PATRIOT
ENGINEERING AND ENVIRONMENTAL, INC.

UNDERGROUND VAULT PILOT STUDY REPORT AND REMEDIATION WORK PLAN

FORMER HOUGHLAND TOMATO CANNERY
CROSSROADS RECYCLING BUILDING
1062 E. EASTVIEW DRIVE
FRANKLIN, INDIANA
IDEM STATE CLEANUP SITE #2013-034567
PATRIOT PROJECT NO. 21-0758-01E

Submitted to: **INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT**
Mr. Tim Johnson
Office of Land Quality, State Cleanup Program
100 N. Senate Ave., IGCN, Room 1101
Indianapolis, IN 46204-2251

Submitted for: **HURRICANE ROAD INDUSTRIAL DEVELOPMENT LLC**
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Attn: Mr. Greg Cafouros

Submitted by: **PATRIOT ENGINEERING AND ENVIRONMENTAL, INC.**
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January 6, 2023

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1.0 INTRODUCTION

Patriot Engineering and Environmental, Inc. (Patriot) was retained by Kroger Gardis & Regas LLP on behalf of Robert Clawson D/B/A Hurricane Road Industrial Development LLC (HRID) to conduct an underground vault pilot study (Pilot Study) and prepare an Underground Vault Remediation Work Plan (RWP) for the Crossroads Recycling building located on the HRID property commonly known as the former Houghland Tomato Cannery (Houghland) at 1062 E. Eastview Drive, Franklin, Johnson County, Indiana (the Site). The Site location is depicted on Figure 1 in Appendix A. Regulatory closure of the Site is being pursued through the Indiana Department of Environmental Management (IDEM) State Cleanup Program using the Remediation Closure Guide (RCG).

1.1 Project Identification

The Site is located at 1062 E. Eastview Drive on the northeast side of Franklin, Johnson County, Indiana (Figure 1). The Site is a portion of the former Houghland property, a former tomato canning operation that was subsequently divided into two properties. Mr. Robert Clawson, doing business as HRID, owns the eastern portion of the former Houghland property. Mr. Clawson leases the buildings on the property to various commercial tenants. Crossroads Recycling leases the 1062 Eastview Drive building that is the subject of the Pilot Study and RWP.

According to the Franklin, Indiana, quadrangle topographic map (United States Geological Survey [USGS] 2016), the Site is located in the southwest quarter of Section 12, Township 12 North, Range 4 East in Needham Township, Johnson County, Indiana. The topography of the Site is relatively flat. The average ground surface elevation is approximately 740 feet above mean sea level.

The project contacts for the Site are:

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The Site geology consists primarily of sand from the ground surface to depths ranging from approximately 27-37 feet below grade, underlain by a hard clay that acts as an aquitard to inhibit further vertical migration of impacted groundwater. Groundwater is encountered at approximately 15 to 20 feet below grade in the sand unit, and the groundwater flow direction is generally toward the southeast in the shallow and deep well networks.

1.2 Previous Investigations

Patriot, in preparing this Pilot Study report and RWP, relied on historical soil, groundwater, and vapor data generated by previous work performed by Patriot and reported in the following documents submitted to the IDEM:

- *Vapor Intrusion Investigation Report* (Patriot, October 25, 2019)
- *Status Report for Sampling Event #1 - Supplemental Vapor Intrusion Investigation* (Patriot, January 30, 2020)
- *Status Report for Sampling Event #2 - Supplemental Vapor Intrusion Investigation* (Patriot, March 31, 2020)
- *Final Report - Supplemental Vapor Intrusion Investigation* (Patriot, May 19, 2020)
- *Indoor Air Vapor Mitigation System Installation and Startup Report* (Patriot, June 4, 2020)

- *Indoor Air Mitigation Monthly Sampling - April and May 2020 Work Plan for Further Site Investigation #4* (Patriot, August 7, 2020)
- *Status Report Indoor Air Mitigation System Performance Sampling and Carbon Filter Replacement* (Patriot, October 6, 2020)
- *Final Report Supplemental Vapor Intrusion Investigation* (Patriot, October 13, 2020)
- *Status Report Indoor Air Mitigation System Performance Sampling and Carbon Filter Replacement* (Patriot, December 17, 2020)
- *Indoor Air Mitigation System Performance Sampling* (Patriot, June 22, 2022).

1.3 Overview of Current Contaminant Conditions

1.3.1 Discovery and Sources of Contamination

The Site has been the subject of environmental investigation activities from 2013 through 2022. Vapor intrusion (VI) investigations conducted at the Site in September 2016, December 2017 and August 2019 involved the collection of one set of paired sub-slab soil vapor and indoor air samples from the Crossroads Recycling building. The analytical data from the samples revealed the presence of several VOCs, including the contaminants of concern (COCs) tetrachloroethene (PCE) and trichloroethene (TCE), with lesser amounts of cis-1,2-dichloroethene (c-DCE) and trans-1,2-dichloroethene (t-DCE). The data indicated that VI may be occurring in the Crossroads Building and Patriot conducted an additional VI investigation in January 2020 where three additional sub-slab ports were installed and a total of four sub-slab and five indoor air samples were collected over a 24-hour period. TCE exceeded the RCG Commercial/Industrial Soil Gas Sub-slab Screening Levels (SGSSLs) in the three sub-slab soil vapor samples (SS-1, SS-2, and SS-4) with the highest sub-slab TCE concentration of 1,570,000 ug/m^3 reported in the duplicate sample SS-2 collected immediately adjacent to the office on the east-central portion of the building. Sub-slab soil vapor sample SS-2 also contained PCE above the RCG Commercial/Industrial SGSSL. TCE exceeded the RCG Residential and Commercial/Industrial Indoor Air Screening Levels (IASLs) in the five indoor air samples with the highest TCE concentration of 95.7 ug/m^3 reported in sample IA-2 collected in the office on the east-central portion of the building. No other VOCs were reported at concentrations above the RCG Residential or Commercial/Industrial IASLs. A site layout map showing sample locations and building layout is included as

Figure 2 in Appendix A and a summary of the sub-slab soil vapor and indoor air analytical results is included in Table 1 in Appendix B.

Patriot performed an expanded VI investigation in February 2020 that consisted of the same procedures from the January 2020 sampling event with the addition of three indoor air samples collected during the approximately 8 hours of business operation to determine whether an occupational exposure to TCE was occurring. The sub-slab soil vapor sample and 24-hour indoor air sample analytical results were similar to the January 2022 results. Comparison of the three paired 24-hour and 8-hour samples revealed TCE concentrations exceeding the RCG Commercial/Industrial IASL in all three 24-hour samples but in only one 8-hour sample (sample IA-6 located in the office area).

Additional subsurface investigations performed at the Site, as described below, revealed the presence of approximately three underground vaults beneath the concrete floor of the Crossroads Recycling building. The area containing the vaults and the assumed configuration of the vaults is shown on Figure 3 in Appendix A. The vaults had been filled with coarse sand, which contained the COCs PCE, TCE, and c-DCE, with TCE present at concentrations exceeding the IDEM RCG Industrial/Commercial Direct Contact Screening Level (IDCSL). The source of the COC impacts in the fill sand is not known but it appears that the COCs in the fill sand are the source of the indoor TCE vapor intrusion that was occurring at the Site.

During Patriot's Further Site Investigation (FSI) #4, seven borings were advanced inside the Site building. Borings B-13 and B-18 encountered dry, coarse fill sand from beneath the concrete floor slab to a depth of approximately 12 feet below the floor grade. A 2- to 3-foot void between the building floor (top of the vault) and the fill sand in boring B-13 allowed Patriot to observe the interior of the western-most vault (Vault 1) using a video camera. The vault is constructed of concrete walls with horizontal steel beams supporting the reinforced concrete at the top of the vault. The north, east and west sidewalls of the vault could be observed but fill sand reached the top of the vault to the south and the southern extent of the vault could not be determined. Based on information from the subsurface investigation and the video inspection, it appears that Vault 1 is approximately 9 feet wide, 15 feet deep, and greater than 10 feet in length. Boring B-18 was advanced approximately 10 feet east of the eastern side of the vault and encountered the same type of fill sand to a depth of 12 feet below grade where refusal was encountered at the same depth as the floor of the verified vault, indicating that a sub-slab vault is present at this location also. The dimensions of the eastern vault or vaults could not be determined during the investigation.

Patriot conducted a ground penetrating radar (GPR) investigation of the area that contains the underground vaults, but the results of the investigation were inconclusive due to the thickness of the concrete floor slab in the building, the presence of steel support beams beneath the concrete, and the equipment stored inside the building. The GPR study did indicate that Vault 1 was approximately 19 feet in length and that the eastern vault (or vaults) was longer than Vault 1 and extended further to the south. Additional investigations revealed that the vaults are rectangular, approximately 10 feet deep, and constructed of concrete with steel beams supporting the vault roof/building floor slab. The investigations also revealed that the vaults contained dry, coarse-grained sand and that no water or other liquids were present in any of the vaults. The fill sand had been placed to a height ranging from the top of the vault to approximately 2 feet below the top of the vault. The investigations delineated the lateral dimensions of the underground vaults but could not conclusively identify the number of vaults within the area. Based on the available data, it appears that there are three vaults (Vault 1, Vault 2, and Vault 3), but the possibility exists that the area identified as Vault 2 and Vault 3 is one large vault or possibly three smaller vaults.

1.3.2 Remedial Measures Taken

Patriot implemented interim remediation activities to mitigate VI conditons at the Site. As an interim measure to reduce COC concentrations, Patriot purchased and installed an Airpura C600DLX Air Purifier (C600) within the office space at the Crossroads Recycling building and a large diameter exhaust fan in the warehouse area where indoor air concentrations of TCE exceeded RCG Commercial/Industrial IASLs. The C600 was installed on April 1, 2020 and is designed to treat airborne chemical and VOC vapors such as TCE and includes a replaceable three-inch bed containing 26 pounds of activated carbon impregnated with potassium iodide for enhanced filtration and remediation. The C600 contains both pre and post filters, is suitable for an area up to 2,000 square feet and has an airflow up to 560 cubic feet per minute. The exhaust fan was placed at one of the overhead doors and was set to blow outward to draw fresh air into the building through the other overhead doors. The tenants occupying the

Crossroads Recycling building were given detailed instructions on the use of the C600 and exhaust fan and were instructed to always keep the air purifier running and the exhaust fan running while the building was occupied. Patriot performed ongoing vapor monitoring and carbon changeouts until a vapor mitigation system was installed.

Patriot installed a sub-slab depressurization system (SSDS) in the Crossroads Recycling building on June 15 and 16, 2021. The SSDS consists of one 4-inch diameter extraction port installed within the vaults immediately adjacent to the office area of the building and connected to a radon-mitigation fan. Pre-installation pilot testing demonstrated that the SSDS has a radius of influence that includes the entire area of the vaults and an area at least five linear feet beyond the vaults to the north, east and west. No sampling was performed to the south of the vaults due to access limitations. The pilot test results indicated that the SSDS would effectively mitigate the PCE and TCE vapor intrusion (VI) that had been occurring in the office and warehouse areas of the building. Patriot performed paired indoor air and sub-slab soil gas sampling to document the effectiveness of the SSDS in reducing the indoor air vapor concentrations to acceptable levels after approximately 12 to 14 days of system operation and again after approximately 4 weeks of system operation. Each sampling event included one sub-slab soil gas sample within the vault area, one indoor air sample in the office area, one indoor air sample in the warehouse area, and one outdoor air control sample. The sampling was conducted using Summa canisters over an approximately 24-hour period. The analytical results for each sampling event indicated that the interim sub-slab vapor mitigation system was adequately controlling TCE vapor intrusion in the Crossroads Recycling building and that VI was not occurring.

Patriot mobilized to the Site on June 1 and June 2, 2022 to perform additional indoor air and sub-slab vapor sampling in the Crossroads Recycling building. The SSDS was turned off approximately 24 hours prior to conducting the additional sampling. The analytical results revealed that no COCs were detected in any of the indoor air, sub-slab soil gas, and outdoor air samples at concentrations exceeding laboratory reporting limits. The data indicated that the interim sub-slab vapor mitigation system continued to control TCE vapor intrusion in the building and that VI is not occurring.

1.3.3 Existing Deed Restrictions, Land Use Restrictions, or Environmental Notices

There are currently no known deed or land use restrictions or environmental notices associated with the Site.

2.0 BASELINE PROJECT ASSESSMENT

2.1 Ecologic Information

The nearest potential ecological feature is Hurricane Creek, located approximately 2,000 feet east of the Site. Hurricane Creek is also the closest major drainage feature. The U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) Interactive Mapper (USFWS, 2009) shows the closest nearby wetland as a Freshwater/Forested Shrub Wetland along Hurricane Creek approximately 2,500 feet southeast of the Site.

The Indiana Department of Natural Resources (IDNR) lists 12 mollusks, three insects, one amphibian, two reptiles, 14 birds, 10 mammals, and seven vascular plants on their Johnson County threatened, endangered or rare species list. Based on the location of the Site in a commercial/industrial area, it is unlikely that any of these species would be present on or near the Site.

2.2 Potentially Susceptible Areas and Receptors

2.2.1 Potentially Susceptible Water Supply Sources

Water from the municipal supply (City of Franklin, which obtains its water from multiple municipal well fields) is readily available in the Site area. Per the IDEM Wellhead Proximity Determinator on-line database, the Site is not located in a wellhead protection area.

The IDNR water well mapper was used to identify water supply wells at or near the Site. There are no water supply wells at the Site or at any of the nearby properties, all of which are provided with potable water by the City of Franklin. A total of 150 wells were identified within an approximately two-mile radius of the Site, with the closest well located in the former Webb Well Field (currently inactive) located east of the Site along Hurricane Creek.

2.2.2 Potentially Susceptible Geological Areas

According to the Indiana Geological Survey (IGS), the Site is not located in or near a Karst area (IGS, 2009). No other potentially susceptible geologic features, such as mined areas or fractured rock areas, are located near the Site.

2.2.3 Potentially Susceptible Human Receptors

Previous vapor intrusion investigations have shown that indoor air vapor intrusion was potentially occurring in the Crossroads Recycling building. Interim measures were implemented to eliminate potential employee exposure to PCE and TCE at concentrations greater the RCG Commercial/Industrial IASLs as described in Section 1.3.2 above. As such, the inhalation exposure pathway is not complete.

Potable water at the Site is supplied by the municipal water system and no groundwater supply wells or other types of groundwater extraction are present on the Site. In addition, the COC-impacted sand is present within concrete vaults and there is no evidence of water or other liquids in the vaults that would allow the COCs to migrate from the vaults into the underlying soil and/or groundwater. As such, the ingestion and dermal contact exposure pathways are not complete for routine site workers, visitors, and the general public.

2.2.4 Potentially Susceptible Ecological Areas

There are no natural areas located on-Site. Off-site ecological areas are not anticipated to be impacted since the extent of groundwater impacts has been defined.

2.3 Potential Contaminant Transport Mechanisms

The impacted fill sand is located within concrete vaults inside the building. Subsurface investigations have documented that the fill sand is dry and there is no water or other liquid in the vaults. Since the vaults are located in the building there is no mechanism for rainwater to enter the vaults. Due to absence of free liquids or infiltration of precipitation, there is no mechanism to the COCs to migrate into the underlying soil or groundwater. The COCs are volatile compounds that have the potential to volatilize upward through cracks or openings in the floor slab. The potential for volatilization to the indoor air of the Site building has been addressed by the installation and ongoing operation of the VI mitigation system.

2.4 Potential Human Exposure Pathways

The potentially susceptible areas discussed in Section 2.2.3 were evaluated in conjunction with the contaminated media, their locations and depths, potential transport mechanisms, and proposed land use to determine potentially complete human exposure pathways at the Site and surrounding properties. There are currently no complete exposure pathways.

2.5 Data Gaps and Additional Field Investigation Requirements

No additional field investigation is required to prior to implementation of this RWP. The only data gap is that the number of vaults and the dimensions of the individual vaults is not known. This data gap has been addressed by the remediation design for the Site.

3.0 REMEDY EVALUATION AND SELECTION

3.1 Remediation Objective

The objective of remedial efforts is to reduce the COC concentrations in the vault fill sand to the lesser of a) the RCG IDCSLs and b) the RCG Commercial/Industrial SGSSLs so that the Site can be closed with an environmental restrictive covenant (ERC) prohibiting residential land use. .

3.2 Evaluation of Remediation Alternatives

There is usually more than one technology available to achieve remediation objectives at any given site. These alternatives are considered and compared as part of the evaluation process leading to the selection of a remedial approach. Site characteristics, cleanup objectives and the contaminants targeted for remediation play a primary role in selecting the appropriate remediation strategy. The estimated time to achieve regulatory closure and potential interruptions to ongoing site activities can also play a role in the selection of an applicable remedy. Overall costs are also a factor. The following remediation technologies were evaluated with respect to these criteria.

- Soil Vapor Extraction (SVE)
- In Situ Chemical Oxidation (ISCO)
- Electrical Resistance Heating (EHR)
- Excavation and off-Site Disposal

3.2.1 SVE

SVE is a remedial technique by which VOC vapors are removed from the subsurface through mechanical means. Low level vacuum blower systems are used to apply a concentrated negative pressure to a series of sealed extraction wells placed within the impacted areas of concern to remove VOC vapors. VOCs trapped in the subsurface pore space or adsorbed to the soil matrix are captured and transported above ground for treatment. Depending on the mass of VOCs removed, air discharge permitting and/or vapor treatment may be required. SVE remediation technology is effective over a wide range of volatile contaminants. It has greater efficacy with heterogeneous stratum and moderate to high soil permeability and can be effective in capturing contaminants located beneath structures. SVE is a conventional technology that is generally considered to be protective of human health and the environment. The estimated timeframe for site remediation using SVE is one year. The presence of dry, coarse sand that is contained on the top, bottom and sides by concrete walls make SVE is a potentially applicable remediation technology for the Site.

3.2.2 ISCO

ISCO is generally a cost-effective method for destroying localized high concentrations of a wide range of organic compounds, particularly BTEX, low molecular weight cPAHs and other organic volatiles. In an oxidation reaction, the oxidizing agent breaks the carbon bonds and converts them into non-hazardous or less toxic compounds, primarily carbon dioxide, water, and chloride. Commonly used oxidizing reagents include potassium permanganate, ozone, and sodium persulfate. ISCO remediation design is site-specific, and successful treatment is typically a function of the effectiveness of the delivery system being able to deliver sufficient amounts of oxidant to the impacted soil and making sufficient "contact". Potassium permanganate and sodium persulfate are commonly used oxidants that are inexpensive and readily available in large quantities.

They are also relatively safe and easy to handle when normal health and safety procedures are followed. Potassium permanganate and sodium persulfate are effective when delivered in an aqueous solution and react throughout a wide range of pH. Better results for sodium persulfate can be obtained at higher pH. Other catalysts such as hydrogen peroxide, heat and ferrous ions can be used to activate sodium persulfate. Besides carbon dioxide and water, the reactions yield primarily manganese dioxide (KMnO4) and sulfate (sodium persulfate). Remediation of VOC-impacted soil can usually be achieved within one year, but multiple injections of oxidizing agents are often required. Bench scale testing of the Site soil with various oxidizing agents would be required to determine whether the Site is amenable to ISCO. ISCO is not effective in high permeability soils because it cannot maintain sufficient contact time with the soil to allow for oxidation to occur. To use ISCO as a remedial option at the Site, the vaults would need to be filled with water to allow oxidants to maintain sufficient contact time with the impacted soil. It is not known whether the vaults are water tight and introducing water into the vaults could result in migration of COCs to the underlying soil and groundwater. Based on these limitations, ISCO is not considered to be a potentially applicable remediation technology for the Site.

3.2.3 ERH

ERH uses arrays of electrodes installed around a central neutral electrode to create a concentrated flow of current toward the central point. Resistance to flow in the soils generates heat greater than 100ºC, producing steam and readily mobile contaminants that are recovered via vacuum extraction and processed at the surface. ERH is adaptable to all soil types and is effective in both the vadose and saturated zones. However, in order for the subsurface to conduct electricity, there must be water present in the subsurface and conductivity will cease before the subsurface is desiccated. The dry fill sand present at the Site will not adequately conduct electricity, making ERH an unsuitable remediation technology for the Site.

3.2.4 Soil Excavation and Off-Site Disposal

Excavation and off-Site disposal involve the mechanical removal of impacted soil from the Site and transporting it to an off-Site facility for land disposal or treatment. The primary benefits of excavation and off-Site disposal are that it is the quickest method of remediating soil and can be cost effective over small- to medium-sized areas. Excavation and disposal is generally less cost effective over large areas or in areas where deep excavation or shoring would be required. Excavation and disposal is also less cost effective if the soil requires disposal as a hazardous waste. Although there is not a large volume of soil present in the vaults, it is located under a thick concrete floor slab that would have to be removed to access the impacted fill sand for excavation and would have to be replaced after completion of the excavation. Removal and replacement of a structural concrete floor slab inside a building would be costly and would cause the client to shut down operations for up to two weeks. Excavation and off-Site Disposal is a potentially applicable remediation technology for the Site, but the cost of removing and replacing the concrete floor and interruption to the tenant's business make this a less desirable remediation alternative.

3.2 Recommended Remediation Strategy

Based on the evaluation of remedial options presented in the preceding paragraphs, the most efficient, cost-effective remedial approach for this site is SVE, as well as the use of an ERC as necessary, to eliminate potential exposure pathways, both currently and in the future.

4.0 SVE PILOT STUDY

Patriot retained Specialty Earth Sciences, LLC (SE Sciences) of New Albany, Indiana to perform the Pilot Test to assess the feasibility of SVE as an effective remediation approach for the Site. The results of the pilot test are documented in a Soil Vapor Extraction Pilot Test Report prepared by SE Sciences, which is included in Appendix C and summarized below.

Prior to the Pilot Study, one 2-inch diameter polyvinyl chloride (PVC) extraction well and three, 1-inch diameter PVC monitoring/observation wells were installed in the westernmost vault at the Site. Each well was constructed with 5 feet of 0.010-inch factory-slotted well screen set at an interval of approximately 5 to 10 feet below surface grade (ft-bsg). The 4-inch diameter PVC extraction pipe for the existing vapor mitigation system was cut and capped during the Pilot Study to prevent short circuiting of air flow. The vapor mitigation system pipe was re-connected following completion of the Pilot Study.

A 20-hp positive displacement blower unit with variable speed motor control was utilized to provide a means of applied vacuum to the subsurface. Ancillary SVE equipment included an air-water separator vessel, inlet filter assembly, discharge silencer, vacuum and pressure gauges, temperature gauges and air velocity monitoring instrumentation, and portable generator.

Differential pressure gauges were connected to the three observation wells to measure vacuum response relative to atmospheric pressure conditions. This information was utilized to estimate the vacuum radius of influence (ROI) under varying levels of applied negative pressure, air flow, and contaminant extraction. All measurements were documented and recorded at predetermined time intervals throughout the study. The SVE Pilot Study findings were as follows:

- Applied vacuum readings ranged from 1.2 to 2.6 inches of water column (in-H2O).
- Measured air velocities associated with the above referenced applied vacuum readings ranged from 4,500-6,400 feet per minute (fpm).
- Calculated air flows ranged from 97.5 to 138.2 standard cubic feet per minute (scfm).
- Effluent air stream contaminant concentrations ranged from 0.2 to 3.5 parts per million (ppmV) via a photoionization detector (PID).
- A calculated radius of influence (ROI) of 20 feet was estimated.
- The optimum air flow rate at the extraction well was 138.2 scfm @ 2.6 in-H2O.
- PID readings increased over the duration of the Pilot Study, demonstrating that applied vacuum successfully captured target contaminants.

Based on the Pilot Study findings, SVE has been selected as the remediation technology for the Stie.

5.0 REMEDIATION DESIGN AND IMPLEMENTATION

5.1 SVE System Design

Patriot retained SE Sciences to prepare the SVE system design and layout for the Site. The Soil Vapor Extraction (SVE) System Design and Layout is provided in Appendix D and is summarized below.

The SVE system will be comprised of three SVE extraction wells, one located within each enclosed, subsurface vault. The general design for each SVE well will consist of 5 feet of 2-inch diameter, flush threaded, 0.010-inch factory-slotted, PVC well screen placed the base of the vault (approximately 5 to 10 feet bgs). The well screen will be connected to the remediation system with 2- to 3-inch diameter, PVC conveyance piping that will be installed within the concrete floor slab. The extraction wells piping will be connected to the remediation system via a manifold assembly with valves to control the air flow from each extraction well, vacuum gauges for operations and maintenance (O&M) monitoring and to monitor SVE efficiency, and sampling ports to allow for vapor sampling from each extraction well. A series of shutoff valves will be incorporated into the inlet piping along with a "fresh air bleed" to control flow rates and applied vacuum pressure to the extraction wells.

A vacuum level of approximately 3.0 in-H2O will be generated utilizing a 5 to 10 horsepower positive displacement vacuum blower assembly. Based on the Pilot Study results, the applied vacuum will be capable of inducing a cumulative air flow of approximately 435 cfm. The blower motor will be connected to an adjustable ambient air dilution valve to enable vacuum level control. Temperature, vacuum, pressure, and oil level gauges will be installed to monitor blower motor performance. The blower outlet piping will be connected to an air-water separator (AWS) vessel to remove soil moisture and condensation from the extraction wells. The blower effluent will be exhausted to the atmosphere after passing through the AWS. The SVE equipment details are provided in Appendix D. An SVE System Specifications and O&M Manual will be provided following system start-up.

5.2 System Installation, Start-up, and O&M

Following IDEM approval of this RWP, Patriot will schedule the installation of the SVE system. The SVE system start-up procedures, proposed operational parameter monitoring schedule, and O&M schedule are provided in the Soil Vapor Extraction System (SVE) System Design and Layout document in Appendix D. The operational parameter monitoring schedule and O&M procedures and schedule are summarized below. All operational parameters, monitoring results, and O&M activities will be recorded in a log book.

Operational Parameter Monitoring Schedule (bi-weekly)

- Measure SVE influent air flow (3 individual manifold lines) and SVE effluent flow at the blower outlet
- Measure vacuum at each of the three well head assemblies, each of the three manifolded SVE influent lines, and the particulate filter(s) inlets and outlets
- Monitor the water level in the AWS vessel and the flower outlet temperature
- Measure VOCs at the blower outlet using a PID

Bi-weekly O&M Schedule

- Clean the blower inlet air filter and evacuate condensation
- Check the blower oil level
- Check the SVE influent manifold for water production and proper airflow
- Check the water level in the AWS vessel and pump out as needed

Monthly O&M Schedule

- Diagnostic blower motor winding check, check amperage
- Grease and lubricate blower bearings
- Drain and remove sediment from the bottom of the AWS Vessel
- Ensure AWS high level float switch is operating properly

As-needed O&M Tasks

- Change blower oil and check belt tension
- Check and clean vacuum transmitter

5.3 Permitting

Based on the known site conditions, it is not anticipated that effluent air treatment or air discharge permitting will be required for the SVE system. To verify this, a sample of the system effluent will be collected for laboratory analysis approximately one week after SVE system start-up. The sample will be collected in a laboratory-supplied 6-liter air sampling canister by connecting the sampling canister directly to a sampling port on the SVE system piping with new Teflon tubing provided by the laboratory. The sample will be logged on a chain of custody form and submitted to an analytical laboratory for VOC analysis by United States Environmental Protection Agency (U.S. EPA) Test Method TO-15. The analytical results and measured air flow from the SVE system will be used to calculate an estimate of the mass of VOCs extracted from the subsurface and emitted to the atmosphere to determine whether effluent treatment or air discharge permitting is required. If permitting or effluent air treatment is needed, Patriot will prepare an RWP addendum to IDEM describing the proposed permitting or treatment.

6.0 MONITORING AND CONFIRMATION SAMPLING PLAN

6.1 SVE System Performance Monitoring

SVE system performance will be monitored using both qualitative and quantitative methods. The SVE system effluent air will be monitored every two weeks using a PID, which will provide a qualitative measurement to evaluate changes in effluent VOC concentrations over time. The PID measurements will be collected by inserting the PID probe into the effluent airstream through a sampling port installed after the AWS vessel and recording the maximum instrument response. The PID will be calibrated following the manufacturer’s instructions prior to each use.

Grab samples of the combined effluent airstream will be collected for laboratory analysis approximately one week after system startup, then monthly for six months, and quarterly thereafter. The samples will be collected in laboratory-supplied 6-liter air sampling canisters by connecting the sampling canisters directly to a sampling port on the SVE system piping with new Teflon tubing provided by the laboratory. The samples will be delivered to the analytical laboratory and analyzed for short list VOCs (PCE, TCE, c-DCE, t-DCE, and vinyl chloride) by U.S. EPA Method TO-15. The analytical results and measured air flow from the SVE system will be used to calculate an estimate of the mass of VOCs being extracted from the subsurface to document the reduction in VOC vapors as remediation progresses to verify the effectiveness of the remediation strategy and attainment of the proposed cleanup objectives.

Grab samples of the effluent airstream from each of the three extractions wells will also be collected approximately one week after system start-up and quarterly thereafter. The samples will be collected in laboratory-supplied 6-liter air sampling canisters by connecting the sampling canisters directly to sampling ports on the SVE system piping upstream of the header with new Teflon tubing provided by the laboratory. The samples will be delivered to the analytical laboratory and analyzed for short list VOCs by U.S. EPA Method TO-15. The data from the individual samples will be used to document the progress of the remediation in each of the vaults and to adjust the airflow to the vaults to maximize the SVE system efficiency.

6.2 Paired Sub-slab Soil Vapor and Indoor Air Sampling

Paired sub-slab soil vapor and indoor air sampling will be conducted to evaluate the effectiveness of the remediation system in meeting the remediation objectives and to assist in determining whether there are more than three vaults at the Site. Sub-slab soil vapor sampling will be conducted at four locations: one in the center of Vault 1 and three evenly spaced across Vaults 2 and 3, as shown on Figure 4 in Appendix A. In the event there are three vaults in the area occupied by Vaults 2 and 3, the even spacing of the sampling locations will likely ensure that one sampling port is in each vault. Paired sub-slab soil vapor and indoor air sampling will be conducted prior to system start-up and when the SVE system performance monitoring described above indicates a significant reduction in VOCs in the SVE effluent airstream. For the post-start up sampling events, the SVE system will be turned off and the sampling will be conducted approximately 7 days after system shutdown. The SVE system will be restarted immediately after collection of the paired sub-slab soil gas samples.

Cox-Colvin® vapor pins will be installed at sub-slab soil gas monitoring locations SS-5, SS-6 and SS-7 following the manufacturer's instructions. A vapor pin is already installed at sub-slab soil gas monitoring location SS-2. During each sampling event, the sub-slab soil gas samples will be collected from the vapor pins over an approximately 8-hour period using 6-liter Summa canisters equipped with laboratory-calibrated flow regulators and vacuum gauges. Before sampling, the sampling train will be leak-checked and the sub-slab port will be leak tested using the water dam method. Sampling will then proceed by attaching the Summa canister directly to the barb of the vapor pin with high density polyethylene (HDPE) tubing.

Two indoor air samples and one outside air control sample will be collected over an approximately 8-hour period concurrently with the sub-slab soil gas samples. The samples will be collected using 6-liter Summa canisters equipped with laboratory-calibrated flow regulators and vacuum gauges. The Summa canisters for the indoor samples will be placed in the Crossroads Recycling office where previous investigations revealed the highest indoor air VOC concentrations and in the warehouse area in the vicinity of the vapor pins. Since the warehouse area is open with no dividing walls and since the sub-slab vapor pin sampling locations are closely spaced, only one indoor air sample will be collected in the warehouse aera.

The Summa canisters will be batch certified and labeled by the laboratory and the flow controllers will be pre-set by the laboratory to collect the sample over an approximately 8-hour period. At each sampling location, the Summa canister number, initial vacuum gauge reading, and sample start time will be recorded on a sampling data sheet, and the sampling will be initiated by opening the flow control valve on the canister. Approximately 7 hours after the sampling start time, the Summa canisters will be retrieved by recording the ending vacuum gauge reading and sampling end time on a sampling data sheet and closing the flow control valve. The Summa canisters will be logged onto a chain-of-custody form and delivered to the analytical laboratory for short list VOC analysis using U.S. EPA Method TO-15. Quality assurance/quality control (QA/QC) procedures for the VI sampling will include the collection and analysis of one duplicate sample.

If the sampling results reveal sub-slab soil gas concentrations greater than the RCG Commercial/Industrial SGSSLs, the airflow from each of the SVE extraction wells will be adjusted to ensure optimal system performance. If the sub-slab soil gas sample results indicate the presence of more than two vaults in the area identified as Vaults 2 and 3 (i.e., higher VOC concentrations in the sample between the extraction wells in Vaults 2 and 3), an additional extraction well will be installed in that location. The SVE system will continue to be operated until the performance sampling indicates diminished VOC effluent, at which time an additional paired sub-slab soil gas and indoor air sampling event will be conducted. When the results of the paired sampling reveal that all sub-slab soil gas samples are below the RCG Commercial/Industrial SGSSLs and all indoor air samples are blow the RCG Commercial/Industrial IASLs, the SVE system will be turned off and confirmatory soil sampling will be conducted.

6.3 Confirmatory Soil Sampling and Sub-Slab Soil Gas Sampling

A Geoprobe® direct push sampling rig (Geoprobe) will be used to advance six borings at the Site to collect confirmatory fill sand samples from within the vaults. The proposed sampling locations are shown on Figure 4. Continuous sampling will be conducted as the borings are advanced from the ground surface to the base of the vaults. The soil samples will be inspected in the field for staining, odors, or other evidence of contamination and screened with a PID by headspace analysis The one sample from each boring that exhibits the greatest potential for COC impacts will be placed in laboratory-supplied sample containers, logged on a chain of custody form, placed on ice in a cooler, and delivered to an analytical laboratory for VOC analysis by U.S. EPA Method 8260 using the methanol preservation method. QA/QC sampling will include one duplicate sample, one matrix spike/matrix spike duplicate (MS/MSD) sample, and one trip blank with each cooler of samples. Since the soil samples are intended to be confirmatory samples, full IDEM data quality documentation will be obtained from the laboratory.

If the analytical results reveal COC concentrations above the RCG Commercial/ Industrial DCSLs, the SVE system will be restarted, and additional sampling will be conducted when the performance monitoring indicates the remediation goals have been met. When the soil sampling reveals COC concentrations below the RCG Commercial/ Industrial DCSLs, the system will be shut down and final paired soil gas/indoor air sampling will be performed. The final paired sampling events will be performed under Summer and Winter worst case conditions using the methodologies described in Section 6.2 above. The SVE system will be turned off a minimum of 30 days prior to any confirmatory paired sampling event and full IDEM data quality documentation will be obtained from the laboratory for the final paired sampling event. If the paired sampling reveals indoor air or sub-slab soil gas concentrations above the remediation goals established for this project, the system will be restarted and operated until performance monitoring indicates the remediation goals have been achieved, at which point the confirmatory paired sampling will be repeated.

7.0 REPORTING

A remediation implementation report will be prepared and submitted to IDEM following SVE system installation and completion of the first month of performance monitoring. System operation and monitoring reports will be submitted quarterly thereafter until the remediation goals have been achieved.

8.0 COMPLETION OF REMEDIAL ACTIVITIES

The objective of remedial efforts is to reduce the COC concentrations in the vault fill sand to the lesser of the RCG IDCSLs and the RCG Commercial/Industrial SGSSLs and to demonstrate that the residual VOC concentrations do not present an unacceptable threat to human health or the environment. This will be accomplished via the proposed remedial activities, as well as site-specific deed restrictions as necessary, and application of multiple lines of evidence demonstrating that there are no complete exposure pathways.

Upon completion of the confirmatory monitoring event, a Remediation Completion Report and No Further Action (NFA) Request will be prepared and submitted to IDEM for review and approval. The report will include an analysis of the existing data, an evaluation of potential exposure pathways, and an evaluation of potential risks from the residual impacts. The NFA request may need to include an ERC for the Site, limiting the property use to commercial/industrial purposes only. Any proposed site-specific ERCs would be submitted to IDEM in draft form for review and approval. Upon approval of the ERC(s) by IDEM, the final ERC(s) would be recorded on the property deed.

Upon receipt of approval of the NFA request from the IDEM, the SVE system at the Site will be abandoned and documentation submitted to IDEM in support of closure.

9.0 SCHEDULE

Initiation of the remedial strategy proposed in this RWP will be implemented promptly upon approval of this RWP by the IDEM. The remedial system installation will require approximately one week to complete. Performance monitoring will be initiated approximately one week following system startup as described in Sections 6.1 and 6.2 above. It is anticipated that the remediation goals will be met within one year of system operation

APPENDIX A

FIGURES

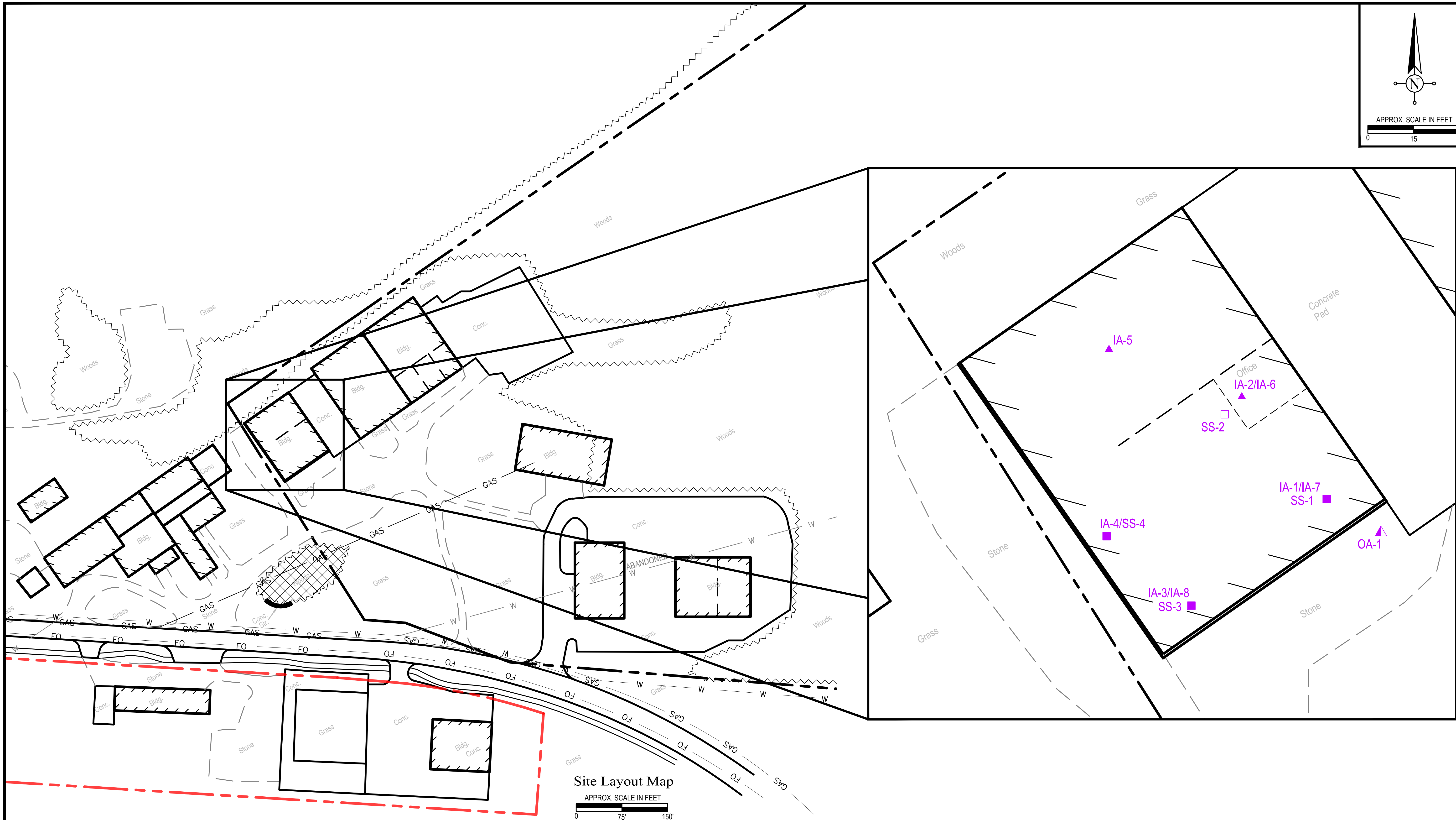
Image Source:
USGS Franklin Topo 2022

Patriot Engineering & Environmental, Inc.

Project:	Underground Vault Pilot Study Report & RWP HRID / Crossroads Recycling Franklin, Indiana IDEM Identification No. 2013-34567
	Drawn By: J. DuMond
Project Number 21-0758-01E	Approved: M. Casper
Date: December 12, 2022	DWG: 21-0758-01_vault

Figure 1

Site Vicinity Map



Patriot Engineering & Environmental, Inc.

LEGEND

- Parcel Line
- Clawson Property Boundary
- W — Water Line
- GAS — Gas Line
- FO — Fiber Optic Line
- Outdoor Air Sample Location
- Indoor Air Sample Location
- Sub-Slab Vapor Sample Location
- Paired Indoor Air and Sub-Slab Vapor Sample Location
- Wooded area with fill and debris

Project: Underground Vault Pilot Study Report & RWP HRID / Crossroads Recycling Franklin, Indiana IDEM Identification No. 2013-34567	
	Drawn By: J. DuMond
Project Number 21-0758-01E	Approved: M. Casper
Date: December 12, 2022	DWG: 21-0758-01_vault

Figure 2

Crossroads Recycling
VI Sample Location Map

Patriot Engineering & Environmental, Inc.

LEGEND

- Soil Boring Location
- Patriot Monitoring Well Location
- Core Hole Sample Inside Vault
- Core Hole Sample Outside Vault
- Approximate Vault Perimeter

Project: Underground Vault Pilot Study Report & RWP HRID / Crossroads Recycling Franklin, Indiana IDEM Identification No. 2013-34567	
	Drawn By: J. DuMond
Project Number21-0758-01E	Approved: M. Casper
Date: January 4, 2023	DWG: 21-0758-01_vault

Figure 3

Approximate Area of Underground Vaults

Patriot Engineering & Environmental, Inc.

LEGEND

- Soil Boring Location
- Patriot Monitoring Well Location
- Sub-Slab Soil Gas Sampling Location
- Confirmatory Soil Sampling Location
- Approximate Vault Perimeter

Project: Underground Vault Pilot Study Report & RWP
HRID / Crossroads Recycling
Franklin, Indiana
IDEM Identification No. 2013-34567

	Drawn By: J. DuMond
Project Number 21-0758-01E	Approved: M. Casper
Date: January 4, 2023	DWG: 21-0758-01_vault

Figure 4

Sub-Slab Soil Gas and Confirmatory Soil Sampling Locations

APPENDIX B

TABLES

TABLE 1

SUMMARY OF VAPOR INTRUSTION LABORATORY ANALYTICAL RESULTS

HURRICANE ROAD INDUSTRIAL DEVELOPMENT - CROSSROADS RECYCLING BUILDING

FRANKLIN, INDIANA

PATRIOT PROJECT NUMBER 19-1979-01E

Sample Identification	Date Collected	Volatile Organic Compounds (VOCs) via TO-15																												
		1,1,1-Trichloroethane	1,1-Dichloroethene	1,2,4-Trimethylbenzene	2-Butanone (MEK)	2-Propanol	Acetone	Benzene	Carbon disulfide	Carbon tetrachloride	Chloroform	Chloromethane	Cyclohexane	Dichlorodifluoromethane	Ethanol	Ethyl acetate	Ethylbenzene	Methylene Chloride	Tetrachloroethene	Tetrahydrofuran	Toluene	Trichloroethene	Trichlorofluoromethane	cis-1,2-Dichloroethene	m&p-Xylene	n-Heptane	n-Hexane	o-Xylene	trans-1,2-Dichloroethene	All Remaining VOCs
Indoor and Outdoor Air																														
IA-1	01/09/2020	<0.46	<0.41	<0.67	0.89 J	<1.0	6.1 J	0.53	<0.33	<0.64	<0.29	0.69	<0.53	1.7	7.0	<0.28	<0.45	2.2 J	0.47 J	<0.39	1.4	18.7	1.1 J	0.38 J	<1.0	<0.57	0.97 J	<0.51	<0.42	BRL
	2/19/2020	<0.46	<0.41	0.72 J	1.3 J	1.4 J	4.7	0.86	<0.33	<0.64	<0.29	0.81	0.59 J	2.6	22	<0.28	0.69 J	<1.8	0.96 J	<0.39	3.2	30.8	1.5 J	0.56 J	2.3 J	<0.57	1.0 J	<0.51	<0.42	BRL
IA-2	01/09/2020	<0.49	<0.43	<0.71	0.59 J	2.1 J	8.2 J	0.49 J	<0.35	<0.68	<0.31	0.69	<0.56	1.8	70.4	3.4	<0.48	2.8 J	1.5	<0.40	1.5	95.7	1.1 J	1.0 J	<1.1	2.8	0.82 J	<0.54	<0.45	BRL
	2/19/2020	<0.48	<0.42	1.0 J	<0.57	1.9 J	8	2.1	<0.34	<0.66	<0.30	0.81	1.7 J	2.5	63.5	1.6	1.1 J	<1.9	2.6	<0.40	7.5	141	1.5 J	1.8	5.4	3.7	3.1	1.1 J	<0.44	BRL
IA-3	01/09/2020	<0.41	<0.37	<0.61	1.3 J	<0.93	6.2 J	0.57	<0.29	<0.57	<0.26	0.68	<0.47	1.6	8.9	<0.25	<0.41	<1.6	0.52 J	<0.39	1.8	16.1	1.0 J	0.30 J	<0.94	<0.51	0.77 J	<0.46	<0.38	BRL
	2/19/2020	<0.46	<0.41	0.98 J	0.81 J	2.7 J	3.8	1.0	<0.33	<0.64	<0.29	0.83	0.66 J	2.8	17.5	<0.28	0.79 J	<1.8	0.99 J	<0.39	4.3	29.7	1.6 J	0.49 J	2.7	<0.57	1.4	<0.51	<0.42	BRL
IA-4	01/09/2020	<0.44	<0.39	<0.64	0.85 J	<0.98	4.2 J	0.55	<0.31	<0.60	<0.28	0.7	<0.50	1.8	5.1	<0.27	<0.43	4.6 J	0.57 J	<0.62	1.9	21.8	1.1 J	0.42 J	<0.99	<0.54	1.3	<0.49	<0.40	BRL
	2/19/2020	<0.73	<0.65	<1.1	<0.87	<1.7	<2.9	0.96	<0.52	<1.0	<0.46	0.88 J	<0.84	2.9	14.3	<0.45	0.84 J	<2.9	1.1 J	<0.62	3.9	36.2	1.6 J	0.61 J	2.9 J	<0.90	1.4 J	<0.82	<0.68	BRL
IA-5	01/09/2020	<0.43	<0.38	<0.63	1.5 J	2.4 J	3.7	0.71	<0.30	<0.60	<0.27	0.61	<0.49	2.0	6.7	<0.26	<0.42	11.5	0.55 J	<0.38	2.3	19	1.0 J	0.40 J	1.3 J	<0.53	1.9	<0.48	<0.40	BRL
	2/19/2020	<0.44	<0.39	0.81 J	<0.53	2.9 J	3.3 J	0.88	<0.32	0.62 J	<0.28	0.8	0.54 J	2.6	12.5	<0.27	0.67 J	<1.7	0.66 J	<0.38	3.2	21.4	1.6 J	<0.32	2.3 J	0.56 J	1.1	<0.50	0.73 J	BRL
IA-6 (8 hour IA-2)	2/19/2020	<0.54	<0.48	<0.79	<0.65	3.1 J	15.7	0.69	<0.38	<0.75	<0.34	1.3	<0.62	2.8	49	1.5	<0.53	26.5	0.63 J	<0.46	2.0	32.1	1.6 J	0.40 J	<1.2	1.4 J	5.8	<0.60	<0.50	BRL
IA-7 (8 hour IA-1)	2/19/2020	<0.50	<0.44	<0.73	<0.59	<1.1	3.3 J	0.64	<0.35	<0.69	<0.32	0.88	<0.57	2.7	11.6	<0.31	<0.49	<1.9	<0.51	<0.42	1.5	1.5	1.5 J	<0.35	<1.1	<0.61	<0.50	<0.55	<0.46	BRL
IA-8 (8 hour IA-3)	2/19/2020	<0.50	<0.44	<0.73	3.3 J	1.2 J	9.3	0.88	<0.35	<0.69	<0.32	0.84	<0.57	2.8	13.4	<0.31	<0.49	<1.9	<0.51	<0.42	2.2	2.4	1.6 J	<0.35	1.4 J	<0.61	0.75 J	<0.55	<0.46	BRL
OA-1	01/09/2020	<0.44	<0.39	<0.64	2.1 J	<0.98	4.3	0.59	<0.31	<0.60	<0.28	0.77	<0.50	2.3	3	<0.27	<0.43	2.3 J	<0.44	<0.39	0.78 J	<0.36	1.3 J	<0.31	<0.99	<0.54	<0.44	<0.49	<0.40	BRL
	2/19/2020	<0.46	<0.41	<0.67	1.8 J	<1.0	4.8	0.40 J	<0.33	<0.64	<0.29	0.74	<0.53	2.7	6.6	<0.28	<0.45	<1.8	<0.47	<0.39	0.80 J	1.1	1.4 J	<0.33	<1.0	<0.57	<0.46	<0.51	0.72 J	BRL
IDEM RCG Residential Indoor Air VESLs		5,200	210	63	5,200	210	32,000	3.6	730	4.7	1.2	94	6,300	100	NE	73	11	630	42		5,200	2.1	NE	NE	NE	420	730	100	NE	Varies
IDEM RCG Industrial Indoor Air VESLs		22,000	880	260	22,000	880	140,000	16	3,100	20	5.3	390	26,000	440	NE	310	49	2,600	180		22,000	8.8	NE	NE	NE	1,800	3,100	440	NE	Varies
Sub-Slab Soil Vapor																														
SS-1	01/09/2020	0.61 J	<0.39	<0.64	1.3 J	2.7 J	10	1.5	<0.31	<0.60	4.4	0.28 J	1.2 J	1.7	16.6	0.74 J	<0.43	10.1	3.3	<0.50	4.4	3,350	1.2 J	107	<0.99	1.2 J	2.0	<0.49	1.3	BRL
	2/19/2020	<0.52	0.83 J	<0.76	1.6 J	4.1 J	18.4	0.58	<0.37	<0.72	1.8	0.33 J	<0.59	2.4	35.2	<0.32	0.79 J	<2.0	0.79 J	0.84 J	3.1	781	1.3 J	54.6	3.0	<0.64	0.94 J	<0.58	1.4	BRL
SS-2	01/09/2020	<214	213 J	<312	<255	<482	<836	<106	<151	<297	1,900	<108	<244	<203	<561	<131	<211	<836	9,780	<0.50	<243	1,270,000	<253	18,800	<483	<263	<215	<238	348 J	BRL
DUP (SS-2)	01/09/2020	<214	223 J	<312	<255	<482	<836	<106	<151	<297	1,860	<108	<244	<203	<561	<131	<211	<836	9,570	<0.50	<243	1,570,000	<253	18,600	<483	<263	<215	<238	350 J	BRL
SS-2	2/19/2020	<214	<189	<312	<255	<482	<836	<106	<151	<297	1,190	<108	<244	<203	<561	<131	<211	<836	3,200	<180	<243	1,360,000	<253	14,100	<483	<263	<215	<238	260 J	BRL
DUP (SS-2)	2/19/2020	<13.3	89.5	<19.5	<15.9	<30.1	<52.3	<6.6	<9.5	<18.5	661	<6.7	<15.2	<12.7	122	<8.2	<13.2	<52.3	1,740	<11.3	<15.2	1,650,000	<15.8	29,500	<30.2	<16.4	<13.4	<14.9	147	BRL
SS-3	01/09/2020	<0.45	<0.40	<0.66	<0.54	2.3 J	8.8	0.77	0.42 J	<0.63	0.76	<0.23	<0.52	1.4 J	37.4	<0.28	<0.45	2.7 J	12.2	<0.50	2.1	169	0.97 J	0.87 J	<1.0	<0.55	1.2	<0.50	<0.42	BRL
	2/19/2020	<0.60	<0.53	<0.87	<0.71	3.3 J	8.6	0.59 J	0.47 J	<0.83	1.0	<0.30	<0.68	2.8	54.7	2.3	1.1 J	33.8	10.2	<0.50	6.8	252	1.7 J	2.7	4.5	<0.73	3.9	<0.66	2.7	BRL
SS-4	01/09/2020	<0.44	<0.39	0.82 J	1.1 J	1.7 J	12.6	0.8	2.2	<0.60	9.7	<0.22	<0.50	1.7	67	<0.27	0.76 J	<1.7	78.5	<0.50	2.8	6,440	1.1 J	74	2.7	<0.54	1.1	0.96 J	3.0	BRL
	2/19/2020	<0.46	0.66 J	0.92 J	<0.55	5.5	13.9	1.0	2.5	<0.64	9.5	0.42 J	0.74 J	2.8	104	0.95 J	0.87 J	<1.8	2.7	1.0	3.8	1,660	1.6 J	73.8	3.5	0.72 J	1.4	0.54 J	3.2	BRL
IDEM RCG Residential SGSSLs		173,333	7,000	2,100	173,333	7,000	1,066,667	120	24,333	157	40	3,133	210,000	3,333	NE	2,433	367	21,000	1,400	2,100	173,333	70	NE	NE	NE	14,000	24,333	3,333	NE	Varies
IDEM RCG Industrial SGSSLs		733,333	29,333	8,667	733,333	29,333	4,666,667	533	103,333	667	177	13,000	866,667	14,667	NE	10,333	1,633	86,667	6,000	8,800	733,333	293	NE	NE	NE	60,000	103,333	14,667	NE	Varies

Notes

All results reported in micrograms per meter cubed (ug/m3)

BOLD = Constituent detected above Method Dectection Limit

BOLD = Constituent detected above IDEM RCG Residential VESLs

BOLD = Constituent detected above IDEM RCG Industrial VESLs

BOLD = Constiuent detected in oudoor air at concentration similar to indoor air

J = Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit

NE = No Screening Level Established for Constituent

IDEM = Indiana Department of Environmental Management

RCG = Remediation Closure Guide

VESL = Vapor Exposure Screening Level

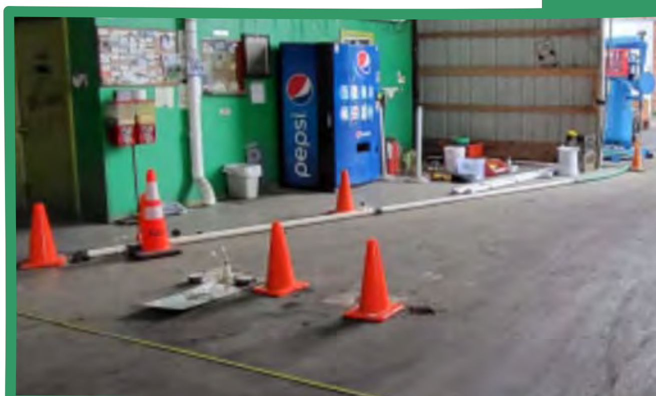
SGSSL = Soil Gas Subslab Screening Level obtained by dividing Indoor Air VESLs by an attenution factor of 0.03

APPENDIX C

SVE PILOT TEST REPORT

Soil Vapor Extraction Pilot Test Report

Crossroad Recycling
Franklin, Indiana



Prepared For:

Patriot Engineering and Environmental
6150 East 75th Street
Indianapolis, Indiana

Prepared By:

Specialty Earth Sciences, LLC
4350 Security Parkway
New Albany, Indiana 47150

SOIL VAPOR EXTRACTION PILOT TEST REPORT

September 1, 2022

Mr. Michael F. Casper, LPG
Patriot Engineering and Environmental, Inc.
6150 East 75th Street
Indianapolis, Indiana 46250

Re: Soil Vapor Extraction Pilot Test Report
Crossroads Recycling
1062 Eastview Drive
Franklin, Indiana
SE SCIENCES PROJECT NO.: 10475-22-441

Dear Mr. Casper:

Specialty Earth Sciences, LLC (SE Sciences) is pleased to submit this summary of results from soil vapor extraction (SVE) pilot testing activities conducted at the subject site on behalf of Patriot Engineering and Environmental, Inc (Patriot).

The findings and interpretations contained herein are based upon the data reviewed and documented within this letter report.

Sincerely,
SPECIALTY EARTH SCIENCES, LLC

CERTIFIED HAZARDOUS MATERIALS MANAGER JASON A. SWEARINGEN 10774 CHMM

Jason A. Swearingen, CHMM
Principal Environmental Scientist

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APPENDICES

1.0 INTRODUCTION

Specialty Earth Sciences, LLC (SE Sciences) performed soil vapor extraction (SVE) pilot testing at the Crossroads Recycling Building located at 1062 Eastview Drive, Franklin, Indiana (Site). The Site is a scrap metal recycling facility located northeast of downtown Franklin (see **Figure 1 – *Site location***). SE Sciences was contracted by Patriot Engineering and Environmental, Inc (Patriot) to perform a SVE pilot test at the Site to assess the feasibility of the technology applied to the Site-specific conditions.

2.0 GEOLOGY

The Site lies within the Trafalgar Formation, a loamy glacial till of the Erie-Huron Lobe. The Trafalgar Formation includes a variety of depositional environments of which the Site lies within an area of hummocky morainal topography (IGS, 1989).

Bedrock mapped in the region beneath the unconsolidated till is Devonian age black and greenish gray shales of the New Albany Shale formation (IGS, 1987). The depth to bedrock is inferred from published data to range from approximately 150 to 200 feet below ground surface (ft bgs) (IGS, 2016).

The SVE pilot test wells were installed by Patriot, as such, the Site-specific geology was not provided; however, it is our understanding that test wells were all installed within a subsurface concrete vault filled with sand.

3.0 PILOT TEST WELL INSTALLATIONS

The SVE pilot test wells were installed by Patriot prior to the pilot test. The test wells included: one (1) SVE well (SVE-1) and three (3) vapor monitoring/observation wells (VM-1, VM-2, and VM-3). Refer to **Figure 2 – *SVE Pilot Test Well Locations*** for a graphical depiction of the test well locations.

3.1 Extraction Well Construction

The SVE well was constructed with 2” diameter, flush-threaded Schedule 40 polyvinyl chloride (PVC) well screen and casing. Construction details include five (5) feet of 0.010-inch factory-slotted well screen placed at an interval of approximately 5 to 10 feet-bgs.

3.2 Observation Well Construction

The observation wells (VM-1, VM-2, and VM-3) were constructed with 1” diameter, flush-threaded Schedule 40 PVC well screen and casing. The three (3) observation wells were constructed with five (5) feet of 0.010-inch factory-slotted well screen placed at an interval of approximately 5 to 10 feet-bgs.

4.0 SOIL VAPOR EXTRACTION TESTS

The SVE pilot test utilized one (1) extraction well (SVE-1) to apply vacuum to a sand-filled, concrete vault. The subsurface vault was located within the eastern portion of the Site building and was measured to be approximately 24 ft long by 29 ft wide and approximately 10 ft deep.

Three (3) observation wells (VM-1, VM-2, and VM-3) were monitored during test activities.

4.1 General SVE Test Methodologies

A 5-hp positive displacement blower unit with variable speed motor control was utilized to provide an applied vacuum to the subsurface, sand-filled vault. Ancillary SVE equipment included an air-water separator vessel, inlet filter assembly, discharge silencer, vacuum and pressure gauges, temperature gauges, air velocity monitoring instrumentation, and portable generator.

SVE PILOT TEST EQUIPMENT

SVE PILOT TEST WELL LAYOUT

Differential pressure gauges were connected to observation wells VM-1, VM-2, and VM-3 to measure vacuum response relative to atmospheric pressure conditions. This information was utilized to estimate the vacuum radius of influence (ROI) under varying levels of applied negative pressure, air flow, and groundwater extraction. All measurements were documented and recorded at predetermined time intervals as illustrated in the attached pilot test data sheets attached as **Appendix A – SVE *Pilot Test Data Sheet***.

Prior to initiating the positive displacement blower and applying vacuum to the subsurface, baseline pressure readings were obtained from the SVE well and performance observation wells. Upon completion of baseline measurements, the vacuum blower was activated.

The following SVE performance parameters were periodically measured and recorded during the pilot test:

- Subsurface negative pressures were measured and recorded at each observation wellhead (in-H_2O) using a Magnehelic® differential pressure gauges.
- Air velocity (feet per minute [fpm]) and corresponding air flow rates were measured and recorded at the vacuum blower intake (influent) using a digital thermal anemometer.
- The vacuum blower variable frequency drive (VFD) was incrementally increased during each SVE pilot test and subsequent air flow velocity (fpm) were recorded.
- Applied vacuum levels were measured and recorded at the SVE-1 wellhead using a vacuum gauge with a 0 to 100 in-H_2O range.
- Volatile Organic Compounds (VOCs) were field screened at the PD blower exhaust utilizing a photo-ionization detector (PID).

SVE pilot test findings for SVE-1 were as follows:

- Applied vacuum readings ranged from 1.2 to 2.6 inches of water column (in-H_2O).
- Measured air velocities associated with the above referenced applied vacuum readings ranged from 4,500-6,400 feet per minute (fpm).
- Calculated air flows ranged from 97.5 to 138.2 standard cubic feet per minute (scfm).

- Effluent air stream contaminant concentrations ranged from 0.2 to 3.5 parts per million (ppmV) via PID.
- The SVE performance parameter schedule utilized during testing is detailed in **Table 1 – *SVE Test Criteria: Performance Parameter Schedule***.

4.2 SVE Pilot Test Analyses

The following section summarizes field data collected during the SVE pilot test, estimates of the SVE ROI, and recommended SVE system performance criteria.

-Vacuum Response-

Using empirical methods to develop an input factor for estimating the vacuum ROI of SVE-1, observed vacuum data (y-axis) for each observation well was plotted against linear distance (x-axis) and evaluated accordingly. Based upon accepted industry practices, sufficient vacuum influence for the source area was considered the distance where the normalized vacuum (observed vacuum divided by applied vacuum) trend line intersected the 0.1″ H_2O column vacuum scaled value (please refer to the attached **Table 2 – *Plotted Test Results in Subsurface***). If all data at the optimum condition was utilized, an approximate vacuum ROI of 20-feet is estimated.

-Air Flow Extraction Rates-

Based on reduced data collected during the pilot test from the vacuum inlet piping, the optimum air flow rate at SVE-1 observed during operation of the PD blower was 138.2 scfm @ 2.6 in-H_2O.

-VOC Vapor Concentrations-

Laboratory analytical air samples were not collected as part of this pilot test. PID readings were collected from the pilot test PD blower exhaust. The PID readings illustrate that extracted vapor concentrations increased over the duration of the SVE pilot test, which demonstrates proof-of-concept for the desired effect (Appendix A).

5.0 CONCLUSIONS

The SVE pilot testing indicated that vapor control can be effectively achieved using this technology.

SVE pilot testing activities indicated favorable subsurface vacuum response and contaminant vapor capture. As such, SVE is considered a viable technology based on the following:

- PID results of vacuum blower exhaust vapor samples indicate that applied vacuum successfully captured target contaminants.
- Vacuum response and extracted vapor concentration increased with higher applied vacuum conditions. Therefore, maintaining the applied vacuum at approximately 2.6 in-H_2O is recommended to achieve maximum vapor recovery. A favorable vacuum ROI is estimated at 20-feet.
- Considering the treatment area is within an enclosed concrete vault (approximately 24 ft x 29 ft x 10 deep), the existing extraction and monitoring wells should suffice for the full-scale SVE system design.

6.0 RECOMMENDATIONS

Based upon the favorable pilot testing results, SE Sciences recommends the following:

- Develop a full scale SVE design, including the following deliverables:
    - SVE well locations figure
    - SVE zone of influence figure
    - remedial well construction schedule
    - remediation system placement and conveyance lines figure
    - SVE well, wellhead and vault details
    - conveyance line friction loss schedule
    - remediation system operations schematic
    - remediation system operations and maintenance schedule.

-END OF DOCUMENT-

TABLES

SVE CRITERIA:
PERFORMANCE PARAMETER SCHEDULE

	Parameter	Points of Observation	Units/Detection Limits	Method
	Vacuum	VM-1, VM-2, AND VM-3 (well heads)	Inches of Water Column	Magnehelic Gauges
		SVE-1 (well head)	Inches of Water Column	0-100″ H2O Gauge
		Barometric Background	Inches of Water Column	3-0-3 Dual Mag. Gauge
	Air Velocity	SVE-1 (well head piping)	Feet Per Minute	Pitot Tube and Mag Gauge Thermal Anemometer

TABLE 2
PLOTTED TEST RESULTS IN SUBSURFACE

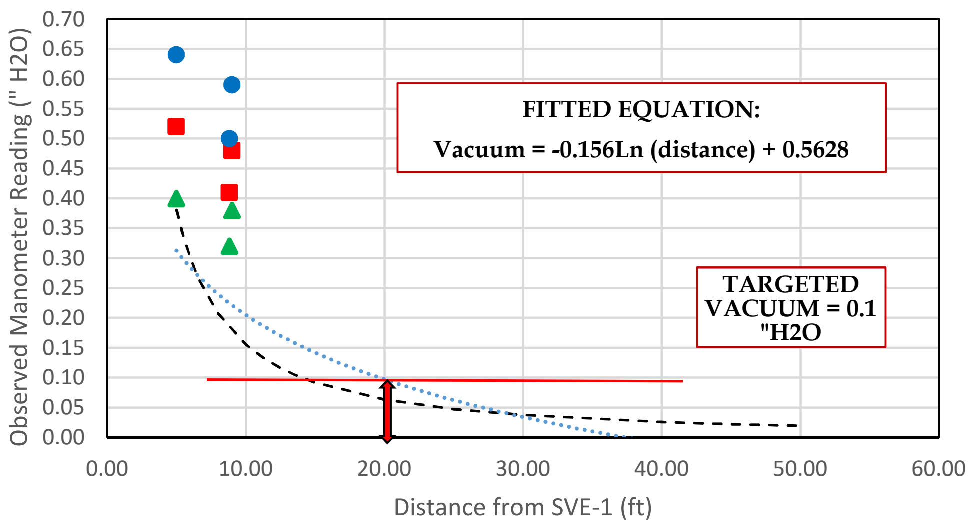
Well ID:	SVE-1	VM-1	VM-2	VM-3	
Purpose:	Extraction	Observation			
Offset Distance (ft):	0	5.00	9.00	8.83	
Applied Vacuum (inH$_2$O)		**Observed Vacuum Response (inH$_2$O)**			
1.3		0.40	0.38	0.32	
1.9		0.52	0.48	0.41	
2.6		0.64	0.59	0.50	

Notes:

Prepared By/Date: EL 9/13/22

inH$_2$O Inches of Water Column

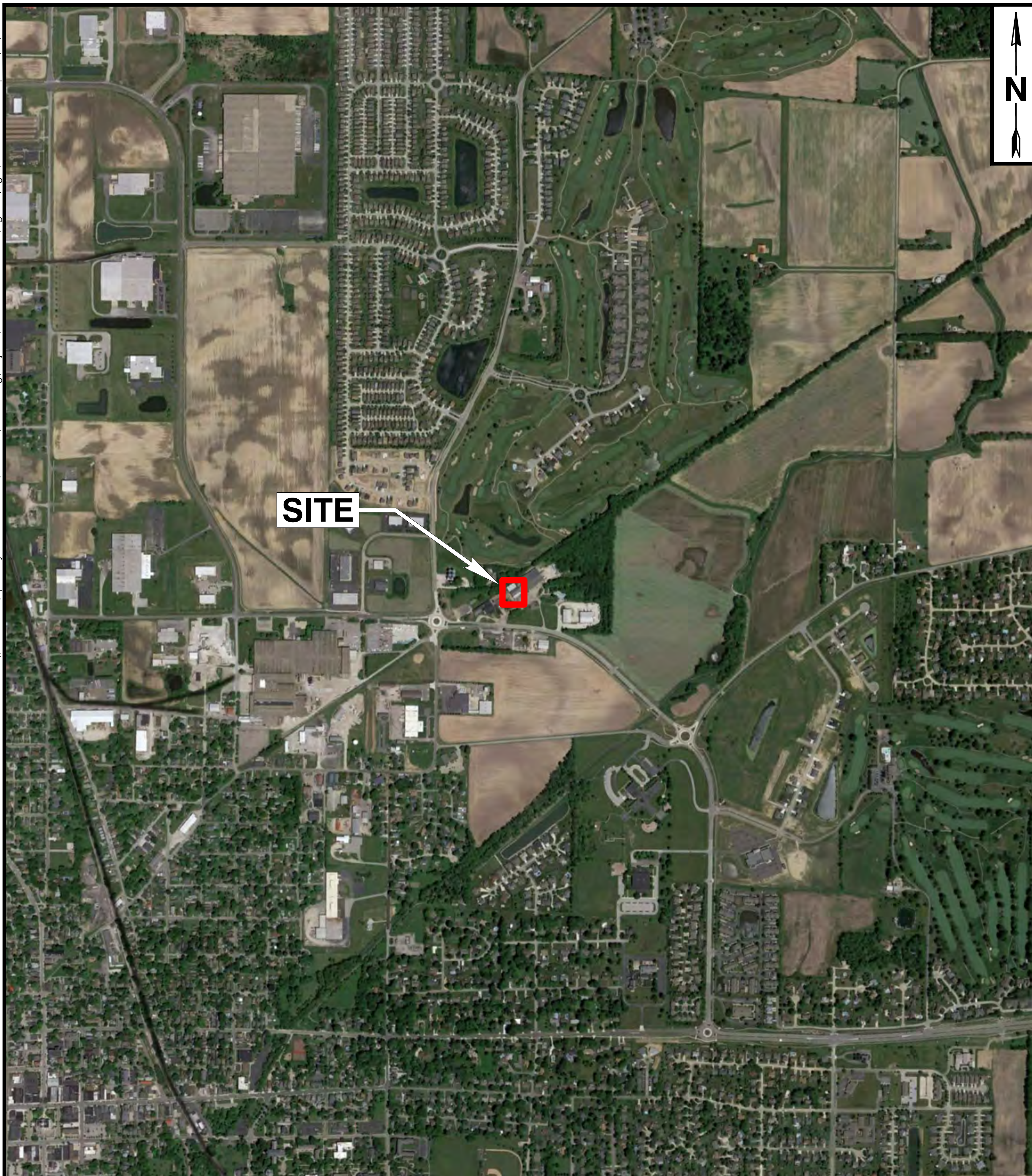
Checked By/Date: JS 9/14/22



ROI to Achieve Reponse: 20 ft

Applied Vacuum ("H2O)	Air Velocity (fpm)	Diameter Pipe (in)	Air Flow Rate (acfm)	Temperature (°F)	Air Flow Rate (scfm)
1.3	4500	2	98.2	70	97.5
1.9	5500	2	120.0	70	119.0
2.6	6400	2	139.6	70	138.2

FIGURES



Specialty Earth Sciences
Technical Center
4350 Security Parkway
New Albany, IN 47150

0 0.25 0.50
APPROXIMATE SCALE IN MILES

EXPLANATION

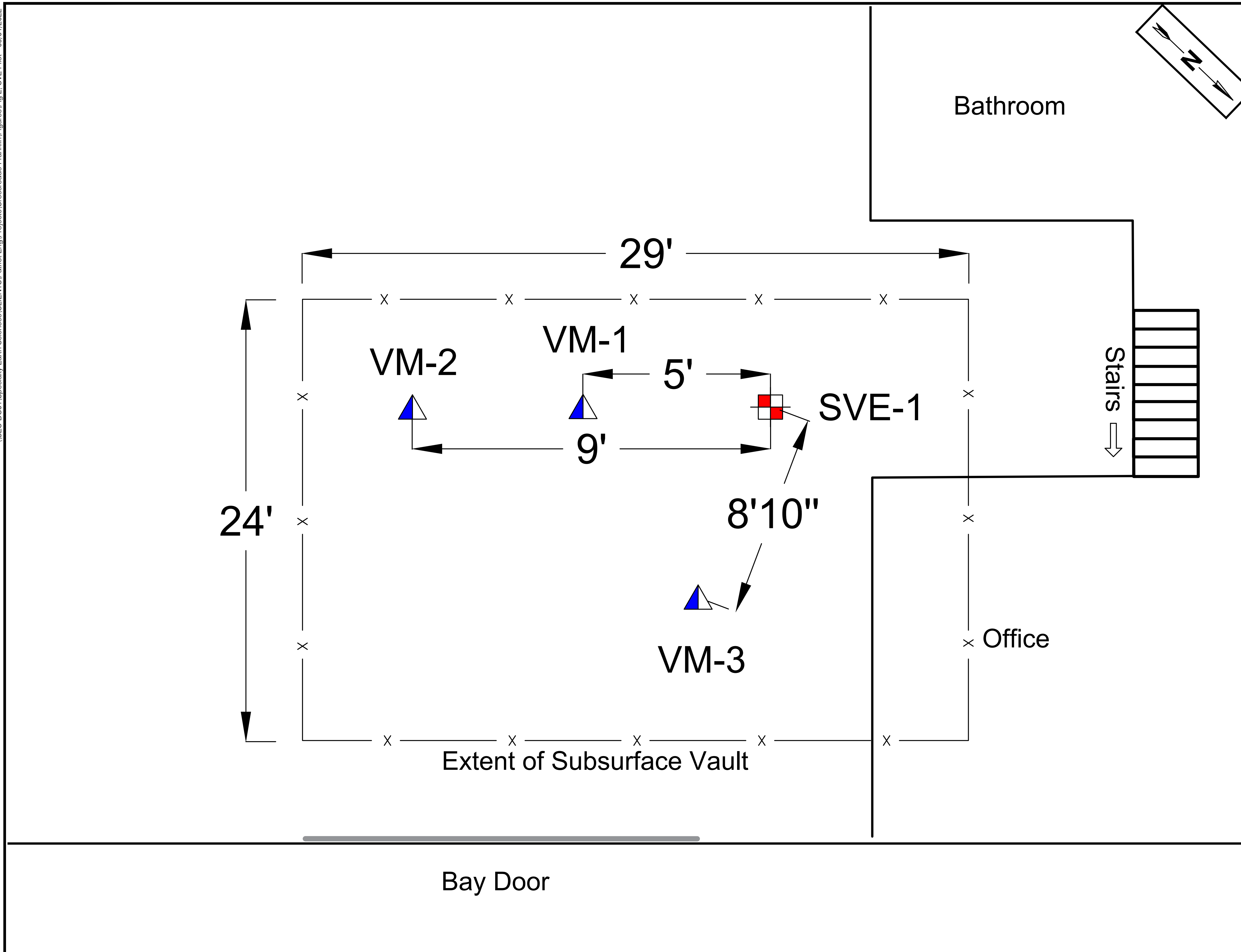
Site Location

Map Source: Google Earth

SITE LOCATION

Crossroads Recycling
1062 Eastview Drive, Franklin IN

Checked By	Project Number	Figure
EL	4350-22-441	1
Drafter	Date	
AT	9/1/2022	



EXPLANATION BLOCK

- SVE-1 Soil Vapor Extraction Well
- VM-1 Vapor Monitoring Well
- —x— Extent of Subsurface Vault
- Building Footprint
- Bay Door
- 5' Distance in Feet

0 2.5 5
APPROXIMATE SCALE IN FEET

Specialty Earth Sciences
Technical Center
4350 Security Parkway
New Albany, IN 47150

SVE PILOT TEST
WELL LOCATIONS

Project	Crossroads Recycling 1062 Eastview Drive, Franklin IN, 46131
Date	September 1, 2022
Project Number	4350-22-441
Figure	2
PE/PG	EL
PM	JS
Drafter	AT

APPENDIX A

SVE PILOT TEST DATA SHEETS

SOIL VAPOR EXTRACTION PILOT TEST
DATA SHEET

Client: Patriot Engineering — Site Personnel: EL / AT

Site Name: Crossroads Recycling, Franklin, IN. — Barometric:

Project Number: 4350-22-441 — Weather : 70° F — Project Manager: J. Swearingen

Test Date: 6/7/2022 — Start Time: 10:00 — Relative Humidity: 60-70%

Pilot Test Data							Monitored Test Wells			
							VM-1	VM-2	VM-3	
							Distance: 5 ft	Distance: 9 ft	Distance: 8.8 ft	Distance:
Actual Time (hr:min)	Elapsed Time (hr:min)	Blower Vacuum (inch H2O)	Wellhead Vacuum Applied (inch H2O)	PID (ppm)	Air Velocity (fpm @ static) Pitot Tube	Motor Speed (Hz)	Vacuum (inch H2O)	Vacuum (inch H2O)	Vacuum (inch H2O)	Vacuum (inch H2O)
10:00	0:00	0	0.0	0	0	0	0.00	0.00	0.00	
10:05	0:05		1.2		4,500		0.40	0.38	0.32	
10:15	0:15		1.3	0.2	4,500		0.40	0.38	0.32	
10:30	0:30		1.3	0.2	4,500		0.40	0.38	0.32	
10:45	0:45		2.6		6,400		0.63	0.58	0.50	
11:00	1:00	34"	2.6		6,400		0.63	0.59	0.50	
11:15	1:15		2.6	1.2	6,400		0.64	0.59	0.50	
11:30	1:30		2.6		6,400		0.64	0.59	0.50	
11:45	1:45	34"	2.6		6,400		0.64	0.59	0.50	
12:00	2:00		2.6	2.0	6,400		0.64	0.59	0.50	
12:15	2:15	34"	2.6		6,400		0.64	0.59	0.50	
12:30	2:30		2.6		6,400		0.64	0.59	0.50	
12:45	2:45	34"	2.6	3.0	6,400		0.64	0.59	0.50	
13:00	3:00		2.6		6,400		0.64	0.59	0.50	
13:15	3:15		2.6		6,400		0.64	0.59	0.50	
13:30	3:30		2.6		6,400		0.64	0.59	0.50	
13:45	3:45		2.6	3.5	6,400		0.64	0.59	0.50	
14:00	4:00		1.9		5,500		0.53	0.48	0.42	
14:10	4:10	27"	1.9		5,500		0.52	0.48	0.41	
14:20	4:20		1.9		5,500		0.52	0.48	0.41	
14:30	4:30	27"	1.9		5,500		0.52	0.48	0.41	

Notes:

APPENDIX D

SVE SYSTEM DESIGN AND LAYOUT

SOIL VAPOR EXTRACTION (SVE) SYSTEM DESIGN AND LAYOUT

Mr. Michael F. Casper, LPG
Patriot Engineering and Environmental, Inc.
6150 East 75th Street
Indianapolis, Indiana 46250

October 22, 2022

Subject: **Crossroads Recycling**
1062 Eastview Drive
Franklin, Indiana
SE SCIENCES PROJECT NO.: 10475-22-441

Dear Mr. Casper:

Specialty Earth Sciences, LLC (SE Sciences) has completed remedial design for the soil vapor extraction (SVE) system to be located at the Crossroads Recycling facility in Franklin, Indiana.

This document includes full-scale SVE system equipment and installation details. Document preparation has been based upon site specific historical data review, site specific SVE pilot test data (June 7, 2022), past work experience at similar sites within the local area, and a standard industry of care.

SE Sciences appreciates the opportunity to assist Patriot Engineering and Environmental, Inc. on this project. Please feel free to contact us at (812) 945-0733 should you have any questions or comments regarding this compilation.

Sincerely,
SPECIALTY EARTH SCIENCES, LLC

CERTIFIED HAZARDOUS MATERIALS MANAGER
JASON A. SWEARINGEN
10774
CHMM

Jason A. Swearingen, CHMM
Principal Environmental Scientist

Technical Center • 4350 Security Pkwy • New Albany, IN 47150 • 812.945.0733 Phone • 812.945.0735 Fax • www.sesciences.com
Central Office • 9963 Crosspoint Boulevard • Indianapolis, IN 46256 • 317.245.6278 Phone

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1.0 SVE SYSTEM DESIGN AND LAYOUT

1.1 SVE Major Component General Description

SVE Well(s)

Based on the conditions at the recycling facility, the proposed SVE system has been designed with a 20 foot radius of influence (ROI) as related to the subsurface sands found within each concrete vault. Data generated during the on-site SVE pilot test, past professional experience at similar sites in the area, and peer reviewed reference material were utilized to develop these design criteria.

The proposed SVE target area will be comprised of three (3) SVE extraction wells; each located within an enclosed, subsurface vault. The general design for each SVE well will consist of 2" diameter, flush-threaded Schedule 40 polyvinyl chloride (PVC) well screen and casing. Construction details will include five (5) feet of 0.010-inch factory-slotted well screen placed at an interval of approximately 5 to 10 feet-bgs., each connecting to a 2 to 3-inch solid conveyance line extending to the remediation equipment.

SVE Well(s) Inlet Piping/Valves

Extracted soil vapor will pass from the extraction well network (located beneath the recycling facility) into the remediation system through the SVE well inlet piping/valves manifold assembly. Vacuum gauges (with readings in inches of H_2O) will be attached to the well inlets for operations and maintenance (O&M) monitoring and to monitor SVE efficiency. A sample port will also be installed at each manifold inlet to allow for vapor sampling. A series of shutoff valves will be incorporated into the inlet piping along with a "fresh air bleed", to better control flow rates and applied vacuum pressure to the three (3) individual SVE extraction wells.

Rotary Lobe Positive Displacement (PD) Vacuum Blower

A site specific vacuum level of approximately 3 inches of H_2O (based on pilot test findings) will be generated by utilizing a 5-10 hp positive displacement (PD) vacuum blower configuration. The applied vacuum will be capable of inducing a cumulative air flow of approximately 435 cubic feet per minute (cfm) (based on the pilot test findings). The applied vacuum and air flow extraction will allow effective recovery of chlorinated hydrocarbon laden soil vapor beneath the Crossroads recycling facility.

The PD vacuum blower motor will be connected to an adjustable ambient air dilution valve, to enable vacuum level control. Various temperature, vacuum, and pressure gauges will be attached to the PD vacuum blower configuration to promote longevity of the equipment and to monitor system productivity. An oil level indicator will also be present on the PD vacuum blower to allow routine inspection of operational fluid levels without interruption of system performance.

Air Water Separator (AWS) Vessel

The AWS is a collection point for soil moisture and condensation that are recovered from the extraction wells by the PD vacuum blower unit. Air is allowed to pass through the tank, while liquids are accumulated and contained for later treatment. The extracted vapor passes from the AWS tank, through the PD vacuum blower, and exhausts to atmosphere.

A high/high level float switch will be connected to the AWS to provide overfill protection and fault notification. Float switch controls will be directly wired into the system's control panel. If accumulated water reaches the height of the high/high level float switch, the remediation system will shut down.

1.2 SVE System Performance Specifications

SVE Extraction Wells

Total Airflow:	435 cfm
Total Vacuum:	2.6″ H_2O column
Well Depth:	10 ft. below grade
Est. ROI:	20 ft. per well (approx.)

PD Vacuum Blower

Total Airflow and Vacuum Demand:

138 cfm per extraction well x 3 extraction wells x 1.05 S.F. = 435 cfm

2.6″ H_2O x 1.15 S.F. (accounts for calculated friction loss) = 3″ H_2O.

435 cfm @ 3″ H_2O total vacuum blower demand.

1.3 SVE System Equipment Details

1.3.1 Vacuum Extraction Blower and Associated Equipment

PD VACUUM BLOWER PACKAGE:

-(1) Tuthill brand, Model 4007-21L2 Competitor Plus or equivalent.
-(1) 5-10 bhp, 230/ 460, /1 or 3/, 1750 rpm, TEFC motor.
-capable of 475 icfm @ 3″ H_2O column.
-positive displacement construction.
-pneu-pack 33-30-C standard package with v-belt drive and OSHA guard.
-(1) incorporated vacuum relief valve.
-(1) inline L-type particulate filter (between A/W separator and blower).
-(1) chamber-absorptive discharge silencer.
-(1) sample port (effluent discharge of blower).
-(1) 2″ adjustable dilution valve w/ silencer.

PD BLOWER AIR FLOW, VACUUM, AND TEMPERATURE INSTRUMENTATION:

-(1) air flow meter on discharge piping –air velocity.
-(2) vacuum gauges (0-100″ H_2O) located before and after particulate filter.
-(1) temperature gauge (0-300 F.), located on blower effluent piping

1.3.2 Recovered Soil Vapor and Moisture Collection Equipment

SVE INLET MANIFOLD CONSTRUCTION (RECOVERED SOIL VAPOR):

-PVC Sch. 80 construction or the like.
-(1) 2-3″ ID header pipe.
-(3) 2″ ID individual inlets.
-(1) 1-2″ ID auxiliary connection with camlock end connection (eg. purge water treatment and disposal).

SVE INLET MANIFOLD FLOW CONTROL AND INSTRUMENTATION:

-(1) adjustable ball valve assembly, each inlet.
-(1) ¼″ ID sample port each.
-(1) 0 – 100″ H_2O vacuum gauge each.

AIR/ WATER SEPARATOR (AWS) VESSEL CONSTRUCTION:

-steel construction.

-vessel will be vertically mounted with a 13" manway access port for cleaning and maintenance.
-tank size to be approximately 30" diameter.
-Approximately 30 gallon "pump out capacity".
-(1) manual liquid drain, with ball valve control.
-Separator to include (1) stainless steel float switch for overfill protection (high/high level shut-off).
-(1) 2-3" camlock inlet connection.

1.3.3 SVE Controls and Instrumentation

CONTROL PANEL ENCLOSURE

-(1) Nema Type 4/12 Control Panel Enclosure, or equivalent, for operation on 230 volt, 1 or 3-phase, 3 wire, 60 hertz, incoming service.

-(1) 5-10 hp SVE Vacuum Blower

Specifically, the control panel is proposed to consist of the following:

-(1) base relay configuration
-(1 lot) power distribution terminal blocks.
-(1 lot) control and alarm fusing.
-(1) IEC manual motor starters/protectors and contactors.
-(1) Fault reset indicator.

Controls:
-hand-off-auto operation control for: (1) SVE Vacuum Blower

-fault condition display with "latched fault integration".
-fault indicators: See Below.
-fault conditions include: (1) Motor Thermal Overload
High/ High level, AWS Separator

-(1 lot) system interlocks, automatic control and alarm circuit relay logic.
-(1) data pocket, for electrical schematics.
-(1 lot) point to point wire numbering and color coding.
-(1) panel assembly and pre-shipment testing.

1.4 SVE System Documentation

Two (2) O&M manuals are recommended with the SVE system fabrication.

Manual to include system start-up procedures, trouble-shooting guide, aerial view of system layout, P&ID schematic, electrical schematic of control panel, pertinent equipment cut-sheets and pump curves.

General Soil Vapor Extraction (SVE) System Start-Up Procedures are attached as **Appendix A**.

FIGURES

SOIL VAPOR EXTRACTION (SVE) SYSTEM DESIGN

CROSSROADS RECYCLING FACILITY
FRANKLIN, INDIANA

OCTOBER 22, 2022

PREPARED BY:

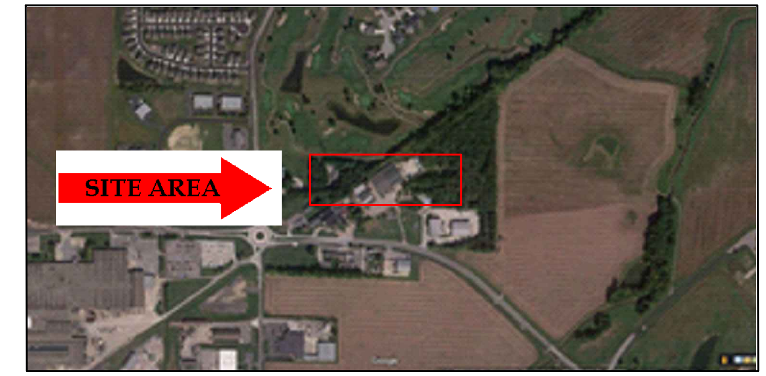
SPECIALTY EARTH SCIENCES, LLC

4350 SECURITY PKWY.
NEW ALBANY, INDIANA 47150
812.945.0733 (p) 812.945.0735 (f)

PROJECT NO. 10475-22-441

SITE LOCATION MAP

NOT TO SCALE



REFERENCE: GOOGLE EARTH (INTERNET)

NORTH

DRAWING INDEX

REV	DATE	BY	SUB	APP	DESCRIPTION	
						DESIGNED JAS
						DRAWN JAS
						CHECKED
						IN CHARGE JAS
						DATE 10-18-22

TITLE: COVER SHEET

FIGURE: i

REV	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED
DRAWN JAS
CHECKED
IN CHARGE JAS
DATE 10-18-22

CLIENT: PATRIOT ENG. & ENV., INC.
PROJECT NAME: CROSSROADS

PROJECT LOCATION: FRANKLIN, IN

SPECIALTY EARTH SCIENCES, LLC
4350 Security Parkway
New Albany, Indiana

SITE MAP

APPROXIMATE SCALE
1" ~ 200'

PROJECT NO.
10475-22-441

DWG NO.
REV.
FIGURE
1

REV	DATE	BY	SUB	APP

LEGEND

Approximate Vault Perimeter

DESIGNED
DRAWN JAS
CHECKED
IN CHARGE JAS
DATE 10-18-22

CLIENT: PATRIOT ENG. & ENV., INC.
PROJECT NAME: CROSSROADS

PROJECT LOCATION: FRANKLIN, IN

SPECIALTY EARTH SCIENCES, LLC
4350 Security Parkway
New Albany, Indiana

CHLORINATED HYDROCARBON IMPACT TARGET AREAS (SUBSURFACE VAULTS)

APPROXIMATE SCALE 1" ~ 10'

PROJECT NO. 10475-22-441

DWG NO.	REV.	FIGURE
		2

REV	DATE	BY	SUB	APP

LEGEND

- Approximate Vault Perimeter
- Soil Vapor Extraction Well

DESIGNED	
DRAWN	JAS
CHECKED	
IN CHARGE	JAS
DATE	10-18-22

CLIENT: PATRIOT ENG. & ENV., INC.
PROJECT NAME: CROSSROADS

PROJECT LOCATION: FRANKLIN, IN

SPECIALTY EARTH SCIENCES, LLC
4350 Security Parkway
New Albany, Indiana

PROPOSED SOIL VAPOR EXTRACTION WELL LOCATIONS

APPROXIMATE SCALE 1" ~ 10'		
PROJECT NO. 10475-22-441		
DWG NO.	REV.	FIGURE 3

LEGEND

- Approximate Vault Perimeter
- SVE Area of Influence (Radius ~ 20 ft)
- Soil Vapor Extraction Well

REV	DATE	BY	SUB	APP

DESIGNED	
DRAWN	JAS
CHECKED	
IN CHARGE	JAS
DATE	10-18-22

CLIENT: PATRIOT ENG. & ENV., INC.
PROJECT NAME: CROSSROADS

PROJECT LOCATION: FRANKLIN, IN

SPECIALTY EARTH SCIENCES, LLC
4350 Security Parkway
New Albany, Indiana

ESTIMATED SOIL VAPOR EXTRACTION AREAS OF INFLUENCE

APPROXIMATE SCALE	1" ~ 10'
PROJECT NO.	10475-22-441

DWG NO.	REV.	FIGURE
		4

LEGEND

Approximate Vault Perimeter

Soil Vapor Extraction Well

2-3" PVC Conveyance Line (Encased in Floor Slab)

REV	DATE	BY	SUB	APP

DESIGNED	
DRAWN	JAS
CHECKED	
IN CHARGE	JAS
DATE	10-18-22

CLIENT: PATRIOT ENG. & ENV., INC.
PROJECT NAME: CROSSROADS

PROJECT LOCATION: FRANKLIN, IN

SPECIALTY EARTH SCIENCES, LLC
4350 Security Parkway
New Albany, Indiana

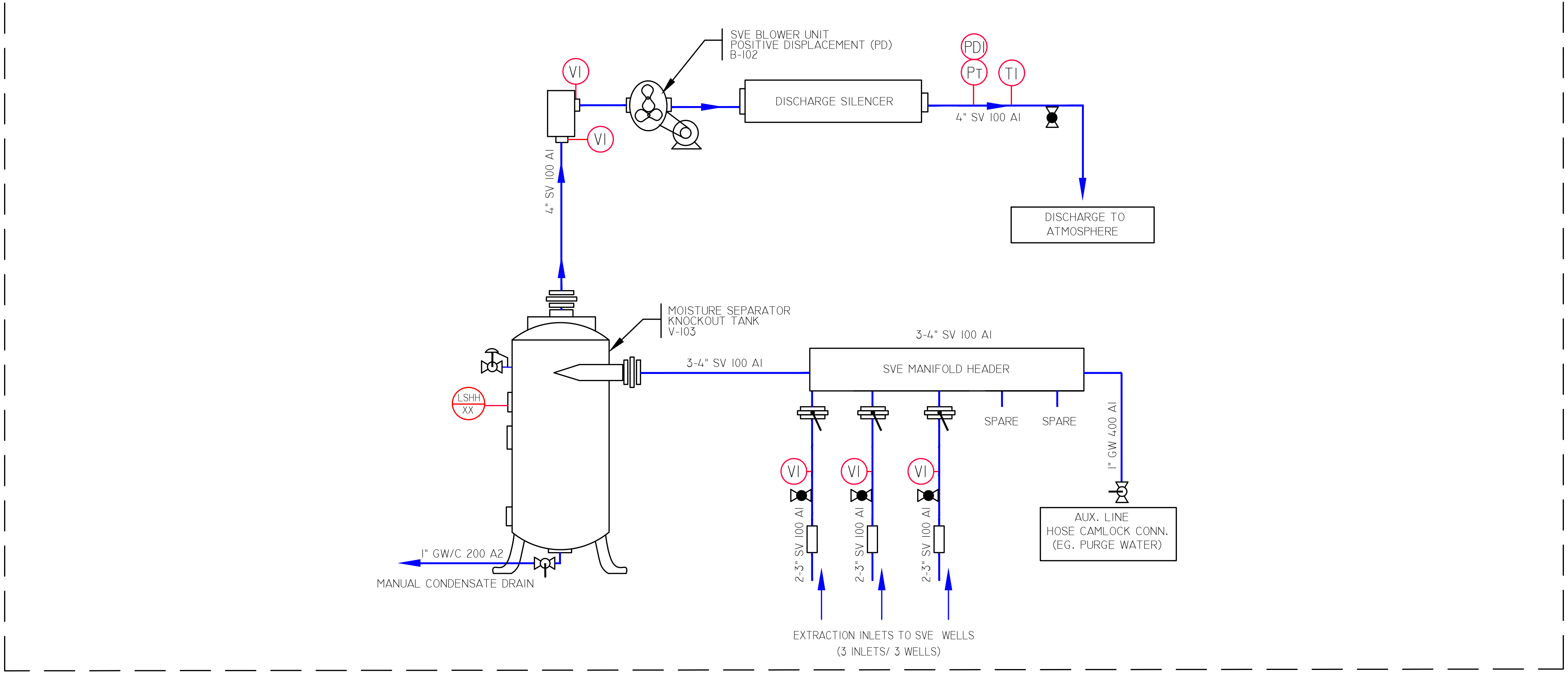
PROPOSED CONVEYANCE LINES AND EQUIPMENT LOCATIONS

APPROXIMATE SCALE 1" ~ 10'

PROJECT NO. 10475-22-441

DWG NO.	REV.	FIGURE
		5

SOIL VAPOR EXTRACTION SYSTEM



LEGEND

- SOLONOID VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- IN-LINE AIR FILTER (L-STYLE)
- 1/4" BALL VALVE (SAMPLE PORT)
- BALL VALVE
- PR PRESSURE RELIEF VALVE
- FLANGE FITTING
- VACUUM RELIEF VALVE

PROCESS ABBREVIATIONS

FE - FLOW ELEMENT
FI - FLOW INDICATOR
IL - ILLUMINATION LIGHT
LSHH - LEVEL SWITCH HIGH/HIGH
LSH - LEVEL SWITCH HIGH
LSL - LEVEL SWITCH LOW
PSHH - PRESSURE SWITCH HIGH
VSHH - VACUUM SWITCH HIGH
TSHH - TEMPERATURE SWITCH HIGH
PI - PRESSURE INDICATOR
VI - VACUUM INDICATOR
TI - TEMPERATURE INDICATOR
PDI - PRESSURE DIFF. INDICATOR
FIT - FLOW INDICATOR TRANSMITTER
PT - PITOT TUBE
S - SAMPLE PORT
VR - VACUUM RELIEF VALVE
PR - PRESSURE RELIEF VALVE

FLUID IDENTIFICATION ABBREVIATIONS

DP - DNAPL PRODUCT
GW- GROUND WATER
V - VAPOR
SV - SOIL VAPOR
TW - TREATED WATER
C - CONDENSATE
A - COMPRESSED AIR
W - WATER

B-102
SVE POSITIVE DISPLACEMENT BLOWER
MANUFACTURER: TUTHILL, ROTRON, OR THE LIKE
MOTOR: 5-10 HP, TEFC, 208-230, /1-3/
MODEL: 500 CFM

V-103
MOISTURE SEPARATOR VESSEL
MANUFACTURER: SE SCIENCES
VOLUME: 80 GALLONS
VACUUM RATING: 29.5" HG.

TOTAL SVE AIR FLOW CRITERIA: ~ 435 CFM
(138 PER EXTRACTION WELL x 3 EXTRACTION WELLS x 1.05 S.F. = 435 CFM)

TOTAL SVE VACUUM LEVEL CRITERIA: 3" H2O COLUMN.
(2.6" H2O OBSERVED x 1.15 S.F. = 3" H2O COLUMN)

2" V 100 A2
- LINE SIZE
- FLUID IDENTIFICATION (SEE LIST OF ABBREVIATIONS)
- LINE NUMBER
- PIPING SPECIFICATIONS: A1 (PVC 80), A2 (BLACK IRON), A3 (STAINLESS STEEL), A4 (PETRO. RESISTANT HOSING), A5 (FABCHEM HOSING)

REV	DATE	BY	SUB	APP	DESCRIPTION

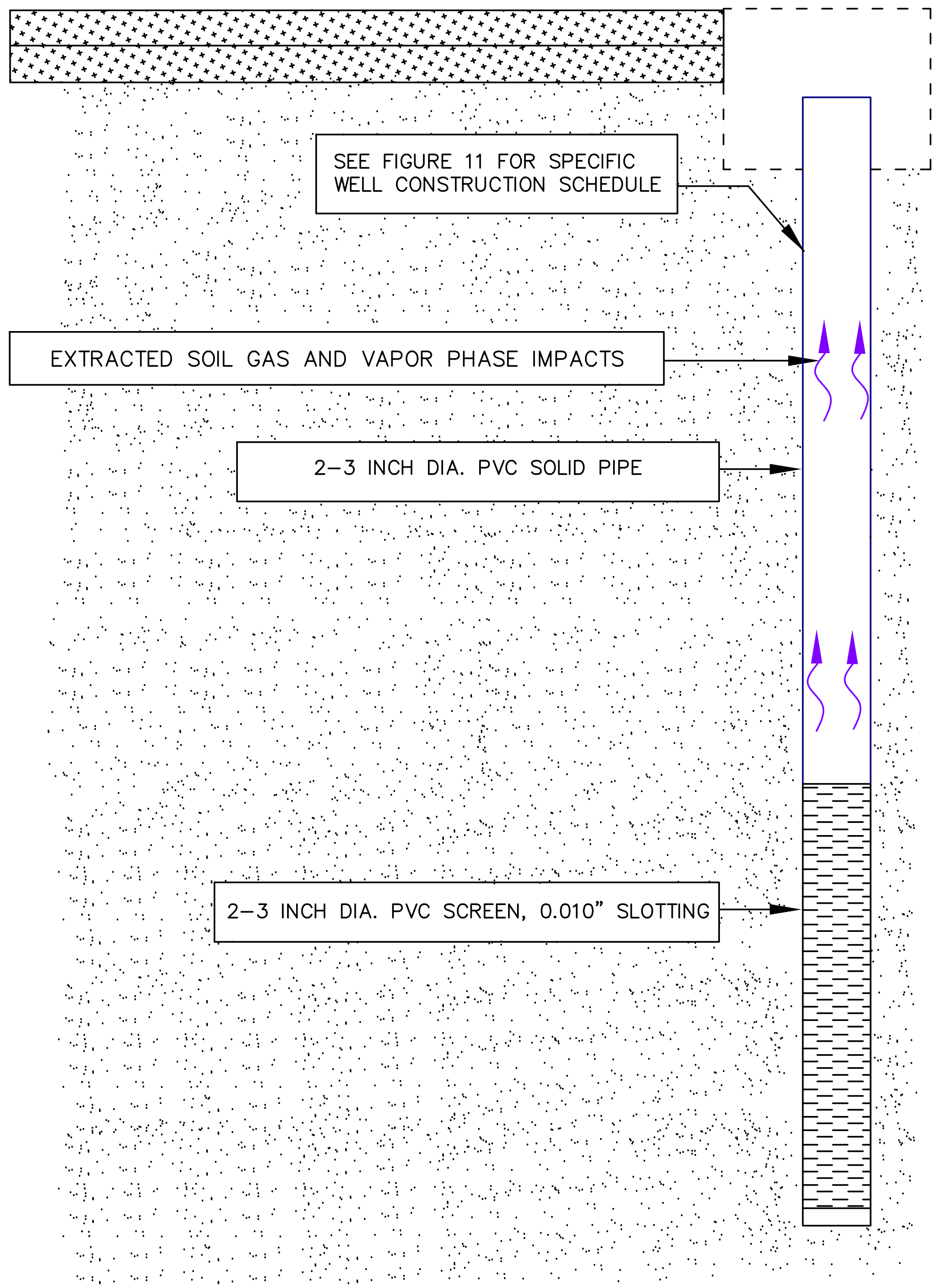
DESIGNED
DRAWN JAS
CHECKED
IN CHARGE JAS
DATE 10-11-22

CLIENT: PATRIOT ENG. & ENV., INC.
PROJECT NAME: CROSSROADS
PROJECT LOCATION: FRANKLIN, IN

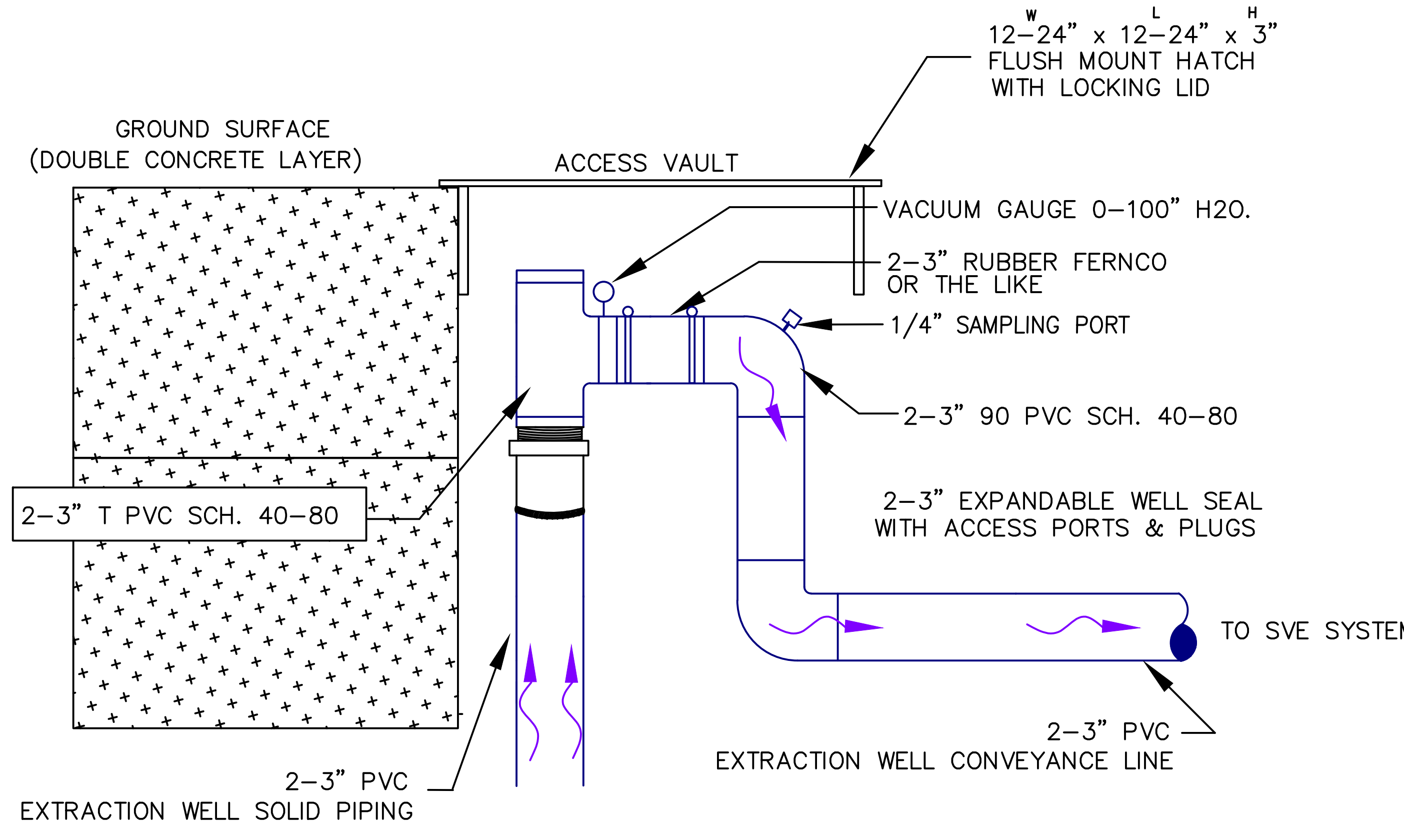
SPECIALTY EARTH SCIENCES, LLC
4350 Security Pkwy.
New Albany, Indiana

PROPOSED OPERATIONS SCHEMATIC OF SOIL VAPOR EXTRACTION SYSTEM

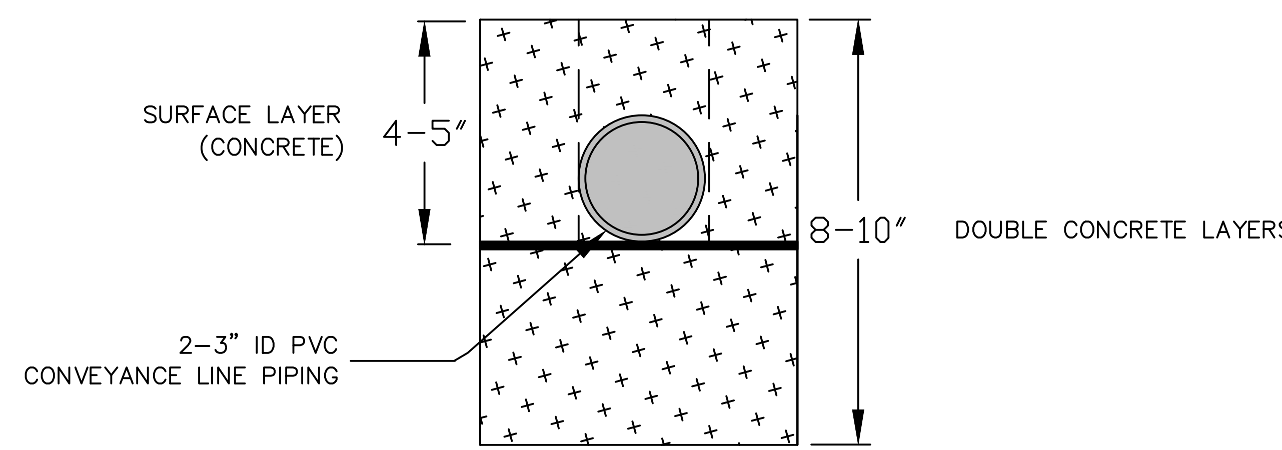
SCALE: Not to Scale
PROJECT NO. 10475-22-441
DWG NO. | REV. | FIGURE 6
PLOT DATE:



NOT TO SCALE



SECTION VIEW DETAIL A



SAW–CUT TRENCH DETAIL B

NOT TO SCALE

REV	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED
DRAWN JAS
CHECKED
IN CHARGE JAS
DATE 10-18-22

CLIENT: PATRIOT ENG. & ENV., INC.
PROJECT NAME: CROSSROADS

PROJECT LOCATION: FRANKLIN, IN

SPECIALTY EARTH SCIENCES, LLC
4350 Security Parkway
New Albany, Indiana

PROPOSED SVE WELL AND
WELL VAULT DETAILS

SCALE Not to Scale
PROJECT NO. 10475-22-441
DWG NO. | REV. | FIGURE 7
PLOT DATE:

Well Number	Soil Vapor Extraction (SVE) Well Construction Data							
	Borehole Dia.	Well I.D.	Depth of Well	Solid Piping (Well-head to Screen)	Screen Slotting	Slotted Piping (Screen Length)	Well Seal Material	Annular Space
	(approx.)		Below Grade (ft)	Length (ft)	Inches	Length (ft)	(Chip Form)	(Materials)
SVE-1	4.25"	2"	10.0	5.0	0.010	5.0	Hydrated Bentonite	Washed Sands
SVE-2	4.25"	2"	10.0	5.0	0.010	5.0	Hydrated Bentonite	Washed Sands
SVE-3	4.25"	2"	10.0	5.0	0.010	5.0	Hydrated Bentonite	Washed Sands

REV	DATE	BY	SUB	APP	DESCRIPTION

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PROJECT LOCATION: FRANKLIN, IN

SPECIALTY EARTH SCIENCES, LLC
4350 Security Parkway
New Albany, Indiana

PROPOSED SVE EXTRACTION WELL CONSTRUCTION SCHEDULE

SCALE Not to Scale
PROJECT NO. 10475-22-441
DWG NO.
REV.
FIGURE 8

PLOT DATE:

Parameter	Frequency	Location(s)	Units/Detection Limits	Method
SVE COMPONENTS				
Air Flow	(Bi)Weekly (Bi)Weekly	SVE Influent Flow (3 Individual Manifold Lines) SVE Effluent Flow (Blower Outlet)	Feet per Minute (fpm)	Thermal Anemometer Pitot Tube & Mag. Gauge
Vacuum	(Bi)Weekly (Bi)Weekly (Bi)Weekly	SVE Well Head Assemblies (3 total) or SVE Influent (3 individual Manifold Lines) Particulate Filters (Inlets and Outlets)	Inches of Water (in. H2O.)	Vacuum Gauges
Collected Liquids	(Bi)Weekly	Moisture Separator Vessel	Gallons (0-25 Gal.)	Visual Site Glass
Temperature	(Bi)Weekly	Blower Outlet	Degrees Fahrenheit (0 - 300 ^{o}f)	Temperature Gauge
VOC's Vapor Field Screening	(Bi)Weekly	SVE Effluent (Blower Outlet)	Parts per Million (ppm^V)	Photo-Ionization Detector (PID)
VOC's Vapor Concentrations	Monthly (first 6 months), Quarterly (thereafter)	SVE Effluent (Blower Outlet)	VOC's = mg/m^3	EPA Method TO-15

NOTES:

SVE	Soil Vapor Extraction
VOC's	Volatile Organic Compounds
ppm^V	Parts per Million Volume
mg/m3	Milligrams per Cubic Meter

REV	DATE	BY	SUB	APP	DESCRIPTION	DESIGNED DRAWN JAS CHECKED IN CHARGE JAS DATE 10-22-22

CLIENT: PATRIOT ENG. & ENV., INC.
PROJECT NAME: CROSSROADS

PROJECT LOCATION: FRANKLIN, IN

SPECIALTY EARTH SCIENCES, LLC
4350 Security Parkway
New Albany, Indiana

PROPOSED OPERATIONAL PARAMETER MONITORING SCHEDULE

SCALE Not to Scale
PROJECT NO. 10475-22-441
DWG NO. | REV. | FIGURE 9

PLOT DATE:

(Bi)Weekly Tasks

System Component	Task	Week 1		Week 2		Week 3		Week 4
SVE Blower(s)	Clean inlet air filter, evacuate condensation							
SVE Blower(s)	Check oil							
SVE Influent Manifold	Check for water production and proper airflow							
Moisture Separator Vessel	Check water level and pump out as needed							

Monthly Tasks

System Component	Task	Week 1		Week 2		Week 3		Week 4
SVE Blower	Diagnostic motor winding check and amperage measurement							
SVE Blower	Grease and lubricate bearings							
Moisture Separator Vessel	Drain and remove sediment from bottom of vessel							
Moisture Separator Vessel	Ensure high level float switch is operating properly							

As-Needed Tasks

System Component	Task	As Needed		As Needed		As Needed		As Needed
SVE Blower(s)	Change oil and check belt tension							
SVE Blower(s)	Check and clean vacuum transmitter							

REV	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED
DRAWN JAS
CHECKED
IN CHARGE JAS
DATE 10-22-22

CLIENT: PATRIOT ENG. & ENV., INC.
PROJECT NAME: CROSSROADS

PROJECT LOCATION: FRANKLIN, IN

SPECIALTY EARTH SCIENCES, LLC
4350 Security Parkway
New Albany, Indiana

PROPOSED OPERATIONS AND MAINTENANCE (O&M) SCHEDULE

SCALE Not to Scale
PROJECT NO. 10475-22-441
DWG NO. | REV. | FIGURE 10

PLOT DATE:

APPENDIX A

GENERAL SVE SYSTEM STARTUP PROCEDURES

GENERAL SOIL VAPOR EXTRACTION (SVE) SYSTEM START-UP PROCEDURES

Start Up Procedures

Before starting any system, thoroughly inspect the system for any damage. Use the provided Operations Schematic (Fig. 6) to verify that the system has been connected correctly. Then, refer to start up procedure.

Control Panel

1. Switch the disconnect to the "OFF" position and open the inner door. Verify that the inner door disconnect is in the off position.

2. Switch on the main incoming power to the panel. CAUTION! – The disconnect now has power!

3. Confirm that incoming power is correct voltage on all lines. If the incoming power has a "high leg" (a four wire delta system), measure the voltage from each leg to ground. Record the following operating conditions:

L1 to ground	____________V
L2 to ground	____________V
L3 to ground	____________V
L1 to L2	____________V
L1 to L3	____________V
L2 to L3	____________V

4. Be sure that all circuit protectors are reset to the on position.

5. Close the inner door. Confirm that all of the green HOA's (Hand-Off-Auto) switches are in the "OFF" position. Turn the inner disconnect to the "ON" position. The panel should have power. All of the alarm faults may be lit depending on panel programming. If so, press the "RESET" indicator. If the alarms will not "clear", an alarm may be still engaged.

6. If the system was pre-wired at the Specialty Earth Sciences facility, then the motors have been synchronized. Rotation needs to be verified by one motor, only. To do so, bump any motor holding the HOA in the "HAND" position for no more than a second (rotation arrows are located on most pieces of equipment). If rotation is backwards, have an electrician

exchange the incoming power leads L1 and L3. Be sure to lock out and tag the main incoming power. Verify that there is not power with a multi-meter.

Air / Water Separator (AWS) Vessel

1. Close ball valve under separator that directs fluid to manual gravity drain towards outside of enclosure.

Transfer Pump (if applicable)

1. Ensure that all valves on discharge side of pump are open.

2. Close all sample taps.

3. Bump the pump to verify rotation by holding the PUMP HOA in the "HAND" position for no more than a few seconds. Rotation arrows are located on the pump to signify proper rotation. If rotation is backwards, have an electrician exchange two of the power leads. Be sure to lock out and tag the main incoming power. Verify that there is not power with a multimeter.

4. Prime the pump.
    a. If there is suction head requirement on the pump inlet due to elevation, the pump may be primed by opening the top plug and adding water until full.
    b. If there is a suction head requirement due to a mechanical vacuum, the pump may be primed by turning off the source of the vacuum. Water should gravity feed into the pump. Open sample ports if applicable to ensure pump is primed.
    c. If there is a positive suction head, the pump should self-prime.
    d. If pump has a priming plug (located on pump housing) loosen plug until water fills the casing and transfer line piping. Retighten priming plug after completion of the above mentioned.

5. Test the prime. Run the pump for a few seconds to verify that water is flowing through the pump at a constant rate and pressure. If not, repeat step 4.

6. Put the Pump HOA in the "AUTO" position. Throttle the pump to the desired flow. Record the following operating conditions:

a. PUMP motor amp draw __________
b. PUMP pressure __________
c. PUMP flow rate __________

Note: Depending on the interlock schedule, the blower may not run until all of the appropriate alarms have been cleared and the correct pieces of equipment enabled. The remaining steps can be finished when the system is completely enabled.

SVE Vacuum Blower

1. Verify that all influent and effluent connections have been made, and open all inlet and outlet valves. If manifold is equipped with a bypass valve, open fully until SVE blower has come up to speed; then adjust valve position accordingly.

2. Once correct motor rotation has been confirmed, put the blower in the "Auto" position to start the blower. Let the blower run for a few seconds and then slowly close the bypass valve to achieve desired vacuum level.

3. If blower unit is controlled through a variable frequency drive (VFD), refer to drive manufacturer literature for operation sequences (e.g. programming pre-set speeds).

4. Once the system has reached the desired operating conditions, record the following parameters:

   a. SVE Blower vacuum before filter __________
   b. SVE Blower vacuum after filter __________
   c. Exhaust temperature __________

   <u>SVE-1:</u>
   d. Airflow rate __________
   e. Vacuum Level __________

SVE-2:

f. Airflow rate __________

g. Vacuum Level __________

SVE-3:

h. Airflow rate __________

i. Vacuum Level __________

4. It is recommended that SVE vacuum blower operations be monitored for an initial 3-5 day period to ensure subsurface negative pressure gradients have achieved the desired steady-state, and blower related equipment is functioning properly.

   Daily measurements should be recorded and compared to the initial baseline above for performance evaluation.