

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FIGURE 7

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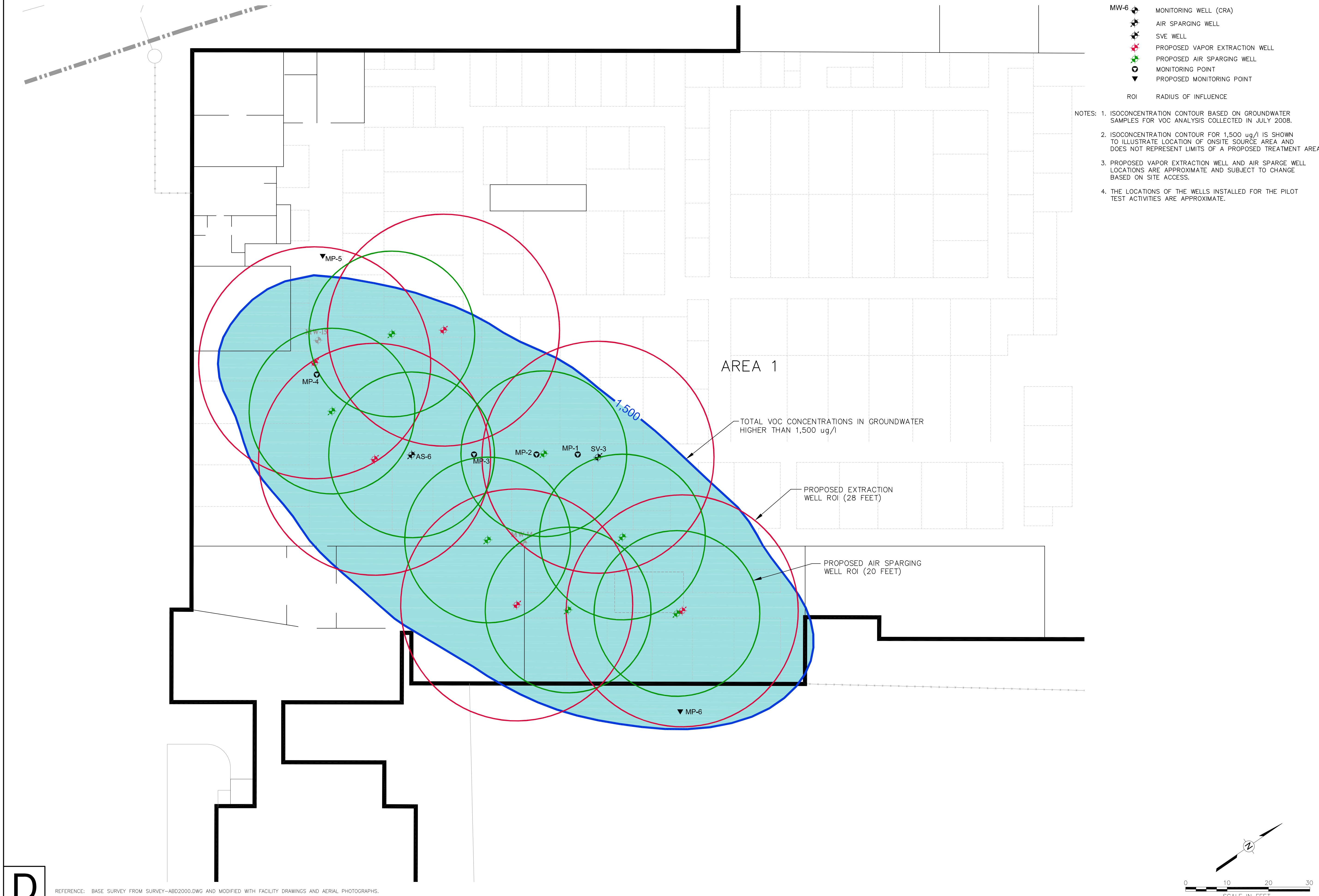

LEGEND

- MW-6 MONITORING WELL (CRA)
- AIR SPARGING WELL
- SVE WELL
- PROPOSED VAPOR EXTRACTION WELL
- PROPOSED AIR SPARGING WELL
- MONITORING POINT
- PROPOSED MONITORING POINT

ROI RADIUS OF INFLUENCE

NOTES:

1. ISOCONCENTRATION CONTOUR BASED ON GROUNDWATER SAMPLES FOR VOC ANALYSIS COLLECTED IN JULY 2008.
2. ISOCONCENTRATION CONTOUR FOR 1,500 ug/l IS SHOWN TO ILLUSTRATE LOCATION OF ONSITE SOURCE AREA AND DOES NOT REPRESENT LIMITS OF A PROPOSED TREATMENT AREA.
3. PROPOSED VAPOR EXTRACTION WELL AND AIR SPARGE WELL LOCATIONS ARE APPROXIMATE AND SUBJECT TO CHANGE BASED ON SITE ACCESS.
4. THE LOCATIONS OF THE WELLS INSTALLED FOR THE PILOT TEST ACTIVITIES ARE APPROXIMATE.

REFERENCE: BASE SURVEY FROM SURVEY-ABD2000.DWG AND MODIFIED WITH FACILITY DRAWINGS AND AERIAL PHOTOGRAPHS.

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PROPOSED AREA 1 AS/SVE WELL LOCATIONS TO ADDRESS GROUNDWATER SOURCE AREA

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FIGURE 8

Drawing Number
00005609-002

Appendix A – Air Sparging/Soil Vapor Extraction System – Design Drawing Package

INDEX OF DRAWINGS

AIR SPARGING/SOIL VAPOR EXTRACTION SYSTEM

DESIGN DRAWING PACKAGE

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SHEET 1

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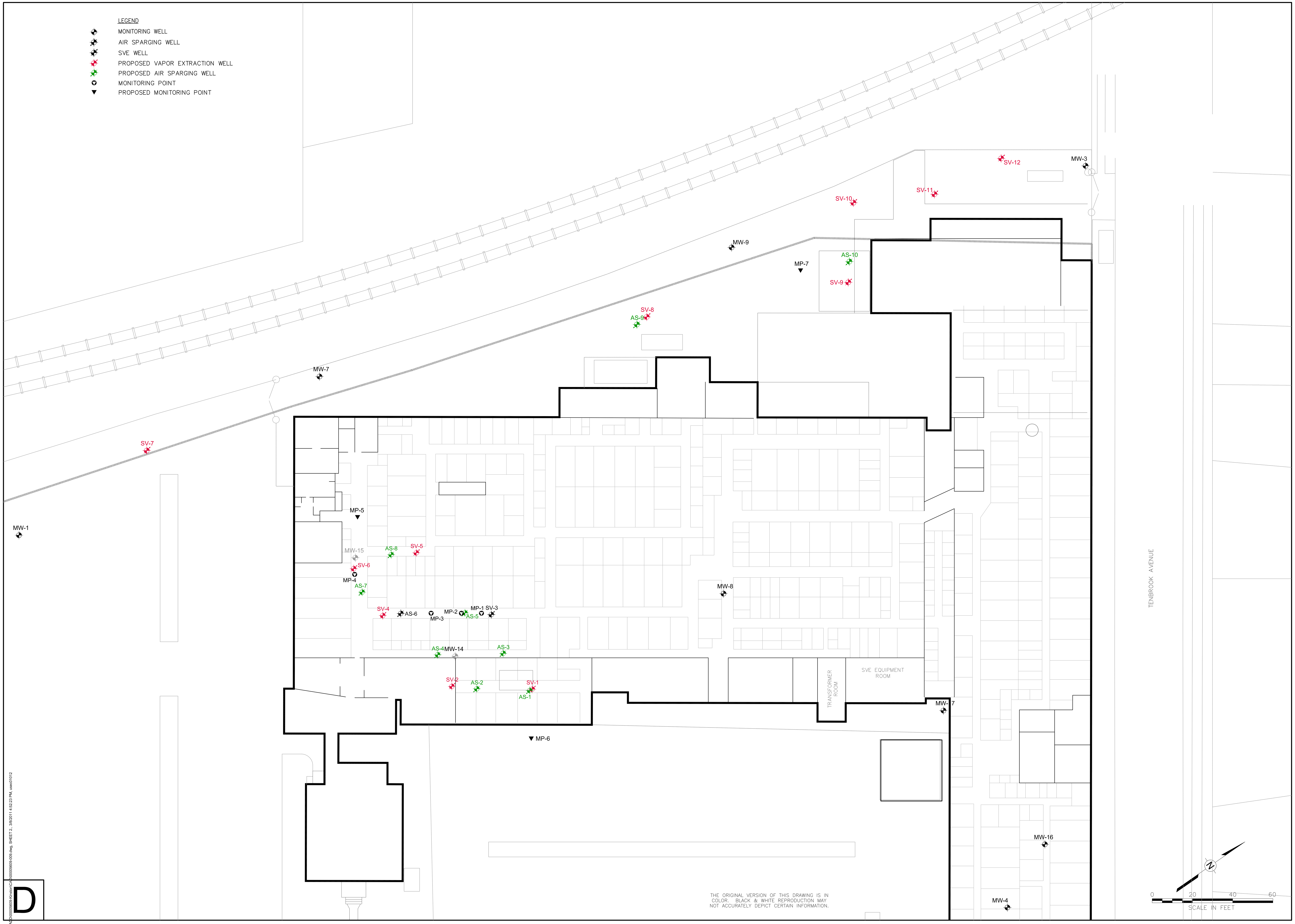

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SHEET 2

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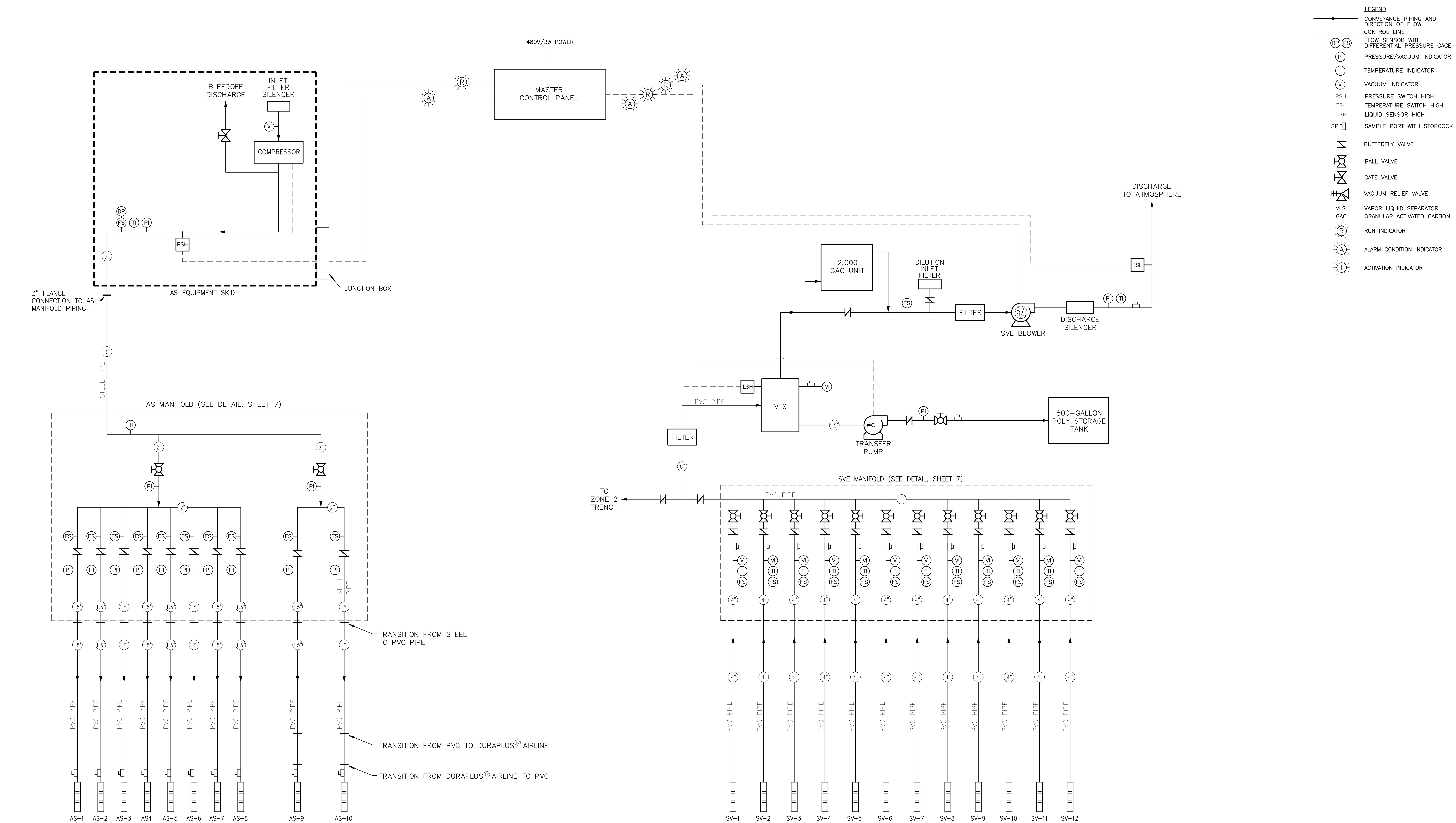

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SHEET 3

Drawing Number
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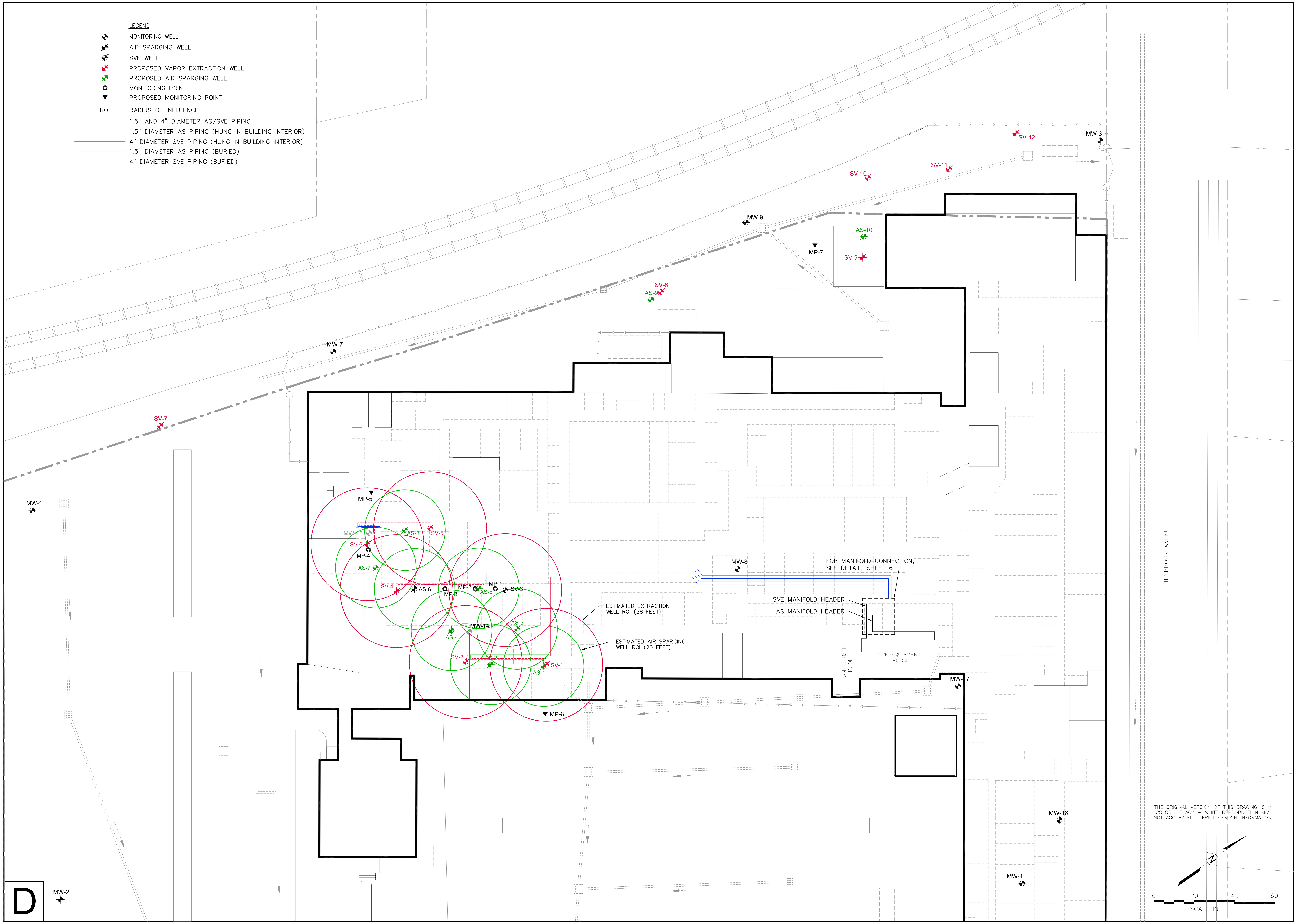

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WELL LOCATIONS AND PIPING ROUTES
CYCLE GROUP 1

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SHEET 4

Drawing Number
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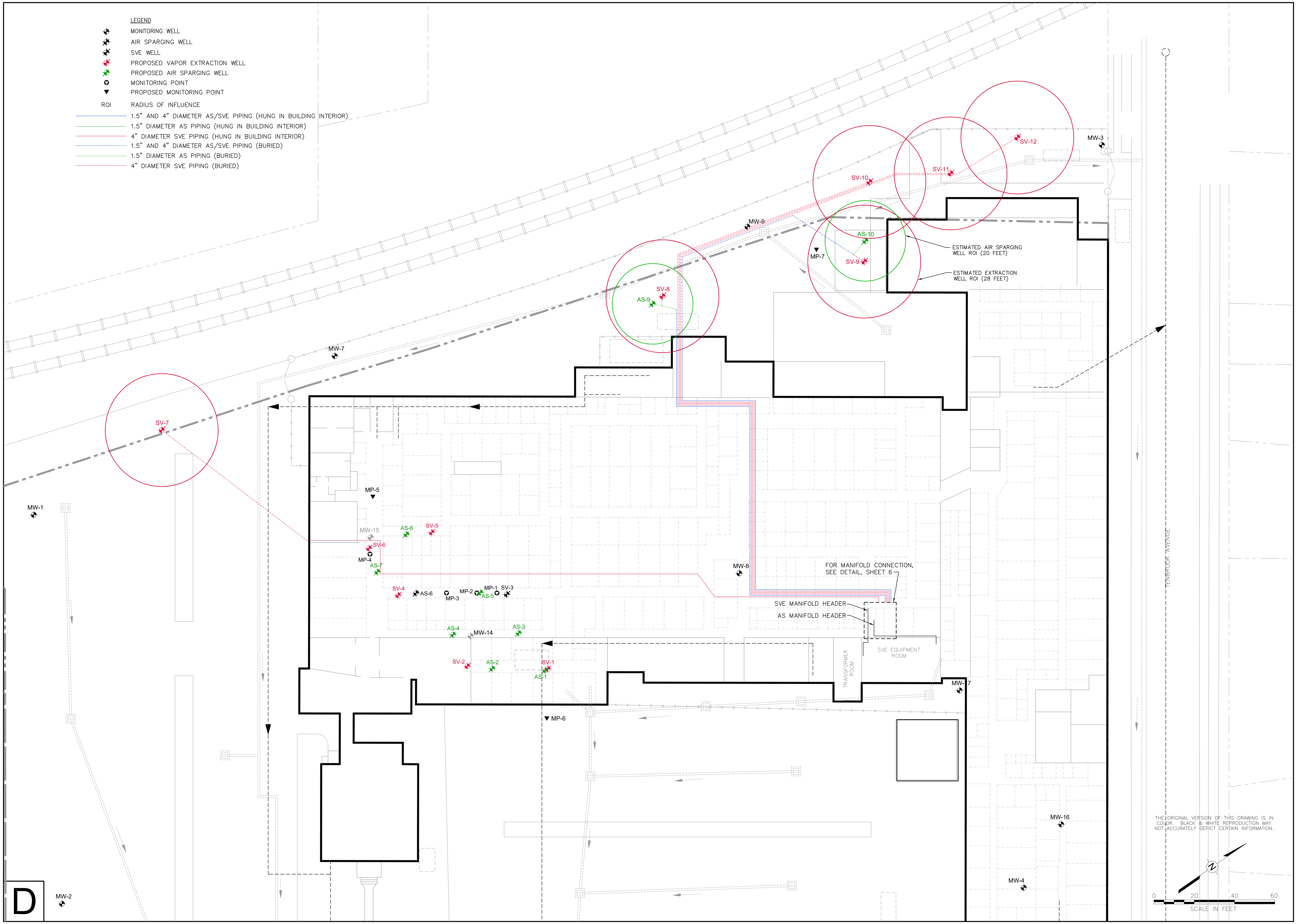

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WELL LOCATIONS AND PIPING ROUTES CYCLE GROUP 2

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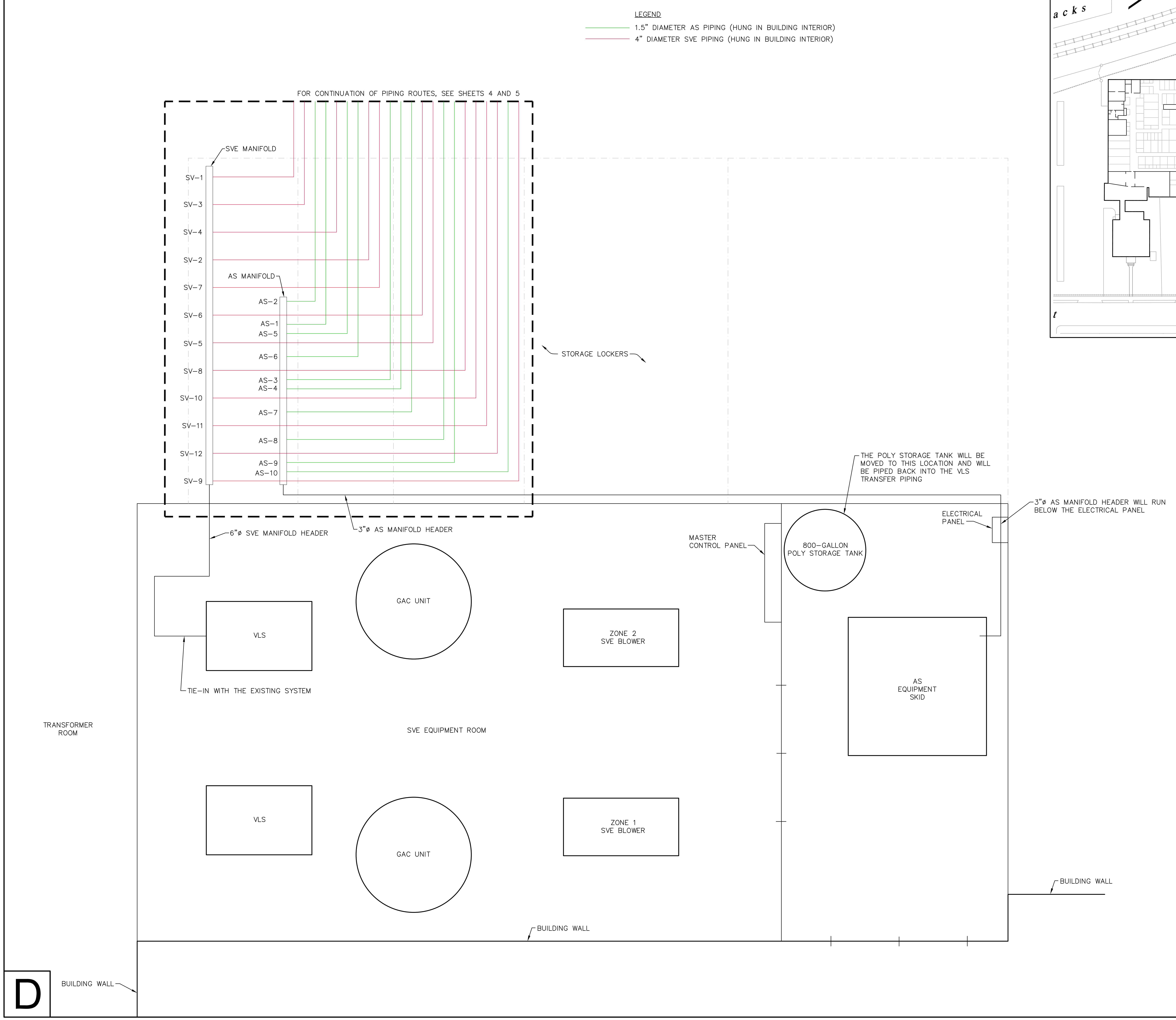
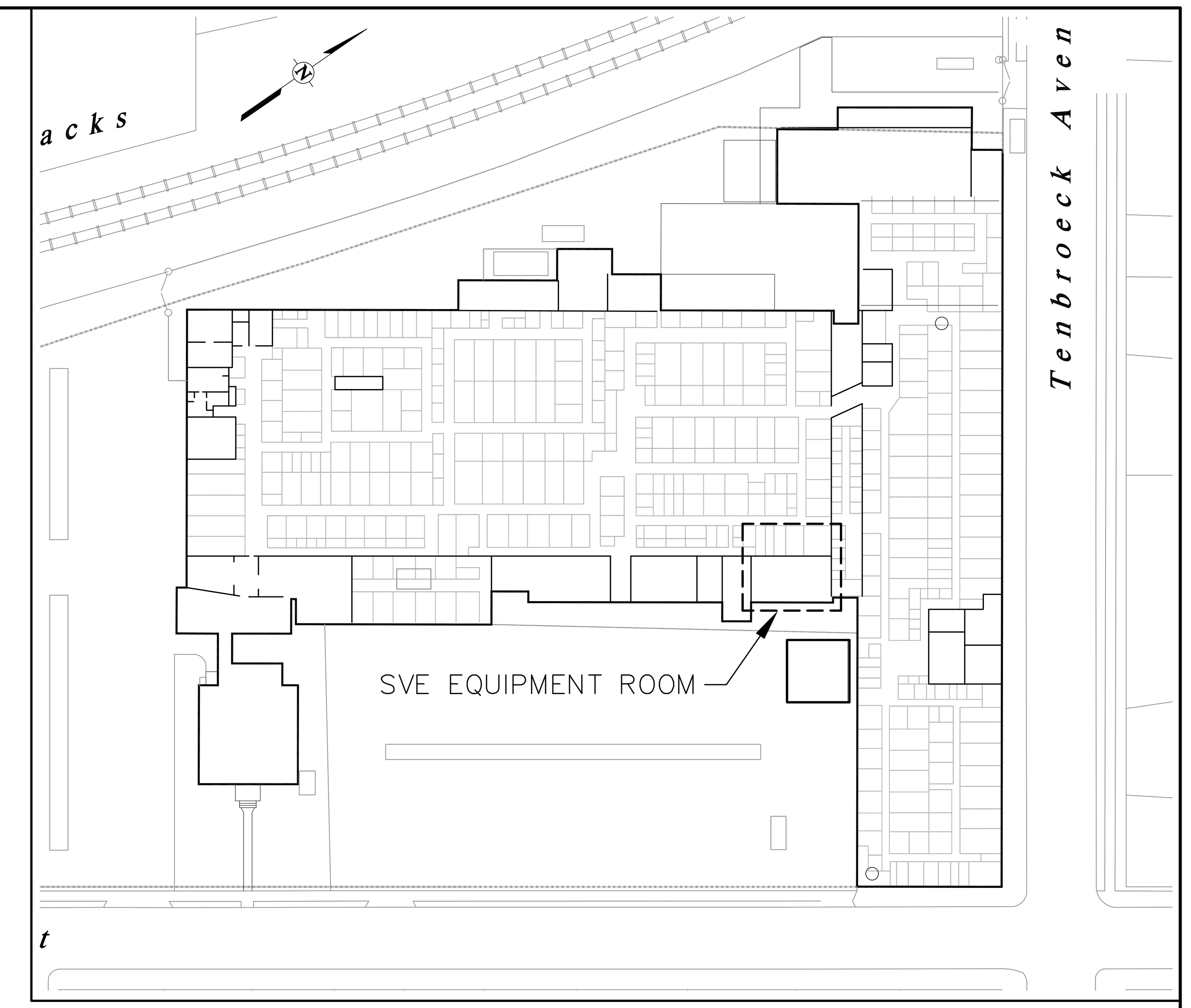
SHEET 5

Drawing Number
00005609-012





LOCATION MAP
SCALE: 1"=60'

D

REVISIONS

REV	DESCRIPTION

SEAL

DATE

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CHECKED	SBP
APPROVED	KBS

SOIL VAPOR EXTRACTION AND AIR SPARGING EQUIPMENT LAYOUT AND MANIFOLD CONNECTION DETAILS

FORMER HUCK MANUFACTURING FACILITY
KINGSTON, NEW YORK
PREPARED FOR
FEDERAL-MOGUL CORPORATION

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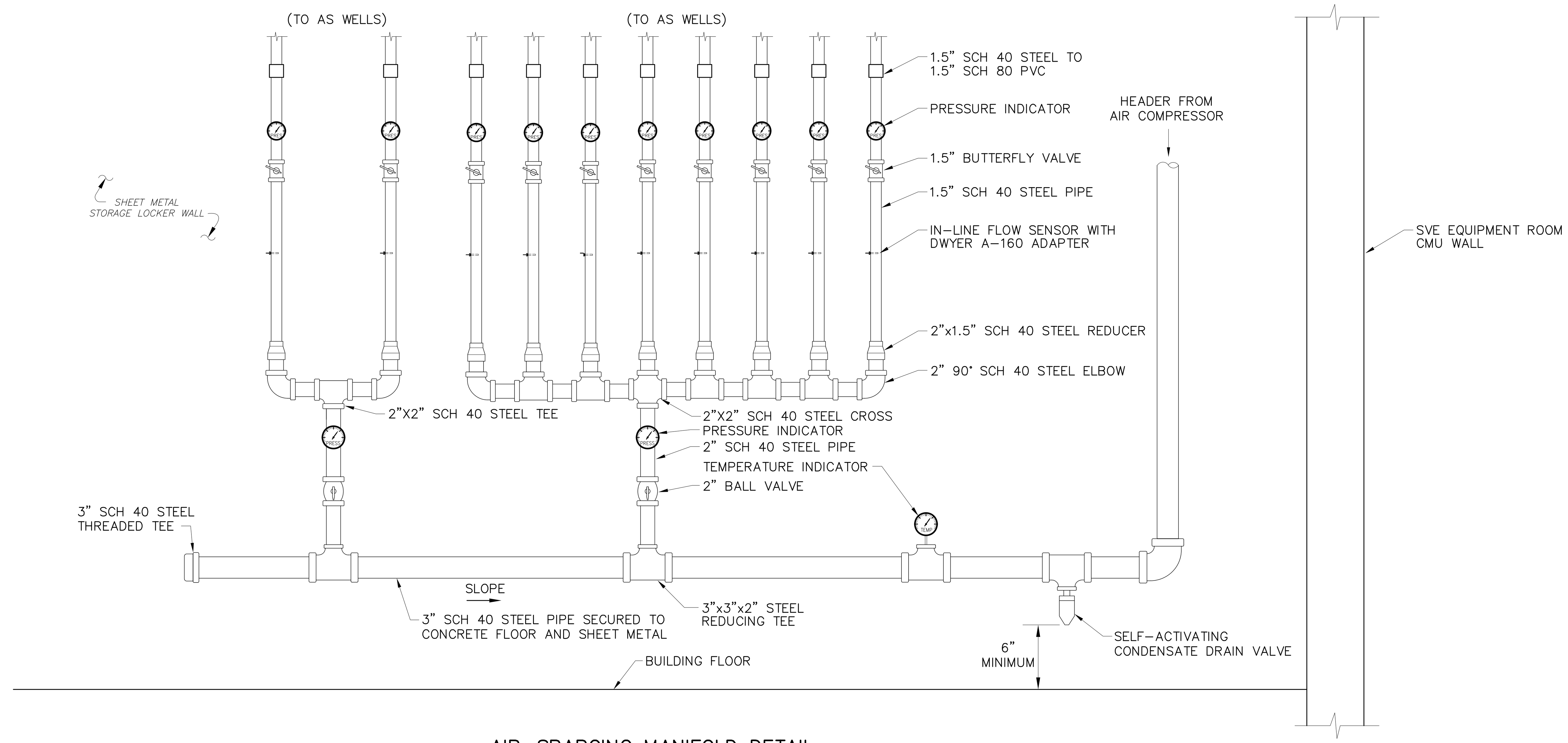
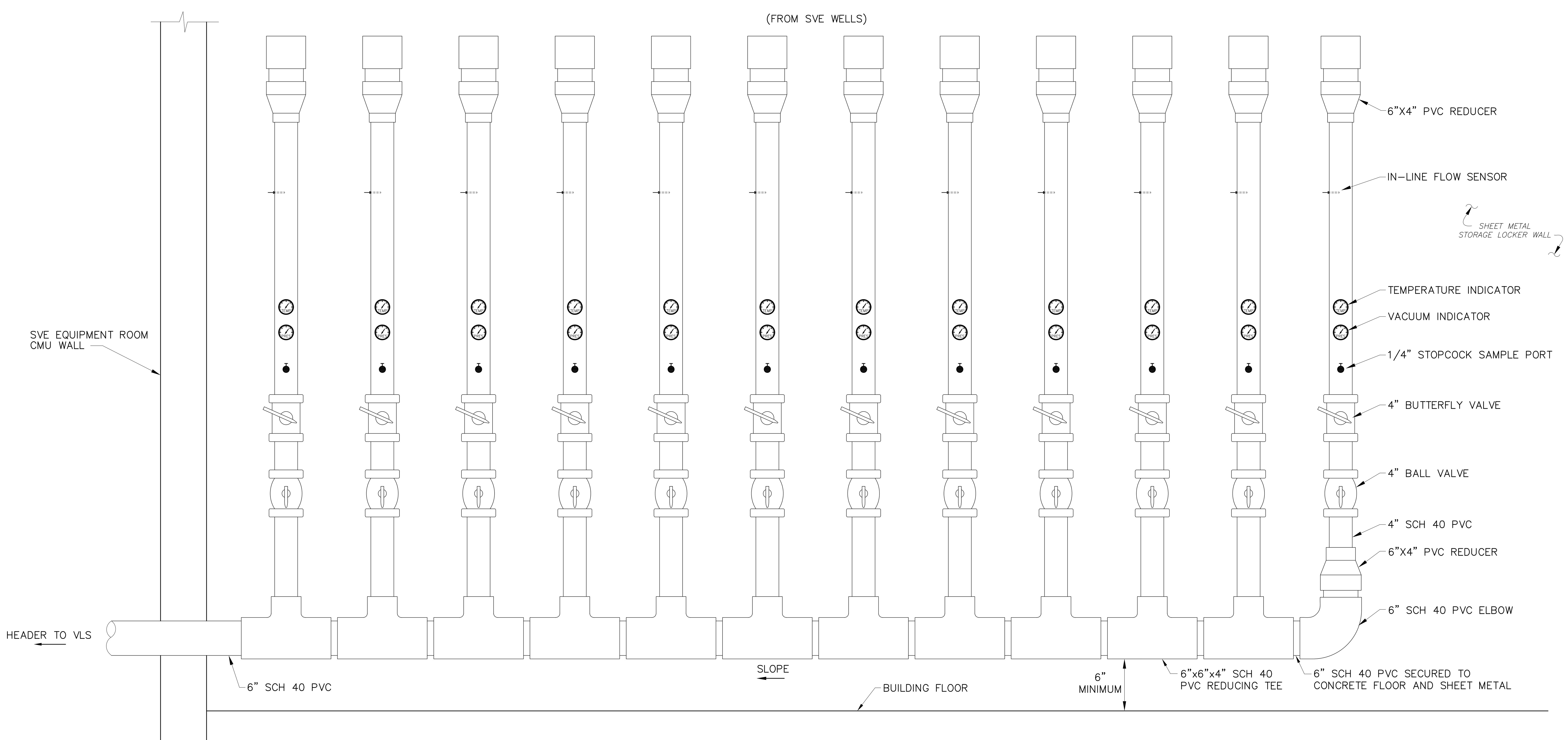
SHEET 6

Drawing Number
00005609-013



AIR-SPARGING MANIFOLD DETAIL
NOT TO SCALE



SOIL-VAPOR EXTRACTION MANIFOLD DETAIL
NOT TO SCALE

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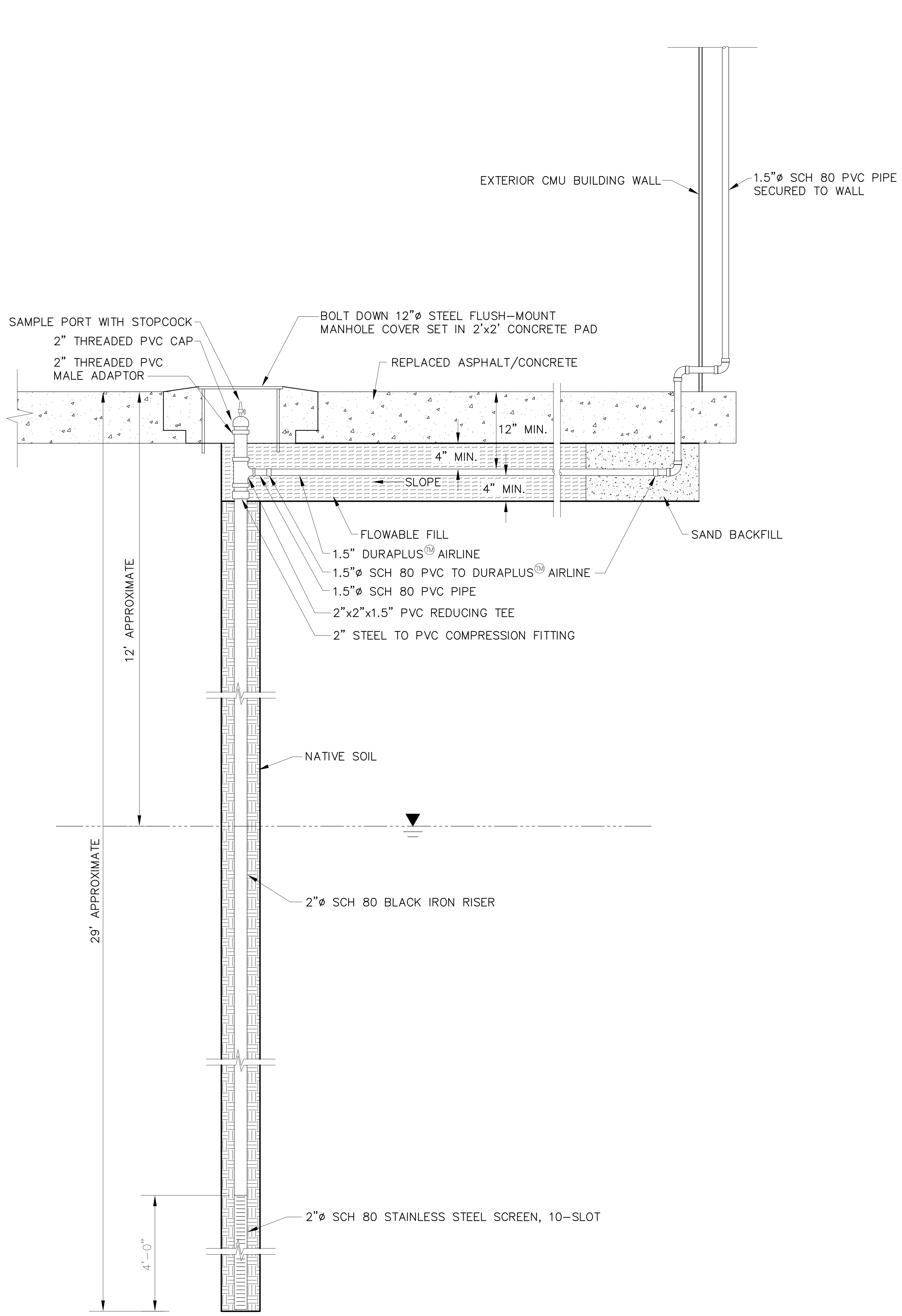
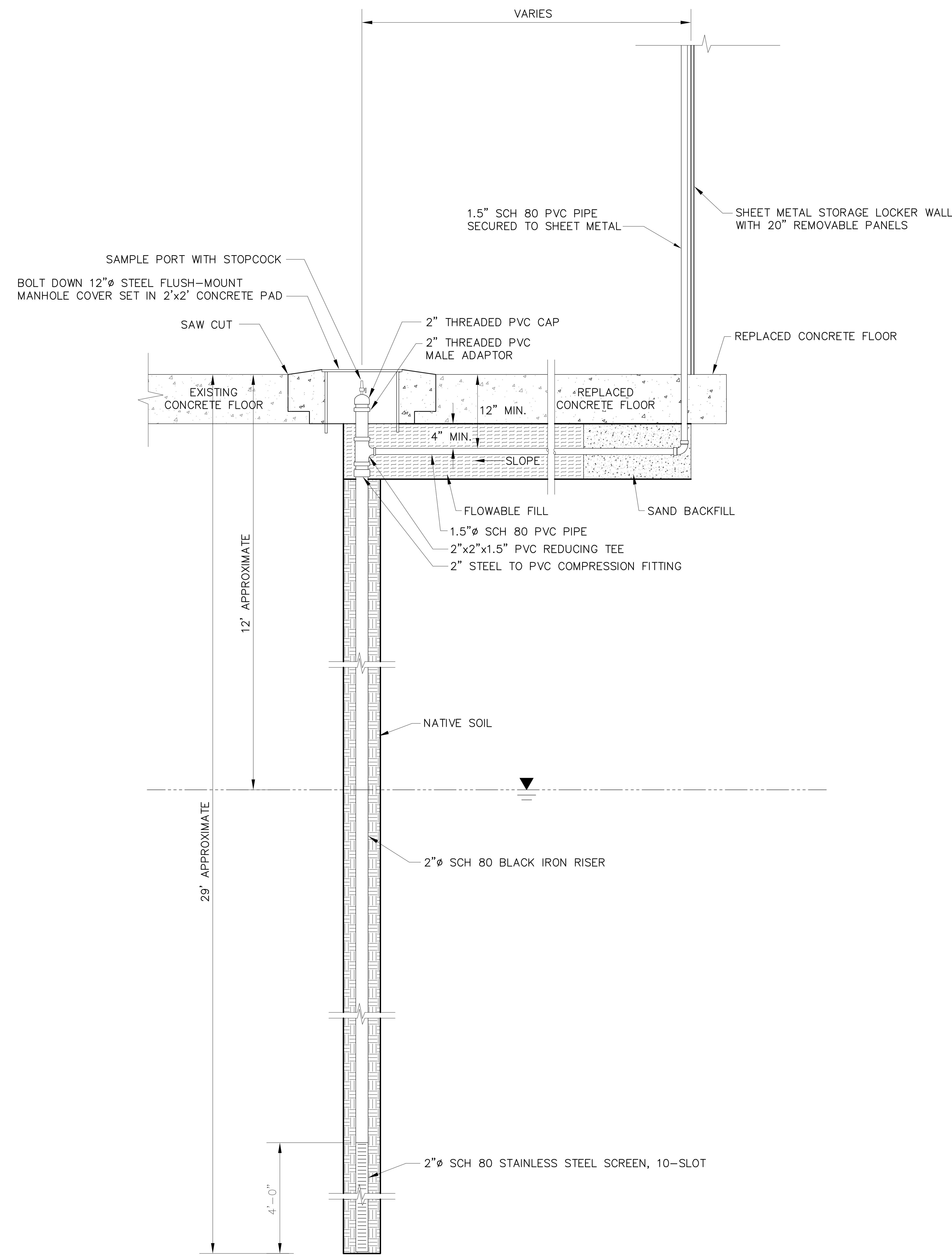


TYPICAL EXTERIOR AIR SPARGING WELL DETAIL (IN ASPHALT/CONCRETE)
1"=1'-0"



TYPICAL INTERIOR AIR SPARGING WELL DETAIL
1"=1'-0"

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AIR SPARGING WELLHEAD COMPLETION DETAILS
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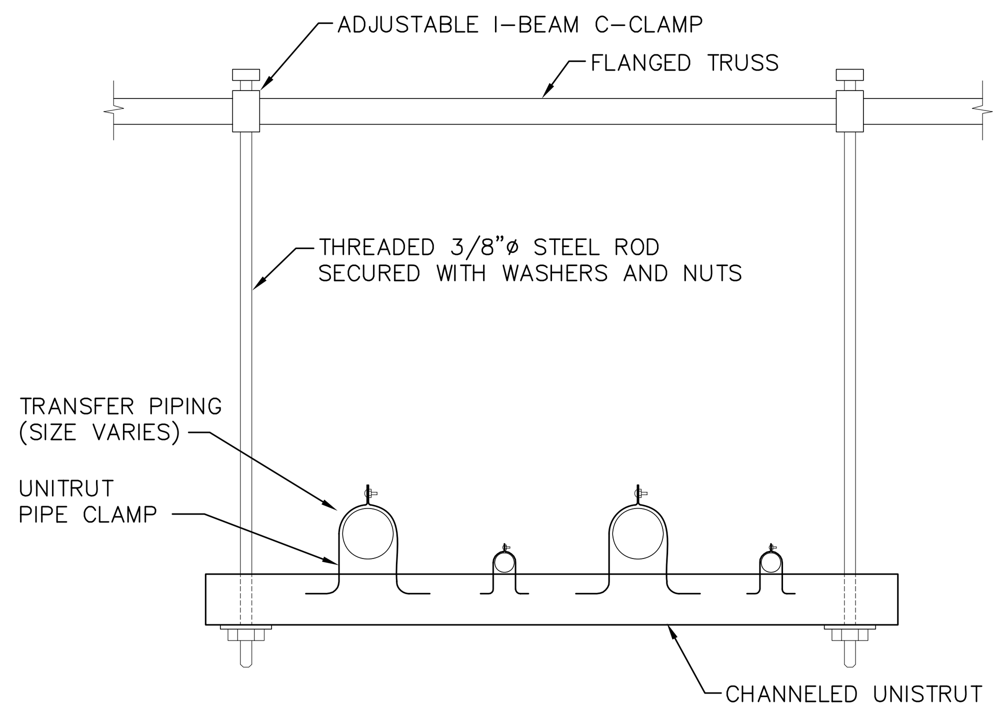
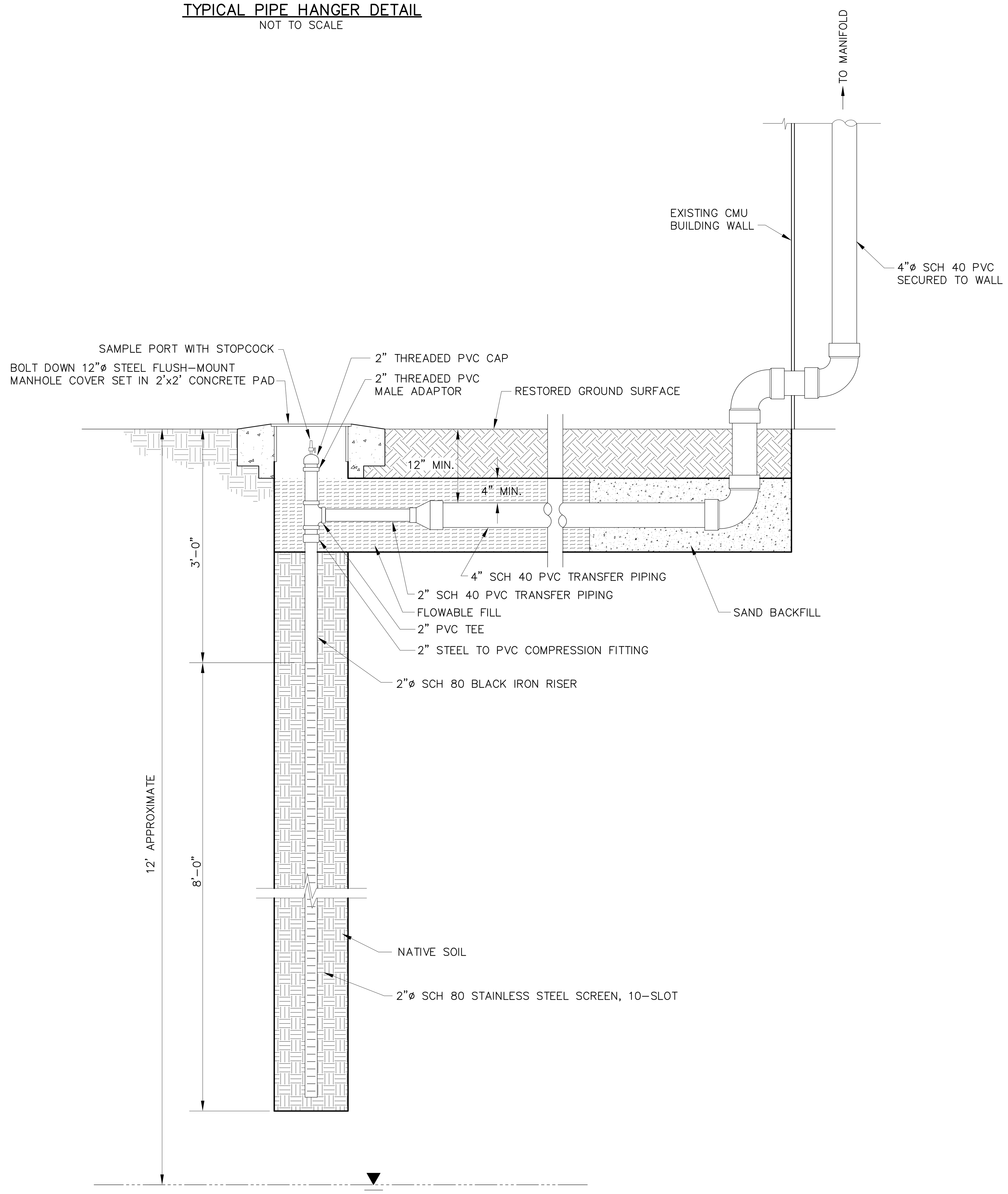


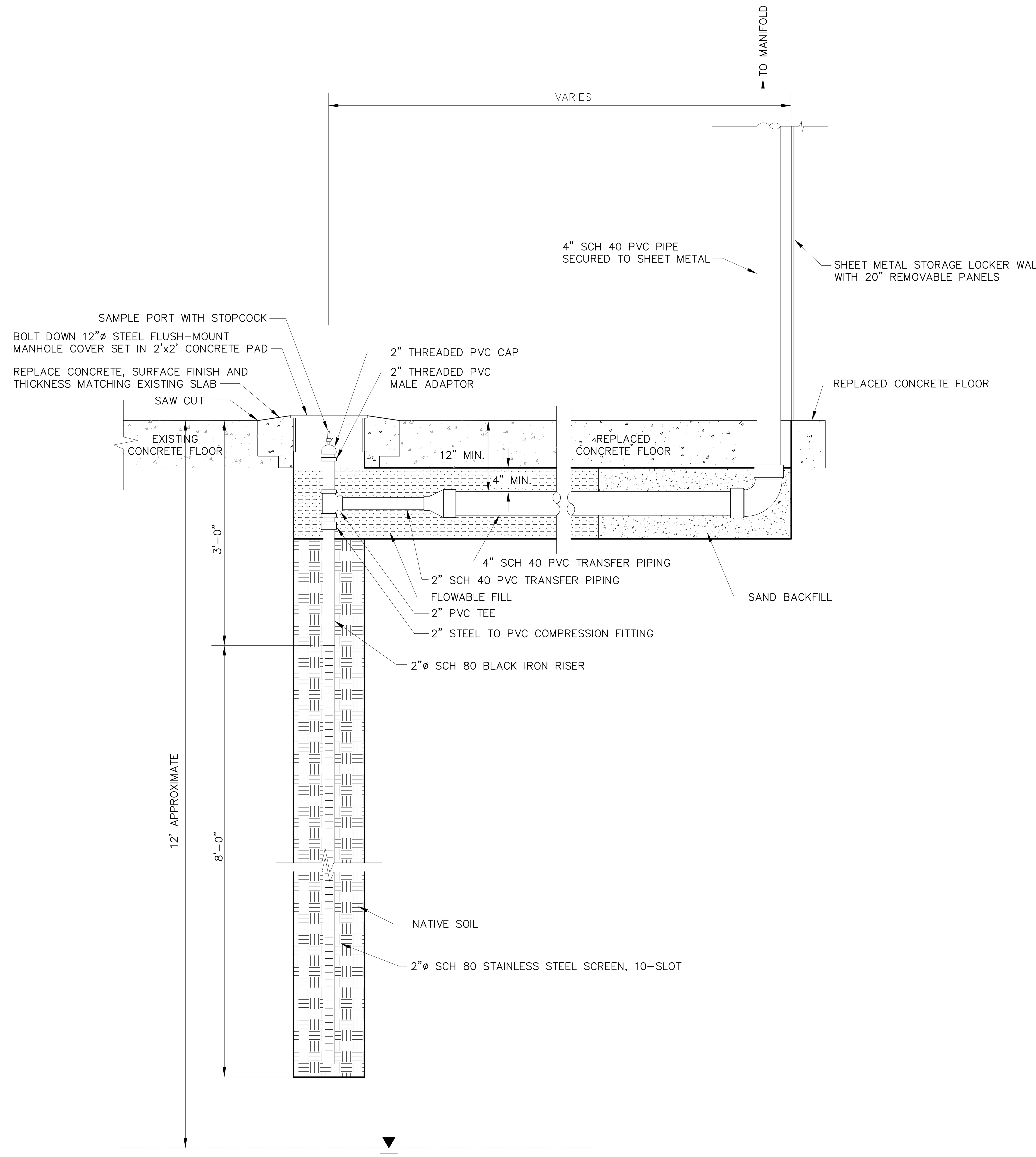
TYPICAL PIPE HANGER DETAIL
NOT TO SCALE

NOTES:

1. HANGER SPACING TO BE IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS
2. HANGERS NOT CONNECTED DIRECTLY TO STRUCTURAL SUPPORTS SHALL BE EVALUATED BY THE ENGINEER.



TYPICAL EXTERIOR SOIL VAPOR EXTRACTION WELL COMPLETION DETAIL
1"=1'-0"



TYPICAL INTERIOR SOIL VAPOR EXTRACTION WELL COMPLETION DETAIL
1"=1'-0"

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SOIL VAPOR EXTRACTION WELLHEAD COMPLETION AND PIPE HANGER DETAILS

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