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REVISED REMEDIAL WORK PLAN
DELPHI AUTOMOTIVE SYSTEMS SITE
1000 LEXINGTON AVENUE
ROCHESTER, NEW YORK
NYSDEC SITE #828064

by Haley & Aldrich of New York
Rochester, New York

for GM Components Holdings, LLC
Rochester, New York

File No. 127982-009
July 2020

Certification

I, Edmund Quinn Lewis, certify that I am currently a NYS registered professional engineer, and I certify that this Remedial Work Plan[1] was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER "Technical Guidance for Site Investigation and Remediation" (DER 10).

087372	6 July 2020	
NYS Professional Engineer Number	Date	Signature

It is a violation of New York State Education Law Article 145 for any person, unless he or she is acting under the direction of a licensed Professional Engineer, to alter this item in any way.

[1] Certification applies to the implementation of an automated Light Non-Aqueous Phase Liquid (LNAPL) Recovery System at the Building 1 and 2 Machining Areas, outlined in Section 4.1.2 of this RWP, as a component of the Site remedy selection: *Enhancement of the existing Groundwater collection system, Site management and LNAPL collection* identified in the NYSDECs Record of Decision dated March 2011 for Site No. 828064.

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1. Introduction

1.1 PURPOSE

This Remedial Work Plan (RWP) has been prepared for implementation under an Order on Consent between GM Components Holdings, LLC (GMCH) and the New York State Department of Environmental Conservation (Department) Index No. B8-0531-98-006. The Delphi Automotive Systems Site, designated by the Department as Site No. 828064 is located at 1000 Lexington Avenue in the City of Rochester, Monroe County, New York ("Site").

The Remedial Investigation (RI) program was conducted from 2001 through 2005 by Delphi Automotive Systems LLC (Delphi) under an Order on Consent Index No. B8-0531-98-06 signed by the Department on February 4, 2002. The Final RI report (Haley & Aldrich of New York, 2005) that delineated the on-site and off-site environmental conditions was submitted to the Department on November 5, 2005. The Feasibility Study (FS) report (Haley & Aldrich of New York, 2008), presenting the remedial action alternatives for the remedy and the site management necessary for the current and future use of the Site, was submitted to the Department on July 31, 2008. This Order on Consent addressing the RI/FS for the Site also addressed the corrective action requirements of the Resource Conservation and Recovery Act (RCRA) program.

Based on the RI program and the FS of the remedy alternatives evaluated to address the Site-related contaminants of concern (COCs), the Department issued a Record of Decision (ROD) on March 31, 2011 which identified the selected remedy as: *Enhancement of the existing Groundwater collection system, Site management and LNAPL collection*. The elements of the selected remedy (as identified on Pages 1-3 of the ROD) include:

1. Continued operation of the remedial systems installed as part of the RCRA corrective actions undertaken at the Site, with the following evaluation and enhancements:

    a. Light Non-Aqueous Phase Liquid (LNAPL) recovery will continue in the Building 22 and the Tank Farm areas. Additional LNAPL recovery methods will be implemented to expand the area and volume of NAPL recovery, in a manner allowing for continued facility manufacturing operations in the areas affected by LNAPL.
    b. An effectiveness study will evaluate NAPL in areas adjacent to collection points to determine if more aggressive collection techniques are required. Methods that will be considered include, but are not limited to: surfactant enhanced recovery, vacuum enhanced recovery and/or additional recovery wells, etc.
    c. Continued operation of the Groundwater Migration Control systems with the installation of additional recovery wells. The operation of the current migration control systems in concert with the recovery of LNAPL interior to the Site will reduce the mass flux of dissolved phase contaminants. At a minimum, expansion of the groundwater migration control system will require the installation of at least two (2) bedrock groundwater recovery wells north of the East Parking Lot.
    d. Continue to maintain a positive pressure in the site buildings to address vapor intrusion in areas of contamination in the subsurface and evaluation of the effectiveness and extent of the mitigation provided by this approach.

2. The existing buildings, pavement and lawns at the Site form a site cover and there are currently no exposed surface soils to be addressed. A site cover will be maintained as a component of any future development, which will consist either of the structures such as buildings, pavement, sidewalks comprising the site development or a soil cover where the upper foot of exposed surface soil will exceed the applicable soil cleanup objectives (SCOs). Where the soil cover is required it will be a minimum of one foot of soil, meeting the SCOs for cover material as set forth in 6 NYCRR Part 375-6.7(d) for industrial use. The soil cover will be placed with the upper six (6) inches of the soil of sufficient quality to maintain a vegetation layer. Any fill material brought to the site will meet the requirements for the identified site use as set forth in 6 NYCRR Part 375-6.7(d).

3. Imposition of an institutional control in the form of an environmental easement for the controlled property that:
    a. Requires the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with 6 NYCRR Part 375-1.8 (h) (3),
    b. Allows the use and development of the controlled property for industrial uses as defined by 6 NYCRR Part 375-1.8 (g), although land use is subject to local zoning laws;
    c. Restricts the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the New York State Department of Health (NYSDOH) or County DOH;
    d. Prohibits agriculture or vegetable gardens on the controlled property; and
    e. Requires compliance with Department approved Site Management Plan (SMP).

4. A Site Management Plan (SMP) is required, which includes the following:
    a. An Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:
        i. Institutional Controls: The Environmental Easement discussed in Paragraph 3 above.
        ii. Engineering Controls: The remedial systems discussed in Paragraph 1 and site cover discussed in Paragraph 2.

    This plan includes, but may not be limited to:
        i. An Excavation Plan which details the provisions for management of future excavations in areas of remaining contamination;
        ii. Descriptions of the provisions of the environmental easement including any land use and/or groundwater use restrictions;
        iii. A provision for evaluation of the potential for soil vapor intrusion in the existing on-site buildings currently subject to positive pressure and for any buildings developed on the site, including provision for implementing actions recommended to address exposures related to soil vapor intrusion;
        iv. Provisions for the management and inspection of the identified engineering controls;
        v. Maintaining site access controls and Department notification; and the steps necessary for the periodic reviews and certification of the institutional and/or engineering controls;

b. A Monitoring Plan to assess the performance and effectiveness of the remedy. The plan includes, but may not be limited to:
    i. Monitoring of groundwater quality to assess the performance and effectiveness of the remedy;
    ii. A schedule for monitoring and a frequency for reporting to the Department;
    iii. Monitoring of indoor air quality for any building occupied or developed on the site as required pursuant to item a. iii above; and
c. An Operation and Maintenance (O&M) Plan to ensure continued operation, maintenance, monitoring, inspection and reporting of any mechanical or physical components of the remedy. The plan includes, but is not limited to:
    i. Compliance monitoring of treatment systems to ensure proper O&M as well as providing the data for any necessary permit or permit equivalent reporting;
    ii. Maintaining site access controls and Department notification; and
    iii. Providing the Department access to the site and O&M records.

1.2 REMEDIAL WORK PLAN CONTENT

The following sections of this document provide the background and details for implementation of the automated LNAPL Recovery System at the Building 1 and 2 Machining Areas portion of the remedy selection through the alternatives analysis process for the Site, overviews of the previously implemented portions of the selected remedy associated with; LNAPL Recovery; Soil Vapor Mitigation; and Groundwater Migration Control, and considerations for management of Overburden Soils post-remedy implementation.

Section 2 presents the property use information and project background, which includes a Site description and historical use summary, and describes the physical and environmental setting and a description of current Site conditions and land use.

Section 3 provides a summary of the results of previous remedial investigations performed and a Site Conceptual Model (SCM) including an assessment of changed conditions anticipated at the Site.

Section 4 describes the remedial approach for implementation of the automated LNAPL Recovery System at the Building 1 and 2 Machining Areas designed to achieve the remedial action objectives (RAOs) identified in the ROD provided as Table 1 to this RWP.

Section 5 describes the Remedial Action Monitoring activities that will be performed as a component of the remedy implementation.

Section 6 describes the Engineering and Institutional Controls, including the scope of an applicable Site Management Plan (SMP), to be implemented as part of the Site remedy for the attainment of the RAOs during and after implementation of the remedial action described in Section 4 as well as the previously implemented portions of the Department selected remedy.

Section 7 provides the structure and schedule for reporting the activities conducted to implement the remedial actions described in this RWP.

Section 8 details the contents of the Final Engineering Report (FER) which will mark the completion of the Remedial Action activities and the commencement of work under the SMP.

Section 9 provides the references identified in this RWP.

This RWP also contains figures and appended information providing additional details to support implementation of the automated LNAPL Recovery System at the Building 1 and 2 Machining Areas remedial action.

Table 1 provides the RAOs for the Site as presented in the ROD.

2. Site Description and History

The Delphi (Site) is located at 1000 Lexington Avenue in Rochester, New York. The Site is listed as #828064 in the Registry of Inactive Hazardous Waste Disposal Sites in New York State. The Site is currently owned by GM Components Holdings, LLC (GMCH) and is an active automotive component manufacturing facility.

2.1 SITE BOUNDARY

The Site consists of approximately 86.5 acres of land located in the City of Rochester, New York. A topographic map of the area and a site plan showing physical features such as driveways, fences, and buildings are presented on Figures 1 and 2.

The Site is bounded on the west by Mt. Read Boulevard, on the north by Driving Park Avenue, on the east by a railroad embankment and on the south by Lexington Avenue.

2.2 PROPERTY HISTORY

General Motors Corporation (GMC) built the original manufacturing building and began manufacturing operations at the Site in 1938. Various GMC divisions operated the facility until ownership of the Site and its operation were transferred to Delphi in 1999. General Motors Components Holdings, LLC (GMCH), a wholly owned subsidiary of General Motors LLC acquired the facility in October 2009 in an asset sale approved by the federal bankruptcy court overseeing Delphi's bankruptcy proceedings. Delphi conveyed the facility to GM LLC by deed in 2009. General Motors, LLC was itself a newly created entity formed in July 2009 in the bankruptcy proceedings of Motors Liquidation Company (formerly known as the now liquidated GMC). Over time, the facility has been used for the production of a wide variety of automotive parts. Automotive fuel systems have been the primary product line since 1945.

Manufacturing processes have included machining and forming of metal parts, metal tube manufacturing, metal plating, heat treating, die casting, solvent degreasing, injection molding of plastic parts, and the assembly of finished automotive parts and fuel systems. Fuel-systems flow-testing and calibration, engine output testing, and related product engineering and testing operations have also been conducted, as have wastewater pre-treatment and steam generation for plant heating.

As noted in the Final RI Report (Haley & Aldrich 2005), subsurface investigations have been conducted at the Site by either GMC or Delphi since 1981. A comprehensive summary of previous remedial investigation findings was presented in the *Data Summary Report* dated September 1998 (Haley & Aldrich of New York, 1998) and data from subsequent groundwater sampling events presented in the *East Parking Lot Area Well Installations and January 1999 Groundwater Sampling Events* reports (Haley & Aldrich of New York, 1999).

Based on historical Site information interim remedial measures (IRMs) to address soil and groundwater contamination prior to issuance of the March 2011 ROD were installed by Delphi Automotive Systems and are currently being operated by GMCH and have been incorporated into the selected remedy for the Site. The four (4) remedial actions that were previously IRMs are described below.

2.2.1 Tank Farm Area LNAPL-Recovery System

A light non-aqueous phase liquid (LNAPL) recovery system located at the northeast corner of the manufacturing building has been in operation since 1989. LNAPL recovery was implemented in this area of the Site to collect a floating oil layer that is present at the overburden soil water table. The LNAPL layer consists of a mixture of Stoddard solvent (a petroleum distillate used as a calibration fluid in fuel-system product testing), other gasoline-like test fuels, and machining oils. The LNAPL-recovery system includes three (3) large (36-inch)-diameter recovery wells (RW-101, RW-2, and RW-3) installed with passive skimmer pumps along a 400-foot-long gravel-backfilled trench. The passive skimmers were replaced with a total-fluids pumping system installed in RW-2 in 1994. LNAPL and groundwater is removed and processed using an oil/water separator, air stripper system and granulated activated carbon (GAC) adsorption prior to discharge to the facility's sanitary sewer for additional treatment at the Monroe County Pure Waters (MCPW) Publicly Owned Treatment Works (POTW).

2.2.2 Blasted Bedrock Trench Groundwater Migration Control System

A groundwater migration-control system designed to capture groundwater moving north from the manufacturing plant was constructed and has been operating since 1992. The system consists of a 1200-foot-long groundwater recovery trench that is located beneath the north parking lot and was created using engineered-blasting techniques to enhance bedrock aquifer permeability. Two recovery wells (GR-1 and GR-2) installed in the 50-foot-deep blasted bedrock zone are used to extract groundwater and pump it to holding tanks for batch testing and subsequent discharge to the municipal sewer for treatment at the MCPW POTW.

2.2.3 Building 22 Area LNAPL Recovery System

An LNAPL-recovery system was installed and has been operating inside Building 22 since 1995. The system was installed to address an LNAPL layer that consists of Stoddard solvent impacted with polychlorinated biphenyls (PCBs). Stoddard solvent was used historically in Building 22 as a calibration fluid for carburetor testing operations. The LNAPL-recovery system consists of a pump installed in Well RW-4 inside Building 22, a total-fluids pump in Well Z, which is located east of Building 22 and the collection of LNAPL and groundwater from the foundation-drain system for the Additional Waste Treatment Area (AWTA) building (Building 14) located north of Building 22. The LNAPL and groundwater collected is routed through a coalescing filter oil-water separator inside the AWTA building. Collected LNAPL is placed in drums and shipped off-site for disposal, and the separated groundwater from the Building 22 system is combined with groundwater collected from the blasted bedrock trench migration-control system recovery wells into holding tanks for batch testing and subsequent discharge to the municipal sewer for treatment at the MCPW POTW.

2.2.4 Soil Vapor Extraction (SVE) System

Delphi installed a soil-vapor extraction (SVE) system in Degreaser Investigation Study Area 5 in June 1996 to address VOC contamination present in soil beneath the floor of the manufacturing building in this area. The Study Area 5 SVE system uses overburden wells to extract soil vapor and until 1999, the SVE vapor effluent stream was treated through granulated activated carbon (GAC) canisters prior to discharge. The concentrations of VOCs in the extracted vapor diminished with time, and at the end of 1999, NYSDEC approved direct discharge of the extracted soil vapor to the atmosphere without carbon filtration.

Periodic monitoring of the extracted soil vapor has demonstrated further decline of the extracted VOC contaminant concentrations. In January 2017, the laboratory analysis of an extracted vapor sample collected from the SVE system discharge did not detect total VOCs at a concentration above the laboratory reporting limits of 2.0 milligrams/cubic meter (mg/M3) (Haley & Aldrich of New York, January 2017). In March 2017, GMCH requested termination of this IRM due to the diminished concentration of the VOCs extracted and the increasing costs to maintain the system (Haley & Aldrich of New York, March 2017).

3. Remedial Investigation Summary

An Order on Consent Index No. B8-0531-98-06 for the performance of a Remedial Investigation and Feasibility Study (RI/FS) signed by Delphi and the Department on February 4, 2002. The objective of the Remedial Investigation (RI) was to determine the nature and extent of contamination at the Site and the objective of the Feasibility Study (FS) was to evaluate remedial alternatives to address the areas of environmental contamination identified.

The RI Work Plan was developed to address data gaps in areas of interest (AOI) where additional data were needed including potential on-site sources of contamination that had not been previously investigated and off-site areas to the north and east of the Site. As outlined in the previously referenced Site related documents, the RI was performed during the period of November 2001 through July 2005 and involved the following investigation activities as summarized in the RI Report (Haley & Aldrich of New York 2005)*:*

- sampling of soil vapor beneath the facility manufacturing building floor at locations for the purposes of delineating the extent of volatile solvent and test fuel releases;
- drilling of soil and bedrock test borings at on-Site and off-Site locations;
- soil sampling for chemical analysis for on-site borings;
- installation of groundwater-monitoring wells;
- installation and sampling at temporary groundwater-sampling locations;
- periodic sampling of groundwater from January 2003 through April 2005 and, where present, light or dense non-aqueous phase liquids (LNAPL and DNAPL);
- periodic monitoring of groundwater elevations and NAPL occurrences in on- and off-site wells;
- sampling of storm water and sanitary wastewater discharges at locations on-site;
- sampling of combined wastewater in two underground municipal sewers at an upstream, on-site, and downstream location in each tunnel; and
- sub-slab soil vapor sampling at locations with simultaneous indoor- and outdoor-air sampling to evaluate the potential for contaminated soil-vapor intrusion at the Site.

The principal findings as presented in the Department approved RI Report concerning environmental conditions included:

- Site groundwater is impacted by chlorinated volatile organic compounds (VOC) originating from the locations of former degreaser systems located inside the manufacturing building. The vertical extent of groundwater contamination is limited to the overburden soil and top 25 feet of underlying bedrock. VOC impacted groundwater extends laterally to the northern Site boundary and to approximately 400 feet beyond the eastern Site boundary.

- Four (4) IRMs installed prior to the ROD issuance are operating at the Site, and in the area along the northern Site boundary these measures have controlled groundwater flow in the horizons affected by the impacted groundwater.

- LNAPL is present within the overburden soils and shallow and intermediate bedrock stratigraphic units between the manufacturing building to slightly beyond the eastern property boundary. LNAPL in the intermediate-bedrock in this area appears to originate from under the southeast corner of the manufacturing building and consists of a light-weight test-fuel fraction and a heavier-weight lubricating-oil fraction comingled with chlorinated VOCs.

- LNAPL in shallow groundwater is also present in several areas within the interior of the Site and it consists of lubricating oils and/or lighter-weight test-fluid products (petroleum distillates used as calibration fluids and test fuel).

- Natural attenuation including the biodegradation of the chlorinated VOCs in groundwater by naturally-occurring bacteria is occurring in the subsurface at the Site.

- PCB compounds are present in the LNAPL detected near Building 22 in the northern portion of the Site. No known source of PCBs has been identified in the vicinity of Building 22.

- A shallow LNAPL occurrence was identified in the north parking lot near the groundwater migration-control system and within its groundwater capture zone for this IRM.

- At the former degreaser locations inside the manufacturing building, overburden soil and soil vapor beneath the floor slab are impacted by VOC. In areas where LNAPL is present, petroleum-related VOC are also present in the sub-slab soil vapor.

- Soil contamination by metals including chromium (Cr), copper (Cu) and zinc (Zn) is present beneath the manufacturing building in former metal plating operations areas. Overburden soil contamination by these metals is also present in an area north of Building 14.

- The infiltration of site contaminants into on-site or off-site sewers does not appear to be a significant migration pathway and does not appear to be adversely impacting wastewater conditions.

3.1 SITE CONCEPTUAL MODEL (SCM)

This Site Conceptual Model (SCM) has been developed based on the information obtained from the implementation of the IRMs, the findings of the RI and the construction of the components of the selected remedy subsequent to the issuance of the ROD by the Department in March 2011.

3.1.1 Site Stratigraphy and Hydrogeology

Four (4) hydrogeologic units have been identified at the Site, and the on-site and off-site wells have been installed to monitor hydrogeologic conditions in these units:

- Overburden Unit - saturated overburden deposits ranging in depth from ground surface to approximately 14 feet below ground surface (bgs).

- Shallow-Bedrock Unit - the overburden-bedrock interface and underlying upper 7 feet of bedrock.

- Intermediate-Bedrock Unit - from 10 feet to approximately 25 feet below the top of bedrock.

- Deep-Bedrock Unit - from 30 feet to 65 feet below the top of rock.

The extent of groundwater contamination at the Site has been found to be restricted to the overburden and the upper 25 feet of bedrock (the Intermediate-Bedrock Unit). The vertical extent of VOC contamination is limited by the decrease in permeability and an absence of transmissive fractures in deep bedrock. Permeability in the shallow- and intermediate-bedrock units ranges from 3.0E-01 centimeters per second (cm/sec) to less than 1.0E-06 cm/sec. Permeability in the deep-bedrock unit is generally very low, ranging from 2.0E-06 cm/sec to less than 1.0E-08 cm/sec at the deep bedrock wells with the exception of well DR-132 where the permeability was 6.2E-04 cm/sec. The permeability of the shallow- and intermediate-bedrock units was enhanced continuously along the migration-control trench by the engineered blasting performed during construction in 1992. The blasted-bedrock trench and groundwater migration-control system recovery wells span the shallow- and intermediate-bedrock units. Groundwater flow direction in the shallow and intermediate-bedrock units is generally to the northeast.

3.1.2 Soil Conditions

The Site is underlain by variable unconsolidated fill materials and overburden soils. The fill and native overburden deposits vary from 5 to approximately 25 feet in total thickness. The overburden is thickest in the area at the north end of the plant and thinnest on the south near Lexington Avenue. The presence or absence of specific soil deposits or fill components is variable across the Site. Bedrock beneath the overburden is the Upper Silurian-aged Rochester Shale, a dolomitic mudstone, which dips gently to the south at approximately 40 feet per mile. Deep bedrock wells on the north side of the Site penetrate the Rochester shale and intersect the underlying Irondequoit Limestone.

Overburden Deposits

Type	Description
Fill	Silt, sand, gravel, and miscellaneous materials including construction and demolition debris, riprap, asphalt, coal ash and cinders, and railroad ties.
Swamp deposits	Soft, dark brown to black clayey silt to loose sandy silt with organic matter and shell fragments. The swamp sediments are present north of the manufacturing building within the footprint of a former canal wide-waters basin.
Lacustrine sediments	Soft gray to brown silty clay to loose to medium dense silty sand, little gravel, bedded.
Glacio-lacustrine sediments	Same as lacustrine, except often red-brown, often underlying glacial till.
Glacial till	Medium dense brown to red-brown silty sand, with trace to little gravel, trace clay.
Residual soil	Loose to medium dense brown sandy silt to silty sand with organics and root fibers (formed from weathered shale bedrock material).
Weathered bedrock	Medium dense to very dense gray-brown silt, little to some fine sand, with the fabric of the parent bedrock material still visible.

Bedrock Units

Formation	Description
Rochester Shale	Moderately hard, fresh, fine grained, gray to brown-gray dolomitic mudstone, with horizontal closely-spaced bedding,

	occasional pits and vugs, occasional fossils, and secondary gypsum mineralization in fractures, vugs, joint openings, and as fossil replacement.
Irondequoit Limestone	Hard, fresh, gray to green-gray, fine to medium grained fossiliferous limestone, with horizontal moderately-spaced bedding and occasional vugs.

3.1.3 Groundwater Conditions

Overburden/Shallow-Bedrock Groundwater

- Overburden and shallow bedrock groundwater are contaminated with LNAPL, consisting of lubricating oils used in fabrication and/or lighter-molecular weight test-fluid products (e.g. Stoddard solvent) used in product-testing.

- PCB compounds are present in the shallow LNAPL at a few locations at Building 22, where the LNAPL consists of primarily Stoddard solvent. No known source for the PCBs has been identified.

- Shallow groundwater at the location of former solvent degreaser systems inside the manufacturing building is contaminated with VOC including trichloroethene (TCE) and its breakdown products (i.e. cis-1, 2-dichloroethene). In the shallow-bedrock unit, the contamination extends downgradient from the former degreaser areas towards the groundwater migration control system located in the north parking lot.

Intermediate-Bedrock Groundwater

- Intermediate bedrock groundwater is contaminated by VOC below the building extending to the north and east towards the east property boundary and the groundwater migration control system located in the North Parking Lot

- The intermediate-bedrock groundwater located under the east side of the manufacturing building and extending slightly beyond the eastern Site boundary is contaminated with LNAPL. The LNAPL is a mixture of petroleum products, including apparent fuels and calibration fluids commingled with a higher molecular-weight machining-oil and VOC.

- PCB compounds are present in the intermediate bedrock LNAPL at the southeast portion of the east parking lot.

Prior to the start-up of the migration-control system in 1992, groundwater flow at the Site generally exhibited a downward vertical component from the overburden to the shallow-bedrock zone and from the shallow zone to the intermediate-bedrock unit. Lateral flow in the overburden, shallow-bedrock, and intermediate-bedrock units tended to be to the north or northeast.

Since the start-up of the groundwater migration-control system, lateral flow in the shallow- and intermediate-bedrock units in the area north of the migration-control trench has reversed, and groundwater in these units currently flows from Driving Park Avenue south towards the trench. An elongated depression of the water table and the potentiometric surface in the shallow-bedrock zone occurs along the migration-control trench and a depression of the potentiometric surface in the intermediate-bedrock zone extends south (upgradient) from the trench to the manufacturing building.

3.1.4 Soil Vapor Conditions

Soil vapor samples were collected in 1991 from within the manufacturing building on approximately 40- to 50-foot centers proceeding outward from potential sources of subsurface contamination. Sub-slab soil vapor sampling identified soil vapor concentrations greater than 100 ppm in areas of known petroleum or VOC soil contamination.

A soil-vapor intrusion (SVI) assessment was also performed in 2005 where sub-slab soil vapor and indoor air samples were concurrently collected at six (6) locations in the manufacturing building in areas where soil, soil vapor, and/or groundwater impacts from contamination by chlorinated VOCs and/or petroleum test fluids were identified during the RI. The average concentrations of trichloroethene (TCE) and tetrachloroethene (PCE) detected in indoor air were below the screening levels published by NYSDOH with one sample (3-E-19) where the TCE concentration exceeded the NYSDOH guidance value of 5.0 ug/m^3. The results of the SVI assessment were provided within the RI Report (Haley & Aldrich of New York, 2005).

The following table presents a summary of the results for the VOCs that were detected in co-located sub-slab vapor and indoor air samples. The sample locations represent the column line within the facility where the sample was obtained.

Sample Location	Analyte	Sub-slab Result (ug/M^3)	Indoor Air Result (ug/M^3)
6-DD-33	cis -1,2-DCE	8,800	4.6
3-E-19		2,300,000	3.2
6-DD-33	m,p-Xylene	210	2.2
4-FF-37		58	2.2
5-C-13		57	2.2
3-E-19		2,500	2.1
2-T-27		ND	2
1-YE-13		62	3.1
6-DD-33	Tetrachloroethene	420	39
6-DD-33	Toluene	380	4.7
4-FF-37		40	4.7
5-C-13		41	6.1
3-E-19		5,400	5.1
2-T-27		ND	3.4
1-YE-13		55	6.4
3-E-19	Trichloroethene	37,000	6.0

ND = Not Detected

Current soil vapor conditions were determined as part of the SVI conducted throughout the manufacturing building in 2014. The results of the SVI were provided to the Department in a report titled *Soil Vapor Intrusion Investigation Results -Delphi Automotive Systems Site #828064* dated 7 October 2014 (Haley & Aldrich of New York, 2014) and are discussed further in Section 4.2 below.

3.1.5 Light Non-Aqueous Phase Liquids (LNAPL) Extent

Based on the information summarized in the RI Report, LNAPL identified at the Site consists primarily of either lubricating oils associated with metal-machining operations or lighter weight fuel-like products used as calibration fluids and test fuel associated with engineering and product-testing operations. In most areas, both machining oil and lighter-weight test fluids are present in the LNAPL with the exception of the Building 22 Area where the LNAPL consists primarily of Stoddard solvent, a lightweight petroleum-based solvent that was used as a fluid in carburetor testing operations.

LNAPL is present at the water table (in overburden and/or shallow bedrock) in five (5) areas of the Site which may, to some degree, be continuous with each other. In a sixth area, LNAPL is present in the intermediate-bedrock groundwater zone although LNAPL is absent at the water table in the overlying groundwater zones.

The areas where LNAPL has been identified include the following:

- Plant 1 machining areas and the adjacent Tank Farm area overburden groundwater,
- Plant 2 machining areas overburden groundwater,
- Plant 1 Courtyard (at well SR-236) in the shallow bedrock groundwater bearing unit,
- the east parking lot intermediate-bedrock groundwater bearing unit,
- the north parking lot shallow bedrock groundwater bearing unit, and
- the Building 22 area overburden and bedrock groundwater bearing units.

4. Remedial Action

The *Enhancement of the existing Groundwater collection system, Site management and LNAPL collection* remedy, as selected by the Department in the March 2011 ROD, includes the continued operation of the four (4) previous IRMs installed at the Site prior to issuance of the above referenced ROD, the evaluation of additional actions to promote the enhanced recovery of LNAPL, and mitigation of the potential for impacted soil vapor intrusion to adversely affect indoor air quality.

Subsequent to the issuance of the ROD, additional elements of the selected remedy that have been implemented include:

- the manual removal of LNAPL where observed within the existing monitoring well network,
- the installation of a SSDS within active manufacturing areas within Plant 1,
- the installation of additional groundwater recovery wells and associated treatment to expand the groundwater migration control system; and,
- the installation of automated LNAPL recovery systems where applicable, based on the performance of the manual LNAPL recovery efforts.

This RWP provides a summary of the installation of the remedy elements since the issuance of the ROD. Additional actions will be implemented and/or expanded as needed to maintain the Site RAOs in compliance with a Department approved SMP to be prepared in accordance with the *Document Template, Site Management Plan with Instructions* (NYSDEC, 2015). The operation, monitoring and performance of the selected remedial actions will be documented in Periodic Review Reports (PRRs) to be provided to the Department.

4.1 LNAPL RECOVERY

4.1.1 Overview

LNAPL recovery using total fluids pumping and oil/water (O/W) separators has continued in the Building 22 and Tank Farm areas and additional LNAPL recovery methods have been implemented in a manner allowing for continued facility manufacturing operations. The additional LNAPL recovery methods used in the active manufacturing areas have consisted of the manual removal of LNAPL from existing monitoring wells installed in the former Underground Storage Tank (UST) A area east of Building 1, near the Machining Oil Recovery basement within Building 1, and in the Central Waste Treatment Area (CWTA) courtyard north of Building 2. The manual LNAPL removal process has recovered over 300 gallons of LNAPL since the initiation of the process in 2013.

The SMP will include procedures to determine the thickness of LNAPL, a method of evaluation to determine the feasibility for recovery and the implementation. Additional methods and/or locations for LNAPL recovery and disposal will be evaluated and proposed in the PRR as appropriate to maintain the Site RAOs.

4.1.2 Building 1 and 2 Machining Areas

Since 2013, periodic manual LNAPL recovery has been performed from existing monitoring wells SR-503, SR-310, SR-311, SR-312, SR-313, SR-326, R-236 and R-309 in Building 1 and SR-102 and SR-318 located to the north of the Building 2 in the CWTA Courtyard area. The volume of LNAPL removed from each monitoring well has been recorded and tracked versus time as referenced above.

Based on the manual LNAPL recovery data collected to date and the comments received from the Department on 13 October 2017, an additional remedial action was implemented to address the LNAPL identified in the Building 1 and 2 Machining Areas to promote enhanced recovery of the detected LNAPL.

The additional remedial action included the installation of automated LNAPL recovery systems that consists of a pneumatic pump with an in-well, oil/water interface sensing probe that self-adjusts to seek the LNAPL layer present in the well.

Three (3) automated LNAPL recovery systems have been installed; one proximal to existing monitoring wells SR-236/R-236 in the former UST A area east of Building 1 in 2018; one in the Building 2 CWTA Courtyard in 2018, and one within the existing monitoring well R-309 located within Building 1 in 2019.

Upon completion of the new recovery well installations, LNAPL levels were measured using an oil/water interface probe and when the LNAPL thickness reached recoverable amounts (typically greater than 0.1 feet),the automated LNAPL recovery systems were installed to initiate system operations. The automated LNAPL system and product recovery drum were placed in containment structures at each well location, and the recovered material has been transferred for off-site disposal in accordance with GMCH Plant waste handling procedures.

Two (2) LNAPL recovery wells were installed by using hollow steam augers to over-drill former monitoring well locations PZ-120 next to R-236/SR-236 well cluster in the Building 1 Courtyard and SR-318 located in the Building 2 CWTA Courtyard. The LNAPL recovery wells were constructed using 6-inch diameter stainless steel casings with a 20-foot long, flush-thread, stainless steel, wire-wrapped well screens. The well screen for the Building 2 CWTA Courtyard recovery well was centered between the overburden and shallow bedrock units and the well screen for the Building 1 Courtyard recovery well was installed across the shallow and intermediate bedrock water units (as determined by field conditions).

A schematic of the automated LNAPL recovery pump system installed at the locations listed above is provided in Figure 3. The construction details of the installed LNAPL recovery wells are provided in Figure 4.

The installation and initial operation of the automated LNAPL recovery pumping wells will be documented in the Final Engineering Report (FER) to be submitted to the Department in accordance with the project schedule provide in Section 7 of this plan.

The SMP will include monitoring procedures and identify requirements to modify the LNAPL recovery systems as necessary to optimize remedial operations. The potential expansion of the LNAPL recovery system will be based on the performance of the recovery wells and access to manufacturing areas where recoverable LNAPL has been identified during the periodic groundwater monitoring program.

4.1.3 Tank Farm Area LNAPL Recovery System

The Tank Farm Area LNAPL recovery system has been in operation in the former Stoddard Tank Farm area located at the northeast corner of Building 1 since 1989. The recovery system includes three (3) large-diameter (36 inch) recovery wells (RW-101, RW-2, and RW-3) installed within a 400-foot long approximately 12-foot deep gravel-filled trench. LNAPL and groundwater is extracted from RW-2 which is located at the center of the trench.

In December 2013, the surface completion of RW-2 was re-constructed with a sub grade vault and an electric diaphragm pump for recovery of LNAPL and groundwater. Concurrent with the RW-2 re-construction, a Groundwater Recovery and Treatment System (GRTS) was installed to manage the recovered LNAPL and overburden groundwater from the groundwater collection trench. The GRTS is equipped with a dedicated oil/water (O/W) separator system for the removal of recovered LNAPL and an air stripper and GAC adsorption system for the treatment of the groundwater prior to discharge of the groundwater to the sanitary sewer for secondary treatment by the Monroe County sewer treatment system.

The SMP will include procedures for the operation, maintenance and management (OM&M) of the former Tank Farm area LNAPL recovery system and the GRTS. The operation and performance of the systems will be presented in the Periodic Review Reports (PRR) to be provided to the Department.

4.1.4 East Parking Lot LNAPL

Measurable LNAPL is present within the Intermediate Bedrock Unit at monitoring wells R-2, R-235, R-237, R-238, and R-241 extending under the East Parking Lot, and slightly beyond the eastern Site property boundary. LNAPL recovery remedial actions for this area will include the following elements:

- Manual LNAPL recovery from monitoring wells R-2, R-235, R-237, R-238, and R-241. The volume of LNAPL recovered from each well will be recorded and tracked versus time in accordance with the SMP. Contingency plans for the installation of automated recovery systems will be employed if determined to be more cost effective than the manual recovery methods.

- Concurrent with the manual removal of LNAPL from the existing monitoring wells, the GRTS will continue to recovery groundwater from extraction wells GR-3 and GR-4 to provide hydraulic control of VOC-impacted groundwater and LNAPL in the northern portion of the East Parking Lot. The effluent from the GR-3 and GR-4 will continue to be treated with a dedicated O/W separator for the recovery of LNAPL and an air stripper system for treatment of the VOCs in groundwater prior to discharge to the sanitary sewer for treatment by Monroe County. For additional information relating to extraction wells GR-3 and GR-4 refer to Section 4.3.

The SMP will include the monitoring program for extraction wells GR-3 and GR-4 and the periodic monitoring for LNAPL and groundwater quality at monitoring wells installed beyond the eastern property boundary to evaluate the performance of the remedial action.

4.1.5 Building 22 Area LNAPL Recovery System

The Building 22 Area LNAPL recovery system has been operating for more than 10 years and consists of a pneumatic pump installed at Well Z, and the foundation drain sump located at the northeast corner of Building 14 (for the recovery of shallow groundwater from underneath the building) interfaced with an O/W separator located in the wastewater treatment building. The recovery system currently recovers less than one (1) gallon of LNAPL annually.

LNAPL recovery procedures for the Building 22 Area will include the following elements:

- Continued operation of the Building 14 Foundation Drain sump as needed for hydraulic control around the building foundation;
- Continued operation of the pneumatic pump installed at Well Z; and,
- Continued monitoring for the presence and manual removal of LNAPL (if present) at RW-4 as part of the groundwater monitoring program.

The SMP will include a monitoring program for the foundation drain sump and Well-Z pneumatic pump system to evaluate the performance of the remedial action.

4.1.6 North Parking Lot – LNAPL

During the RI, LNAPL was detected intermittently within monitoring wells (PZ-136, -137, -138 and -139) installed along the municipal sewer tunnel beneath the North Parking Lot. The source of the LNAPL in the North Parking Lot is unknown, but the RI data suggested that LNAPL may have migrated to this area within the fill material placed around the sewer tunnel.

A groundwater migration-control, collection, and treatment system designed to capture contaminated groundwater north from the manufacturing plant was constructed within the North Parking Lot and placed in operation in 1992. The system consists of a 1200-foot-long blasted bedrock trench created using engineered-blasting techniques to enhance the permeability of the shallow and intermediate bedrock water bearing units. Two wells (GR-1 and GR-2) were installed in the approximately 50-foot-deep blasted bedrock trench to recover groundwater.

Upon start-up of the system, LNAPL was detected at monitoring well R-240 located southeast of the groundwater migration-control trench. However, LNAPL has not been observed within the groundwater recovered from GR-2 as part of the periodic monthly discharge monitoring activities or at monitoring well R-240 located adjacent to the trench during the periodic groundwater monitoring events conducted at the Site since 2010.

In 2015, the southern portion of the North Parking Lot was utilized for the installation of a solar panel array for the collection of solar power to offset a portion of the facility's electricity demand. As part of the installation of the system, shallow soil samples were collected from beneath the North Parking lot asphalt cover. LNAPL was not encountered during the sampling program. The results of the sampling program were provided to the Department in October 2015 (Project Status Report, Haley & Aldrich of New York, 2015).

Ongoing remedial actions to address the North Parking Lot LNAPL will be documented in the SMP and include:

- Monitoring for the presence/absence of LNAPL at R-240 as part of the periodic groundwater quality monitoring events; and,
- Monitoring of GR-2 pump discharge for the presence of LNAPL as part of the monthly MCPW POTW sewer permit sampling program.

Contingency plans will be included within the SMP for the installation of additional treatment technologies to separate the LNAPL from the recovered groundwater if LNAPL is identified within the groundwater migration control system. The contingency control technologies could include an O/W separator and/or an appropriate adsorption treatment system prior to discharge to the Monroe County sewer system.

4.2 SOIL VAPOR MITIGATION

The investigation of soil-vapor conditions at the facility was conducted in three (3) phases from 1990 through the completion of the RI in 2005. The initial soil-vapor quality screening was conducted in 1990 and included the collection of soil vapor samples at locations from beneath the building floor slab. The results were provided to the Department in a report titled *Soil Vapor Survey Report, Lexington Avenue Facility Degreaser Investigation* (Haley & Aldrich of New York, 1990). The second soil-vapor investigation was conducted in 1996 and focused on specific former degreaser locations within the facility.

During the RI, a soil-vapor intrusion (SVI) assessment sampling event was performed where sub-slab soil vapor and indoor air samples were collected simultaneously at six (6) locations within the manufacturing building in areas where soil, soil vapor, and/or groundwater impacted by chlorinated VOCs and/or petroleum test fluids had been identified. The combined results of these assessments identified areas beneath the manufacturing building where the concentrations of VOCs historically exceeded the screening values for evaluating soil-vapor intrusion (NYSDOH, 2006). A summary of the results of these investigations was provided to the Department in the Work Plan, *Vapor Assessment Program, Former Delphi Automotive Systems #C828064* dated 13 March 2014 (Haley & Aldrich of New York, 2014).

This SVI Work Plan was implemented throughout the facility in 2014 to evaluate the sub-slab soil-vapor and indoor air quality conditions. The results of the SV/IA sampling program were provided to the Department in a report titled *Soil Vapor Intrusion Investigation Results -Delphi Automotive Systems Site #828064* dated 7 October 2014 (Haley & Aldrich of New York, 2014).

The sampling program was conducted to identify appropriate corrective actions based on the sampling results and the potential for contaminated soil-vapor to adversely affect the indoor air quality. Proposed corrective actions presented in the report included the following technology options:

- **Floor sealants:** Floor sealants restrict diffusion of soil gas through the facility floor and expansion joints. This technology has been implemented widely within Building 2 at the facility.

- **Heating, Ventilation and Air Conditioning (HVAC) System management:** HVAC management involves maintaining adequate air exchanges with an existing or an installed HVAC system to create a positive pressure environment. By maintaining the building interior air pressure to above ambient conditions, the potential for soil vapor intrusion can be controlled.

- **Sub-slab depressurization system (SSDS):** Sub-slab depressurization includes the installation of suction pits beneath the facility floor connected to extraction fans to create a negative pressure beneath the floor slab relative to the building interior space.

A pilot test program was conducted at two (2) locations within Building 1 in January 2015 (Phase 1) and May 2015 (Phase 2) to assist in the design of a SSD system and included the following elements:

- The installation of a suction pit cavity below the concrete floor.
- The installation of extraction piping to a temporary/portable vacuum blower system with discharge of the extracted vapor to the outdoor atmosphere through flexible hosing.
- The installation of vacuum monitoring points (VMPs) through the concrete floor at a range of distances from the suction pit.
- Operation of the temporary/portable vacuum blower system with periodic monitoring of the sub-slab vacuum to determine the radius of vacuum influence measured at the VMPs.

The results of the pilot testing activities were submitted to the Department in a report titled *Sub-Slab Depressurization Pilot Test, Delphi Automotive Systems Site #828064* dated 29 February 2016 (Haley & Aldrich of New York, 2016). The report included the results from the pilot testing activities and the final design details for the SSDS. The report was revised on 27 February 2017 based on comments received from the Department on 15 December 2016 and the installation of additional suction points with dedicated suction fans was completed in September 2017.

Figure 5 presents the layout of the suction pits and vacuum monitoring points installed within Building 1. The FER will include the documentation of the installation and start-up of the SSDS installed within Building 1. The SMP will provide the procedures for operations, maintenance and monitoring (OM&M) of the SSD system.

4.3 GROUNDWATER MIGRATION CONTROL SYSTEM

The operation of the groundwater migration control systems is designed to recover groundwater from within the overburden, shallow and intermediate bedrock groundwater bearing units located to the northeast of the Site. As discussed above, the groundwater migration control systems previously installed as IRMs were expanded to include the installation and operation of two (2) additional bedrock groundwater recovery wells north of the east parking lot and the construction of a treatment system as a component of the remedy selected in the ROD.

4.3.1 Groundwater

The groundwater migration control systems installed as IRMs and selected as part of the final remedy in the ROD consist of the following:

- The shallow groundwater recovery trench installed in the former Stoddard Tank Farm area east of Building 1 in 1989. The recovery trench is equipped with three (3) recovery wells (RW-101, RW-2 and RW-3) located within the overburden soils. The trench recovers groundwater from the overburden groundwater bearing unit for discharge to the sanitary sewer for additional treatment at the MCPW POTW in accordance with the facility's MCPW sewer use permit.

- The blasted bedrock trench (BBT) installed in the North Parking Lot in 1992 with two (2) groundwater recovery wells (GR-1 and GR-2). The BBT recovery wells extract groundwater from the shallow and intermediate bedrock groundwater bearing units for discharge in accordance with the facility's Monroe County sewer use permit.

In addition to the continued operation of the groundwater migration control systems, the installation of additional bedrock groundwater recovery wells, designated as GR-3 and GR-4 were installed in accordance with a Department approved work plan dated 5 May 2011. The *Groundwater Recovery Wells (GR-3 and GR-4) Installation Report* presenting the details of the well installation and the results of groundwater recovery pump tests was submitted to the Department on 26 March 2012 (Haley & Aldrich of New York, 2012).

The design for the additional bedrock groundwater recovery wells GR-3 and GR-4, and the connection of the existing recovery well RW-2 to a proposed integrated groundwater/LNAPL pretreatment system *Groundwater Recovery Treatment System* was submitted to the Department on 1 July 2013 (Haley & Aldrich – July 2013). A general description of the GRTS components, construction and operation is described in the following sections.

4.3.1.1 Additional Recovery Well Installation

Two (2) 4-inch diameter bedrock recovery wells (GR-3 and GR-4) were installed to enhance the existing groundwater recovery systems. Both recovery wells were installed by a sonic drill rig using core-case methods to the top of bedrock where a temporary 8-inch casing was installed through the overburden to the top of rock. A nominal 6-inch diameter borehole was then advanced in bedrock using sonic drilling methods. Well GR-3 was installed through approximately 17 feet of unconsolidated overburden and into the uppermost 25 feet of bedrock with a total depth of approximately 42 feet below ground surface (bgs). Well GR-4 was drilled through approximately 8 feet of unconsolidated overburden and into the uppermost 36 feet of bedrock to a total depth of approximately 44 feet bgs. Both wells were constructed using 4-inch diameter Schedule 40 PVC casing with a 20-foot long, flush-thread, stainless steel, 0.020-inch wire-wrapped well screen.

The static water level in GR-3 was recorded at 19 ft bgs after installation. Pump testing performed after well installation provided a sustained yield of approximately 0.25 gallons per minute (gpm), with continuous drawdown. To control and maintain flow, a low-flow submersible pump equipped with a variable frequency drive (VFD) was installed to maintain continuous flow.

The static water level in GR-4 was recorded at 21 feet bgs after installation. Pump testing performed after well installation indicated that GR-4 provided a sustained yield of approximately 7 gpm while maintaining a stable groundwater level. A submersible pump equipped with a variable frequency drive (VFD) was installed to enable for the adjustment of the pump flow based upon either groundwater level or total flow rate.

Groundwater is pumped underground to the treatment building via transfer piping installed with flow meters placed at each wellhead. In addition to the extracted groundwater conveyance piping, two electrical conduits were installed: one for electrical power (pump) and one for instrumentation (e.g., level transducer, flow meters).

The existing overburden groundwater recovery well RW-2 was also modified with the installation of a sub-grade vault and an electric diaphragm pump for the recovery of groundwater and LNAPL. Extracted LNAPL and groundwater is conveyed to the treatment building for the recovery of LNAPL and treatment of dissolved VOC.

4.3.1.2 Treatment System Building

Subsequent to the installation of GR-3 and GR-4, a building was constructed to the east of the manufacturing building adjacent to the RW-2 well vault to house a groundwater treatment and control system. The building is an 800 square feet pre-fabricated, pre-engineered metal building insulated for heat retention and sound dampening. The building was constructed on a concrete foundation with a curb for spill prevention, ramps/steps for access into the containment area, and a sump (with pump) for the collection of any spilled liquids.

4.3.1.3 Treatment System Components

The combined groundwater treatment system installed within the treatment building includes the equipment to separate extracted groundwater and recovered LNAPL and treat the VOC impacted groundwater for discharge to the facility sanitary sewer and additional treatment at the Monroe County sewer treatment facility. The on-site treatment system includes the following components:

<u>Groundwater / NAPL Separation</u>

Two (2) O/W separators were installed to separate NAPL from the extracted groundwater and segregate the recovered NAPL for proper handling and disposal. The collected LNAPL is managed and disposed by the facility. The aqueous phase effluent from the O/W separators is pumped to an equalization tank.

<u>Equalization Tank</u>

The equalization tank is constructed of high-density polyethylene (HDPE) and equipped with a small centrifugal circulation pump and vented to the outside of the building. A non-contact level sensor in the tank controls a variable-speed centrifugal treatment feed pump to maintain a constant level in the tank. An additional redundant high-high level switch has been installed to shut down the system in case of failure of the level sensor.

<u>Filtration</u>

The effluent from the equalization tank passes through a duplex bag filter system to remove solids. A differential pressure sensor installed across the bag filter housings monitored by the control system alerts operators when the bag filters need to be changed.

<u>Treatment of Organic Compounds</u>

A shallow tray air stripper was installed to remove the VOCs from the groundwater that passes through the O/W separators and the equalization tank. The treated water effluent from the air stripper is pumped through a 1000-pound (lb) liquid phase granulated activated carbon (LGAC) vessel prior to discharge to the facility's sanitary sewer. The calculated VOC discharge concentration was provided to the Department in a letter dated 11 May 2014 (Haley & Aldrich of New York, 2014).

Treated Water Discharge

The treated groundwater is discharged via 4-inch diameter PVC piping installed underground to the sanitary sewer connection located at the east of the facility. A sample port and totalizing flow meter has been installed to collect flow measurements and enable sampling of the final system effluent for compliance with the facility's Monroe County sewer use general permit discharge limits of less than (<) 100 milligrams per liter (mg/L) Total Oil and Grease (O&G), <2.13 mg/L Total Toxic Organics (TTO), and the total polychlorinated biphenyl (PCB) action level of <0.3 microgram per liter (ug/L).

Control System

The treatment system utilizes an Allen-Bradley Programmable Logic Controller (PLC) interfaced with a personal computer (PC) for the logging of historical data and to enable automated operation of the treatment system. The control system includes:

- Flow or level control of the GR-3 and GR-4 well pumps;
- Pump control for all treatment system pumps (e.g., oil-water separator discharge pumps, air stripper feed pump, discharge pump);
- Air Stripper on/off control;
- Monitoring and logging of all monitored system variables, including pressures, flow and levels; and
- Annunciating alarms if system parameters are outside of the normal operating range.

The control system sends e-mail and/or text message alerts when alarms are present in the treatment system, and shuts down the system in the case of critical alarms (e.g., equipment or instrument failures, pipe breaks, pipe or filter blockage, etc).

The OM&M procedures for the LNAPL/groundwater pre-treatment components associated with the GRTS and the reporting requirements will be provided in the SMP. The FER will include the documentation of the installation and operation of the GRTS.

4.3.2 Overburden Soils Management

Impacted overburden soils will be managed in accordance with a Department approved SMP that will include the methods and procedures for conducting any future intrusive work that will modify the existing Site cover systems (i.e. vegetation, pavement, building slab, etc.) currently in place at the Site.

Intrusive work that may encounter residual contamination will be conducted in accordance with the procedures defined in the SMP. A Site Health and Safety Plan (HASP), and Community Air Monitoring Plan (CAMP) will be provided as attachments to the SMP for Department approval.

5. Remedial Action Monitoring

5.1 SITE SPECIFIC HEALTH, SAFETY, AND SECURITY

The project areas are located within the boundaries of the active manufacturing facility with facility-specific health and safety program requirements. These requirements include the preparation of a Contractor Health and Safety Plan (HASP) pursuant to OSHA 29 CFR 1910.120 and GMCH requirements.

All contractor personnel will be required to complete a GMCH Plant health and safety training session before mobilization to the project areas.

Access to the Site is restricted by GMCH and on a daily basis, all contractor personnel will be required to sign-in and sign-out through Plant security to gain access to the Site.

5.2 PROJECT MONITORING

Procedures for monitoring and reporting on the performance of the remedial actions will be included in the Department approved SMP. The SMP will also describe the methods for evaluating the effectiveness of the remedy to reduce or mitigate exposure to the residual contamination at the Site, document the condition of the cover system, and other affected environmental media.

The installation and start-up of the automated LNAPL recovery systems as described in Section 4.1 will be documented in the FER.

6. Site Management Plan – Engineering and Institutional Controls

6.1 SITE MANAGEMENT PLAN

The Site Management Plan will be prepared following relevant document template and guidance (NYSDEC 2015) and describe both the function and purpose of the existing engineering controls. The SMP will include the following components (and as outlined in Pages 13-14 of the ROD):

a. Engineering and Institutional Control Plan that identifies all use restrictions and engineering controls for the Site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective. This plan will include but may not be limited to:
   i. an Excavation Work Plan which details the provisions for management of future excavations in areas of remaining contamination;
   ii. a summary of the provisions of the Environmental Easement (EE) applicable to the Site;
   iii. maintaining Site access controls and Department notification; and
   iv. a contingency plan that would provide emergency contacts, a local hospital route map, and response procedures for emergency situations.

b. Site Monitoring Plan to assess the performance and effectiveness of the remedy. The plan will include:
   i. monitoring of indoor air and groundwater quality and LNAPL recovery rates to assess the performance and effectiveness of the remedy, Appendix C provides the Indoor Air Quality Monitoring Plan to be implemented for the evaluation of the effectiveness of the installed SSD system;
   ii. a schedule of monitoring and frequency of submittals to the Department;
   iii a contingency plan for the expansion of the LNAPL recovery and sub-slab depressurization (SSD) systems based on the results of the monitoring program and/or changes to facility manufacturing operations.

c. Operation and Maintenance (O&M) Plan to ensure continued operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy. The plan includes, but is not limited to:
   i. monitoring of groundwater well network and soil vapor mitigation systems to ensure proper operation;
   ii. maintaining Site access controls and Department notifications;
   iii. providing the Department access to the Site and O&M records; and
   iv. operating the components of the remedy until the remedial objectives have been achieved, or until the Department determines that continued operation is technically impracticable or not feasible.

d. Inspections, Reporting and Certifications section to describe the:
   i. type and frequency of inspections and the process for documenting those inspections, evaluating the results, and performing the appropriate record keeping of inspection documentation;
   ii. process for certification of the engineering and institutional controls
   iii. preparation and submittal of the periodic review reports; and
   iv. provisions for development of corrective measures plans.

The following table provides a probable monitoring frequency to be included in the draft SMP for review and approval by the Department.

Monitoring Program	**Frequency**	**Matrix**	**Analysis**
Soil Cover	Annually	Soil Cover	N/A
Excavation	Per Event	Imported Soil	As required at 6 NYCRR Part 375-6.7 (d)
Remedy Performance	Annually	Groundwater	Water Quality Parameters, VOCs
	Quarterly	LNAPL	Thickness and Volume Recovered
Groundwater Flow	Annually and After System Maintenance and/or Shutdowns	Groundwater	Water Levels
Treated Groundwater	Monthly	Process water	VOCs, PCBs, and Total Oil & Grease
Soil Vapor Intrusion	Monthly	System operation	Vacuum Measurements
	Tri-annual – Fall, Winter, Spring	Sub-slab pressure field influence	
	Annually	Sub-slab Vapor/Indoor Air	VOCs

The monitoring results will be evaluated to determine if the remedy continues to be an effective means to achieve the RAOs and that evaluation will be included in the Periodic Review Reports (PRR) submitted in accordance with the requirements of a Department approved SMP.

The SMP will be enforced through a recorded Environmental Easement (EE) that will be prepared in accordance with the easement template that is presented in Appendix D.

7. Schedule

7.1 REMEDIAL ACTION IMPLEMENTATION SCHEDULE

The anticipated implementation schedule for the remaining elements of the remedial action are outlined below.

Additional submittals are identified for the completion of tasks relating to the implementation of the selected Site remedy: *Enhancement of the existing Groundwater collection system, Site management and LNAPL collection*.

Remedial Program Elements
Project Schedule

Item	Task	Date
1	Environmental Easement (EE) Checklist Package Submittal	November 2020
2	Draft Site Management Plan (SMP) Submittal	November 2020
3	Draft Final Engineering Report (FER) Submittal	After the SMP/EE approval by the Department.

8. Reporting

8.1 FINAL ENGINEERING REPORT

After the Department's review and approval of an SMP and EE submittals, the FER will be prepared in accordance with the requirements of Section 5.8 (b) of the *Technical Requirements for Site Investigation and Remediation*, DER-10 (NYSDEC, 2010).

The FER will include:

1. Certification by the preparer in accordance with article 145 of the Education Law.

2. A description of the remedy elements at the Site including the automated LNAPL Recovery System recently installed at the Building 1 and 2 Machining Areas.

3. A summary of the remedial elements and actions completed shall include:

    a. A description of any changes to the design documents with an explanation,
    b. Quantities and concentrations of the COCs removed as part of the remedy,
    c. A list of the waste streams and materials disposed from the Site with the location of disposal.

4. Figures that show areas of the Site where removal actions have been implemented (if any).

5. Tables of documentation samples collected during the removal actions (if any).

6. As-Built Drawings for the remedial systems installed under this RWP with a Professional Engineer's Certification.

7. Identification of the Engineering and Institutional Controls employed at the Site in accordance with the Environmental Easement.

8. A summary of the process conditions for the operation of the groundwater/LNAPL recovery systems including flow and concentration of COCs treated.

9. References

1. Program Policy DER-10, Technical Guidance for Site Investigation and Remediation, New York State Department of Environmental Conservation (NYSDEC), May 2010.

2. Remedial Investigation Report, Delphi Automotive Systems Site, 1000 Lexington Avenue Rochester, New York, Registry Site No. 8-28-064, EPA ID No. NYD002215234, Haley & Aldrich of New York, October 2005.

3. Feasibility Study Report, Delphi Automotive Systems Site, 1000 Lexington Avenue, Rochester, New York, Registry Site No. 8-28-064, Haley & Aldrich of New York, July 2008.

4. Record of Decision, Delphi Automotive Systems Site, 1000 Lexington Avenue, Rochester, New York, Registry Site No. 8-28-064, NYSDEC, March 2011.

5. 6 NYCRR Part 375, Environmental Remediation Program Regulations Subparts 375-1 to 375-4 and 375-6, New York State Department of Environmental Conservation, December 2006.

6. Document Template, Site Management Plan with Instructions, New York State Department of Environmental Conservation, August 2015.

7. Data Summary Report, Previous Remedial Investigations, Delphi Automotive Systems, 1000 Lexington Avenue, Rochester, New York, Site No. 8-28-064. Haley & Aldrich of New York, September 1998.

8. Report on East Parking Lot Area Well Installations and January 1999 Groundwater Sampling Events, Delphi Automotive Systems, Lexington Avenue Facility, Rochester, New York. Haley & Aldrich of New York, February 1999.

9. Results of North Parking Lot Soil Sampling Program, Project Status Update – 10 October 2015, Haley & Aldrich of New York, 2015.

10. Soil Vapor Survey Report, Lexington Avenue Facility Degreaser Investigation, (Haley & Aldrich of New York, 1990).

11. Vapor Assessment Program – Delphi Automotive Systems Site #828064, Haley & Aldrich of New York, March 2014.

12. Soil Vapor Intrusion Investigation Results -Delphi Automotive Systems Site #828064, Haley & Aldrich of New York, October 2014.

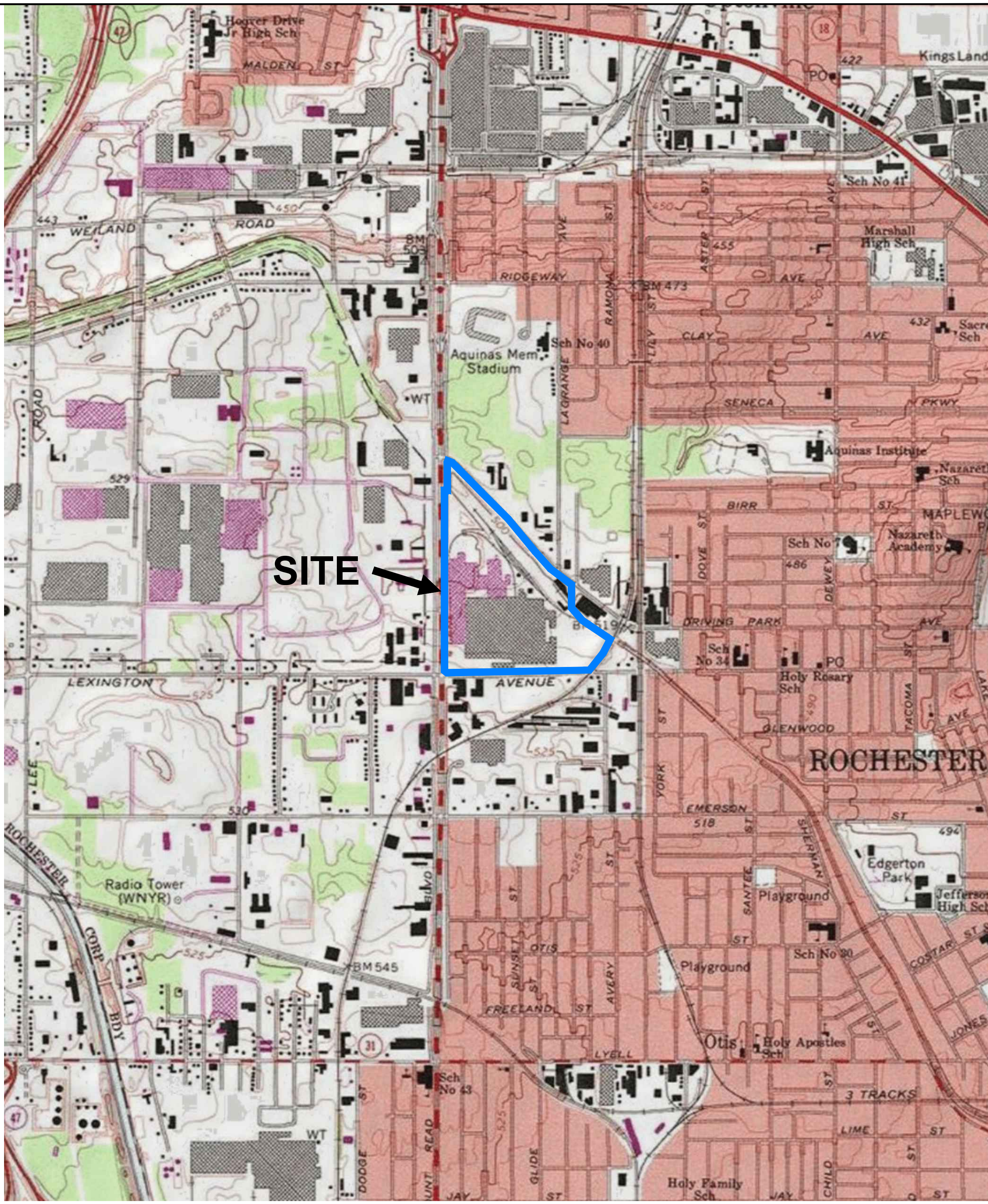
13. Sub-Slab Depressurization Pilot Test Results, Delphi Automotive Systems Site #828064 Haley & Aldrich of New York, February 2016.

14. DAR-1 Analysis – Groundwater Recovery and Treatment System, Delphi Automotive Systems Site – NYSDEC Site #828064, 1000 Lexington Avenue, Rochester, New York, Haley & Aldrich of New York, May 2014.

15. Report on Groundwater Recovery Wells (GR-3 and GR-4) Installation Report, Haley & Aldrich of New York, March 2012.

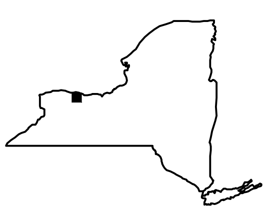
16. Groundwater Recovery Treatment System (GRTS) Report, Haley & Aldrich of New York, July 2013.

17. Department Comment Letter on Revised RWP dated 22 December 2017 received on 4 May 2020.



USGS QUADRANGLE:
ROCHESTER WEST, NY

SITE COORDINATES: 43°10'54"N, 77°39'22"W



HALEY ALDRICH

DELPHI AUTOMOTIVE SYSTEMS SITE #828064
1000 LEXINGTON AVENUE
ROCHESTER, NEW YORK

PROJECT LOCUS

APPROXIMATE SCALE: 1 IN. = 2000 FT
JULY 2020

FIGURE 1

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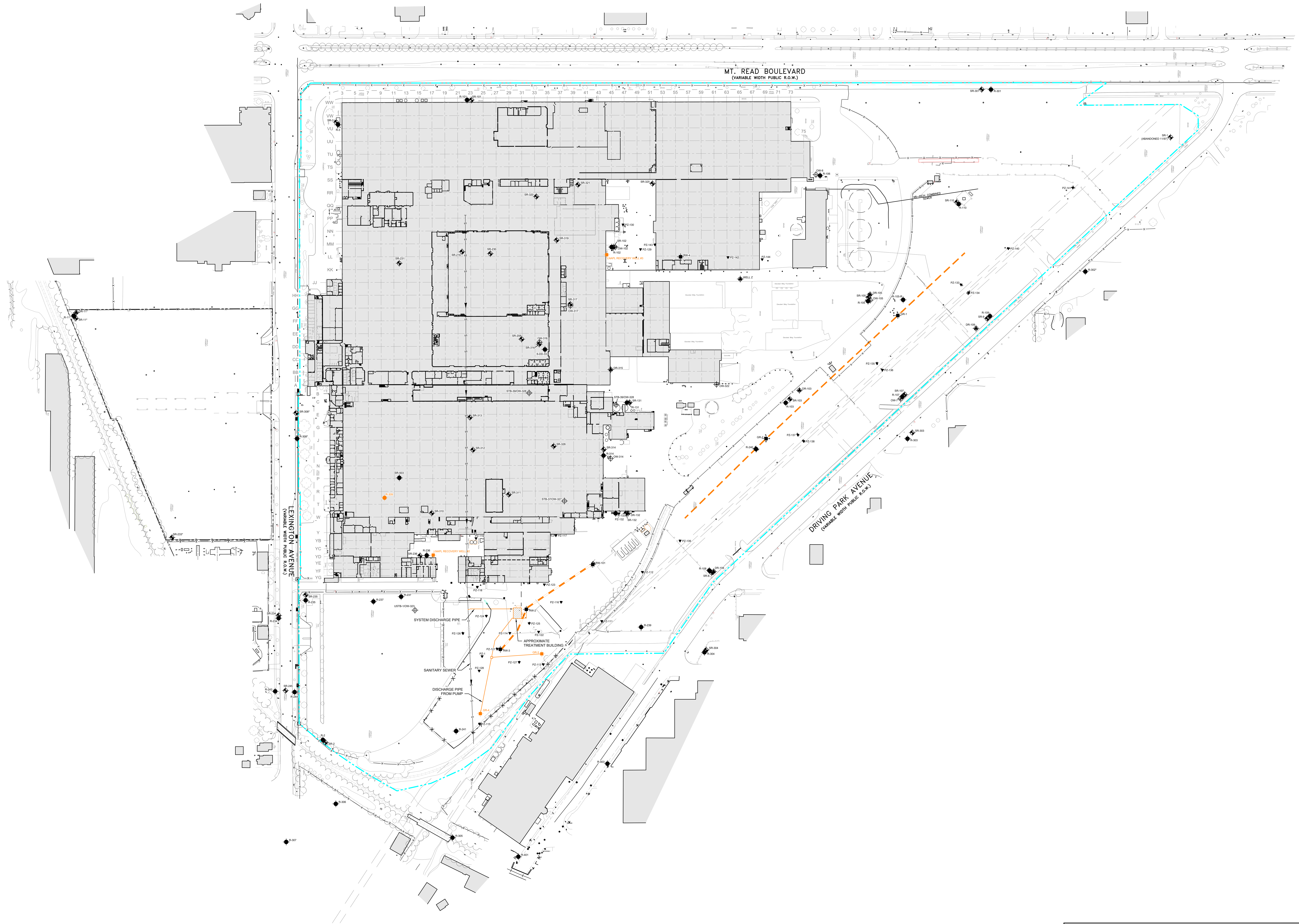

LEGEND:

- PROPERTY LINE (PARCELS)
- OW-7 OVERBURDEN WELL
- SR-1 SHALLOW BEDROCK WELL
- R-107 INTERMEDIATE BEDROCK WELL
- DR-109 DEEP BEDROCK WELL
- WELL Z
- RW-3 RECOVERY WELL (FLOATING PRODUCT)
- GR-1 RECOVERY WELL (GROUNDWATER)
- PZ-111 PIEZOMETER
- LNAPL RECOVERY LOCATION
- OBJECTS IN ORANGE REPRESENT REMEDIATION FEATURES

NOTE:
ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

0 100 200 300 400
SCALE IN FEET

HALEY ALDRICH

DELPHI AUTOMOTIVE SYSTEMS SITE #828064
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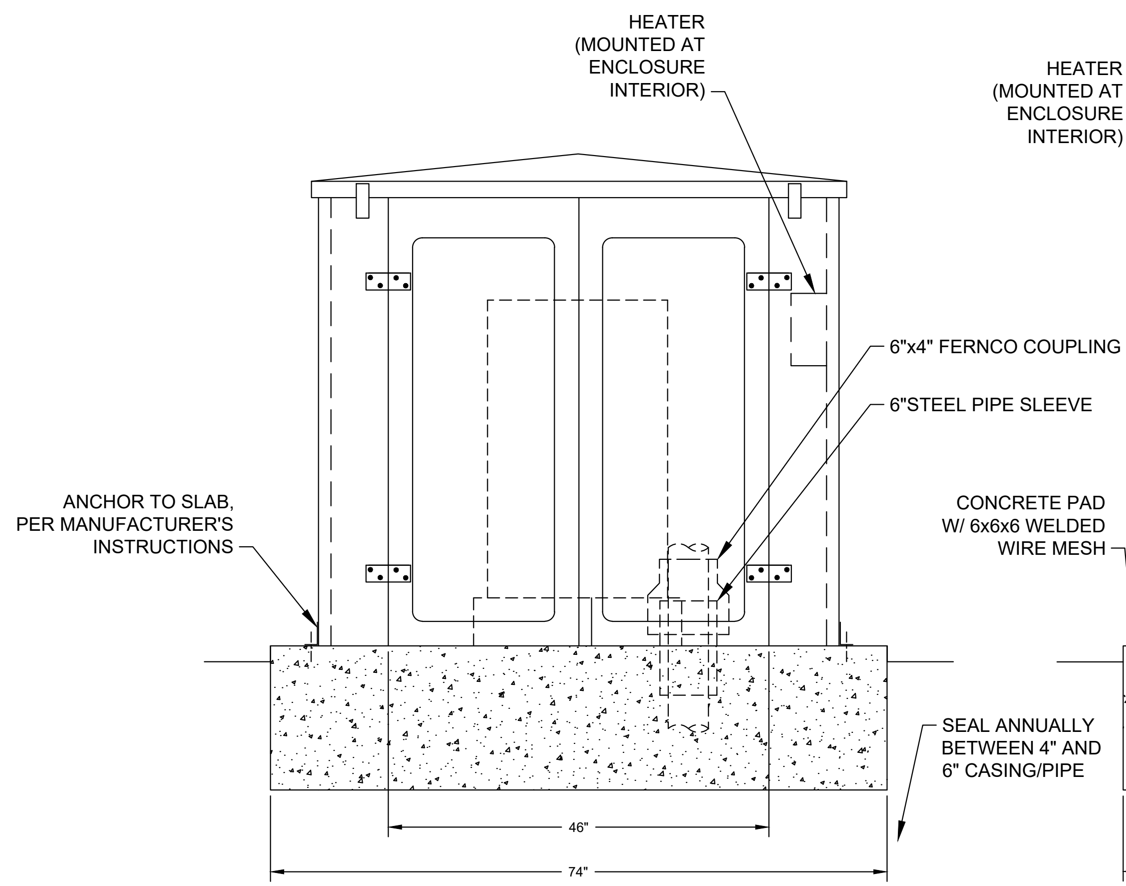
ROCHESTER, NEW YORK

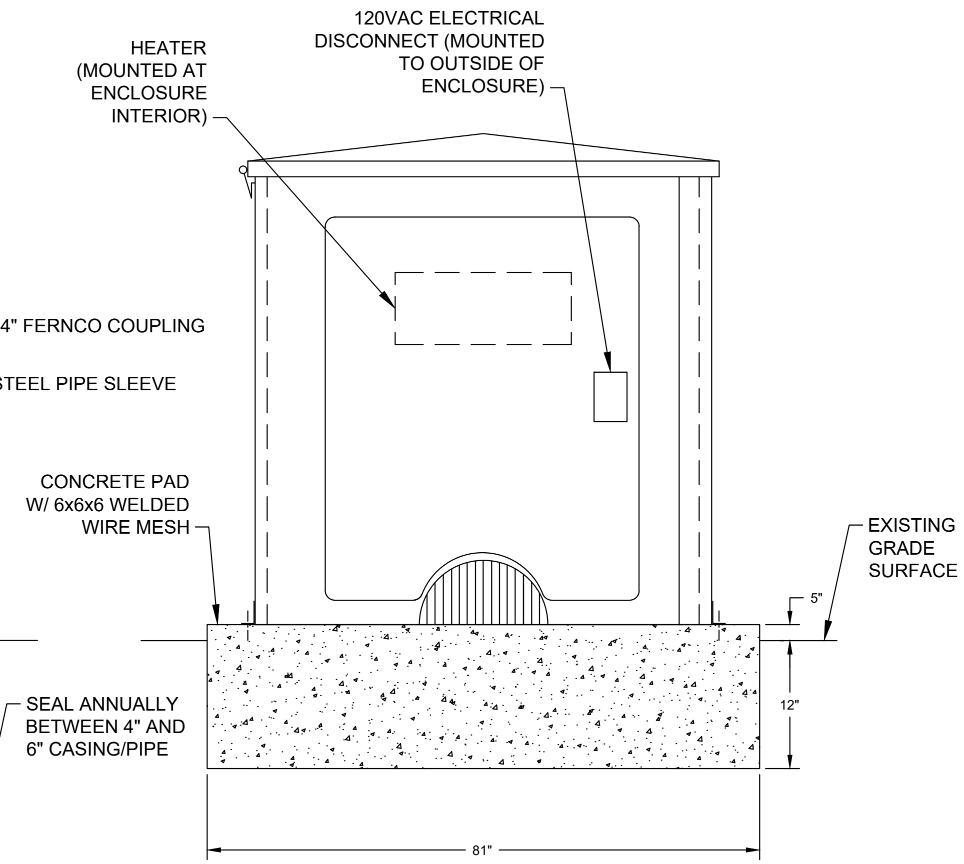
BASE PLAN

SCALE: AS SHOWN
JULY 2020

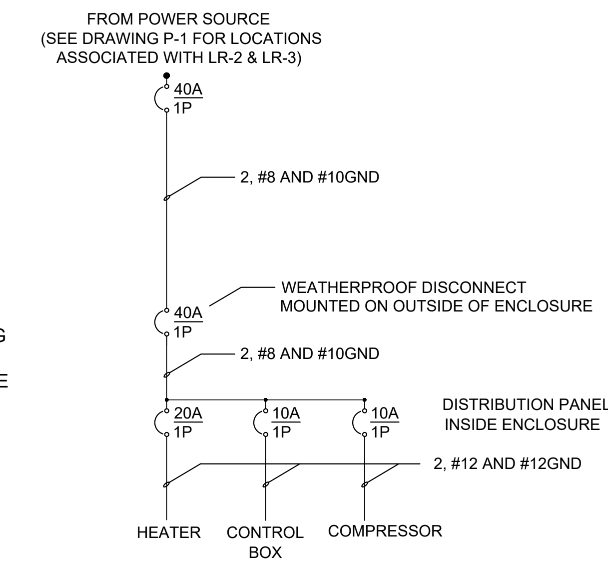
FIGURE 2



1 - **LR-2 & LR-3 EQUIPMENT ENCLOSURE - FRONT ELEVATION**
SCALE: NOT TO SCALE



2 - **LR-2 & LR-3 EQUIPMENT ENCLOSURE - SIDE ELEVATION**
SCALE: NOT TO SCALE



5 - **LR-2 &LR-3 EQUIPMENT ENCLOSURE - ELECTRICAL ONE LINE**
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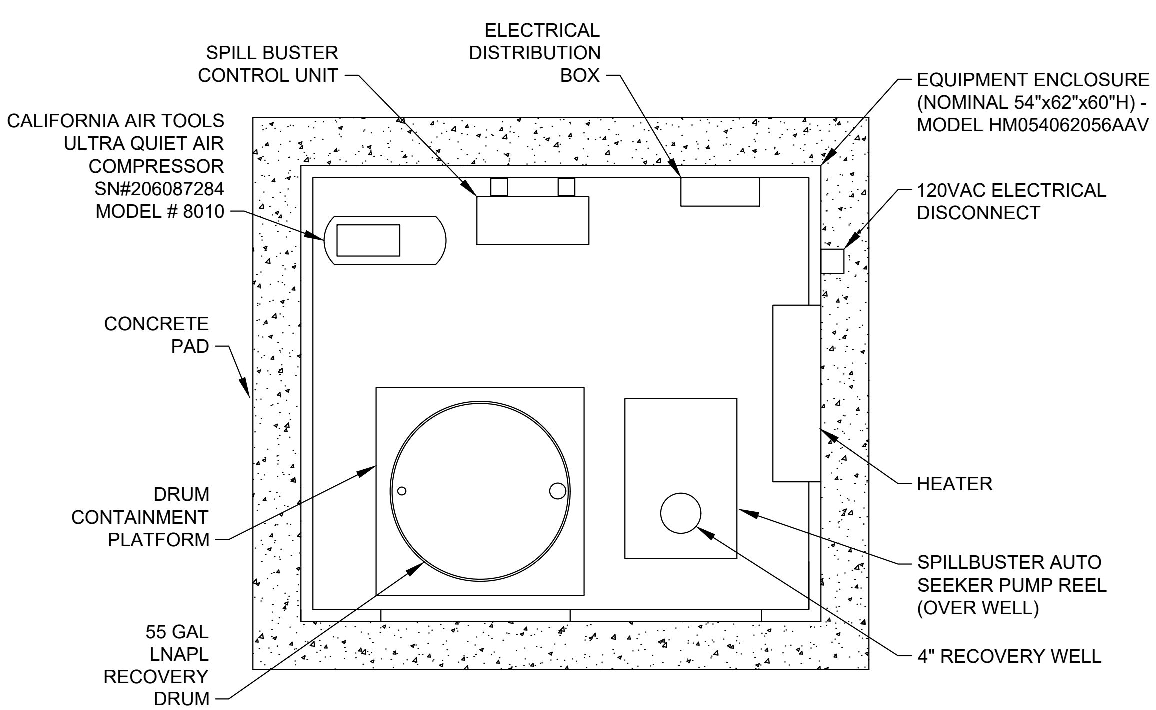
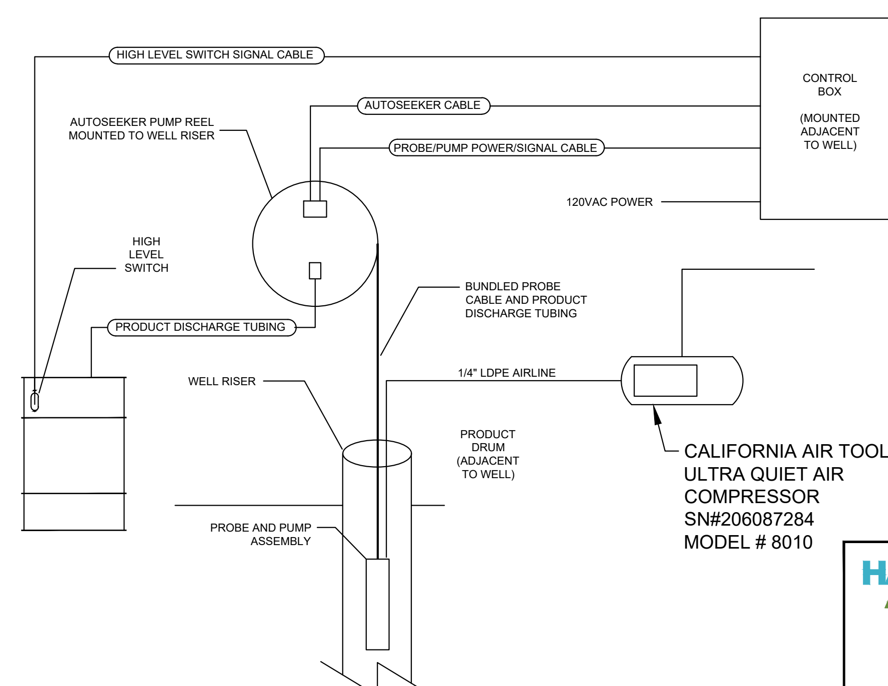


3 - **LR-2 & LR-3 EQUIPMENT ENCLOSURE - PLAN VIEW**
SCALE: NOT TO SCALE



4 - **SPILL BUSTER - PROCESS FLOW SCHEMATIC**
SCALE: NOT TO SCALE
QTY
(2) EXISTING SPILLBUSTERS TO BE RELOCATED

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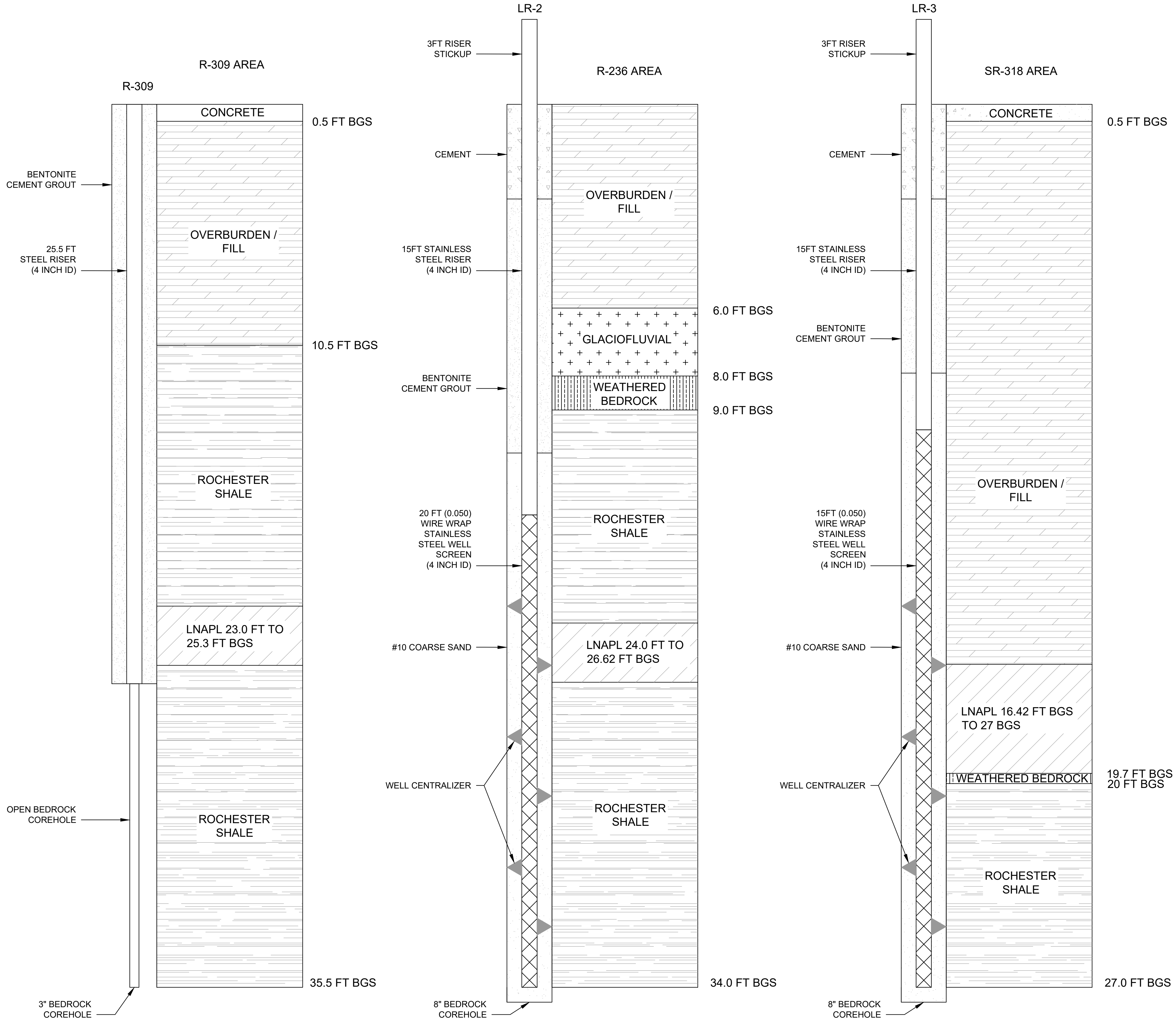
LNAPL RECOVERY SYSTEMS - PUMP SYSTEM / ENCLOSURE DETAILS

SCALE: NONE
JULY 2020

FIGURE 3



LEGEND:

BGS	BELOW GROUND SURFACE
FT	FEET
LNAPL	LIGHT NON-AQUEOUS PHASE LIQUID

LITHOLOGY GRAPHICS:

- CONCRETE; CEMENT
- BENTONITE CEMENT GROUT
- OVERBURDEN/FILL
- ROCHESTER SHALE
- WEATHERED BEDROCK
- GLACIOFLUVIAL

NOTE:

1. LNAPL THICKNESS AND LOCATION AS DETERMINED DURING WELL INSTALLATION.

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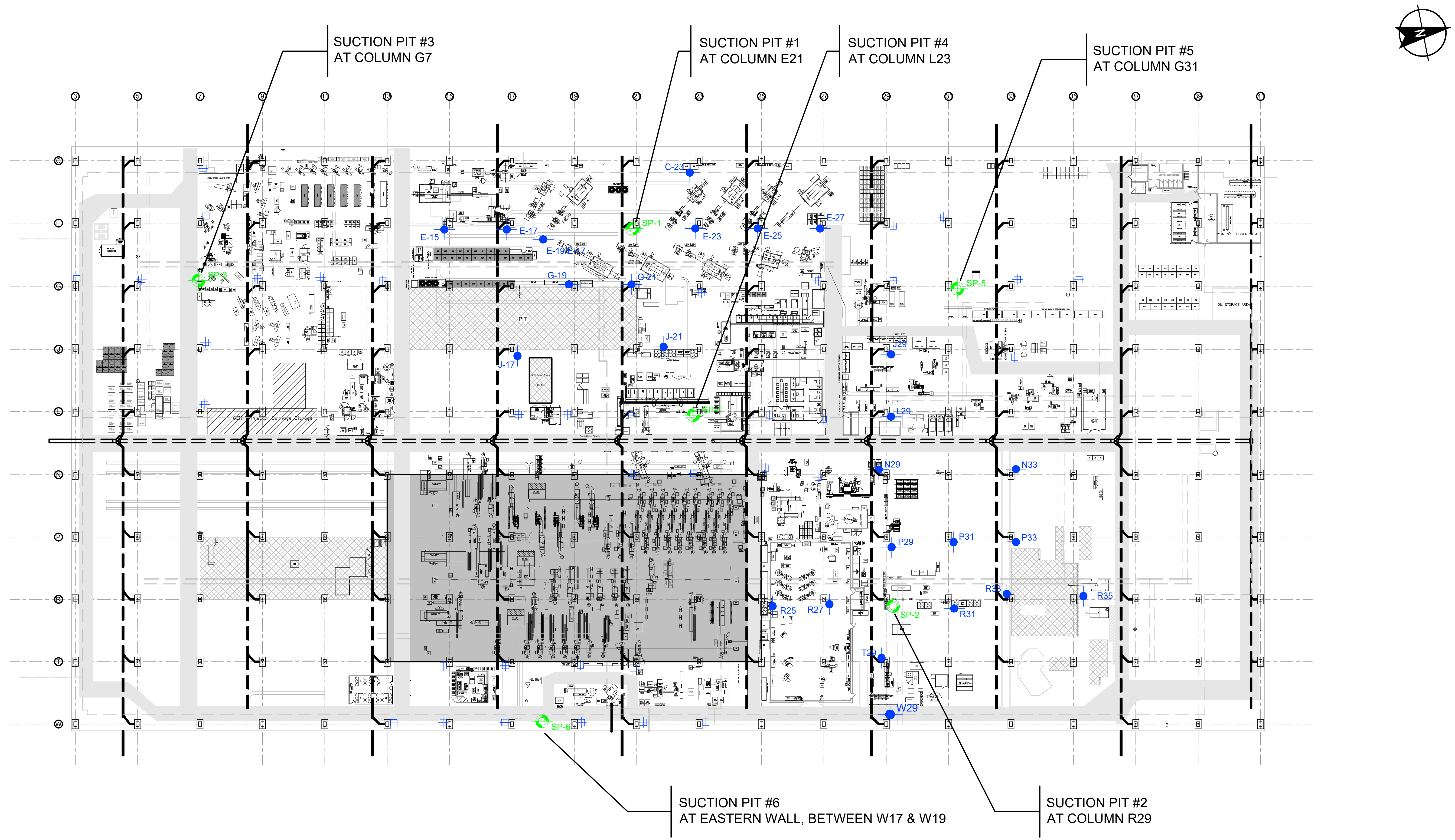
LNAPL RECOVERY SYSTEMS - WELL CONSTRUCTION DETAILS

SCALE: NONE
JULY 2020

FIGURE 4



LEGEND

COLUMN LINE

SUCTION PITS (SP-1 & SP-2 INSTALLED; SP-3, SP-4 & SP-5 PROPOSED)

INSTALLED PILOT TEST VACUUM MONITORING POINT LOCATIONS

PROPOSED ADDITIONAL LONG TERM VACUUM MONITORING POINT LOCATIONS

PIT OR VAULT THAT EXTENDS BELOW THE FLOOR

RESTRICTED AREA DUE TO OPERATIONS (E.G., CRANE)

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SUCTION PIT LOCATIONS
PHASE II SSDS INSTALLATION

SCALE: AS SHOWN
JULY 2020

FIGURE 5

ERVIN, DAYNA Printed: 7/4/2020 8:02 PM Layout: SITE FIG 1
\\HALEYALDRICH.COM\SHARE\ROC_COMMON\127982_GMCH LEXINGTON\2020\CAD\127982-009-B011.DWG

TABLE 1

SUMMARY OF THE REMEDIATION OBJECTIVES

The objectives of the remedial program have been established through the remedy selection process stated in 6NYCRR Part 375. The goal for the remedial program is to restore the Site to pre-disposal conditions to the extent feasible. At a minimum, the remedy shall eliminate or mitigate all significant threats to public health and the environment presented by the contamination identified at the Site through the proper application of scientific and engineering principles.

The remedial action objectives (RAOs) for this Site are:

Media of Concern	**Public Health Protection**	**Environmental Protection**
Soil	• Prevent ingestion/direct contact with contaminated soil. • Prevent inhalation of or exposure from contaminants volatilizing from contaminants in soil.	• Prevent migration of contaminants that would result in groundwater contamination.
Groundwater	• Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards. • Prevent contact with, or inhalation of volatiles, from contaminated groundwater.	• Restore ground water aquifer to pre-disposal/pre-release conditions, to the extent practicable. • Remove the source of ground water contamination.
Soil Vapor	• Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at the Site.	

<u>Source:</u>

RECORD OF DECISION, Delphi Automotive Systems State Superfund Project, Rochester, Monroe County, Site No. 828064, March 2011.

RWP APPENDIX A

Field Method Guidelines

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DRILLING TECHNIQUES

DRILLING TECHNIQUES

INTRODUCTION

This section will provide a brief description of common methods for conducting subsurface investigations. It should be noted that every drilling technology has its limitations.

PROCEDURES REFERENCED

- FMG 2.3 - Soil Borings.
- FMG 2.4 - Bedrock Coring.
- FMG 2.6 - Soil Classification.
- FMG 2.7 - Rock Classification.
- FMG 3.2 - Overburden Wells.
- FMG 3.3 - Top of Bedrock Wells.
- FMG 3.4 - Deep Bedrock Wells.
- FMG 3.6 - Piezometers.

PROCEDURAL GUIDELINES

It is important that the drilling method or methods used minimize disturbance of subsurface materials and not contaminate the subsurface and groundwater. The actual drilling method would be dependent upon site-specific geologic conditions. It is important to note that the drilling equipment selected be decontaminated before and between borehole locations to prevent cross contamination (see FMG 9.0 - Equipment Decontamination). Where possible drilling methods that minimize waste generation (soil cuttings), and wastewater generation (decontamination water), should be selected for GM Remediation Team investigation/remedial tasks.

In other settings it may be desirable to dictate drilling procedures that minimize turbidity/maximize the ability to achieve sediment-free groundwater. Generally, rotosonic techniques or rotary spun casing techniques achieve these objectives, or oversizing the borehole/sand pack may be considered, as well.

Rotosonic Drilling

This method consists of a combination of rotation with high frequency vibration to advance a core barrel to a desired depth. Once the vibration is stopped, the core barrel is retrieved, and the sample is vibrated or hydraulically extracted into plastic sleeves or sample trays. Monitoring wells shall be installed through the outer casing with minimal formation disturbance and mixing of formation materials. Rotosonic drilling generally requires less time than more traditional methods and minimizes soil mixing and soil disturbance (preferred for well locations where low turbidity is an important objective). Continuous, relatively undisturbed samples can be obtained through virtually any formation. Conventional sampling tools can be employed as attachments (i.e., hydropunch, split spoon, Shelby tube, etc.). No mud, air, water, or other circulating medium is required. The rotosonic method can drill easily through formations such as rock, sand, clay, or glacial till. The main limitation of this method is the availability of equipment, the large area required (i.e., drill units are quite large), and costs.

Direct-Push (Geoprobe™)

Direct-push refers to the sampler being "pushed" into the soil material without the use of drilling to remove the soil. This method relies on the amount of the drill weight combined with percussion for advancement of the tool string. Discrete soil samples are continuously obtained as well groundwater and vapor samples can also be collected utilizing this method. Subsurface investigations typically probe to depths of 30 feet or more, depths will vary based on site-specific geology.

Direct-push method is widely used for UST investigations and property investigations. This method is used extensively for initial site screening activities to delineate vertical and horizontal plume presence and can significantly reduce investigative costs.

This method is becoming more popular due to the limited cuttings that are produced during the sampling process and the sampling process speed.

The use of the Geoprobe™ 6600 also allows for the installation of 2-inch diameter monitoring wells in that the 4 1/4-inch hollow-stem auger method can be utilized.

Rotary Method

This method consists of a drill rod attached to a drill bit (soils: tricone, drag; rock: button studded, diamond studded) that rotates and cuts through the soils and rock. The cuttings produced are forced to the surface between the borehole wall and the drill rod by drilling fluids which generally consist of water, drilling mud, or air. The drilling fluids not only force the cuttings to the surface but also keep the drilling bit cool. Using rotary methods for well installations can be difficult as it usually requires several steps to complete the installation. First, the borehole is drilled; then temporarily cased; then the well is installed; and then the temporary casing is removed. In some cases, the borehole may remain open without installing a casing but this will only occur in limited instances (i.e., cohesive soils).

i) Water Rotary

When using water rotary, the potable water supply shall be analyzed for contaminants of concern. Water rotary is the preferred rotary method since the potable water is the only fluid introduced into the borehole during drilling. However, the use of water as a fluid is generally only successful when drilling in cohesive soils. The use of potable water (only) also reduces well development time, when compared to mud rotary.

ii) Air Rotary (typically used in rock)

When using air rotary, the air compressor must have an in-line oil filter system assembly to filter the oil mixed with the air coming from the compressor. This will help eliminate contaminant introduction into the formation. The oil filter system shall be regularly inspected. Air compressors not having an in-line oil filter system are not acceptable for air rotary drilling. A cyclone velocity dissipater or similar air containment system shall also be used to funnel the cuttings to one location rather than letting the cuttings blow uncontrolled out of the borehole. Air rotary may not be an acceptable method for well installation where certain contaminants are present in the formation. Alternatively, it may be necessary to provide treatment for the air being exhausted from the borehole during the installation process.

iii) Mud Rotary

Mud rotary is the least preferred rotary method because contamination can be introduced into the borehole from the constituents in the drilling mud (i.e., Ohio, Michigan). The drilling muds are generally non-toxic and do not introduce contaminants into the borehole, however, it is possible for mud to commonly infiltrate and affect water quality by sorbing metals and polar organic compounds (Aller et al., 1991). Chemical composition and priority pollutants analysis may be obtained from the manufacturer. Mud rotary shall utilize only potable water and pure (no additives) bentonite drilling muds. The viscosity of the drilling mud shall be kept as low as possible in order to expedite well development. Proper well development is essential to ensure the removal of all the drilling mud and to return the formation to its previously undisturbed state.

<u>Hollow-Stem Auger</u>

The hollow-stem continuous-flight auger is among the most frequently used in the drilling of monitoring wells (overburden wells) or for placement of overburden casings for bedrock wells.

The primary advantages of hollow-stem augering are that:

- Generally, no additional drilling fluids are introduced into the formation.

- Representative geologic soil samples can be easily obtained using split-spoon samples in conjunction with the hollow-stem augers.
- Monitoring wells can be installed through the augers eliminating the need for temporary borehole casings.

Disadvantages of hollow-stem augering are:

- Creates problems for select parameters.
- Large volumes of cuttings are typically generated.
- Decontamination is fairly time consuming/labor intensive.
- Relatively slow when compared to direct-push methods (soil sampling tasks).

Installing monitoring wells through hollow-stem augers is a relatively simple process although precautions need to be taken to ensure that the well is properly backfilled. This can be particularly problematic in cases where flowing sand is present.

Hollow-stem augers are available with inside diameters of 2.5, 3.25, 4.0, 4.25, 6.25, 8.25, and 10.25 inches. The most commonly used are 4.25 inches for 2-inch (5 cm) monitoring wells and 6.25 inches for 4-inch (10 cm) monitoring wells. Boreholes can usually be drilled with hollow-stem augers to depths up to 100 feet (30 m) in unconsolidated clays, silts, and sands. Removing augers in flowing sand conditions while installing monitoring wells may be difficult since the augers have to be removed without being rotated. A bottom plug or pilot bit assembly should be utilized to keep out soils and/or water that have a tendency to plug the bottom of the augers during drilling. If flowing sands are encountered, potable water (analyzed once for contaminants of concern) may be poured into the augers to equalize the pressure to keep the formation materials and water from coming up into the auger once the bottom plug is removed.

<u>Dual-Wall Reverse Circulation Air Method of Drilling</u>

This method consists of two concentric strings of drill pipe (an outer casing and a slightly smaller inner casing). The outer drill pipe is advanced using rotary drilling with a donut-shaped bit attached to the dual casing string cuts an area only the width of the two casings and annulus between. Compressed air is continually forced down the annulus between the inner casing carrying the drill cuttings and groundwater. At the surface, the inner casing is connected to a cyclone hopper where the drill cuttings and groundwater fall out the bottom of the hopper, and air is disbursed out the top. The dual wall provides a fully cased borehole in which to install a monitoring well. The only soil or groundwater materials exposed at any time are those at the drill bit. Therefore, the potential for carrying contamination from one stratum to another is minimal. Depth-specific groundwater samples can be collected during drilling; however, since the groundwater is aerated, analysis for volatile compounds may not be valid.

Well Points

In some limited cases, well points (sand points) are driven into place without the use of augers. This method provides no information on the geologic condition (other than the difficulty of driving which may be related to formation density). Well points are most often used simply to provide dewatering of a geologic unit prior to excavation in the area. Well points are also used in monitoring shallow hydrogeologic conditions such as in stream beds.

REFERENCES

Numerous publications are available describing current monitoring well design and construction procedures.

Driscoll, F.G., 1986. Groundwater and Wells, 2nd Edition. Johnson Division.

EPA/625/6-90/0166 (July 1991), Handbook Ground Water Volume II: Methodology.

Freeze, R.A. and Cherry, J.A., 1979. Groundwater. Prentice Hall, Inc.

National Water Well Association, 1989. Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells.

Environmental Protection Agency (1986), RCRA Groundwater Monitoring Technical Enforcement Guidance Document, OSWER-9950.1.

In addition, the following ASTM publications apply:

ASTM D5474	Guide for Selection of Data Elements for Ground-Water Investigations
ASTM D5787	Practice for Monitoring Well Protection
ASTM D5521	Guide for Development of Ground-Water Monitoring Wells in Granular Aquifers
ASTM D5978	Guide for Maintenance and Rehabilitation of Ground-Water Monitoring Wells
ASTM D5299	Guide for Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes and Other Devices for Environmental Activities
ASTM D5092	Standard Practice for Design and Installation of Ground Water Monitoring Wells in an Aquifer.

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WELL CONSTRUCTION MATERIALS

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REVISION NO 0	REVISION DATE:

WELL CONSTRUCTION MATERIALS

INTRODUCTION

In environmental subsurface investigations, the information used to evaluate subsurface conditions often relies heavily on the installation of quality groundwater monitoring wells. The application and use of the proper well construction materials to the specific well installation is crucial to obtaining representative and reliable groundwater samples.

The two general types of wells are groundwater monitoring wells and pumping (also referred to as recovery, extraction, or withdrawal) wells. The specific use of a groundwater well dictates the types of materials used to construct it.

This FMG outlines the general types and use of well construction materials and considerations involved in selecting appropriate materials for specific well installation applications. Installation of these materials are described in detail in the specific well installation FMGs listed below.

PROCEDURES REFERENCED

- FMG 3.2 - Overburden Wells.
- FMG 3.3 - Top of Bedrock Wells.
- FMG 3.4 - Deep Bedrock Wells.
- FMG 3.5 - Pump Wells.
- FMG 3.6 - Piezometers.

EQUIPMENT DESCRIPTIONS

Well Screen

Well screen is the portion of the well pipe that contains appropriately sized openings and allows groundwater to enter the well. The screen materials used in groundwater monitoring wells are crucial to ensuring the installation of an efficient, productive, and durable groundwater well.

The diameter of the well screen is generally dependent upon the application of the well. For monitoring wells used in groundwater level measurements and groundwater sampling, screen diameter will generally be 2.0-inch inner diameter (ID) flush-threaded screen segments (piezometers are typically 1.0-inch inner diameter but may be 2-inch also). These screen segments are typically available in 10-foot lengths. Four-inch diameter or larger well screens are usually reserved for recovery or production well applications where larger diameters permit greater groundwater withdrawal rates. Larger diameter wells also allow a well to serve additional functions such as housing oil recovery systems.

Screen material will be either thermoplastic Schedule 40 Poly Vinyl Chloride (PVC) (ASTM D1785, ASTM D2665, ASTM F480) or Schedule 5 Type 316 stainless steel, depending primarily on the depth of the well and the groundwater quality (degree and nature of contamination). Shallower depths and generally low levels of contaminants in groundwater allow for PVC applications, whereas greater depths and severely degraded groundwater quality, or the presence of free-phase oils or solvents, may necessitate stainless steel due to its greater strength and resistance to chemical degradation. It should be noted that PVC and stainless steel are appropriate for the vast majority of environmental applications, and are generally accepted by regulatory agencies. Well materials other than PVC or stainless steel should be used only in certain instances, to be determined and approved by the Project Manager on a case-by-case basis.

Certain applications such as investigation of inorganic (metals) concentrations in groundwater, or the presence of low pH (acidic) conditions, may preclude the use of stainless steel wells. Stainless steel, which contains molybdenum in addition to its iron content, may leach out metal compounds which could lead to misleading groundwater analysis results.

PVC may likewise leach out or degrade specific thermoplastic elements of its composition which may compromise the well integrity or groundwater analyses. PVC generally performs well in acidic groundwater conditions; however, it may degrade in the presence of certain organic compounds such as ketones, aldehydes, or chlorinated compounds in high concentrations. Certain additives to the PVC may also affect groundwater quality.

Well screen slot sizes and well screen type will also be consistent for groundwater monitoring wells. Screen slot size is typically 0.010 inches; 0.020-inch slot size may be more appropriate for coarser formation materials or where the well may serve as a recovery well for free-phase oils. For monitoring applications, slot type should be either factory machine-slotted or continuous-wrap slotted. Perforated, bridge-slotted or louver-slotted well screens are generally not acceptable for most environmental applications and should be avoided.

Screen slot sizes may vary from these two sizes when used in production or recovery (pumping) well applications where the need to maximize groundwater withdrawal is essential. In such cases, screen slot sizes can be manufactured to exact specifications for a particular well based on particle size analysis results and formation transmissivity or permeability.

Well Riser Pipes and Casings

Well riser pipe is a solid extension of the well screen that extends from the screen up to the surface. The riser pipe protects the well screen, prevents outside groundwater from entering the well, and allows groundwater pumped from down in the open interval to be routed up through the well to the surface.

Well riser pipe should be of the same material and size as the well screen described above. In instances to be determined and approved by the Project Manager on a case-by-case basis only, differing materials may be approved for use in the same well (e.g., stainless steel well screen connected to PVC riser). Well risers should extend to the surface and should either be cut at grade in flush-mount completions or as an approximately 3-foot stickup to be covered with a steel protective casing.

Well riser pipe sections shall be flush-threaded and fitted with neoprene, rubber, or other appropriately constructed, durable o-rings to properly seal the threaded pipe joints. Glues or cements are not to be used in well construction.

In installations of bedrock monitoring wells, which have an open rock monitoring interval and a permanent well casing that extends from bedrock to the surface, the permanent casing (or casings in telescoping wells) shall be made of carbon steel or low-carbon steel (greater than 0.8 percent carbon and less than 0.8 percent carbon, respectively). The well casing should be a minimum of 4 inches in diameter (at least 4 inches diameter for the innermost casing).

On sites wells where dense, non-aqueous phase liquid (DNAPL) is present or may be a concern, in screened wells it is advisable to install a collection sump on the base of the well below the well screen to collect infiltrated DNAPL for possible measurement and/or sampling. Sumps should be installed as a 1- to 5-foot section of solid riser material with a sealed bottom placed below the well screen.

Sand Packs

The filter pack, or sand pack, installed in a well replaces formation material immediately around a well with a more permeable material (sand). The sand pack separates the well screen from the formation, increases the hydraulic diameter of the well, and prevents fines (silt or clay) from entering or clogging the well screen.

Sand pack of an appropriate size shall be utilized based on the well screen slot size being used. Sand pack size should be chosen so that the majority of the sand (sand pack has inherent variation in its particle grain size distribution) is larger than the screen slot size while sized small enough to prevent deleterious amounts of formation fines from entering the well through the sand pack. Screen slot sizes of 0.010-inch and 0.020-inch typically use a sand pack such as Morie or U.S. Silica No. 1, No. 0, No. 00N, or equivalent.

Sand pack shall be washed silica sand with a silica content of at least 95 percent. Sands should meet one or more of the following requirements: NSF 61, AWWA B-100, ANSI, or equivalent standards for uniformity and chemical inertness. In cases to be determined and approved by the Project Manager on a case-by-case basis only, differing sand pack materials may be approved for use in a well. Sand packs used for production and recovery wells with larger screen slot sizes will use larger particle sized sand packs of the same type and quality. The slot size and sand pack size for recovery wells should be chosen based on results of formation grain size distribution analysis.

Seals

Bentonite and grout seals are installed above the sand pack to isolate the monitoring interval and prevent groundwater from infiltrating into the well screen from other water-bearing zones. Seals also prevent migration of backfill or formation materials downward into the sand pack.

Bentonite is the generic name for a group of a naturally occurring clay minerals (montmorillonites) that come in a variety of forms: pellets, chips, granulated, or powdered. This material is commercially available as "Wyoming Bentonite". When hydrated it swells to many times its original volume and forms an ultra-low permeability clay seal.

Bentonite chips or pellets are generally used to create a seal immediately above the sand pack. The chips/pellets are dropped inside the augers or well casing by hand down through the water column onto the top of the sand pack. Care must be taken to prevent "bridging" of the bentonite particles in the casing above the target zone. Measurements of the depth to the top of the seal must be obtained during installation of the seal to ensure its proper position and thickness. In the absence of significant water in a casing or borehole, potable water must be added to hydrate the bentonite. The bentonite seal will be allowed to set for a minimum of one-half hour, in order to hydrate properly, before additional seals (grout) are applied. Once the bentonite has set for one-half hour the grout seal may be placed, as described below.

In saline groundwater environments, such as where ocean water may infiltrate the monitoring interval, a zeolite-based seal material may be used, as saline conditions may hamper the performance of bentonite pellets.

Portland cement grout (grout) forms a concrete-like seal that can be more manageable than bentonite (e.g., able to be pumped through a water pump). Grout is generally placed on top of the hydrated bentonite seal to form a solid cement seal around the well riser up to the surface. In certain circumstances, only under approval of the GM Project Manager, soil cuttings may be used to backfill the borehole in lieu of grout.

The grout mixture will consist of one 94-pound bag of Portland cement and 3 to 5 pounds of powdered bentonite added per sack of cement. Two pounds of calcium chloride may also be added (under certain conditions, e.g., very cold days) to accelerate the setting time of the grout, as well as to increase the dry strength of the grout. The grout will be thoroughly mixed with 6.5 gallons of potable water per sack of cement. Grout is generally placed using either the tremie or Halliburton grouting methods. These are described in the specific well installation FMGs.

Protective Casings and Surface Seals

Once the well screen, riser, and all seals have been placed to ground surface, the well riser must be protected. This includes protection from vehicles, damage, surface water infiltration, and weather. This is typically accomplished using either a flush-mount roadbox or a stickup casing.

Flush-mount roadboxes are circular steel casing segments with a heavy-duty steel lid with locking bolts. These units are widely available and come in a number of diameters and lengths, depending on the well diameter. A stickup protective casing is generally a length of carbon or stainless steel pipe with a locking top.

For a typical 2-inch monitoring well, the roadbox should be at least 6 inches in diameter; a stickup casing should be at least 4 inches in diameter. A roadbox should be at least 12 inches in length (they are typically 16 to 18 inches long) and is installed flush with the ground surface. A stickup casing should be at least 5 to 6 feet long such that approximately 2.5 to 3 feet is below ground surface and 2.5 to 3 feet is protruding above grade. In wells where a permanent steel casing is installed (serves as the well riser pipe) and brought to the ground surface, it may be used as the protective casing provided it is equipped with a semi-permanent, metal, locking cap or cover that can be affixed to the steel casing.

Flush-mount installations should have at least the last 18 inches of the open borehole filled with coarse sand, placed up to ground surface to allow drainage of surface water infiltration down through and out of the roadbox. This also prevents infiltrating surface water from accumulating up over the top of the well riser and draining down into the well. This sand drain is not necessary in the locking cap stickup casings.

Both roadbox and stickup casings must be secured in the ground with concrete, which also serves as a surface seal.

In areas of high vehicle traffic activity, protective steel bollards should be installed. This is typically a vertically oriented, concrete-filled, steel pipe (minimum 4 inches diameter) cemented at least 3 feet into the ground, acting as a "guard rail" for the well casing and preventing it from being damaged by vehicles. Three bollards should be placed around a well to provide adequate protection.

EQUIPMENT/MATERIALS

- Drilling equipment.
- Well screen and riser materials.
- Sand pack.
- Bentonite pellets/chips.
- Powdered bentonite.
- Portland cement.

REFERENCES

ASTM D1785-99, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

ASTM D2665-00, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

ASTM F480-00, Standard Specification for Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), Schedule 40 and Schedule 80.

ASTM A53/A53M-01, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless for Ordinary Uses.

Campbell, M.D., and Lehr, J.H., Water Well Technology, McGraw Hill, 1973.

Cold Weather Concreting, ACI Committee 306, Materials Journal, Volume 85, Issue 4, July 1, 1988.

Driscoll, Fletcher G., Groundwater and Wells, Johnson Filtration Systems, Inc., 1986.

Freeze, R. Allen, and Cherry, John A., Groundwater, Prentice-Hall, 1979.

USEPA, 1986, RCRA Groundwater Monitoring Technical Enforcement Guidance Document, Office of Solid Waste and Emergency Response, 1986.

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WELL DEVELOPMENT

LIST OF FORMS
(Following Text)

REMEDIATION TEAM	FIELD METHOD GUIDELINE NO.: FMG 3.7
REAL ESTATE & FACILITIES	EFFECTIVE DATE: MARCH 14, 2011
GENERAL MOTORS	
REVISION NO.: 0	REVISION DATE:

WELL DEVELOPMENT

INTRODUCTION

This procedure is for the development of groundwater monitoring wells that have been installed in overburden, top of bedrock, or deep bedrock formations. Before a newly constructed well can be used for water quality sampling, measuring water levels, or aquifer testing, it must be developed. Well development refers to the procedure used to clear the well and formation around the screen of fine-grained materials (sands, silts, and clays) produced during drilling or naturally occurring in the formation.

Well development is completed to remove fine grained materials from the well but in such a manner as to not introduce fines from the formation into the sand pack. Well development continues until the well responds to water level changes in the formation (i.e., a good hydraulic connection is established between the well and formation) and the well produces clear, sediment-free water to the extent practical.

PROCEDURES REFERENCED

- FMG 3.2 - Overburden Wells.
- FMG 3.3 - Bedrock Wells.
- FMG 10.0 - Waste Characterization.

PROCEDURAL GUIDELINES

The well development procedures presented below are the recommended standards. However, due to variations in conditions, changes in these standards may be necessary in order to facilitate successful monitoring well development.

Well development can be accomplished by using in-place pumps or by using portable equipment; either peristaltic, bladder, or other appropriate pumps depending on well depth. In the case of developing wells installed utilizing the mud rotary methods (least preferred method) it would be beneficial to surge the well prior to and during development to help break down the filter cake that may have built up on the well screen.

- Don appropriate safety equipment.
- All equipment used for development purposes entering each monitoring well will be cleaned using a soapy wash (laboratory grade), tap water rinse, isopropyl alcohol rinse (or other rinse agent that is appropriate for site-specific conditions), and distilled/deionized water rinse.
- Uncap well and allow water level to stabilize. Attach appropriate pump and lower tubing into well.
- Turn on pump. If well runs dry, shut off pump and allow to recover.
- Collect the groundwater sample in a glass jar to determine relative turbidity, and measure and record the temperature, pH, turbidity, and specific electrical conductance.
- The above steps will be repeated until groundwater is relatively silt-free; no further change is noted; the temperature, pH, turbidity, and specific conductance readings have stabilized to within 10 percent.
- The time period between development and groundwater sampling will be dependent upon the project objectives, and the chemicals of concern (COCs). When sampling for COCs sensitive to turbidity presence (i.e., SVOCs, PCBs, metals), an extended time period between the development activity and the sampling event will be observed. On REALM/ENCORE sites sampling will be conducted in accordance with the following:

Primary COC	***Time Period Between Development and Sampling***
General Chemistry	24 hours
VOCs	24 hours
SVOCs, PCBs, Metals	2 weeks

Waste Disposal

- All waste generated will be disposed in accordance to the methods and procedures contained in FMG 10.0 - Waste Characterization.
- All water generated during cleaning and development procedures will be collected and contained in accordance to the site-specific disposal requirements.
- Personal protective equipment, such as gloves, disposable clothing, and other disposable equipment, resulting from personnel cleaning procedures and from soil sampling and handling activities, will be placed in plastic bags. These bags will be transferred into appropriately labeled 55-gallon drums or a covered roll-off box for appropriate disposal.

EQUIPMENT/MATERIALS

- Appropriate health and safety equipment.
- Knife.
- Power source (e.g., generator, battery).
- Field book.
- Form FMG 3.7-01 - Well Development and Stabilization Form.
- Well keys.
- Graduated pails.
- Pump and tubing.
- Cleaning supplies (including non-phosphate soap, buckets, brushes, laboratory-supplied distilled/deionized water, tap water, isopropyl alcohol or other site-specific rinse agent (e.g., nitric acid solution), aluminum foil, plastic sheeting, etc.).
- Water level meter.
- pH/temperature/conductivity meter.
- Turbidity meter.
- Clear glass jars (e.g., drillers' jars).

REFERENCES

Environmental Protection Agency (1986), RCRA Ground-Water Monitoring Technical Enforcement Guidance Document, OSWER-9950.1.

Environmental Protection Agency (1987), A Compendium of Superfund Field Operations Methods, EPA/540/P-87/001.

Environmental Protection Agency (1988), Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, EPA/540/G-89/004.

WELL DEVELOPMENT AND STABILIZATION FORM

PROJECT NAME: ______________________ PROJECT NO.: __________

DATE OF WELL DEVELOPMENT: ______________________

DEVELOPMENT CREW MEMBERS: ______________________

PURGING METHOD: ______________________

SAMPLE NO.: ______________________

SAMPLE TIME: ______________________

WELL INFORMATION

WELL NUMBER: ______________________

WELL TYPE (diameter/material) ______________________

MEASURING POINT ELEVATION: ______________________

STATIC WATER DEPTH: ______________________ ELEVATION: __________

BOTTOM DEPTH: ______________________ ELEVATION: __________

WATER COLUMN LENGTH: ______________________

SCREENED INTERVAL: ______________________

WELL VOLUME: ______________________

Note: For 2-inch diameter well: 1 foot = 0.14 gallons (Imp) or 0.16 gallons (US)
1 meter = 2 liters

	UNITS	*1*	*2*	*3*	*4*	*5*	*TOTAL/ AVERAGE*
VOLUME PURGED (volume/total volume):							
FIELD pH:							
FIELD TEMPERATURE:							
FIELD CONDUCTIVITY:							
CLARITY/TURBIDITY VALUES:							
COLOR:							
ODOR:							
COMMENTS:							

COPIES TO: ____

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WASTE CHARACTERIZATION

INTRODUCTION

The following procedure describes the techniques for characterization of investigation derived waste (IDW) for disposal purposes.

PROCEDURAL GUIDELINES

IDW may consist of soil cuttings (augering, boring, well installation soils, test pit soils), rock core or rock flour (from coring, reaming operations), groundwater (from well development, purging, and sampling activities), decontamination fluids, personal protective equipment (spent gloves, tyveks), (PPE), and disposal equipment (DE).

This procedure applies when disposition of investigation soils and/or groundwater is required in accordance with the project Work Plan. Generally, this procedure is applicable to Facilities where the Project Manager has assessed the areas of investigation and has developed a waste handling plan. In some areas and/or sections within a Facility it is permitted to return soil cuttings/test pit soils and groundwater to the source area (RCRA guidance allows waste management techniques within an area of concern without 'triggering' new points of waste generation). In other areas it may not be practical to return cutting/soils to their origin, and are better handled by this characterization/disposal procedure. This practice is consistent with USEPA procedure for IDW at RCRA facilities and CERCLA sites (Reference 1, 2).

Typically investigative derived wastes are dealt with following "Best Management Practices"; and are not handled under RCRA regulations until proven to be listed and/or identified characteristically hazardous waste. Investigative soils and groundwater cannot be considered a listed waste (in most circumstances) due to the lack of generator knowledge concerning chemical source, chemical origin and timing of chemical introduction to the subsurface. Consequently, waste sampling and characterization is performed to determine if the wastes exhibit a characterization of hazardous waste. Once the waste characterization is complete RCRA regulations apply if determined hazardous, if determined to be non-hazardous solid wastes, best management practices apply.

The disposal of soil cuttings and/or purged groundwater must be reviewed on a case by case basis prior to initiation of field activities. Two scenarios typically exist:

i) Sufficient Facility and/or site information exists that allows investigative cutting and/or purged groundwater to be placed back into the borehole or spread on the ground surface; or discharged or in the case of purged water directly onto the ground surface - No disposal required.

ii) Site conditions warrant that all materials handled will be contained and disposed of.

DISPOSAL PROCEDURES

The following outlines the waste characterization procedures to be employed when IDW disposal is required.

Soil/Rock Cuttings

Soils removed from boring activities and well construction tasks (including, rock flour from bedrock coring) will be contained within an approved container, suitable for transportation and disposal.

- Once placed into the approved container, any free liquids (i.e., groundwater) will be poured off for disposal as waste fluids, or solidified within the approved container using a solidification agent such as speedy-dri (or equivalent). No free liquid as determined by the "paint filter test" shall be present.
- Contained soils will be screened for the presence of Volatile Organic Compounds (VOCs), using a photoionization detector (PID); this data will be logged for future reference.
- Once screened, full and closed the container will be labeled in accordance with the Facility labeling requirements and placed into the Facility container storage area. At a minimum the following information will be shown a each container label: date of filling/generation, Facility name, source of soils (i.e., borehole or well), and Facility contact. If necessary, the exterior of the container will be cleaned to remove any lose dirt/cuttings.
- Prior to container closure, representative samples from a percentage of the containers will be collected for waste characterization purposes and submitted to the project laboratory. The waste characterization sampling scheme will be dictated by the Work Plan and establish the volume of soils required for analysis (depending on parameters required), the number of containers considered representative, the homogenization procedure, volatile analysis collection procedure (if required) and preparation handling requirements. Typically at a location where an undetermined site-specific parameter group exists, sampling and analysis may consist of the full RCRA Waste Characterization (ignitability, corrosivity, reactivity, toxicity), or a subset of the above based upon data collected, historical information and generator knowledge.

Groundwater

Well construction development, purging and sampling groundwater which requires disposal will be contained. Containment may be performed in 55-gallon drums, tanks suitable for temporary storage (i.e., Nalgene or Facility provided tanks 500 to 1,000 gallons) or if large volumes of groundwater are anticipated, drilling "frac" tanks may be utilized (20,000 gallons ±), or tanker trailer (5,000 to 10.000 gallons ±). In all cases the container/tank used for groundwater storage must be clean before use such that cross-contamination does not occur.

Decontamination Waters/Decontamination Fluids

- Decontamination waters and/or fluids will be segregated, contained, and disposed of accordingly.
- Decontamination waters may be disposed of with the contained groundwater once analytical results have been acquired. Depending on the extent of chemistry present it may be appropriate to discharge the decontamination waters to the Publicly Owned Treatment Works (POTW); or discharge to an on-site treatment system; or send off site for treatment. (Proper permitting may be required.)
- Spent Solvent/Acid Rinses - Solvents and acids used during decontamination activities must be segregated and disposed separately from the groundwater/decontamination water. Often if only small amounts of solvents are involved these can be left to evaporate. If large volumes are involved then containerization, labeling, and storage is required.

PPE/DE

- A number of disposal options exists for spent PPE/DE generated from investigation tasks. The options typically employed are:
  - i) Immediately disposed of within on-site dumpster/municipal trash; or
  - ii) If known to be contaminated with RCRA hazardous waste, disposed of off site at a RCRA Subtitle C facility; or alternatively PPE/DE decontaminated and disposed of on site within dumpster/municipal trash; or
  - iii) Contained and stored until the final remedy is implemented.

WASTE CHARACTERIZATION PROCEDURES

The Work Plan will identify the appropriate sampling strategy and analytes required to determine the IDW characteristics and disposal requirements. USEPA SW-846 (Reference 5, Chapters 9 and 10) describes the rationale for sampling plan development and sampling procedures. Generally random sampling and preparation of a composite sample of the media is employed for most investigative programs. The "GM Statistical Guidance – 2nd Edition" (Reference 4, Section 2.5) outlines the statistical rationale and approaches applicable to one-time waste streams. Often a minimum of four representative samples are required to gain valid waste characteristic data to determine the disposal option applicable (if statistics are employed).

Sampling procedures for IDW are:

- Solid Wastes - Grab sampling using precleaned sample spoons from bulk piles, lugger boxes, or as drums are being filled is commonly employed. In some instances sufficient media mixing may be evident to permit drum sampling from a random number of drums by accessing only the top solids. In other instances where stratification is evident, a sample trier/hand auger or device to collect from the entire vertical profile is required. Typically, a composite sample(s) from representative areas of the container(s) is homogenized and submitted for analysis. If VOCs are being evaluated, compositing and homogenization is not permitted. Individual grab samples are typically required for VOCs.
- Waste Waters - Grab sampling techniques using precleaned bailers or sampling pumps are typically employed. Waters in bulk are typically sampled once using a bailer or pump. The Work Plan will outline the appropriate sample frequency and analytes necessary to adequately characterize the contained waters. Facility sewer discharge permit parameters will be evaluated when disposal to the POTW is being considered.

  Note: If NAPL is present special sampling and handling requirements will apply. Precautions to separate the NAPL from the wastewater will commonly be employed, due to the special material handling and waste disposal requirements when dealing with phase materials.
- Spent Solvent/Acid Rinses - The need for sampling must be determined in consultation with the waste management organization handling the materials. If known that only the solvent and/or acids are present, then direct disposal/treatment using media specific options maybe possible without sampling (i.e., incineration).
- PPE/DE - Typically not sampled and included with the disposal of the solid wastes.

EQUIPMENT/MATERIALS

- Sample spoons, trier, auger.
- Sample mixing bowl.
- Sampling bailer, or pump.
- Sample glassware.

REFERENCES

USEPA RCRA - Guidance and Policies: Management of Remediation Waste Under RCRA (October 1998).

USEPA RCRA - Management of Contaminated Media (October 1998).

USEPA CERCLA Guidance (Options Relevant to RCRA Facilities): Guide to Management of Investigation-Derived Wastes (January 1992).

2nd Edition - GM Statistical Guidance Section 2.5.1. Solid Waste Characterization Subsection 2.5.1.1. One-Time Waste Stream Characterization (July, 2000).

USEPA Office of Solid Waste - SW-846 Chapter 9 Sampling Plan, Chapter 10 Sampling Methods (September 1986).

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EQUIPMENT DECONTAMINATION

EQUIPMENT DECONTAMINATION

INTRODUCTION

This procedure describes decontamination of field equipment potentially exposed to contaminants. Proper decontamination is required to reduce the risk of transfer of contaminants from areas of contamination to other areas and to minimize the potential for cross-contamination that would compromise sample quality. The degree of decontamination required will be dependent on the nature of the activity, equipment used, and on the amount of exposure to contaminants.

PROCEDURES REFERENCED

- FMG 2.0 - Subsurface Investigations.
- FMG 5.0 - Aquifer Characterization.
- FMG 6.0 - Sample Collection for Laboratory Analysis.
- FMG 8.0 - Field Instruments – Use/Calibration.
- FMG 10.0 - Waste Characterization.

PROCEDURAL GUIDELINES

Decontamination activities must be performed in a controlled area outside any exclusion zones established on the site. Care must be taken to minimize the potential for transfer of contaminated materials to the ground or onto other materials. Regardless of the size or nature of the equipment being decontaminated, the process will utilize a series of steps that involve removal of gross material (dirt, grease, oil, etc.), washing with a detergent, and multiple rinsing steps. In lieu of a series of washes and rinse steps, steam cleaning with low-volume, high-pressure equipment (i.e., steam cleaner) is acceptable.

Drill rigs, backhoes, and other exploration equipment must be decontaminated prior to initiating site activities, in between exploration locations to minimize cross-contamination potential, and prior to mobilizing off site after completion of site work. Heavy equipment is generally best deconned with a combination of steam-cleaning equipment and detergent scrubbing. Particular attention should be paid to parts in direct contact with contaminants, e.g., shovels, tires, augers, drilling decks, etc.

Control and containerization of all decontamination fluids is critical. A decontamination pad must be constructed that is appropriate for the size and type of equipment being decontaminated. At a minimum, the decontamination pad will have the following elements:

- An impermeable barrier capable of containing decontamination fluids.
- A low point where fluids will collect and can be pumped into appropriate containers.
- Durability to withstand equipment such as vehicle and foot traffic.
- Appropriate ancillary equipment such as racks to place decontaminated equipment to drain without further exposure to contaminated fluids.
- Labels to alert personnel as to the potential presence of contaminated materials.

Decontamination of Specific Sampling Equipment

The following specific decontamination procedure is recommended:

- Brush loose soil off of equipment.
- Wash equipment with laboratory grade detergent (i.e., Alconox or equivalent).
- Rinse with tap water (three rinses minimum).
- Rinse equipment with reagent grade methanol for VOC samples (this requirement may not be appropriate for sites where methanol is a contaminant of concern).
- Rinse equipment with nitric acid for metal samples (especially important for sites with potentially high metals concentrations.
- Rinse equipment with distilled water.
- Allow water to evaporate before reusing equipment

Decontamination of Monitoring Equipment

Because monitoring equipment is difficult to decontaminate, care should be exercised to *prevent* contamination. Sensitive monitoring instruments should be protected when they are at risk of exposure to contaminants. This may include enclosing them in plastic bags allowing an opening for the sample intake. Ventilation ports should not be covered.

If contamination does occur, decontamination of the equipment will be required; however, immersion in decontamination fluids is not possible. As such, care much be taken to wipe the instruments down with detergent-wetted wipes or sponges, and then with deionized water-wetted wipes or sponges.

Disposal of Wash Solutions and Contaminated Equipment

All contaminated wash water, rinsates, solids and materials used in the decontamination process that cannot be effectively decontaminated (such as polyethylene sheeting) will be containerized and disposed of in accordance with applicable regulations and GM requirements. All containers will be labeled with an indelible marker as to contents and date of placement in the container, and any appropriate stickers required (such as PCBs).

Sampling of containerized wastes will be performed immediately upon completion of the investigations to minimize storage time on site. Storage of decontamination wastes on site will not exceed 90 days under any circumstances.

EQUIPMENT/MATERIALS

Decontamination equipment and solutions are generally selected based on ease of decontamination and disposability.

- Polyethylene sheeting.
- Metal racks to hold decontaminated equipment.
- Soft-bristle scrub brushes or long-handle brushes for removing gross contamination and scrubbing with wash solutions.
- Large galvanized wash tubs, stock tanks, or wading pools for wash and rinse solutions.
- Plastic buckets or garden sprayers for rinse solutions.
- Large plastic garbage cans or other similar containers lined with plastic bags can be used to store contaminated clothing.
- Contaminated liquids and solids should be segregated and containerized in DOT-approved plastic or metal drums, appropriate for off-site shipping/disposal if necessary.

REFERENCES

ASTM D5088 - Practice for Decontamination of Field Equipment Used at Non-Radioactive Waste Sites.

RWP APPENDIX B

Indoor Air Quality Monitoring Plan

www.haleyaldrich.com

INDOOR AIR QUALITY MONITORING PLAN
DELPHI AUTOMOTIVE SYSTEMS SITE #828064
1000 LEXINGTON AVENUE,
ROCHESTER, NEW YORK

by Haley & Aldrich of New York
Rochester, New York

for New York State Department of Environmental Conservation
Region 8 Office
Avon, New York

File No. 127982-010
July 2020

HALEY & ALDRICH OF NEW YORK
200 Town Centre Drive
Suite 2
Rochester, NY 14623
585.359.9000

6 July 2020
File No. 127982-010

New York State Department of Environmental Conservation
Division of Environmental Remediation
6274 East Avon-Lima Road
Avon, New York 14414

Attention: Kelly C. Cloyd, PhD.
Environmental Geologist II

Subject: Indoor Air Quality Monitoring Plan
Delphi Automotive Systems Site #HW828064
1000 Lexington Avenue
Rochester, New York

On behalf of GM Components Holdings, LLC (GMCH), Haley & Aldrich of New York (Haley & Aldrich) has prepared this Indoor Air Quality Monitoring Plan to evaluate the performance of the installed sub-slab depressurization system (SSDS) at the Delphi Automotive Systems Site #HW828064 (Site) located at 1000 Lexington Avenue, Rochester, New York as shown on Figure 1. This work plan was prepared in general conformance with the New York State Department of Health (NYSDOH) *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* dated October 2006.

Background

Two (2) soil vapor intrusion (SVI) investigations have been conducted at the Site. In 2005, subslab soil-vapor and indoor air samples were collected a five (5) locations throughout the facility as part of the Remedial Investigation (RI). The findings of the investigation were presented in the RI report dated 7 November 2005. In May 2014, a supplemental investigation was conducted to determine the subslab soil-vapor and indoor air concentrations of volatile organic compounds (VOC) throughout the GMCH Rochester Operations facility in accordance with the work plan dated 14 March 2014 and approved with conditions by the Department on 9 April 2014. The results of the May 2014 investigation that are summarized below was provided to the Department in a report dated 7 October 2014.

VOC identified as trichloroethene (TCE) and cis-1,2-dichloroethene (DCE) were detected in the indoor air at 5 of the 11 locations sampled throughout the facility. All 5 locations were within Building 1 with the highest concentrations (e.g. TCE, 14 ug/M^3) detected at the eastern end of the building (W-25). VOC detected in the sub-slab soil-vapor included vinyl chloride (VC), methylene chloride, cis-1,2-DCE, TCE, chloroethane (CA), 1,1-dichloroethane (DCA), 1,1,1-trichloroethane (TCA), and tetrachloroethene (PCE).

The highest concentration of VOC detected in the sub-slab soil vapor during the supplemental investigation was detected at location E-19 where vinyl chloride and cis-1,2-DCE were present at concentrations several orders of magnitude greater than the concentration detected within the corresponding indoor air sample. Subsequent to the 2014 investigation, a sub-slab depressuization system (SSDS) was designed and installed where the VOC concentration detected in the sub-slab soil vapor and/or the indoor air samples were greater than the comparison criteria in the decision matrices provided in the NYSDOH guidance (2006).

Scope of Work

This work plan describes the tasks to conduct an evaluation of the potential for soil vapor intrusion (SVI) to impact the indoor air quality within the facility. The work plan includes the procedures for the collection and analysis of the subslab soil-vapor, and indoor and outdoor air quality samples; an evaluation of the potential of alternative sources of VOC and, the methods of data reduction and evaluation to determine the performance of the SSDS to mitigate the potential for impacted subslab soil-vapor to adversely affect the indoor air quality within the facility. The subslab soil-vapor and indoor air sampling locations are shown on Figure 2.

1.1 PRODUCT INVENTORY

Prior to the collection of subslab soil-vapor or indoor and outdoor air quality samples, an inventory of products used within the manufacturing areas near the sample collection areas will be completed to identify potential sources of VOC that could impact the indoor air quality. If VOC containing products are identified within the proposed sampling areas, the Safety Data Sheets (SDS) for the products will be obtained from the facility and the products will be removed from the sampling area at least 24 hours prior to the sampling event.

1.2 SUB SLAB SOIL VAPOR SAMPLING POINTS

Permanent subslab soil-vapor sampling points will be installed to a depth of approximately 2 inches below the base of the facility floor slab. The sampling points will be sealed with hydrated bentonite or cement grout to prevent the infiltration of indoor air into the sub-slab vapor sample during sampling, and capped until the time of sampling.

1.3 SAMPLING PROCEDURES

The procedures to be used for the sampling event will include the following elements:

1. Six (6)-liter SUMMA® canisters equipped with a dedicated pre-calibrated 8-hour integrated flow controller supplied by a NYSDOH certified laboratory will be placed on a table or bench at the selected indoor air and outdoor air sampling locations so that the intake of the flow controllers is at the approximate height of the breathing zone for facility workers (36 – 54 inches above the floor).

Six (6)-liter SUMMA® canisters equipped with a dedicated pre-calibrated 8-hour integrated flow controller supplied by a NYSDOH certified laboratory will be connected to sub-slab vapor sampling points co-located with the indoor air sampling locations. Prior to the initiation of sampling, the sampling point will be evacuated to purge any stagnant vapors within the point and confirm the integrity of the surface seal. During the purging process, helium (He) tracer gas will be released around the point at the floor surface, and the extracted sub-slab soil vapor will be analyzed for the presence of He using a handheld He detector system. Purging will be conducted at a rate of less than (<) 200 milliliters/minute (0.2 L/min). The samples will be collected immediately after purging. (Note: The 8-hour integrated flow controllers will be calibrated for a sample flow rate of approximately 12.5 milliliters/minute, which is below the maximum flow rate of 0.2 L/min specified by the NYSDOH guidance.)

2. Indoor air and sub-slab soil vapor samples will be collected simultaneously over an 8-hour period during the heating season (November 1st through April 1st) when the facility heating, ventilation and air conditioning (HVAC) systems are operating and the SSDS system is operating.

3. The SUMMA canister vacuum gauge readings will be recorded on a field form during sampling to document the sample collection process. The collection of the sample at each location will be terminated after 8-hours or when the remaining vacuum measured in the canister is less than 5 inches of mercury (in. Hg)

4. The final vacuum reading recorded at the end of the sampling period will be placed on the sample Chain-of-Custody (COC) form prior to shipping to the laboratory and each canister final vacuum reading will be recorded at the laboratory to confirm sample integrity during shipment. After collection, the samples will be shipped at ambient temperature under a COC to a NYSDOH certified laboratory and analyzed in accordance with EPA Method TO-15. Table 1 provides the parameters of analysis and the VOC target compound laboratory reporting limits.

Schedule

The SVI sampling event will be conducted annually during the typical heating season to evaluate the performance of the engineering controls installed at the Site. The sampling program will be completed over approximately five (5) days and the findings of the evaluation will be summarized within the site Periodic Review Report (PRR) as specified with the Site Management Plan (SMP).

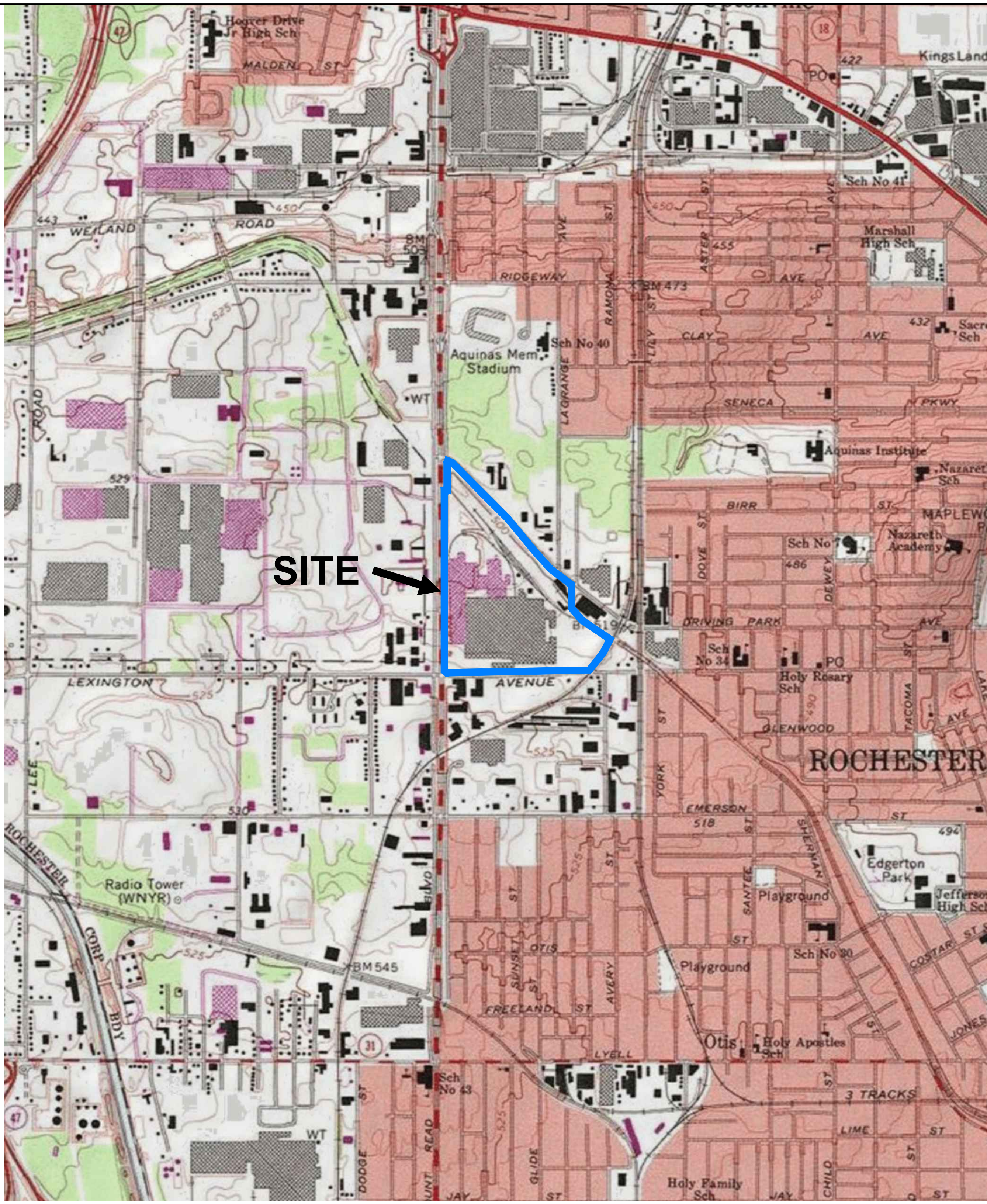
Attachments:

Table 1: TO-15 Reporting Limits
Figure 1: Site Plan
Figure 2: Sampling Locations
Appendix A: Sub-Slab Soil Vapor Sampling Protocol
Appendix B: Indoor and Outdoor Air Sampling Protocol

Delphi Automotive Systems Site #828064		TO-15 Volatile Organics in Air			
Indoor Air Quality Monitoring Plan Samples					
Target Reporting Limits		Volatile Organics			
Analyte	Cas No.	PQL	units	MDL	Units
CHLOROBENZENE	108-90-7	0.2	ppbv	0.0601	ppbv
1,1,1-TRICHLOROETHANE	71-55-6	0.2	ppbv	0.0665	ppbv
1,1,2-TRICHLOROETHANE	79-00-5	0.2	ppbv	0.0287	ppbv
1,1,2-TRICHLOROTRIFLUOROETHANE	76-13-1	0.2	ppbv	0.0687	ppbv
1,1-DICHLOROETHANE	75-34-3	0.2	ppbv	0.0514	ppbv
1,1-DICHLOROETHENE	75-35-4	0.2	ppbv	0.049	ppbv
1,2,4-TRICHLOROBENZENE	120-82-1	0.63	ppbv	0.148	ppbv
1,2,4-TRIMETHYLBENZENE	95-63-6	0.2	ppbv	0.0483	ppbv
1,2-DIBROMOETHANE	106-93-4	0.2	ppbv	0.0185	ppbv
1,2-DICHLOROBENZENE	95-50-1	0.2	ppbv	0.0603	ppbv
1,2-DICHLOROETHANE	107-06-2	0.2	ppbv	0.0616	ppbv
1,2-DICHLOROPROPANE	78-87-5	0.2	ppbv	0.0599	ppbv
1,2-DICHLOROTETRAFLUOROETHANE	76-14-2	0.2	ppbv	0.0458	ppbv
1,3,5-TRIMETHYLBENZENE	108-67-8	0.2	ppbv	0.0631	ppbv
1,3-BUTADIENE	106-99-0	2	ppbv	0.0563	ppbv
1,3-DICHLOROBENZENE	541-73-1	0.2	ppbv	0.0597	ppbv
1,4-DICHLOROBENZENE	106-46-7	0.2	ppbv	0.0557	ppbv
1,4-DIOXANE	123-91-1	0.2	ppbv	0.0554	ppbv
2,2,4-TRIMETHYLPENTANE	540-84-1	0.2	ppbv	0.0456	ppbv
2-BUTANONE (MEK)	78-93-3	1.25	ppbv	0.0493	ppbv
2-CHLOROTOLUENE	95-49-8	0.2	ppbv	0.0605	ppbv
2-PROPANOL	67-63-0	1.25	ppbv	0.0882	ppbv
4-ETHYLTOLUENE	622-96-8	0.2	ppbv	0.0666	ppbv
4-METHYL-2-PENTANONE (MIBK)	108-10-1	1.25	ppbv	0.065	ppbv
ACETONE	67-64-1	1.25	ppbv	0.0569	ppbv
ALLYL CHLORIDE	107-05-1	0.2	ppbv	0.0546	ppbv
BENZENE	71-43-2	0.2	ppbv	0.046	ppbv
BENZYL CHLORIDE	100-44-7	0.2	ppbv	0.0598	ppbv
BROMODICHLOROMETHANE	75-27-4	0.2	ppbv	0.0436	ppbv
BROMOFORM	75-25-2	0.6	ppbv	0.0786	ppbv
BROMOMETHANE	74-83-9	0.2	ppbv	0.0609	ppbv
CARBON DISULFIDE	75-15-0	0.2	ppbv	0.0544	ppbv
CARBON TETRACHLORIDE	56-23-5	0.2	ppbv	0.0585	ppbv
1,1,2,2-TETRACHLOROETHANE	79-34-5	0.2	ppbv	0.0576	ppbv
CHLORODIBROMOMETHANE	124-48-1	0.2	ppbv	0.0494	ppbv
CHLOROETHANE	75-00-3	0.2	ppbv	0.0489	ppbv
CHLOROFORM	67-66-3	0.2	ppbv	0.0574	ppbv
CHLOROMETHANE	74-87-3	0.2	ppbv	0.0544	ppbv
CIS-1,2-DICHLOROETHENE	156-59-2	0.2	ppbv	0.0389	ppbv
CIS-1,3-DICHLOROPROPENE	10061-01-5	0.2	ppbv	0.0588	ppbv
CYCLOHEXANE	110-82-7	0.2	ppbv	0.0534	ppbv
DICHLORODIFLUOROMETHANE	75-71-8	0.2	ppbv	0.0601	ppbv
ETHANOL	64-17-5	0.63	ppbv	0.0832	ppbv
ETHYLBENZENE	100-41-4	0.2	ppbv	0.0506	ppbv
HEPTANE	142-82-5	0.2	ppbv	0.0626	ppbv
HEXACHLORO-1,3-BUTADIENE	87-68-3	0.63	ppbv	0.0656	ppbv
ISOPROPYLBENZENE	98-82-8	0.2	ppbv	0.0563	ppbv
M&P-XYLENE	1330-20-7	0.4	ppbv	0.0946	ppbv
METHYL BUTYL KETONE	591-78-6	1.25	ppbv	0.0682	ppbv

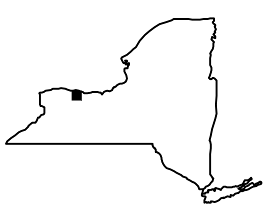
Delphi Automotive Systems Site #828064		TO-15 Volatile Organics in Air			
Indoor Air Quality Monitoring Plan Samples					
Target Reporting Limits		Volatile Organics			
Analyte	Cas No.	PQL	units	MDL	Units
METHYL METHACRYLATE	80-62-6	0.2	ppbv	0.0773	ppbv
METHYL TERT-BUTYL ETHER	1634-04-4	0.2	ppbv	0.0505	ppbv
METHYLENE CHLORIDE	75-09-2	0.2	ppbv	0.0465	ppbv
N-HEXANE	110-54-3	0.2	ppbv	0.0457	ppbv
NAPHTHALENE	91-20-3	0.63	ppbv	0.154	ppbv
O-XYLENE	95-47-6	0.2	ppbv	0.0633	ppbv
PROPENE	115-07-1	0.4	ppbv	0.0932	ppbv
STYRENE	100-42-5	0.2	ppbv	0.0465	ppbv
TETRACHLOROETHENE	127-18-4	0.2	ppbv	0.0497	ppbv
TETRAHYDROFURAN	109-99-9	0.2	ppbv	0.0508	ppbv
TOLUENE	108-88-3	0.2	ppbv	0.0499	ppbv
TRANS-1,2-DICHLOROETHENE	156-60-5	0.2	ppbv	0.0464	ppbv
TRANS-1,3-DICHLOROPROPENE	10061-02-6	0.2	ppbv	0.0435	ppbv
TRICHLOROETHENE	79-01-6	0.2	ppbv	0.0545	ppbv
TRICHLOROFLUOROMETHANE	75-69-4	0.2	ppbv	0.0673	ppbv
VINYL ACETATE	108-05-4	0.2	ppbv	0.0639	ppbv
VINYL BROMIDE	593-60-2	0.2	ppbv	0.0727	ppbv
VINYL CHLORIDE	75-01-4	0.2	ppbv	0.0457	ppbv

FIGURES



USGS QUADRANGLE:
ROCHESTER WEST, NY

SITE COORDINATES: 43°10'54"N, 77°39'22"W



HALEY ALDRICH

DELPHI AUTOMOTIVE SYSTEMS SITE #828064
1000 LEXINGTON AVENUE
ROCHESTER, NEW YORK

SITE PLAN

APPROXIMATE SCALE: 1 IN. = 2000 FT
JULY 2020

FIGURE 1

ERVIN, DAYNA Printed: 12/5/2017 11:10 AM Layout: A004
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LEGEND

- COLUMN LINE
- SUB SLAB SOIL VAPOR/ INDOOR AIR SAMPLING LOCATIONS
- INDOOR AIR SAMPLING LOCATION
- ADDITIONAL IA/SS SAMPLE LOCATION

NOTES:

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. REFERENCE FILE FOR THE DRAWING AS PROVIDED BY GMCH FACILITY ENGINEERING 2014.

0 160 320
SCALE IN FEET

HALEY ALDRICH

DELPHI AUTOMOTIVE SYSTEMS SITE #828064
1000 LEXINGTON AVENUE
ROCHESTER, NEW YORK

INDOOR AIR AND SUB SLAB
SOIL VAPOR SAMPLE LOCATIONS

SCALE: AS SHOWN
JULY 2020

FIGURE 2

APPENDIX A

Sub-Slab Soil Vapor Sampling Protocol

SUB-SLAB SOIL VAPOR SAMPLING PROCEDURE	
DELPHI AUTOMOTIVE SYSTEMS SITE	EFFECTIVE DATE: 12/21/2005
REVISION #: **2**	REVISION DATE: 11/8/17

SUB SLAB SOIL VAPOR SAMPLING

INTRODUCTION

This procedure is for the collection of sub-slab soil vapor samples from sampling points for laboratory analysis in accordance with USEPA Method TO-15.

SUPPLIES/ EQUIPMENT REQUIREMENTS

Sub-Slab Soil Vapor
SUMMA can with tag
Critical orifice (8-hr Flow Controller)
Pressure gauge
Chain Of Custody
2" Bosch Hammer drill
Bosch Hammer drill ¾ inch bit
Shielded Extension Cord
¼ inch OD HDPE tubing roll
20 Vapor points to use with ¼ inch tubing
40-50 lbs bentonite
5 gallon bucket glass beads
40-50lbs Portland cement
Bowl and spatulas to mix cement
Water bottle to hydrate bentonite
5 gallons water
Plastic Sheeting cut into 4 X 3 feet squares
¼ inch OD Tygon tubing
Gil Air hand pump set at <.2L/min
Tedlar bags from SKC

Extras/Miscellaneous
Broom/dustpan for mess
Paper towels
Garbage bags
Razors or pocketknife
Nitrile gloves
Stakes/spray paint to mark utilities COCs
Thermometer

Adjustable wrenches
Tape measure
Camera/batteries
Watch
FID/PID
Locks and Chains
Bucket or Box
Helium (He) Gas Detector

PREPARATORY AND SAMPLING POINT INSTALLATION FOR SUB-SLAB SOIL VAPOR SAMPLING REQUIREMENTS

Preparatory requirements apply to temporary and permanent sampling point installations. Personal protective equipment will be donned in accordance with the requirements of the Project Specific Health and Safety Plan (HASP).

1. Don a new pair of Nitrile gloves prior to soil vapor sampling activities at each location.
2. Verify soil vapor sampling point identification using location layout figures. Vapor sampling location can only be selected after determining location is free from products that may contain VOCs. PID readings from sampling areas should be recorded on chain and daily field forms.
3. Drill hole in concrete using 2” hammer drill and five-eights (5/8) OR three-quarter (3/4) inch drill bits. Ensure that drilled hole extends below the floor slab. Clean up any debris.
4. Begin by selecting correct length of HDPE tubing depending on slab depth. A general rule of thumb is to allow 18-24 inches of additional tubing to “stick out of the hole”. Attach soil vapor sampling point screen (if used) to one end of the tubing and lower into hole.
5. Fill hole with ½ cup of glass beads/sand to ensure that vapor sampling point is secured in the matrix. Add dry bentonite to the top of the slab and then hydrate. Finish securing point with additional hydrated bentonite around the base of the tubing. Tubing should clear slab enough to easily attach SUMMA equipment.
6. If there is no matrix soil directly under the slab, drop tubing into hole and secure at the top of the slab with hydrated bentonite. In other words, omit step 5.

WELL PURGING AND STABILIZATION

- Soil Vapor Points will be sampled in order of increasing VOC concentrations (if known or anticipated). Personal protective equipment will be donned in accordance with the requirements of the Project-Specific HASP.
    1. Lay out sheet of clean polyethylene around the Soil Vapor sampling point for placement of the sampling equipment.

2. A Gil-Air 5R sampling pump attached to a 1.0-liter Tedlar bag will be used to collect purge volume from sub slab vapor points. Using the sampling point installation information to obtain depth and calculate the volume of soil vapor present in the point, using the formula $\pi \mathbf{r^2 h}$. (1" = 2.54 cm, 1L = 1,000 cm^3). For example, a ½" diameter sampling point that is 1.5 feet deep contains approximately 0.31L of air.

3. Purge the installed sampling point by connecting the tubing to a pre-calibrated personal sampling pump Gil-Air 5R pump (or equivalent device) using High Density Polyethylene (HDPE) tubing and extract at least three (3) – dead volumes of soil vapor from the sampling point.

4. Purge the sampling point at flow rates not to exceed 0.2 L/minute to remove 1 to 3 well volumes. This will ensure the sample collected for analysis is representative of soil vapor located in the vadose zone.

5. After purging, immediately shut off the pump and close off the well point to the atmosphere using a hose clamp or similar device.

6. Cover the sampling point with a shroud (e.g. 5-gallon bucket), seal the bucket rim to the floor and pass the sampling tubing (installed within the sampling point) through a hole in the top of the bucket and attach to a Helium Gas (He) Detector.

7. Release He gas into the bucket through the hole on the top of the bucket and tape the hole shut with duct tape and record the He concentration in the soil vapor stream extracted from the sample point through the sample tubing. If the He reading is less than 1% by volume, proceed to sample collection. If reading is >1% rehydrate the bentonite seal and re-test.

8. Verify the vacuum level in the passive SUMMA® canister (or equivalent device) to be used for sample collection using the vacuum gauge supplied by the laboratory. Attach the gauge directly to the SUMMA® canister via the ¼ inch male fitting and open the valve approximately 1¼ turn. Record the initial vacuum on the Soil Vapor Survey Sampling form.

9. Attach the integrated flow controller to the SUMMA® canister using a stainless steel open end wrench. (Note: Do not over tighten. ¼ turn past finger tight should be adequate to create a proper seal.)

10. Connect the SUMMA® canister to the sampling tubing, open the valve on the SUMMA® canister gradually at least 1¼ turn and record the sample start time on the sampling record.

11. At the conclusion of the sample collection, record the final time on the sampling record and close the valve. Disconnect integrated flow controller.

12. Replace the ¼" cap on the canister inlet. Label the SUMMA® canister sample tag with proper sample location, vacuum readings and sampling time interval (e.g. 4 hours).

13. Fill out Chain of Custody with project name, file number, sample identifications, SUMMA canister and related equipment serial numbers, date and time collected, and analysis requirements. Retain copies of the Chain of Custody record and relevant shipping information. Place canisters back into their original boxes and ship them to the laboratory via an overnight courier.

    - Sample number/ID
    - Date and time
    - Parameters to be analyzed
    - Project Number
    - Sampler's initials

FIELD NOTES

Field notes must document all the events, equipment used, and measurements collected during the sampling activities. The field forms should document the following for each well sampled:

- Identification of sub slab vapor well point location
- Sub-slab vapor well point depth
- Purge volume and pumping rate
- The amount of time required to purge the well point
- Purge/sampling device used
- Sample identification
- Parameters requested for analysis
- Laboratory to which samples were shipped
- Chain of custody number for shipment to laboratory
- Field observations on sampling event
- Name of sample collector(s)

- Climatic conditions including air temperature
- Problems encountered and any deviations made from the established sampling protocol.
- Sample Identification Key

REFERENCES

1. U.S.E.P.A., Soil Gas Sampling SOP# 2042, 1 June 1996, REV. #: 0.0

2. Compendium of Methods for the Determination of Organic Compounds in Ambient Air, EPA/625/R-96/010a, 2nd Edition, June 1999, USEPA ORD, Washington DC.

3. U.S.E.P.A., Soil Gas Sampling SOP# 2042, 1 June 1996, REV. #: 0.0

4. Compendium of Methods for the Determination of Organic Compounds in Ambient Air, EPA/625/R-96/010a, 2nd Edition, June 1999, USEPA ORD, Washington DC.

5. USEPA RCRA Groundwater Monitoring: Draft Technical guidance (EPA/530-R-93-001).

6. New York State Department of Health (NYSDOH) “Guidance for Evaluating Soil Vapor Intrusion in the State of New York”, October 2006.

7. USEPA “DRAFT Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion)”, 2002.

Photo #1 – Typical Personal Air Sampling Pump

Photo #2 – Example Sub-Slab Well point Installation

APPENDIX B

Indoor and Outdoor Air Sampling Protocol

INDOOR/OUTDOOR AMBIENT AIR SAMPLING PROCEDURE	
DELPHI AUTOMOTIVE SYSTEMS SITE	EFFECTIVE DATE: 12/21/2005
REVISION #: **2**	REVISION DATE: 11/8/17

INDOOR/OUTDOOR AMBIENT AIR SAMPLING

INTRODUCTION

This procedure is for the collection of vapor samples from temporary well points for laboratory analysis in accordance with USEPA Method TO-15. This procedure includes technique for indoor, and outdoor ambient air sample collection.

SUPPLIES/ EQUIPMENT REQUIREMENTS

Ambient Indoor / Outdoor
SUMMA can with tag
Flow control (8-hr for outdoor, 8-hr for indoor)
Pressure gauge

Extras/Miscellaneous
Broom/dustpan
Paper towels
Garbage bags

Nitrile gloves
Stakes/spray paint to mark utilities COCs
Thermometer
Adjustable wrenches
Tape measure
Camera/batteries
Watch
FID/PID from Hazco rentals

PREPARATORY AND AMBIENT AIR SAMPLING

Preparatory requirements apply to temporary wells and permanent wells. Personal protective equipment will be donned in accordance with the requirements of the RI Health and Safety Plan.

- Personal protective equipment will be donned in accordance with the requirements of the Project Health and Safety Plan.

1. Don a new pair of Nitrile gloves prior to indoor/outdoor air sampling activities at each location.

2. Verify the sampling location and assign a unique identification using the sampling plan and structure layout. Review the Building Inventory and note the presence of any

potential sources of VOCs present in the indoor or outdoor space (i.e. solvents, paints, gasoline cans, etc.). If appropriate, remove prior to sampling to mitigate impacts during sample collection.

SAMPLE TRAIN PURGING AND STABILIZATION

- Indoor and outdoor air sampling trains will be setup at locations in order of increasing chemical concentrations (known or anticipated). Equipment calibration, field documentation, sampling, and chain of custody procedures will be conducted in accordance with the Project Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP). Personal protective equipment will be donned in accordance with the requirements of the Project Health and Safety Plan.

1. For indoor air sampling locations, the SUMMA® canister should be placed at between 4-5 feet from the floor in the "breathing zone".
2. Outdoor sampling locations will be selected after reviewing several factors such as wind direction, weather, safety and proximity to soil vapor sample location.
3. Attach the gauge to the ¼" male fitting on the Summa® canister and open the valve approximately 1¼ turn. Record the initial vacuum on the Soil Vapor Survey Sampling (sampling record), close the valve, and attach flow controller.
4. If separate component flow controllers and vacuum gauges are provided, be sure to select the appropriate flow controller for location. 8-hour controllers are designated for outdoor ambient air and indoor air samples. (Note: Do not over tighten. ¼ turn past finger tight should be adequate to create a proper seal.)
5. Record the initial vacuum on the Soil Vapor Survey Sampling (sampling record), close the valve, and remove the vacuum gauge. Open the valve on the SUMMA® canister gradually at least 1¼ turn and record the sample start time on the sampling record.
6. At the conclusion of sample collection, record the final time and vacuum reading on the sampling record and close the valve.
7. Close the valve, remove the vacuum gauge and flow controller and replace the ¼" cap on the canister inlet. Label the SUMMA® canister sample tag with the Location ID, vacuum readings and sampling time interval (e.g. 4 hours).
8. Fill out Chain of Custody with project name, file number, sample identifications, SUMMA® canister and related equipment serial numbers, date and time collected, and analysis requirements. Retain copies of the Chain of Custody record and relevant shipping information. Place canisters back into their original boxes and ship them to the laboratory via an overnight courier.

- Sample number/ID
- Canister and flow controller serial numbers
- Date and time
- Parameters to be analyzed
- Project Number
- Sampler's initials

FIELD NOTES

Field notes must document all the events, equipment used, and measurements collected during the sampling activities. SOP 1.4 describes the data/recording procedure for field activities. The field forms should document the following for each well sampled:

- Identification of sampling location
- Sample identification
- Parameters requested for analysis
- Laboratory to which samples were shipped
- Chain of custody number for shipment to laboratory
- Field observations on sampling event
- Name of sample collector(s)
- Climatic conditions including air temperature, barometric pressure
- Description of the Indoor/Outdoor Air Sampling Location
- Height from the floor of the SUMMA® canister intake valve
- Problems encountered and any deviations made from the established sampling protocol due to safety concerns.
- Sample Identification Key

REFERENCES

1. U.S.E.P.A., Soil Gas Sampling SOP# 2042, 1 June 1996, REV. #: 0.0

2. Compendium of Methods for the Determination of Organic Compounds in Ambient Air, EPA/625/R-96/010a, 2nd Edition, June 1999, USEPA ORD, Washington DC.

3. USEPA RCRA Groundwater Monitoring: Draft Technical guidance (EPA/530-R-93-001).

4. New York State Department of Health (NYSDOH) “Guidance for Evaluating Soil Vapor Intrusion in the State of New York”, October 2006.

5. USEPA “DRAFT Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion)”, 2002.

Photo #1 – Typical Personal Air Sampling Pump

Photo #2 – Example Co-located Ambient Air /Sub-Slab Sampling Point

RWP APPENDIX C

Environmental Easement Template

ENVIRONMENTAL EASEMENT GRANTED PURSUANT TO ARTICLE 71, TITLE 36 OF THE NEW YORK STATE ENVIRONMENTAL CONSERVATION LAW

THIS INDENTURE made this _______day of _____________, 20__, between Owner(s) Enter property owner(s) name, having an office at Enter property owner's address, County of Dutchess, State of New York (the "Grantor"), and The People of the State of New York (the "Grantee."), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233,

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to encourage the remediation of abandoned and likely contaminated properties ("sites") that threaten the health and vitality of the communities they burden while at the same time ensuring the protection of public health and the environment; and

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to establish within the Department a statutory environmental remediation program that includes the use of Environmental Easements as an enforceable means of ensuring the performance of operation, maintenance, and/or monitoring requirements and the restriction of future uses of the land, when an environmental remediation project leaves residual contamination at levels that have been determined to be safe for a specific use, but not all uses, or which includes engineered structures that must be maintained or protected against damage to perform properly and be effective, or which requires groundwater use or soil management restrictions; and

WHEREAS, the Legislature of the State of New York has declared that Environmental Easement shall mean an interest in real property, created under and subject to the provisions of Article 71, Title 36 of the New York State Environmental Conservation Law ("ECL") which contains a use restriction and/or a prohibition on the use of land in a manner inconsistent with engineering controls which are intended to ensure the long term effectiveness of a site remedial program or eliminate potential exposure pathways to hazardous waste or petroleum; and

WHEREAS, Grantor, is the owner of real property located at the address of Enter street address of property in the Choose municipality type of Enter property municipality, County of Enter property county and State of New York, known and designated on the tax map of the County Clerk of Enter clerk county as tax map parcel numbers: Section Enter Tax ID Section #. Block Enter Tax ID Block # Lot Enter Tax ID Lot #, being the same as that property conveyed to Grantor by deed dated Enter Deed Date and recorded in the Enter county name or leave blank for NY City deeds County Clerk's Office in Liber and Page Enter Instrument # or Liber and Page #s. The property subject to this Environmental Easement (the "Controlled Property") comprises approximately Enter Acreage +/- acres, and is hereinafter more fully described in the Land Title Survey dated Enter original survey date and, if applicable, "and revised on" and revised survey date prepared by Enter revised surveyor's name or original surveyor's name if not revised, which will be attached to the Site Management Plan. The Controlled Property description is set forth in and attached hereto as Schedule A; and

WHEREAS, the Department accepts this Environmental Easement in order to ensure the protection of public health and the environment and to achieve the requirements for remediation established for the Controlled Property until such time as this Environmental Easement is extinguished pursuant to ECL Article 71, Title 36; and

NOW THEREFORE, in consideration of the mutual covenants contained herein and the terms and conditions of Choose an Oversight Document TypeNumber: Enter SAC# or BCA/Consent Order Index # and "as amended by Amendment(s) #(s)" as applicable, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement")

1. Purposes. Grantor and Grantee acknowledge that the Purposes of this Environmental Easement are: to convey to Grantee real property rights and interests that will run with the land in perpetuity in order to provide an effective and enforceable means of encouraging the reuse and redevelopment of this Controlled Property at a level that has been determined to be safe for a specific use while ensuring the performance of operation, maintenance, and/or monitoring requirements; and to ensure the restriction of future uses of the land that are inconsistent with the above-stated purpose.

2. Institutional and Engineering Controls. The controls and requirements listed in the Department approved Site Management Plan ("SMP") including any and all Department approved amendments to the SMP are incorporated into and made part of this Environmental Easement. These controls and requirements apply to the use of the Controlled Property, run with the land, are binding on the Grantor and the Grantor's successors and assigns, and are enforceable in law or equity against any owner of the Controlled Property, any lessees and any person using the Controlled Property.

A. (1) The Controlled Property may be used for:

Choose the allowable land use if current land use is selected, enter current use.

(2) All Engineering Controls must be operated and maintained as specified in the Site Management Plan (SMP);

(3) All Engineering Controls must be inspected at a frequency and in a manner defined in the SMP;

(4) The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Automatic County Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;

(5) Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;

(6) Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in the SMP;

(7) All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with the SMP;

(8) Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP;

(9) Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy shall be performed as defined in the SMP;

(10) Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by this Environmental Easement.

B. The Controlled Property shall not be used for Choose the correct list of inapplicable uses., and the above-stated engineering controls may not be discontinued without an amendment or extinguishment of this Environmental Easement.

C. The SMP describes obligations that the Grantor assumes on behalf of Grantor, its successors and assigns. The Grantor's assumption of the obligations contained in the SMP which may include sampling, monitoring, and/or operating a treatment system, and providing certified reports to the NYSDEC, is and remains a fundamental element of the Department's determination that the Controlled Property is safe for a specific use, but not all uses. The SMP may be modified in accordance with the Department's statutory and regulatory authority. The Grantor and all successors and assigns, assume the burden of complying with the SMP and obtaining an up-to-date version of the SMP from:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, New York 12233
Phone: (518) 402-9553

D. Grantor must provide all persons who acquire any interest in the Controlled Property a true and complete copy of the SMP that the Department approves for the Controlled Property and all Department-approved amendments to that SMP.

E. Grantor covenants and agrees that until such time as the Environmental Easement is extinguished in accordance with the requirements of ECL Article 71, Title 36 of the ECL, the property deed and all subsequent instruments of conveyance relating to the Controlled Property shall state in at least fifteen-point bold-faced type:

This property is subject to an Environmental Easement held by the New York State Department of Environmental Conservation

pursuant to Title 36 of Article 71 of the Environmental Conservation Law.

F. Grantor covenants and agrees that this Environmental Easement shall be incorporated in full or by reference in any leases, licenses, or other instruments granting a right to use the Controlled Property.

G. Grantor covenants and agrees that it shall, at such time as NYSDEC may require, submit to NYSDEC a written statement by an expert the NYSDEC may find acceptable certifying under penalty of perjury, in such form and manner as the Department may require, that:

(1) the inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under the direction of the individual set forth at 6 NYCRR Part 375-1.8(h)(3).

(2) the institutional controls and/or engineering controls employed at such site:

(i) are in-place;

(ii) are unchanged from the previous certification, or that any identified changes to the controls employed were approved by the NYSDEC and that all controls are in the Department-approved format; and

(iii) that nothing has occurred that would impair the ability of such control to protect the public health and environment;

(3) the owner will continue to allow access to such real property to evaluate the continued maintenance of such controls;

(4) nothing has occurred that would constitute a violation or failure to comply with any site management plan for such controls;

(5 the report and all attachments were prepared under the direction of, and reviewed by, the party making the certification;

(6) to the best of his/her knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program, and generally accepted engineering practices; and

(7) the information presented is accurate and complete.

3. Right to Enter and Inspect. Grantee, its agents, employees, or other representatives of the State may enter and inspect the Controlled Property in a reasonable manner and at reasonable times to assure compliance with the above-stated restrictions.

4. Reserved Grantor's Rights. Grantor reserves for itself, its assigns, representatives, and successors in interest with respect to the Property, all rights as fee owner of the Property, including:

A. Use of the Controlled Property for all purposes not inconsistent with, or limited by the terms of this Environmental Easement;

B. The right to give, sell, assign, or otherwise transfer part or all of the underlying fee interest to the Controlled Property, subject and subordinate to this Environmental Easement;

5. Enforcement

A. This Environmental Easement is enforceable in law or equity in perpetuity by Grantor, Grantee, or any affected local government, as defined in ECL Section 71-3603, against the owner of the Property, any lessees, and any person using the land. Enforcement shall not be defeated because of any subsequent adverse possession, laches, estoppel, or waiver. It is not a defense in any action to enforce this Environmental Easement that: it is not appurtenant to an interest in real property; it is not of a character that has been recognized traditionally at common law; it imposes a negative burden; it imposes affirmative obligations upon the owner of any interest in the burdened property; the benefit does not touch or concern real property; there is no privity of estate or of contract; or it imposes an unreasonable restraint on alienation.

B. If any person violates this Environmental Easement, the Grantee may revoke the Certificate of Completion with respect to the Controlled Property.

C. Grantee shall notify Grantor of a breach or suspected breach of any of the terms of this Environmental Easement. Such notice shall set forth how Grantor can cure such breach or suspected breach and give Grantor a reasonable amount of time from the date of receipt of notice in which to cure. At the expiration of such period of time to cure, or any extensions granted by Grantee, the Grantee shall notify Grantor of any failure to adequately cure the breach or suspected breach, and Grantee may take any other appropriate action reasonably necessary to remedy any breach of this Environmental Easement, including the commencement of any proceedings in accordance with applicable law.

D. The failure of Grantee to enforce any of the terms contained herein shall not be deemed a waiver of any such term nor bar any enforcement rights.

6. Notice. Whenever notice to the Grantee (other than the annual certification) or approval from the Grantee is required, the Party providing such notice or seeking such approval shall identify the Controlled Property by referencing the following information:

County, NYSDEC Site Number, NYSDEC Brownfield Cleanup Agreement, State Assistance Contract or Order Number, and the County tax map number or the Liber and Page or computerized system identification number.

Parties shall address correspondence to:

Site Number: Enter DEC Site #
Office of General Counsel
NYSDEC
625 Broadway
Albany New York 12233-5500

With a copy to:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, NY 12233

All notices and correspondence shall be delivered by hand, by registered mail or by Certified mail and return receipt requested. The Parties may provide for other means of receiving and communicating notices and responses to requests for approval.

7. Recordation. Grantor shall record this instrument, within thirty (30) days of execution of this instrument by the Commissioner or her/his authorized representative in the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

8. Amendment. Any amendment to this Environmental Easement may only be executed by the Commissioner of the New York State Department of Environmental Conservation or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

9. Extinguishment. This Environmental Easement may be extinguished only by a release by the Commissioner of the New York State Department of Environmental Conservation, or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

10. Joint Obligation. If there are two or more parties identified as Grantor herein, the obligations imposed by this instrument upon them shall be joint and several.

IN WITNESS WHEREOF, Grantor has caused this instrument to be signed in its name.

Enter Grantor's Name:

By: ____

Print Name: _________________________________

Title:_____________________ Date:_____________

Grantor's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF)

On the _______ day of _________, in the year 20 __, before me, the undersigned, personally appeared ___________________, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

____
Notary Public - State of New York

THIS ENVIRONMENTAL EASEMENT IS HEREBY ACCEPTED BY THE PEOPLE OF THE STATE OF NEW YORK, Acting By and Through the Department of Environmental Conservation as Designee of the Commissioner,

By: ____
Robert W. Schick, Director
Division of Environmental Remediation

Grantee's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF ALBANY)

On the _______ day of _________, in the year 20__, before me, the undersigned, personally appeared Robert W. Schick, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

____
Notary Public - State of New York

SCHEDULE "A" PROPERTY DESCRIPTION

Enter Property Description