



September 30, 2015

Mr. Rob Will  
Freeway Properties LLC  
4724 Roosevelt Way Northeast  
Seattle, Washington 98105

**RE: Feasibility Study and SVE/AS Pilot Study Report  
Freeway Properties LLC  
4724 Roosevelt Way Northeast and 4701 11th Avenue Northeast  
Seattle, Washington 98105  
RGI Project No. 2014-068G  
Ecology VCP No. NW2584**

Dear Mr. Will:

The Riley Group, Inc. (RGI) is pleased to present this Feasibility Study (FS) and Soil Vapor Extraction (SVE)/Air Sparge (AS) Pilot Study report regarding the Freeway Properties LLC property located at 4724 Roosevelt Way Northeast and 4701 11th Avenue Northeast, Seattle, Washington (hereafter referred to as the Property), Figure 1. The Property is occupied by the University Volkswagen-Audi dealership.

The Property totals approximately 0.59 acres and consists of two tax parcels (King County tax parcels 6746701635 and 6746701440). Tax parcels 6746701635 (addressed 4724 Roosevelt Way Northeast) and 6746701440 (4701 11th Avenue Northeast) are herein referenced the west and east parcels, respectively. The west and east tax parcels are divided by a north-south oriented improved alley right-of-way (ROW), see Figure 2.

## **1. INTRODUCTION**

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Soil and groundwater conditions, and the nature and extent of subsurface contamination, underlying the west and east parcels of the Property have been reported in RGI's Remedial Investigation (RI) report dated August 31, 2015 (RGI project number 2014-068C). In summary:

- The Property is underlain by up to 11 feet of fills (sand, silt, and gravel including wood, and brick/concrete debris). Underlying these fills, native soils to depths of up to 60 to 65 feet below ground surface (bgs) generally consist of dense silty sand with varying amounts of gravel, which are in turn underlain by very dense glacial till (a compact heterogeneous mixture of silt, sand, and gravel).
- An approximate 15-foot thick perched water bearing zone was encountered beneath the Property at depths of approximately 45 to 60 feet bgs. This perched water bearing zone is located above the underlying very dense glacial till. Depth to groundwater beneath the Property is approximately 45 feet bgs. Groundwater bail down (or slug test) results estimated the sustainable yield for the perched water bearing zone was at most 0.16 gallons per minute (gpm). Based on this low yield, RGI concludes the perched water bearing zone is not considered potentially potable for human consumption [in accordance

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with WAC 173-340-720(2)(ii)]. Groundwater flow direction appears to be towards the south (see Figure 4).

- The Property historical uses and/or improvements (for example, former UST fuel systems, see Figure 2) have resulted in a release of petroleum hydrocarbons to the subsurface environment. The contaminated media identified during the RI included soil, soil vapor, and groundwater.
- In general, contaminated soils were:
  - a) Encountered beneath the east and west parcels of the Property at various intervals between the depths of 15 feet to 60 feet bgs.
  - b) Not encountered a depths shallower than 15 feet bgs.

The attached Figure 3 and Table 1 include a summary of all the soil data obtained to-date. In addition, the attached cross-sections (Figures 5, 6, and 7) illustrate the lateral and vertical occurrence of the contaminants of concern (COCs) in the subsurface soil beneath the Property.

- Relatively high dissolved-phase total petroleum hydrocarbons (TPH, as diesel and/or weathered gasoline), BTEX (benzene, toluene, ethylbenzene, and xylene), and naphthalene concentrations were detected in the perched water beneath the west and east parcels of the Property.

The attached Figure 4 and Table 2 include a summary of all the groundwater data obtained to-date. In addition, the attached cross-sections (Figures 5, 6, and 7) illustrate the occurrence of the contaminants of concern (COCs) in groundwater beneath the Property.

## **2. FEASIBILITY STUDY AND SVE/AS PILOT STUDY**

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The purpose of this FS and SVE/AS pilot study is as follows:

- Evaluate the effectiveness of several remedial alternatives, or combination of alternatives, in bringing soil and groundwater contamination underlying the Property into compliance with the Model Toxics Control Act (MTCA) Cleanup Regulation (WAC 173-340-350(8)).

This report is organized in the following order:

- Remedial Action Objectives (Section 2.1).
- Description and Evaluation of Remedial Technologies (Section 2.2).
- SVE/AS Pilot Test (Section 3.0).
- FS and SVE/AS Pilot Test Conclusions (Section 4.0).

### **2.1 Remedial Action Objectives**

In accordance with MTCA, the remedial action objectives (RAOs) must meet requirements that protect human health and the environment. The RAOs identified for the Property include:

- Prevent and/or limit risks associated with direct human contact of the COCs within soil, groundwater, and/or air.
- Prevent and/or limit potential risks of soil impacting groundwater or other terrestrial impacts.

## 2.2 Description and Evaluation of Remedial Alternatives

Reducing the COCs associated with petroleum hydrocarbons and volatile organic compounds (VOCs) in soil, groundwater, and/or soil vapor can be accomplished with the appropriate remedial technology, or combination of technologies.

The Remedial Alternatives (RAs) evaluated for the Property (including both west and east parcels) are considered *industry standard*, based on subsurface conditions, and can be effective approaches to remediate sites. A total of five RAs are described and were evaluated for this Site and include the following:

- Alternative 1. Capping and Containment
- Alternative 2. Excavation
- Alternative 3. SVE and/or AS
- Alternative 4. In-Situ Chemical Oxidation (ICSO)
- Alternative 5. Enhanced Degradation/Attenuation

The RAs presented above must comply with the MTCA threshold requirements (WAC 173-340-360(2)(a)) prior to implementation of a remedial action. The MTCA threshold and other FS requirements are included in Appendix A for reference which are also outlined, defined, and evaluated in Appendix A and the attached Table 6.

### 2.2.1 ALTERNATIVE 1. CAPPING AND CONTAINMENT

Capping and containment involve the installation of physical barriers that limit exposure of human and terrestrial ecology receptors to the contaminated media by confining and limiting the mobility of contaminants. These barriers can be either natural or engineered. Examples of capping and containment include concrete or asphalt pavement and installation of barrier walls.

Both the west and east parcels of the Property are currently covered with impervious asphalt and concrete pavement. The impermeable surface partially satisfies the RAOs stated above. Therefore, RGI considers capping and containment a feasible RA to:

- Prevent and/or limit risks associated with direct human contact of COCs within soil and groundwater, and minimizing the potential for infiltration of storm water/precipitation into the subsurface (and potentially increasing the chance for downward migration of contaminants).

Although the existing capping and containment on the Property meets the objective listed above it does not reduce elevated concentrations of the COCs in soil or groundwater beneath the Property, therefore, the capping and containment in this instance is not considered a preferred RA.

### 2.2.2 ALTERNATIVE 2. EXCAVATION

Remedial excavation is a common means of soil remediation from a source area by physically removing contaminants and is generally effective, straightforward, permanent, and comparatively inexpensive.

Excavation is commonly used when soil contamination is relatively shallow, accessible, and groundwater quality is not adversely affected.

If soil contamination is deeper and/or extends below the groundwater table, the remedial excavation approach often requires:

- Special permitting.
- Temporary shoring design and installation.
- Handling and re-use of clean overburden soils.
- Contaminated groundwater dewatering, storage, treatment, and disposal.

The excavation approach is not considered a preferred RA for either the west or east parcels of the Property based on the following facts:

- The known soil contamination underlying the west and east parcels is generally deeper than 15 feet bgs and extends to depths of up to 65 feet bgs. Since the current and future use of the Property will remain “as-is”, these depths are not suitable to routine remedial excavation.
- The known soil contamination is located within the perched water bearing zone. Remedial excavation would require the groundwater handling, pumping, storing, treating, and disposal.
- The existing Property and/or adjoining property buildings, roads, and/or utilities prohibits this remedial technology.
- The exceedingly high cost, disruption to current Property use and traffic, and high intensive nature.

### 2.2.3 ALTERNATIVE 3. SOIL VAPOR EXTRACTION (SVE) AND AIR SPARGE (AS)

SVE is an in-situ remedial technology that reduces gasoline-range TPH and VOC concentrations by extracting and recovering the VOC-laden soil vapor from the subsurface. This is accomplished by using a series of vapor extraction wells installed throughout the contaminated areas. Higher levels of SVE effluent soil vapor recovered from the subsurface generally require treatment prior to discharge to the atmosphere (for example, granulated carbon filters and thermal treatment/catalytic oxidation).

The SVE technology includes a wide range of options, or combination of technologies (for example, standard SVE, dual phase extraction, SVE with AS, or SVE with dedicated groundwater extraction pumps).

The AS technology is also an in-situ remedial technology that injects air into groundwater and enables a phase transfer of hydrocarbons from a dissolved phase into a vapor phase. The sparged air with entrained hydrocarbon vapors rises into the capillary fringe and vadose zone soils where they can be extracted via the SVE system.

The effectiveness of both AS and/or SVE are limited by low soil permeability, the presence of stratified soils, and the aquifer or water bearing properties (for example, type of aquifer, low hydraulic conductivities, and low specific yield capacity).

Based on our preliminary screening, the SVE remedial technology with AS was considered a preferred RA based on the following facts:

- Contaminated soils with elevated gasoline-range TPH, BTEX, and naphthalene concentrations generally occur at depths greater than 15 feet bgs and extent to depths of up to 60 feet bgs.
- The contaminated perched water bearing zone is located between approximately 45 feet to 60 feet bgs has relatively high gasoline-range TPH and VOC dissolved-phase concentrations.
- The native soils underlying the Property consist of a silty sand to sand silt (though dense in nature).
- Both SVE and AS may enhance the degradation and attenuation of petroleum hydrocarbons (specifically in groundwater), by increasing dissolved oxygen levels within the water bearing zone.

Based on our preliminary assessment of SVE/AS and the Client's accelerated construction schedule to complete the new auto showroom on the east parcel, RGI performed a SVE/AS pilot test in November 2014 and January 2015 on the Property. The pilot test was performed to further evaluate SVE/AS as preferred remedial technology. In addition, the pilot test was performed to obtain data pertaining to radius of influence, air flow, contaminant mass recovery rates, preferential airflow regimes, and other data necessary to design the installation and operation this type of system (see Section 3.0 for discussion of the SVE/AS pilot test procedure and findings).

#### 2.2.4 ALTERNATIVE 4. IN-SITU CHEMICAL OXIDATION

In-situ Chemical Oxidation (ISCO) is a remedial technology involving injection of chemicals into the subsurface that react with and eventually breakdown a variety of VOC and petroleum-related hydrocarbons into their benign byproducts (for example, carbon dioxide and water). The chemicals are applied to, or injected into, the subsurface environment using direct-push technology and/or through permanently installed injection wells.

ISCO technology is most effective in water saturated source and smear zone (capillary fringe) areas. ISCO can be effective for remediating groundwater with low and high dissolved phase VOC and petroleum hydrocarbon concentrations. ISCO technology is generally not suitable for free product remediation (free product has not been observed at the Site). The ISCO technology is often used for remediating low concentrations of the COC, after another technology has successfully removed the larger contaminant mass (for example, via excavation or SVE).

As with AS/SVE, the effectiveness of the ISCO technology is limited by low soil permeability and the presence of varying soil strata/type.

This remedial technology was not selected as a preferred remedial technology for the Property based on the following considerations:

- Contaminated soils with elevated gasoline-range TPH and BTEX concentrations generally occur at depths greater than 15 feet bgs and extent to depths of up to 60 feet bgs.
- The contaminated perched water bearing zone located between approximately 45 feet to 60 feet bgs has relatively high gasoline-range TPH and VOC dissolved-phase concentrations.
- Based on the above, frequent injections will be required and will likely not be as effective and permanent as the SVE/AS remedial technology.

### 2.2.5 ALTERNATIVE 5. ENHANCED DEGRADATION AND ATTENUATION

Enhanced degradation/attenuation bioremediation techniques include the stimulation of any existing microbial bacteria in the subsurface environment that are capable of reducing the contaminant mass. For example the bioremediation technique may include the injection of a carbon-based food source and a specific strain of bacteria best suited for breaking down or consuming the COC of interest, and possible oxidant or reducing agent in order to maintain the appropriate aerobic or anaerobic subsurface conditions. The application process will consist of a series of injection wells, similar to that required for the ISCO remedial technology (Alternative 4).

This enhanced degradation/attenuation remedial technology was not selected as a preferred remedial technology based on the following:

- The relatively high concentrations of gasoline-range TPH and BTEX in groundwater underlying the Property.
- The excessive length of time likely required to meet the remedial action objectives.
- The comparable cost of installing the required number of deep wells (that could be otherwise suited for other preferred remedial technologies, for example SVE).

### **3. SOIL VAPOR EXTRACTION & AIR SPRAGE PILOT TEST RESULTS**

In October 2014, RGI performed the SVE/AS pilot test on the west parcel using the existing monitoring wells MW1 (as the AS test well) and MW3 (as the SVE test well). Both the MW1 and MW3 wells were installed as groundwater monitoring wells and constructed of 2-inch diameter SCH 40 PVC. Well MW1 was screened across the shallow water bearing interval and vadose zone soils from 66 feet to 18 feet bgs. Likewise, well MW3 was screened across the shallow water bearing interval and vadose zone soils from 60 ft. bgs to 20 ft. bgs. The distance between MW1 and the MW3 was approximately 21 ft.

In June 2015, RGI performed an AS and SVE pilot test on the east parcel using wells specifically designed for SVE (well SVE1) and AS (well AS1) pilot test wells. Both SVE1 and AS1 wells were installed in May, 2015 and constructed of 2-inch diameter SCH 40 or 80 PVC. Well SVE1 was screened above the perched water bearing zone from 40 ft. to 25 ft. bgs. The AS1 well was screened below the groundwater elevation, screened at depths of 58 ft. to 54 ft. bgs. The distance between the AS1 and SVE1 wells is approximately 12.4 ft.

Well log construction details for MW1, MW3, AS1, and SVE1 are also included in Appendix B.

The wells selected for the remedial pilot study were located where relatively high gasoline-range TPH, BTEX, and naphthalene concentrations in soil/groundwater were identified previously and, therefore, are likely representative of the mass recovery rates that a full scale AS and/or SVE system will produce.

PES Environmental, Inc. (PES), under contract with RGI provided support and technical input during the course of the pilot study. In addition, PES supported and provided the technical analysis and interpretation of AS and SVE pilot test generated data.

### 3.1 SVE/AS Test General Procedures

Prior to beginning the pilot tests, selected wells were fitted with airtight Fernco connectors and ball valves with barbed fittings to allow for the collection of initial background vadose zone pressures and vacuum readings during the test. Magnehelic® vacuum/pressure gauges were used to measure and record initial background pressures at wells and induced vacuum responses throughout the pilot study. Negligible background pressures were detected in wells prior to commencement of the pilot tests.

The SVE pilot test was performed using a Rotron 1.5 horsepower explosion-proof regenerative blower. SVE piping was connected from the pilot test well to the blower with a series of vacuum gauges, a moisture separating knockout tank, and a bypass valve to control flow rate and vacuum from the extraction test wells. No water or gasoline condensate accumulated in the knockout tank during the pilot study.

The AS test was performed using either a five or eight horsepower rated compressor, in-line filter to remove oil from the compressed air, pressure gauges, a pressure relieving bleed-off valve, and an in-line air flow meter.

During the pilot test, extracted soil vapor was exhausted vertically to the atmosphere. Pilot testing, for up to 8-hours, is exempt from effluent treatment by the Puget Sound Clean Air Agency (PSCAA).

RGI collected several effluent air samples using Tedlar™ bags, supplied by the analytical laboratory, to quantify the concentrations of gasoline-range TPH and VOCs being recovered during the SVE/AS pilot study. Effluent air samples were collected using a portable electric air pump at the startup (for background), during, and end of the pilot test period.

Air samples were analyzed by ALS Environmental laboratories located in Everett, Washington following chain of custody procedures for analysis of gasoline-range TPH and BTEX using EPA Method NWTPH-Gx and EPA Method 8021, respectively.

The pilot test performed regarding the west and east parcels of the Property, and findings, are further discussed below.

### 3.2 West Parcel SVE/AS Pilot Test, 2014

A detailed account of the AS/SVE pilot test operating parameters, field observations, vacuum and pressure readings, and air sampling field screening and laboratory results are included in the attached Table 3 and summarized below.

The air sparge test well MW1 was equipped with an airtight fitting at the wellhead. The wellhead fitting permitted a 1-inch diameter sparge line to be installed down the well to convey air into the water column (while maintaining a sealed well). The air compressor line connected to the downwell sparge line).

Observation Wells (OBWs) used during this portion of the pilot test included MW1, MW2, MW4, MW5 and B3E.

The pilot test was performed in a two-step process as follows:

- Step 1 (SVE only). Step 1 maintained a SVE blower vacuum of 54-inches H<sub>2</sub>O and a vacuum of 10-inches H<sub>2</sub>O at the water knockout drum. Step 1 ran for approximately 100 minutes.

- Step 2 (SVE and AS). Step 2 maintained a SVE blower vacuum of 54-inches H<sub>2</sub>O and a vacuum of 10-inches H<sub>2</sub>O at the knockout drum. During the air sparge test, a pressure of 7 PSI was maintained at the AS wellhead and the pressure was roughly equivalent to the static water pressure head in MW1. The SVE/AS test operated for a period of approximately 50 minutes.

The induced air velocity during the SVE and AS test was not recorded due to instrumentation malfunction in the field.

During the pilot test, the induced vacuum responses in OBWs MW1, MW2, and MW4 ranged from 1.4 to 1.9; 0.3 to 0.15; and 1.5 to 2.3 inches H<sub>2</sub>O, respectively.

Induced vacuum readings at both MW2 (located approximately 50 feet from SVE test well MW3) and MW4 (located approximately 24 feet from SVE test well MW3) (decreased during the SVE/AS pilot test. The decrease in vacuum may potentially be related to the injected air at the air sparge well MW1.

Effluent air samples were collected from the SVE test well (MW3). PID readings for these samples ranged from 16 parts per million-volume (ppmv) to 15,000 ppmv. In general, the effluent air gasoline-range TPH and BTEX concentrations increased as the test progressed with time.

During the AS/SVE pilot test, a total of five air vapor samples were collected from the SVE pilot test well MW3 and submitted for gasoline-range TPH and BTEX laboratory analysis. The analytical results in µg/L, and corresponding ppmv, units are summarized below.

Sample ID	Time	Gasoline TPH (µg/L/ppmv)	Benzene (µg/L/ppmv)	Toluene (µg/L/ppmv)	Ethylbenzene (µg/L/ppmv)	Xylenes (µg/ppmv)
<b>SVE Pilot Test</b>						
<b>MW3-1:50 (before test)</b>	1:50	38,000/9,100	<5/<5	<5/<1.5	11/2.5	<15/<3.4
<b>MW3-3:00</b>	3:00	54,000/13,000	<20/<6.2	<20/<5.2	46/10	<60/<14
<b>MW3-3:30</b>	3:30	89,000/21,000	<10/<3.1	<10/<2.6	50/11	61/14
<b>AS/SVE Pilot Test</b>						
<b>MW3-4:20</b>	4:20	73,000/18,000	170/52	60/16	57/13	53/12
<b>MW3-5:00</b>	5:00	75,000	<50	<50	64	<150

### 3.3 East Parcel SVE/AS Pilot Test – June 9, 2015

A detailed account of the SVE and AS pilot test operating parameters, field observations, vacuum and pressure readings, and air sampling field screening and laboratory results are included in the attached Table 4 and summarized below.

The SVE and AS pilot test was performed in a five step process as follows:

- Step 1 (SVE only) maintained a SVE blower vacuum of 26-inches H<sub>2</sub>O and a vacuum of 15-inches H<sub>2</sub>O at the SVE pilot well. Step 1 ran for approximately 80 minutes with an air flow of 225 feet per minute (FPM) or 5.2 cubic feet per minute (CFM).
- Step 2 (SVE only) maintained a SVE blower vacuum of 28-inches H<sub>2</sub>O and a vacuum of 30-inches H<sub>2</sub>O at the SVE pilot well. Step 2 ran for approximately 30 minutes with an air flow of 320 FPM (or 7.4 CFM).



- Step 3 (SVE only) maintained a SVE blower vacuum of 32-inches H2O and a vacuum of 46-inches H2O at the SVE pilot well. Step 3 ran for approximately 145 minutes with an air flow of 360 FPM (or 8.3 CFM).
- Step 1 (SVE and AS) maintained a SVE blower vacuum of 32-inches H2O, a vacuum of 46-inches H2O at the SVE pilot well and air flow rate of 400 FPM (or 9.2 CFM). The AS compressor operated at 40 PSI, an air flow rate of 6 SCFM, and ran for approximately 40 minutes.
- Step 2 (SVE and AS) maintained a SVE blower vacuum of 32-inches H2O, a vacuum of 46-inches H2O at the SVE pilot well and air flow rate of 400 FPM (or 9.2 CFM). The AS compressor operated at 50 PSI, an air flow rate of 10 SCFM, and ran for approximately 30 minutes.

In general, during the SVE-only pilot test, the induced vacuums at each OBW increased each successive step test as follows:

- MW6: 4.6- to 15-inches H2O. MW6 is located approximately 2.4 feet from SVE1.
- MW5: 0.96- to 3.4-inches H2O. MW5 is located approximately 44 feet from SVE1.
- MW8: 0.75- to 2.4-inches H2O. MW8 is located approximately 46 feet from SVE1.
- MW9: 0.21- to 1.2-inches H2O. MW9 is located approximately 67 feet from SVE1.
- B3E: 0.65- to 2.2-inches H2O. B3E is located approximately 70 feet from SVE1.
- MW4: 0.19- to 0.6-inches H2O. MW4 is located approximately 77 feet from SVE1.

During the SVE and AS pilot test, the induced pressures recorded at MW6 and MW8 (the only wells monitored during the SVE/AS pilot test) increased each successive step test as follows:

- MW6: 24 to 40 PSI. MW6 is located approximately 15 feet from AS1.
- MW8: 0 to 2.5 PSI. MW8 is located approximately 50 feet from AS1.

In summary, Initial vacuum and pressure readings did increase during each step of the SVE-only and SVE/AS pilot test.

During the SVE and SVE/AS pilot test, a total of three air vapor samples were collected from OBWs SVE1 and MW6 and submitted for gasoline-range TPH and BTEX laboratory analysis. The analytical results in µg/L, and corresponding ppmv, units are summarized below.

Sample ID	Time	Gasoline TPH (µg/L/ppmv)	Benzene (µg/L/ppmv)	Toluene (µg/L/ppmv)	Ethylbenzene (µg/L/ppmv)	Xylenes (µg/ppmv)
<b>SVE Pilot Test</b>						
<b>SVE-1 Step 3</b>	2:40	ND/ND	ND/ND	ND/ND	ND/ND	ND/ND
<b>AS/SVE Pilot Test</b>						
<b>AS-MW6- Step 2</b>	6:50	120,000/29,000	ND/ND	ND/ND	190/43	120/20
<b>SVE-1-AS Step 2</b>	6:55	11,000/2,600	25/7.7	25/6.5	8.1/18	20/4.5

### 3.3 East Parcel AS Pilot Test – June 10, 2015

A detailed account of the AS pilot test operating parameters, field observations, vacuum and pressure readings, and air sampling field screening and laboratory results are included in the attached Table 5 and summarized below.

The air sparge test well AS1 was glue fitted with short section of SCH 80 PVC pipe equipped with a threaded end cap and the required quick-connect air fitting. The air compressor line connected to the sparge well connection (Note: no smaller diameter pipe, or stinger, was installed or used, to convey air into the water column).

OBWs for the AS pilot test included SVE1, MW5, MW6, and MW8. OBWs were used to record induced pressure readings, dissolved oxygen (DO) concentrations, and collect air samples. DO readings in groundwater were collected using a down-well DO sensor during the course of the pilot test. The air sparge air flow readings were recorded using a 1.5-inch diameter Hedland in-line air flow meter.

Prior to the start of the test, RGI obtained pressure/vacuum readings and groundwater levels from the air sparge test well and nearby OBWs. The screened portion of the sparge well AS1 was located approximately 11 feet of water (water level was 45.5 feet below TOC). Background DO concentrations ranged from 0.25 mg/L to 0.4 mg/L.

At the beginning of the sparge test, the air compressor was turned on with the bleed-off valve wide open. The bypass valve was manually closed until a sufficient pressure was introduced to the well until breakout pressure and airflow was observed. The breakout pressure is the minimum injection pressure required to dewater the well casing to the top of the screened interval and force air flow out of the well screen.

The air sparge pilot test was performed in a two-step process as follows:

- Step 1: AS only. In summary, step 1 was performed at 19 PSI and corresponding air flow of approximately 4.8 SCFM for a period of approximately 125 minutes.
- Step 2: AS only. In summary, step 2 was performed at 40 PSI with a corresponding air flow of approximately 12.5 SCFM for a period of approximately 135 minutes.

#### 3.3.1 AS BLOWER TEST STEP 1

During Step 1, the dissolved oxygen, PID, and depth to water measurements are summarized as follows:

- DO concentrations in groundwater at MW6 and MW8 OBWs increased from 0.40 to 1.35 mg/L and 0.31 to 0.36 mg/L, respectively. MW6 and MW8 are located 10 feet and 49.3 feet, respectively from the sparge well AS1.
- PID readings increased from 0.8 ppmv (baseline) to 1,040 ppmv for MW6 and 6.7 ppm to 400 ppmv for MW8. Based on these results, air sparging appeared to increase VOC concentrations in the vapor phase.
- Depth to water measurements at MW6 ranged from 45.49 feet below TOC (baseline) to 45.3 feet below TOC (at the end of Step 1).

### 3.3.2 AS BLOWER TEST STEP 2

During Step 2, the dissolved oxygen, PID readings, and depth to water measurements are summarized as follows:

- DO concentrations in groundwater at the nearby OBWs increased up to 1.9 mg/L for MW6 (located 10 feet from the sparge well AS1) and up to 0.41 mg/L for MW8 (located 49.3 feet from sparge well AS1). It should be noted that the DO concentration in MW8 is only slightly above the background DO concentrations in this well and the other OBWs. In addition, induced DO concentrations of 4 to 6 mg/L over background levels are desired result for concluding that air sparge is an effective remedial technology.
- PID readings increased up 1,700 ppmv for MW6 and 920 ppmv for MW8.
- Depth to water at MW6 was 44.4 feet below TOC (approximately 1 foot higher than the depth to water baseline).

In summary, and based on the AS pilot test and as is expected, DO levels increased at the OBW located closest to the sparge well (MW6). However, at 1.9 mg/L, the observed DO concentration is considered to be at the low end of what may be feasible for effective air sparging (as stated above, over 4 mg/L is preferred). Based on these results, air sparging appeared to increase VOC concentrations in the vapor phase, at least on a localized scale. However, the radius of influence created during the air sparge pilot test appears limited in its lateral extent of influence. The air sparge process did result in raising (or mounding) groundwater elevations.

Based on the results of the pilot test, AS was not selected as a preferred technology due to its apparent limited radius of influence, low DO concentrations, and perched water zone's low hydraulic conductivity.

During the AS pilot test, a total of three air vapor samples were collected from OBWs SVE1, MW5, and MW6 and submitted for gasoline-range TPH and BTEX laboratory analysis. The analytical results in µg/L, and corresponding ppmv, units are summarized below.

Sample ID	Time	Gasoline TPH (µg/L/ppmv)	Benzene (µg/L/ppmv)	Toluene (µg/L/ppmv)	Ethylbenzene (µg/L/ppmv)	Xylenes (µg/ppmv)
<b>AS Pilot Test</b>						
<b>AS1-MW6 Step 2</b>	1:20	46,000/11,000	ND/ND	ND/ND	140/93	1,300/290
<b>AS1-SVE1- Step2</b>	1:20	92,000/22,000	ND/ND	ND/ND	230/52	740/170

### 3.4 RADIUS OF INFLUENCE (ROI) AND CAPTURE ZONE (CZ)

The ROI is the maximum distance from a SVE well where the effect of a mechanically-induced vacuum is measurable and potentially effective. The CZ is the volume around the well screen where SVE pore velocity and soil pore volume exchange rates are suitable for effective remediation. For purposes of this pilot study, the effective ROI from an extraction well is a two dimensional starting point to develop a SVE CZ, and the ROI is defined as where a vacuum response equals ten percent of the vacuum applied at the SVE pilot test wells. For the purposes of this pilot study, the CZ is considered to be a cylinder which extends from the top of the pilot test well screen down to the water table, and the SVE flow is horizontal through the perimeter

of the CZ and distributed evenly across the entire depth of the CZ. The recommended minimum SVE pore velocity at the edge of the CZ is 0.01 cm/s with a recommended pore volume exchange rate of two to four pore volumes per day (*from Engineering and Design, Soil Vapor Extraction and Bioventing. No. 1110-1-4001, June 2, 2002*).

An initial ROI of 30 feet was estimated for SVE1 based on data obtained during the AS/SVE pilot study, using the calculations shown in Appendix D as calculated by PES Environmental, Inc. However, when a 20 foot cylinder height (i.e., distance from top of SVE1 well screen to groundwater) was applied to the 30 foot ROI, the calculated pore velocity at the edge of the ROI was less than the 0.01 cm/s threshold, and therefore inadequate. The next step included using the pilot test flow rates and threshold pore velocity to calculate a CZ of 15 feet. A pore volume exchange rate of 3.8 was estimated for the 15 foot CZ.

Using the most reasonable data from June 9, 2015 pilot study, the calculated CZ for SVE1 was approximately 15 feet and allows adjacent wells to be spaced approximately 12 to 13 feet apart and still provide full coverage of the area to be remediated. Dewatering to a depth of approximately 55 feet will be necessary to allow SVE to address contaminated soil below the water table.

### **3.5 PORE VOLUME CALCULATIONS**

Considering the average depth to the perched water bearing zone (45 feet bgs), dewatered depth (55 feet bgs), an estimated air filled soil porosity for a silty sand-sandy silt estimated to be 20%, and using an average ROI of 15 feet as proposed above, it is estimated that approximately 3 to 4 pore volumes will be exchanged each day. Assuming an approximate 7,000 square foot treatment area and 40 foot deep treatment zone (i.e., 15 feet bgs to 55 feet bgs), the top of contaminated soil at 15 feet, at an extraction rate of approximately 400 to 600 SCFM will be required.

### **3.6 ESTIMATED INITIAL VOLUME CONTAMINANTS RECOVERY**

Based on the vapor samples collected during the October 30, 2014 SVE pilot test at MW-3, the initial concentrations of gasoline-range TPH were between 54,000 µg/L and 89,000 µg/L. Assuming the maximum 7.4 scfm vapor flow rate observed during the June 9, 2015 SVE pilot test, the estimated gasoline-range TPH extracted per hour from the pilot test was approximately 1.5 to 2.5 pounds per hour (lbs/hr). If this extraction rate is extrapolated to a full scale SVE system, it is assumed that a catalytic oxidizer will be needed for cost effective vapor treatment.

The actual conditions will change over time, where levels of gasoline-range TPH extracted will be expected to decline proportionally to the length of time that the system operates.

Gasoline-range TPH/BTEX removal rates during full-scale SVE system operation may be higher than those observed during this testing; especially when multiple wells are incorporated into the SVE system. The additive effect of multiple wells and the larger zone of influence represented by those wells may result in greater contaminant mass capture initially.

#### 4. FEASIBILITY STUDY AND SVE/AS PILOT STUDY CONCLUSIONS

Based on the results of the Feasibility Study (FS) and SVE/AS pilot study, the five remedial alternatives (RAs) were evaluated in general accordance with the MTCA threshold and other RA selection criteria requirements (WAC 173-340-360(2)(a)). The selection criteria and associated evaluation for each RA is summarized in the attached Table 6. The evaluation included the following:

- Meeting the Threshold Requirements.
- Permanency.
- Consideration of Public Concerns.
- Restoration Time Frame.
- Implementability.

Based on the evaluation, and as shown on Table 6, SVE (or low flow-high vacuum dual phase extraction) coupled with dedicated groundwater extraction pumps (as needed) has been selected as the highly preferred remedial technology for the Property.

#### PROJECT LIMITATIONS

This report is the property of RGI and Freeway Properties, LLC and their authorized representatives or affiliates and was prepared in a manner consistent with the level of skill and care ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions. This report is intended for specific application to the property located at 4724 Roosevelt Way Northeast and 4701 11th Avenue Northeast, Seattle, Washington. No other warranty, expressed or implied, is made.

We trust that this report meets your current project needs. Please contact the undersigned at (425) 415-0551 should you have any questions or need additional information.

Sincerely,

**THE RILEY GROUP, INC.**



Paul D. Riley, LG, LHG  
Principal

#### Attachments

- Figure 1, Property Vicinity Map*
- Figure 2, 1905-1950 Former Improvements and Test Probe / Well Locations*
- Figure 3, Summary of Soil Laboratory Results*
- Figure 4, Summary of Groundwater Flow Direction and Laboratory Results*
- Figure 5, Cross-Section A-A'*
- Figure 6, Cross-Section B-B'*
- Figure 7, Cross-Section C-C'*
- Table 1, Summary of Soil Sample Analytical Laboratory Results*



*Table 2, Summary of Groundwater Monitoring Well Sampling and Analytical Laboratory Results*

*Table 3, SVE and Air Sparge Pilot Test – October 2014*

*Table 4, SVE and Air Sparge Pilot Test – June 9, 2015*

*Table 5, Air Sparge Pilot Test – June 10, 2015*

*Table 6, Comparison of Remedial Options*

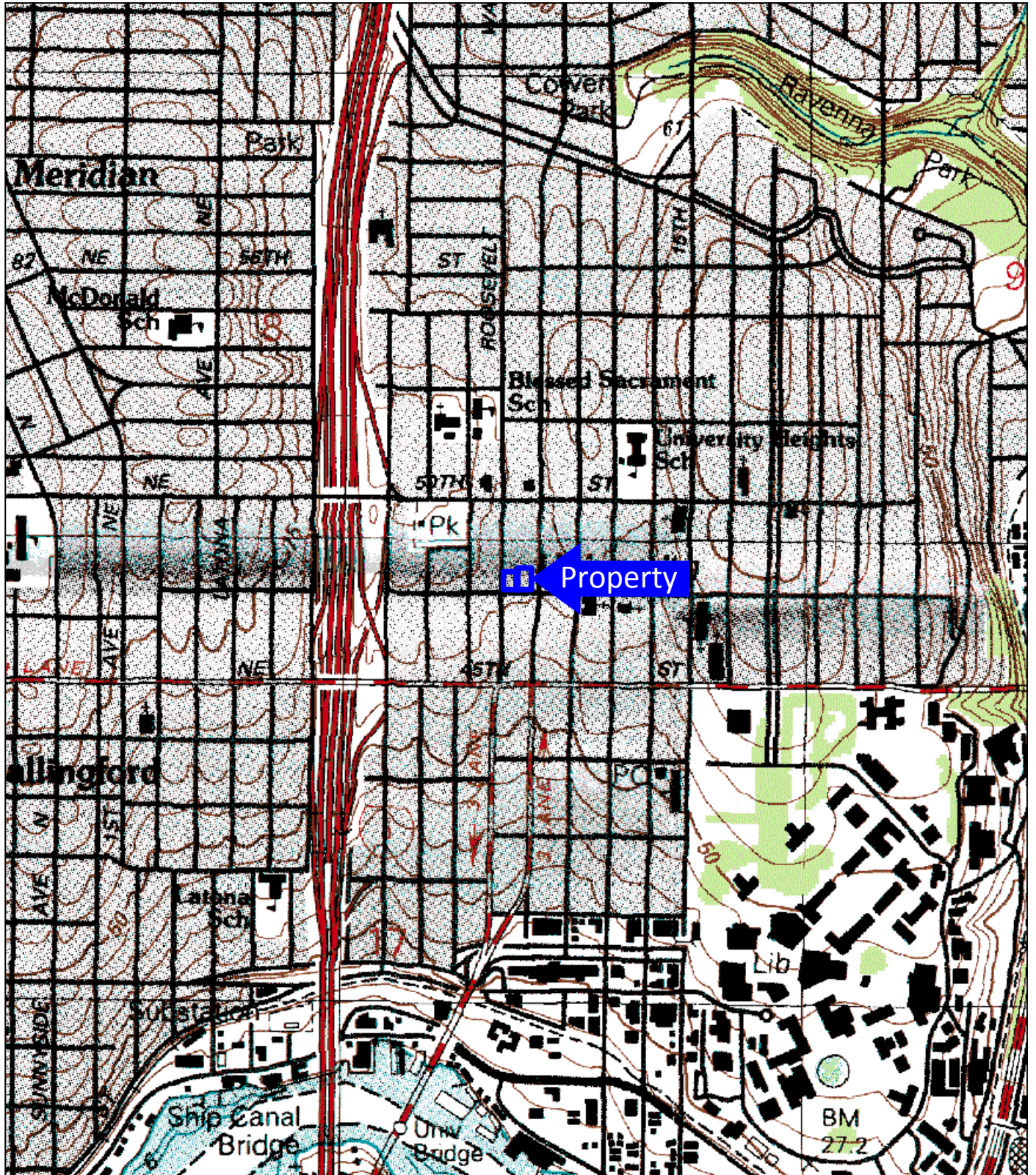
*Appendix A, Summary of the MTCA Evaluation of Remedial Alternative Criteria*

*Appendix B, Wells Logs for SVE and AS Pilot Test Wells*

*Appendix C, Air Vapor Sampling Analytical Laboratory Reports*

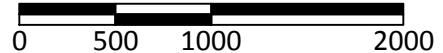
*Appendix D, SVE Pilot Test Capture Zone Calculations Memorandum by PES Environmental, Inc.*

*Report Distribution: Mr. Rob Will, Freeway Properties LLC (bound copy and electronic PDF)*  
*Mr. Grant Yang, Washington State Department of Ecology (bound copy and electronic PDF)*



USGS, 1983, Seattle North, Washington  
7.5-Minute Quadrangle

Approximate Scale: 1"=1000'



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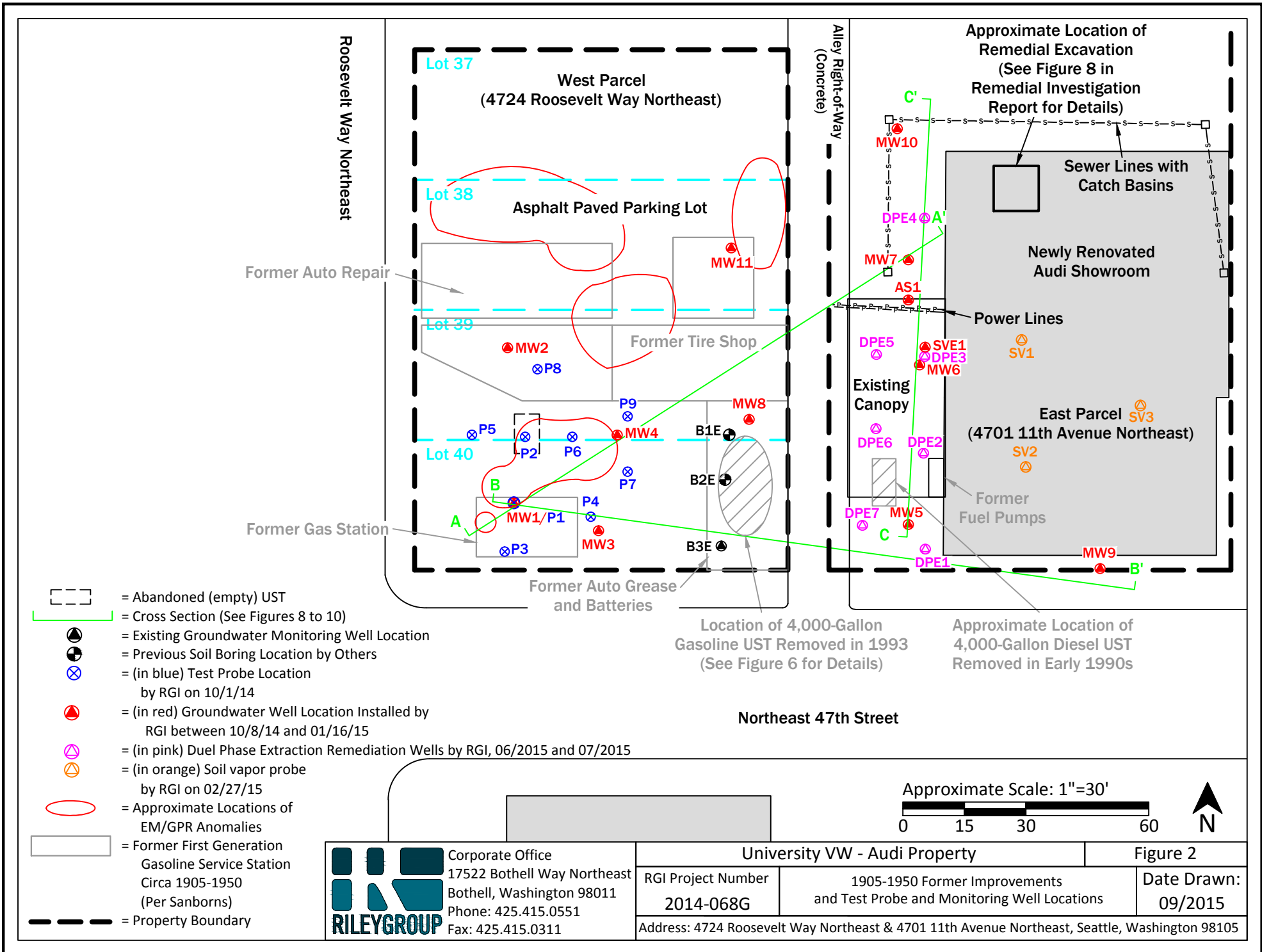
RGI Project Number  
2014-068G

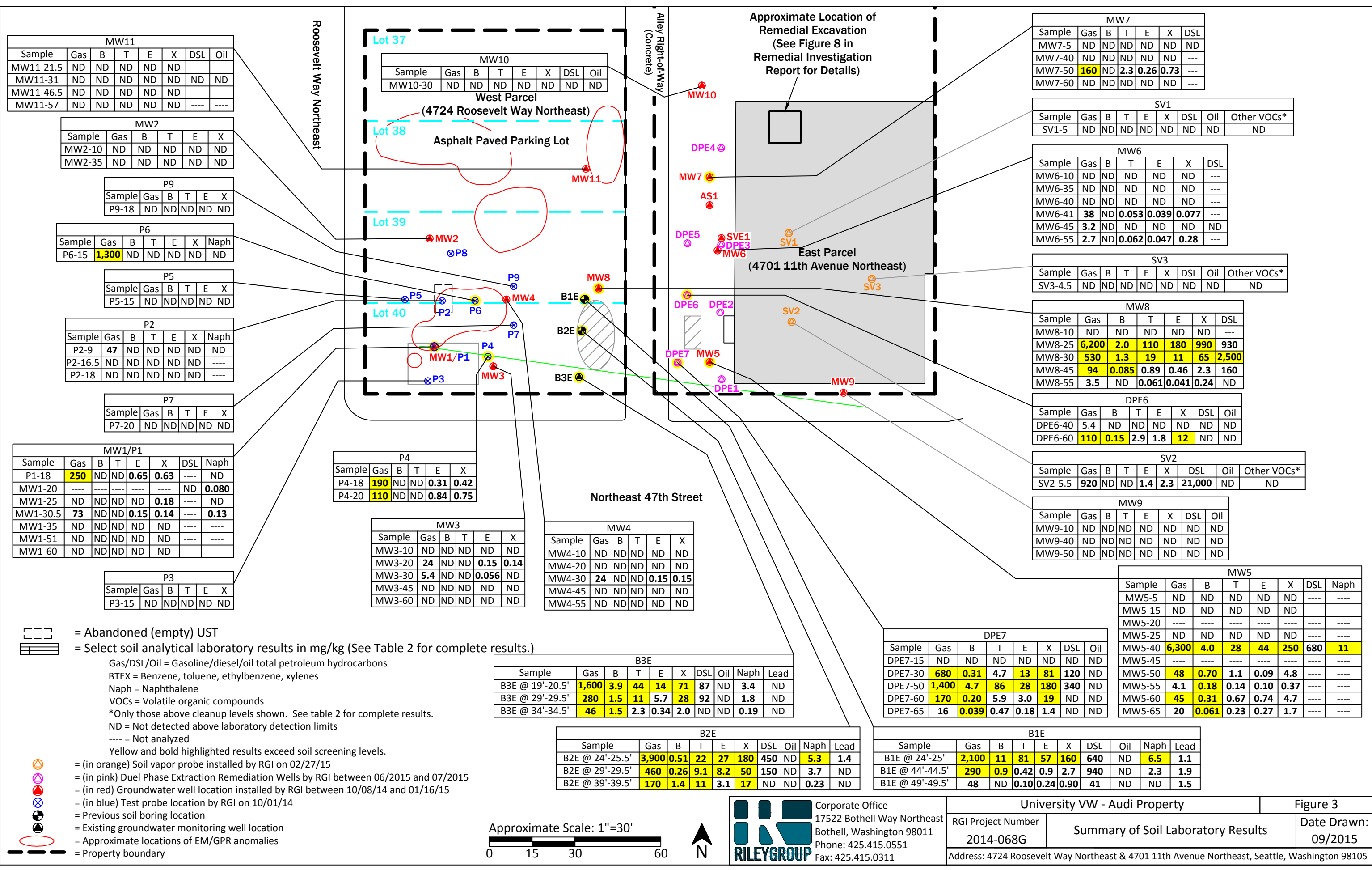
Property Vicinity Map

Figure 1

Date Drawn:  
09/2015

Address: 4724 Roosevelt Way Northeast & 4701 11th Avenue Northeast, Seattle, Washington 98105





MW11							
Sample	Gas	B	T	E	X	DSL	Oil
MW11-21.5	ND	ND	ND	ND	ND	---	---
MW11-31	ND	ND	ND	ND	ND	---	---
MW11-46.5	ND	ND	ND	ND	ND	---	---
MW11-57	ND	ND	ND	ND	ND	---	---

MW2					
Sample	Gas	B	T	E	X
MW2-10	ND	ND	ND	ND	ND
MW2-35	ND	ND	ND	ND	ND

P9					
Sample	Gas	B	T	E	X
P9-18	ND	ND	ND	ND	ND

P6						
Sample	Gas	B	T	E	X	Naph
P6-15	<b>1,300</b>	ND	ND	ND	ND	ND

P5					
Sample	Gas	B	T	E	X
P5-15	ND	ND	ND	ND	ND

P2						
Sample	Gas	B	T	E	X	Naph
P2-9	<b>47</b>	ND	ND	ND	ND	ND
P2-16.5	ND	ND	ND	ND	ND	---
P2-18	ND	ND	ND	ND	ND	---

P7					
Sample	Gas	B	T	E	X
P7-20	ND	ND	ND	ND	ND

MW1/P1							
Sample	Gas	B	T	E	X	DSL	Naph
P1-18	<b>250</b>	ND	ND	<b>0.65</b>	<b>0.63</b>	---	ND
MW1-20	---	---	---	---	---	ND	<b>0.080</b>
MW1-25	ND	ND	ND	ND	<b>0.18</b>	---	ND
MW1-30.5	<b>73</b>	ND	ND	<b>0.15</b>	<b>0.14</b>	---	<b>0.13</b>
MW1-35	ND	ND	ND	ND	ND	---	---
MW1-51	ND	ND	ND	ND	ND	---	---
MW1-60	ND	ND	ND	ND	ND	---	---

P3					
Sample	Gas	B	T	E	X
P3-15	ND	ND	ND	ND	ND

MW10							
Sample	Gas	B	T	E	X	DSL	Oil
MW10-30	ND	ND	ND	ND	ND	---	---

P4					
Sample	Gas	B	T	E	X
P4-18	<b>190</b>	ND	ND	<b>0.31</b>	<b>0.42</b>
P4-20	<b>110</b>	ND	ND	<b>0.84</b>	<b>0.75</b>

MW3					
Sample	Gas	B	T	E	X
MW3-10	ND	ND	ND	ND	ND
MW3-20	<b>24</b>	ND	ND	<b>0.15</b>	<b>0.14</b>
MW3-30	<b>5.4</b>	ND	ND	<b>0.056</b>	ND
MW3-45	ND	ND	ND	ND	ND
MW3-60	ND	ND	ND	ND	ND

MW4					
Sample	Gas	B	T	E	X
MW4-10	ND	ND	ND	ND	ND
MW4-20	ND	ND	ND	ND	ND
MW4-30	<b>24</b>	ND	ND	<b>0.15</b>	<b>0.15</b>
MW4-45	ND	ND	ND	ND	ND
MW4-55	ND	ND	ND	ND	ND

B3E									
Sample	Gas	B	T	E	X	DSL	Oil	Naph	Lead
B3E @ 19'-20.5'	<b>1,600</b>	<b>3.9</b>	<b>44</b>	<b>14</b>	<b>71</b>	<b>87</b>	ND	<b>3.4</b>	ND
B3E @ 29'-29.5'	<b>280</b>	<b>1.5</b>	<b>11</b>	<b>5.7</b>	<b>28</b>	<b>92</b>	ND	<b>1.8</b>	ND
B3E @ 34'-34.5'	<b>46</b>	<b>1.5</b>	<b>2.3</b>	<b>0.34</b>	<b>2.0</b>	ND	ND	<b>0.19</b>	ND

B2E									
Sample	Gas	B	T	E	X	DSL	Oil	Naph	Lead
B2E @ 24'-25.5'	<b>3,900</b>	<b>0.51</b>	<b>22</b>	<b>27</b>	<b>180</b>	<b>450</b>	ND	<b>5.3</b>	<b>1.4</b>
B2E @ 29'-29.5'	<b>460</b>	<b>0.26</b>	<b>9.1</b>	<b>8.2</b>	<b>50</b>	<b>150</b>	ND	<b>3.7</b>	ND
B2E @ 39'-39.5'	<b>170</b>	<b>1.4</b>	<b>11</b>	<b>3.1</b>	<b>17</b>	ND	ND	<b>0.23</b>	ND

DPE7							
Sample	Gas	B	T	E	X	DSL	Oil
DPE7-15	ND	ND	ND	ND	ND	ND	ND
DPE7-30	<b>680</b>	<b>0.31</b>	<b>4.7</b>	<b>13</b>	<b>81</b>	<b>120</b>	ND
DPE7-50	<b>1,400</b>	<b>4.7</b>	<b>86</b>	<b>28</b>	<b>180</b>	<b>340</b>	ND
DPE7-60	<b>170</b>	<b>0.20</b>	<b>5.9</b>	<b>3.0</b>	<b>19</b>	ND	ND
DPE7-65	<b>16</b>	<b>0.039</b>	<b>0.47</b>	<b>0.18</b>	<b>1.4</b>	ND	ND

B1E												
Sample	Gas	B	T	E	X	DSL	Oil	Naph	Lead			
B1E @ 24'-25'	<b>2,100</b>	<b>11</b>	<b>81</b>	<b>57</b>	<b>160</b>	<b>640</b>	ND	<b>6.5</b>	<b>1.1</b>			
B1E @ 44'-44.5'	<b>290</b>	<b>0.9</b>	<b>0.42</b>	<b>0.9</b>	<b>2.7</b>	<b>940</b>	ND	<b>2.3</b>	<b>1.9</b>			
B1E @ 49'-49.5'	<b>48</b>	ND	<b>0.10</b>	<b>0.24</b>	<b>0.90</b>	<b>41</b>	ND	ND	<b>1.5</b>			

MW7						
Sample	Gas	B	T	E	X	DSL
MW7-5	ND	ND	ND	ND	ND	---
MW7-40	ND	ND	ND	ND	ND	---
MW7-50	<b>160</b>	ND	<b>2.3</b>	<b>0.26</b>	<b>0.73</b>	---
MW7-60	ND	ND	ND	ND	ND	---

SV1								
Sample	Gas	B	T	E	X	DSL	Oil	Other VOCs*
SV1-5	ND	ND	ND	ND	ND	ND	ND	ND

MW6							
Sample	Gas	B	T	E	X	DSL	
MW6-10	ND	ND	ND	ND	ND	---	
MW6-35	ND	ND	ND	ND	ND	---	
MW6-40	ND	ND	ND	ND	ND	---	
MW6-41	<b>38</b>	ND	<b>0.053</b>	<b>0.039</b>	<b>0.077</b>	---	
MW6-45	<b>3.2</b>	ND	ND	ND	ND	ND	
MW6-55	<b>2.7</b>	ND	<b>0.062</b>	<b>0.047</b>	<b>0.28</b>	---	

SV3								
Sample	Gas	B	T	E	X	DSL	Oil	Other VOCs*
SV3-4.5	ND	ND	ND	ND	ND	ND	ND	ND

MW8							
Sample	Gas	B	T	E	X	DSL	
MW8-10	ND	ND	ND	ND	ND	---	
MW8-25	<b>6,200</b>	<b>2.0</b>	<b>110</b>	<b>180</b>	<b>990</b>	<b>930</b>	
MW8-30	<b>530</b>	<b>1.3</b>	<b>19</b>	<b>11</b>	<b>65</b>	<b>2,500</b>	
MW8-45	<b>94</b>	<b>0.085</b>	<b>0.89</b>	<b>0.46</b>	<b>2.3</b>	<b>160</b>	
MW8-55	<b>3.5</b>	ND	<b>0.061</b>	<b>0.041</b>	<b>0.24</b>	ND	

DPE6							
Sample	Gas	B	T	E	X	DSL	Oil
DPE6-40	5.4	ND	ND	ND	ND	ND	ND
DPE6-60	<b>110</b>	<b>0.15</b>	<b>2.9</b>	<b>1.8</b>	<b>12</b>	ND	ND

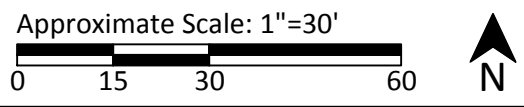
SV2								
Sample	Gas	B	T	E	X	DSL	Oil	Other VOCs*
SV2-5.5	<b>920</b>	ND	ND	<b>1.4</b>	<b>2.3</b>	<b>21,000</b>	ND	ND

MW9							
Sample	Gas	B	T	E	X	DSL	Oil
MW9-10	ND	ND	ND	ND	ND	ND	ND
MW9-40	ND	ND	ND	ND	ND	ND	ND
MW9-50	ND	ND	ND	ND	ND	ND	ND

MW5								
Sample	Gas	B	T	E	X	DSL	Naph	
MW5-5	ND	ND	ND	ND	ND	---	---	
MW5-15	ND	ND	ND	ND	ND	---	---	
MW5-20	---	---	---	---	---	---	---	
MW5-25	ND	ND	ND	ND	ND	---	---	
MW5-40	<b>6,300</b>	<b>4.0</b>	<b>28</b>	<b>44</b>	<b>250</b>	<b>680</b>	<b>11</b>	
MW5-45	---	---	---	---	---	---	---	
MW5-50	<b>48</b>	<b>0.70</b>	<b>1.1</b>	<b>0.09</b>	<b>4.8</b>	---	---	
MW5-55	<b>4.1</b>	<b>0.18</b>	<b>0.14</b>	<b>0.10</b>	<b>0.37</b>	---	---	
MW5-60	<b>45</b>	<b>0.31</b>	<b>0.67</b>	<b>0.74</b>	<b>4.7</b>	---	---	
MW5-65	<b>20</b>	<b>0.061</b>	<b>0.23</b>	<b>0.27</b>	<b>1.7</b>	---	---	

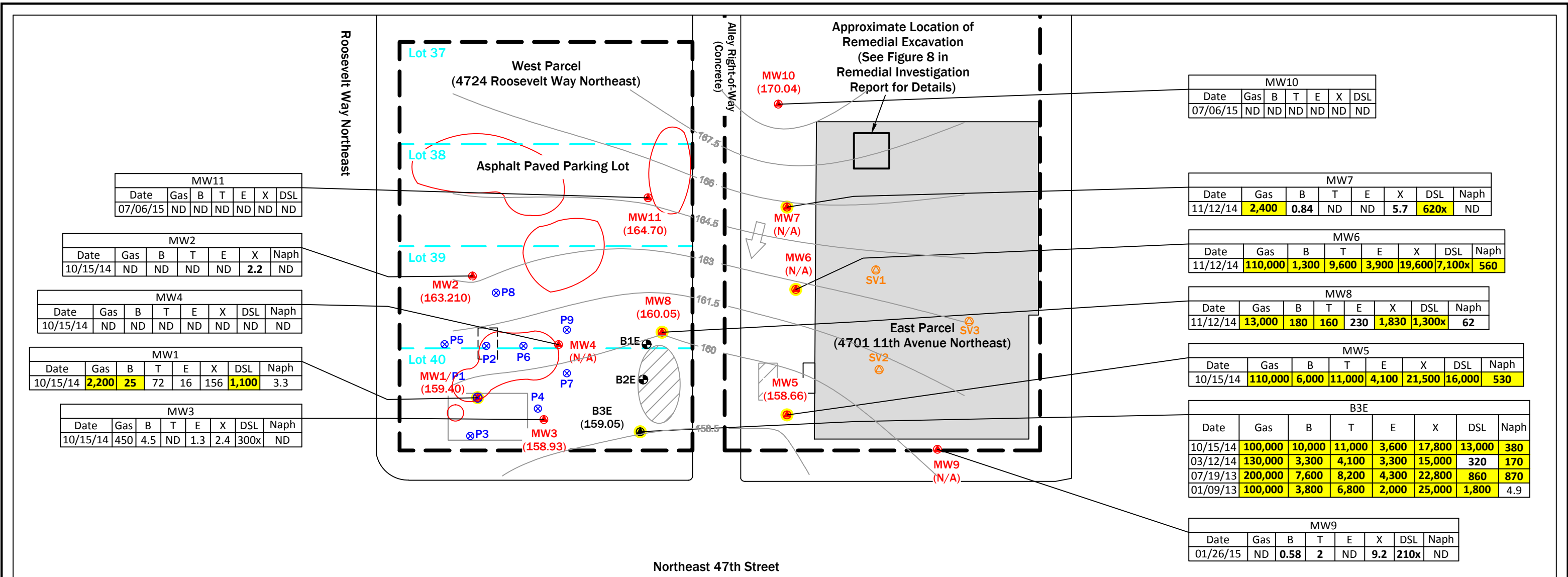
[Dashed Box] = Abandoned (empty) UST  
 [Table] = Select soil analytical laboratory results in mg/kg (See Table 2 for complete results.)  
 Gas/DSL/Oil = Gasoline/diesel/oil total petroleum hydrocarbons  
 BTEX = Benzene, toluene, ethylbenzene, xylenes  
 Naph = Naphthalene  
 VOCs = Volatile organic compounds  
 \*Only those above cleanup levels shown. See table 2 for complete results.  
 ND = Not detected above laboratory detection limits  
 --- = Not analyzed  
 Yellow and bold highlighted results exceed soil screening levels.

= (in orange) Soil vapor probe installed by RGI on 02/27/15  
 = (in pink) Duel Phase Extraction Remediation Wells by RGI between 06/2015 and 07/2015  
 = (in red) Groundwater well location installed by RGI between 10/08/14 and 01/16/15  
 = (in blue) Test probe location by RGI on 10/01/14  
 = Previous soil boring location  
 = Existing groundwater monitoring well location  
 = Approximate locations of EM/GPR anomalies  
 = Property boundary



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 RGI Project Number: 2014-068G  
 Address: 4724 Roosevelt Way Northeast & 4701 11th Avenue Northeast, Seattle, Washington 98105  
 Figure 3  
 Summary of Soil Laboratory Results  
 Date Drawn: 09/2015



MW10							
Date	Gas	B	T	E	X	DSL	
07/06/15	ND	ND	ND	ND	ND	ND	ND

MW7								
Date	Gas	B	T	E	X	DSL	Naph	
11/12/14	2,400	0.84	ND	ND	5.7	620x	ND	

MW6								
Date	Gas	B	T	E	X	DSL	Naph	
11/12/14	110,000	1,300	9,600	3,900	19,600	7,100x	560	

MW8								
Date	Gas	B	T	E	X	DSL	Naph	
11/12/14	13,000	180	160	230	1,830	1,300x	62	

MW5								
Date	Gas	B	T	E	X	DSL	Naph	
10/15/14	110,000	6,000	11,000	4,100	21,500	16,000	530	

B3E								
Date	Gas	B	T	E	X	DSL	Naph	
10/15/14	100,000	10,000	11,000	3,600	17,800	13,000	380	
03/12/14	130,000	3,300	4,100	3,300	15,000	320	170	
07/19/13	200,000	7,600	8,200	4,300	22,800	860	870	
01/09/13	100,000	3,800	6,800	2,000	25,000	1,800	4.9	

MW9							
Date	Gas	B	T	E	X	DSL	Naph
01/26/15	ND	0.58	2	ND	9.2	210x	ND

MW11							
Date	Gas	B	T	E	X	DSL	
07/06/15	ND	ND	ND	ND	ND	ND	ND

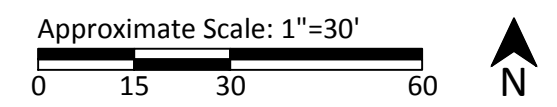
MW2							
Date	Gas	B	T	E	X	DSL	Naph
10/15/14	ND	ND	ND	ND	2.2	ND	ND

MW4							
Date	Gas	B	T	E	X	DSL	Naph
10/15/14	ND	ND	ND	ND	ND	ND	ND

MW1							
Date	Gas	B	T	E	X	DSL	Naph
10/15/14	2,200	25	72	16	156	1,100	3.3

MW3							
Date	Gas	B	T	E	X	DSL	Naph
10/15/14	450	4.5	ND	1.3	2.4	300x	ND

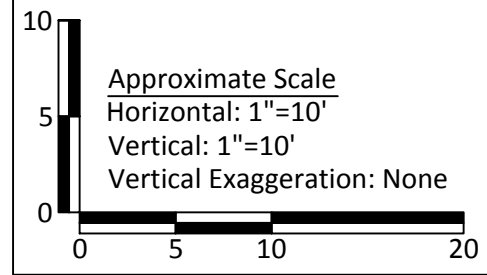
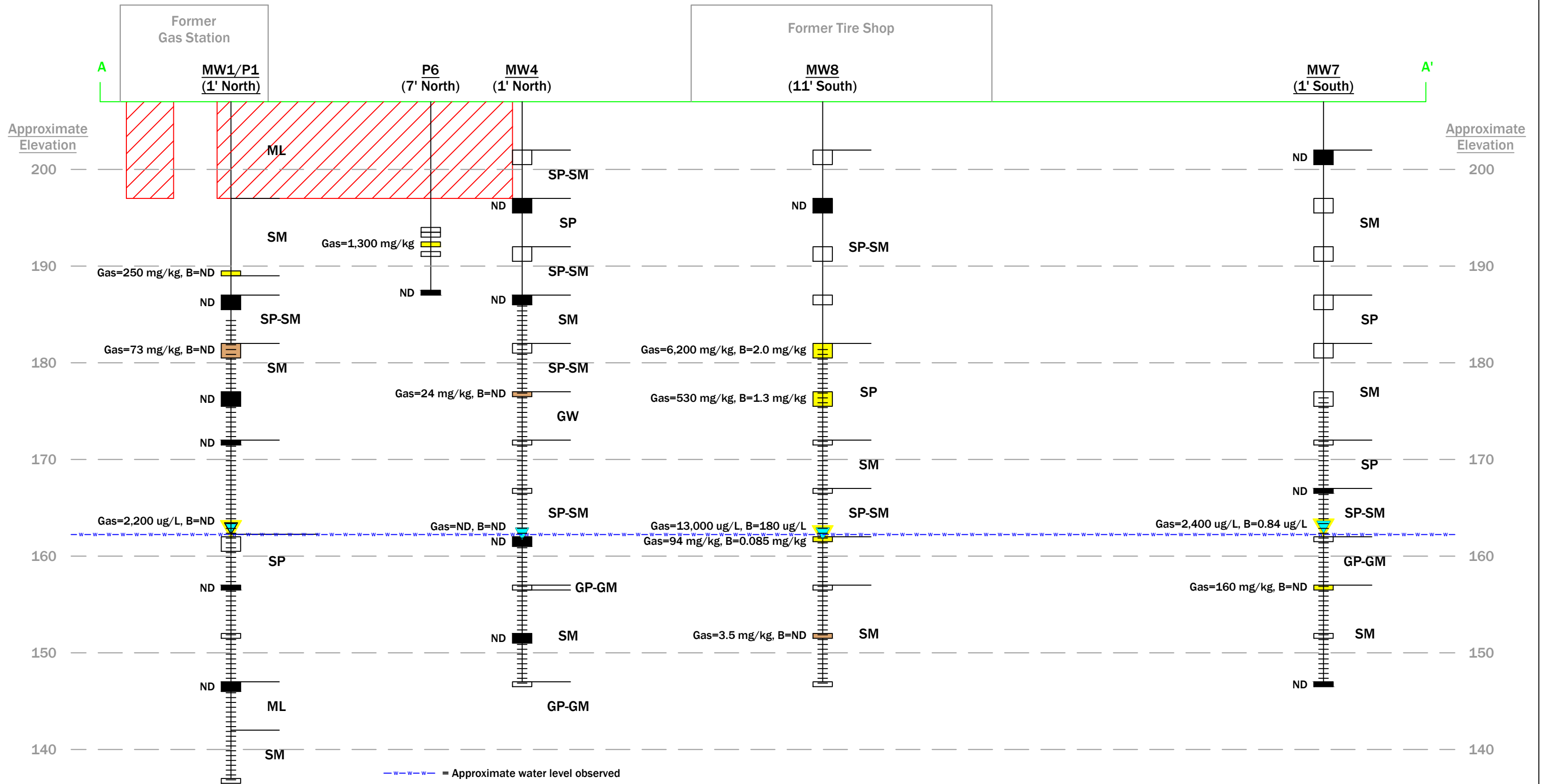
- = Abandoned (empty) UST
- = Groundwater contours generated using Surfer Software (based on Kriging method).  
Contours based on July 6, 2015 water level measurements.
- = Groundwater Flow Direction
- = Select groundwater analytical laboratory results in ug/L (See Table 2 for complete results.)  
Gas/DSL = Gasoline/diesel total petroleum hydrocarbons  
BTEX = Benzene, toluene, ethylbenzene, xylenes  
Naph = Naphthalene  
ND = Not detected above laboratory detection limits  
---- = Not analyzed  
Yellow and bold highlighted results exceed groundwater screening levels.  
x = The sample chromatographic pattern does not resemble the fuel standard used for quantitation.
- = (in red) Groundwater well location installed by RGI between 10/08/14 and 01/16/15
- = (in orange) Soil vapor probe by RGI on 02/27/15
- = (in blue) Test probe location by RGI on 10/01/14
- = Previous soil boring location
- = Existing groundwater monitoring well location
- = Approximate locations of EM/GPR anomalies
- = Property boundary



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University VW - Audi Property		Figure 4
RGI Project Number 2014-068G	Summary of Groundwater Flow Direction and Laboratory Results	Date Drawn: 09/2015
Address: 4724 Roosevelt Way Northeast & 4701 11th Avenue Northeast, Seattle, Washington 98105		

Looking Northwest



-w-w-w- = Approximate water level observed

**Groundwater sample location with contaminants of concern (COCs):**

- ▲ (blue) Not analyzed or detected below screening levels
- ▼ (yellow) Detected above groundwater screening levels

**Soil sample location with COCs:**

- (white) Not analyzed
- (black) Not detected
- (orange) Detected below soil screening levels
- (yellow) Detected above soil screening levels

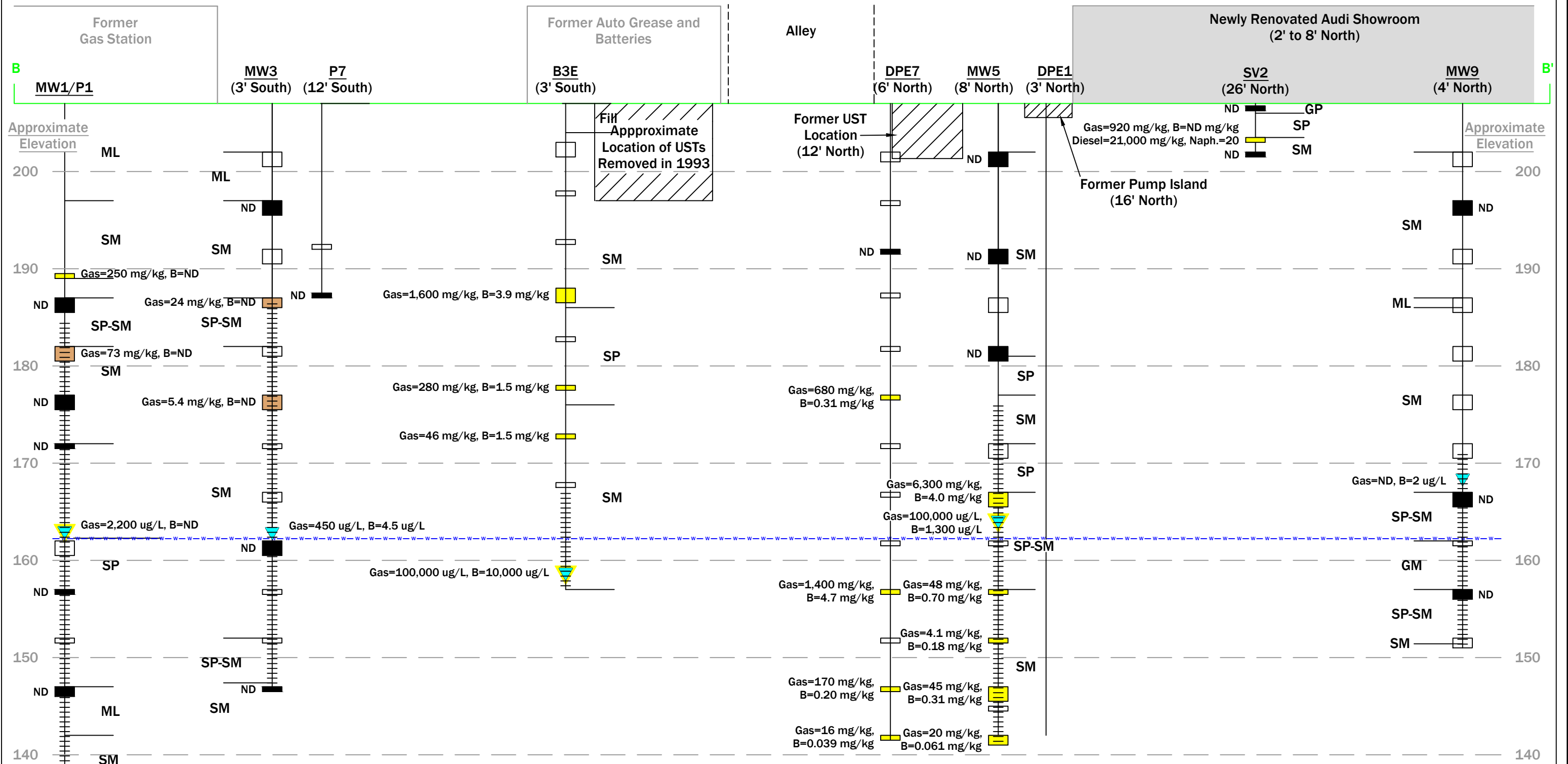
COCs: gasoline TPH, benzene, toluene, ethylbenzene, xylenes, and/or naphthalene

▨ (red hatched) = Approximate Locations of EMAG/GPR Anomalies

▨ (white hatched) = Former First Generation Gasoline Service Station Circa 1905-1950 (Per Sanborns)

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	RGI Project Number 2014-068G	Cross Section A-A'	Date Drawn: 09/2015
	Address: 4724 Roosevelt Way Northeast & 4701 11th Avenue Northeast, Seattle, Washington 98105		

Looking North



—w—w—w— = Approximate water level observed

Groundwater sample location with contaminants of concern (COCs):

- Not analyzed or detected below screening levels
- Detected above groundwater screening levels

Soil sample location with COCs:

- Not analyzed
- Not detected
- Detected below soil screening levels
- Detected above soil screening levels

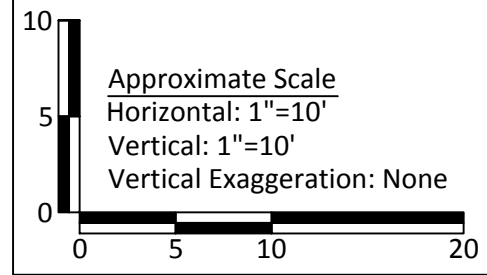
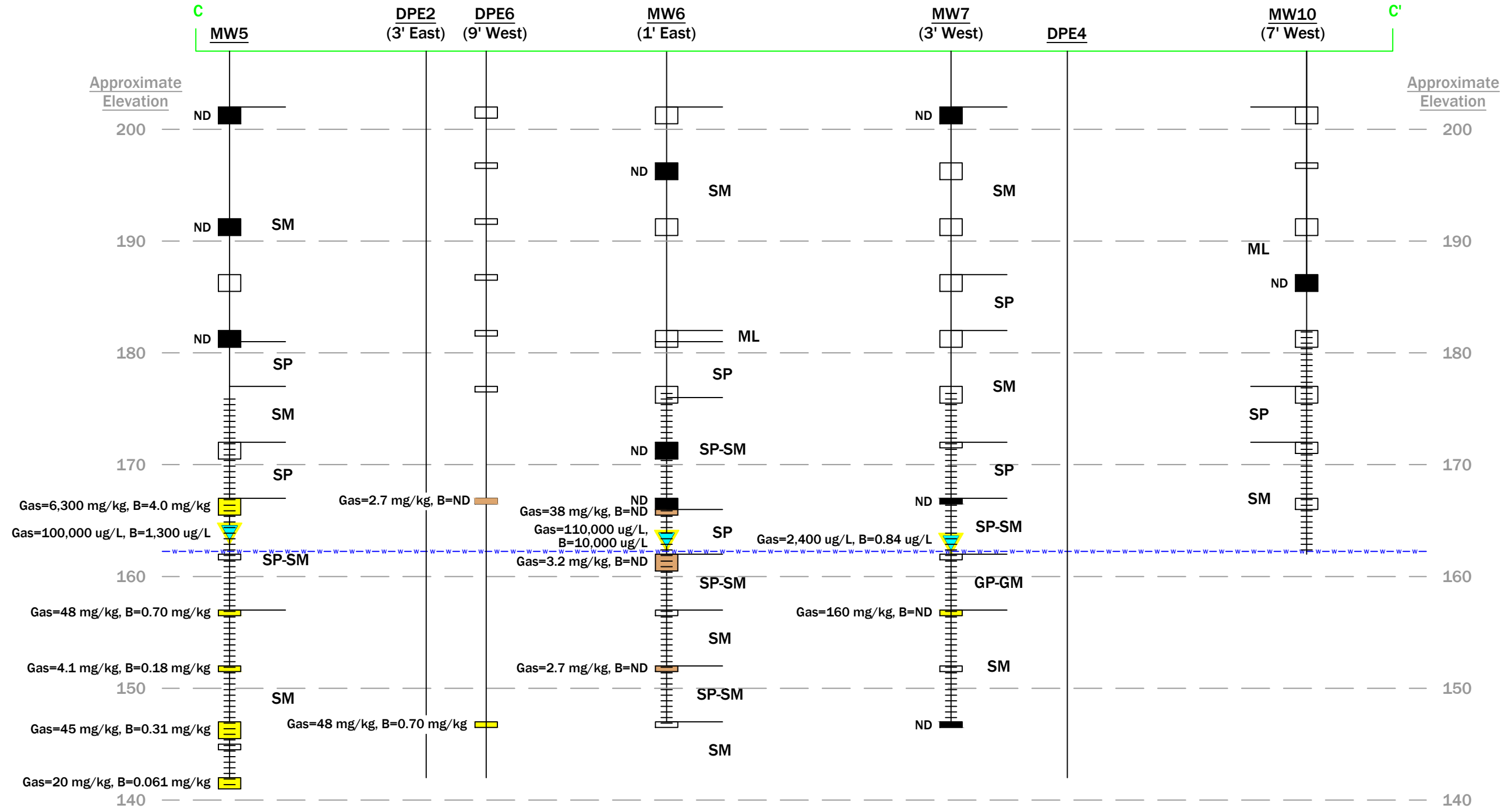
COCs: gasoline TPH, benzene, toluene, ethylbenzene, xylenes, and/or naphthalene

Approximate Scale  
Horizontal: 1"=10'  
Vertical: 1"=10'  
Vertical Exaggeration: None

Legend: = Former First Generation Gasoline Service Station Circa 1905-1950 (Per Sanborns)

<p>Corporate Office 17522 Bothell Way Northeast Bothell, Washington 98011 Phone: 425.415.0551 Fax: 425.415.0311</p>	University VW - Audi Property		Figure 6
	RGI Project Number 2014-068G	Cross Section B-B'	Date Drawn: 09/2015
	Address: 4724 Roosevelt Way Northeast & 4701 11th Avenue Northeast, Seattle, Washington 98105		

Looking West



—w—w—w— = Approximate water level observed

Groundwater sample location with contaminants of concern (COCs):

- ▲ Not analyzed or detected below screening levels
- ▼ Detected above groundwater screening levels

Soil sample location with COCs:

- Not analyzed
- Not detected
- Detected below soil screening levels
- Detected above soil screening levels

COCs: gasoline TPH, benzene, toluene, ethylbenzene, xylenes, and/or naphthalene

**RILEYGROUP**  
Corporate Office  
17522 Bothell Way Northeast  
Bothell, Washington 98011  
Phone: 425.415.0551  
Fax: 425.415.0311

University VW - Audi Property		Figure 7
RGI Project Number 2014-068G	Cross Section C-C'	Date Drawn: 09/2015
Address: 4724 Roosevelt Way Northeast & 4701 11th Avenue Northeast, Seattle, Washington 98105		

Table 1, Page 1 of 6. Summary of Soil Sample Analytical Laboratory Results

University VW - Audi Property

4724 Roosevelt Way Northeast and 4701 11th Avenue Northeast, Seattle, Washington 98105

The Riley Group, Inc. Project No. 2014-068G

Sample Number	Sample Depth	Sample Date	PID	Gasoline TPH	BTEX				Diesel TPH	Oil TPH	HCID			VOCs Not Included in TPH Screening Level Calculations	SVOCs	Naph.	cPAHs	TCLP Metals (ug/L)	Total RCRA 8 Metals								
					B	T	E	X			Gasoline	Diesel	Heavy Oil						As	Ba	Cd	Total Cr	Pb	Hg	Se	Ag	
<b>Sub-Slab Soil Vapor Temp Wells</b>																											
SV1-5	5	02/27/15	0.1	ND<2	ND<0.02	ND<0.05	ND<0.05	ND<0.1	ND<50	ND<250	---	---	---	ND	---	ND<0.05	---	---	---	---	---	---	---	---	---	---	---
SV2-5.5	5.5	02/27/15	135	920	ND<0.02	ND<0.05	1.4	2.3	21,000	ND<250	---	---	---	ND	---	20	---	---	---	---	---	---	---	---	---	---	---
SV3-4.5	4.5	02/27/15	0	ND<2	ND<0.02	ND<0.05	ND<0.05	ND<0.1	ND<50	ND<250	---	---	---	ND	---	ND<0.05	---	---	---	1.4	---	ND<1	8.28	1.44	ND<1	---	---
<b>Hot Spot Remedial Excavation Samples</b>																											
NSW4	4	01/12/15	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
NSW6	6	01/12/15	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
ESW4	4	01/12/15	---	ND<2	ND<0.03	ND<0.05	ND<0.05	ND<0.1	ND<50	ND<250	---	---	---	ND	---	ND<0.05	---	---	---	1.4	---	ND<1	8.28	1.44	ND<1	---	---
ESW6	6	01/12/15	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
SSW6	6	01/12/15	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
WSW4	4	01/12/15	---	870	ND<0.03	ND<0.05	0.088	0.10	3,800	ND<250	---	---	---	ND	---	4.9	---	---	---	5.79	---	ND<1	18.3	3.61	ND<1	---	---
WSW6	6	01/12/15	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
BOT7	7	01/12/15	---	ND<2	ND<0.03	ND<0.05	ND<0.05	ND<0.1	ND<50	ND<250	---	---	---	ND	---	ND<0.05	---	---	---	1.52	---	ND<1	8.81	1.58	ND<1	---	---
SS1	---	01/12/15	---	170	ND<0.03	ND<0.05	ND<0.05	ND<0.1	210	ND<250	---	---	---	ND	---	0.53	---	---	4.87	---	ND<1	16.5	4.48	ND<1	---	---	
SS2	---	01/12/15	---	25	ND<0.03	ND<0.05	ND<0.05	ND<0.1			ND	---	---	---	ND	---	0.12	---									---
SS3	---	01/12/15	---	67	ND<0.03	ND<0.05	ND<0.05	ND<0.1			ND	---	---	---	ND	---	0.28	---									---
<b>Test Probe Investigation</b>																											
P1-18	18	10/01/14	1429	250	ND<0.03	ND<0.05	0.65	0.63	---	---	---	---	---	---	---	ND<0.05	---	---	---	---	---	---	---	---	---	---	---
P2-5	5	10/01/14	21.9	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P2-9	9	10/01/14	127	47	ND<0.03	ND<0.05	ND<0.05	ND<0.1	---	---	---	---	---	---	---	ND<0.05	---	---	---	---	---	---	---	---	---	---	---
P2-15	15	10/01/14	97.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P2-16.5	16.5	10/01/14	49.9	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P2-18	18	10/01/14	22.5	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P3-15	15	10/01/14	7.9	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P4-16	16	10/01/14	3.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P4-18	18	10/01/14	27.8	190	ND<0.02	ND<0.02	0.31	0.42	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P4-20	20	10/01/14	98	110	ND<0.02	ND<0.02	0.84	0.75	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P5-15	15	10/01/14	50.2	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P6-13.5	13.5	10/01/14	28.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P6-14	14	10/01/14	175	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P6-15	15	10/01/14	264	1,300	ND<0.03	ND<0.05	ND<0.05	ND<0.1	---	---	---	---	---	---	---	ND<0.05	---	---	---	---	---	---	---	---	---	---	---
P7-15	15	10/01/14	1.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P7-20	20	10/01/14	2.2	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P8-19	19	10/01/14	2.9	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P9-18	18	10/01/14	3.1	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
<b>Monitoring Wells</b>																											
MW-1 Screened Interval 66-18 ft bgs, Total boring depth 70 ft bgs																											
MW1-20	20	10/08/14	3141	---	---	---	---	---	ND<50	ND<250	---	---	---	---	---	0.080	ND<0.01	---	1.17	30.7	ND<1	10.2	3.17	ND<1	ND<1	ND<1	
<b>MTCA Method A Soil Screening Levels for Unrestricted Land Uses</b>				100/30 <sup>1</sup>	0.03	7	6	9	2,000		100/30 <sup>1</sup>	2,000		Analyte Specific	Analyte Specific	5	0.1	Analyte Specific	20	---	2	2,000 <sup>2</sup>	250	2	---	---	
<b>MTCA Method B Soil Screening Levels for Unrestricted Land Uses<sup>3</sup></b>				---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	16,000	---	---	---	---	400	400

**Table 1, Page 2 of 6. Summary of Soil Sample Analytical Laboratory Results**  
**University VW - Audi Property**  
**4724 Roosevelt Way Northeast and 4701 11th Avenue Northeast, Seattle, Washington 98105**  
**The Riley Group, Inc. Project No. 2014-068G**

Sample Number	Sample Depth	Sample Date	PID	Gasoline TPH	BTEX				Diesel TPH	Oil TPH	HCID			VOCs Not Included in TPH Screening Level Calculations	SVOCs	Naph.	cPAHs	TCLP Metals (ug/L)	Total RCRA 8 Metals								
					B	T	E	X			Gasoline	Diesel	Heavy Oil						As	Ba	Cd	Total Cr	Pb	Hg	Se	Ag	
MW1-25	25	10/08/14	1856	ND<2	ND<0.03	ND<0.05	ND<0.05	<b>0.181</b>	----	----	----	----	----	ND	----	ND<0.05	----	----	----	----	----	----	----	----	----	----	
MW1-30.5	30.5	10/08/14	1540	<b>73</b>	ND<0.03	ND<0.05	<b>0.15</b>	<b>0.14</b>	----	----	----	----	----	ND	----	<b>0.13</b>	----	----	----	----	----	----	----	----	----	----	
MW1-35	35	10/08/14	31.6	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW1-46	46	10/08/14	1.3	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW1-51	51	10/08/14	2.5	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW1-56	56	10/08/14	2.9	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW1-60	60	10/08/14	3.0	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW1-70	70	10/08/14	1.8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW-2 Screened Interval 45-14 ft bgs, Total boring depth 65 ft bgs																											
MW2-10	10	10/09/14	0.1	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW2-15	15	10/09/14	0.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW2-25	25	10/09/14	0.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1.98	----
MW2-30	30	10/09/14	0.7	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	2.38	----	
MW2-35	35	10/09/14	0.5	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW2-40	40	10/09/14	0.9	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW2-45	45	10/09/14	0.5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW2-50	50	10/09/14	1.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW2-55	55	10/09/14	0.8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW2-60	60	10/09/14	0.7	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW2-65	65	10/09/14	0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-3 Screened Interval 60-20 ft bgs, Total boring depth 60 ft bgs																											
MW3-5	5	10/09/14	0.8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW3-10	10	10/09/14	1.2	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW3-15	15	10/09/14	1.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW3-20	20	10/09/14	315.6	<b>24</b>	ND<0.02	ND<0.02	<b>0.15</b>	<b>0.14</b>	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW3-25	25	10/09/14	94.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW3-30	30	10/09/14	473.2	<b>5.4</b>	ND<0.02	ND<0.02	<b>0.056</b>	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW3-35	35	10/09/14	22.4	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW3-40	40	10/09/14	11.8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW3-45	45	10/09/14	3.0	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW3-50	50	10/09/14	22.4	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW3-55	55	10/09/14	2.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW3-60	60	10/09/14	3.0	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-4 Screened Interval 60-20 ft bgs, Total boring depth 60 ft bgs																											
MW4-5	5	10/10/14	0.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW4-10	10	10/10/14	0.7	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW4-15	15	10/10/14	0.9	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW4-20	20	10/10/14	34.4	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MTCA Method A Soil Screening Levels for Unrestricted Land Uses				100/30 <sup>1</sup>	0.03	7	6	9	2,000	100/30 <sup>1</sup>	2,000	Analyte Specific	Analyte Specific	5	0.1	Analyte Specific	20	----	2	2,000 <sup>2</sup>	250	2	----	----	----	----	
MTCA Method B Soil Screening Levels for Unrestricted Land Uses <sup>3</sup>				----	----	----	----	----	----	----	----	----	----	----	----	----	----	16,000	----	----	----	----	400	400	----	----	

**Table 1, Page 3 of 6. Summary of Soil Sample Analytical Laboratory Results**  
**University VW - Audi Property**  
**4724 Roosevelt Way Northeast and 4701 11th Avenue Northeast, Seattle, Washington 98105**  
**The Riley Group, Inc. Project No. 2014-068G**

Sample Number	Sample Depth	Sample Date	PID	Gasoline TPH	BTEX				Diesel TPH	Oil TPH	HCID			VOCs Not Included in TPH Screening Level Calculations	SVOCs	Naph.	cPAHs	TCLP Metals (ug/L)	Total RCRA 8 Metals								
					B	T	E	X			Gasoline	Diesel	Heavy Oil						As	Ba	Cd	Total Cr	Pb	Hg	Se	Ag	
MW4-25	25	10/10/14	29.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW4-30	30	10/10/14	87.7	24	ND<0.02	ND<0.02	0.15	0.15	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW4-35	35	10/10/14	2.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW4-40	40	10/10/14	1.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW4-45	45	10/10/14	1.0	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW4-50	50	10/10/14	0.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW4-55	55	10/10/14	1.6	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW4-60	60	10/10/14	1.5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW-5 Screened Interval 65-30 ft bgs, Total boring depth 65 ft bgs																											
MW5-5	5	10/08/14	1.4	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW5-15	15	10/08/14	0.8	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW5-20	20	10/08/14	1.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	2.11	----	----
MW5-25	25	10/08/14	1.4	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	2.13	----	----	----
MW5-35	35	10/08/14	1017	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW5-40	40	10/08/14	2428	6,300	5.4	28	44	250	680	ND<250	----	----	----	ND	----	11	ND<0.01	----	ND<1	20.7	ND<1	9.15	1.76	ND<1	ND<1	ND<1	
MW5-45	45	10/08/14	1069	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1.73	----	----	----
MW5-50	50	10/08/14	228.1	48	0.70	1.1	0.09	4.8	----	----	ND<20	ND<50	ND<250	----	----	----	----	----	----	----	----	----	2.17	----	----	----	
MW5-55	55	10/08/14	195.1	4.1	0.18	0.14	0.10	0.37	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1.83	----	----	----	
MW5-60	60	10/08/14	19.6	45	0.31	0.67	0.74	4.7	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW5-62.5	62.5	10/08/14	87.3	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW5-65	65	10/08/14	101.3	20	0.061	0.23	0.27	1.7	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW-6 Screened Interval 60-30 ft bgs, Total boring depth 60 ft bgs																											
MW6-5	5	11/04/14	0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW6-10	10	11/04/14	0.1	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW6-15	15	11/04/14	0.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW6-25	25	11/04/14	0.3	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW6-26	26	11/04/14	0.3	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW6-30	30	11/04/14	0.3	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW6-35	35	11/04/14	42.4	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW6-40	40	11/04/14	27.9	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW6-41	41	11/04/14	969.2	38	ND<0.02	0.053	0.039	0.077	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW6-45	45	11/04/14	15,000+	3.2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW6-50	50	11/04/14	15,000+	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW6-55	55	11/04/14	71.1	2.7	ND<0.02	0.062	0.047	0.28	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW6-60	60	11/04/14	1504	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-7 Screened Interval 60-30 ft bgs, Total boring depth 60 ft bgs																											
MW7-5	5	11/07/14	24.4	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW7-10	10	11/07/14	2.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MTCA Method A Soil Screening Levels for Unrestricted Land Uses				100/30 <sup>1</sup>	0.03	7	6	9	2,000		100/30 <sup>1</sup>	2,000		Analyte Specific	Analyte Specific	5	0.1	Analyte Specific	20	----	2	2,000 <sup>2</sup>	250	2	----	----	
MTCA Method B Soil Screening Levels for Unrestricted Land Uses <sup>3</sup>				----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	16,000	----	----	----	----	400	400

**Table 1, Page 4 of 6. Summary of Soil Sample Analytical Laboratory Results**  
**University VW - Audi Property**  
**4724 Roosevelt Way Northeast and 4701 11th Avenue Northeast, Seattle, Washington 98105**  
**The Riley Group, Inc. Project No. 2014-068G**

Sample Number	Sample Depth	Sample Date	PID	Gasoline TPH	BTEX				Diesel TPH	Oil TPH	HCID			VOCs Not Included in TPH Screening Level Calculations	SVOCs	Naph.	cPAHs	TCLP Metals (ug/L)	Total RCRA 8 Metals										
					B	T	E	X			Gasoline	Diesel	Heavy Oil						As	Ba	Cd	Total Cr	Pb	Hg	Se	Ag			
MW7-15	15	11/07/14	2.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
MW7-20	20	11/07/14	12.3	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
MW7-25	25	11/07/14	0.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
MW7-30	30	11/07/14	0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
MW7-35	35	11/07/14	0.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
MW7-40	40	11/07/14	8.8	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
MW7-45	45	11/07/14	258.7	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
MW7-50	50	11/07/14	454.2	160	ND<0.02	2.3	0.26	0.73	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
MW7-55	55	11/07/14	53.3	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
MW7-60	60	11/07/14	15.3	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
MW-8 Screened Interval 60-25 ft bgs, Total boring depth 60 ft bgs																													
MW8-5	5	11/07/14	0.6	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
MW8-10	10	11/07/14	1.2	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
MW8-15	15	11/07/14	1.4	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
MW8-20	20	11/07/14	1.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
MW8-25	25	11/07/14	15,000+	6,200	2.0	110	180	990	930	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
MW8-30	30	11/07/14	15,000+	530	1.3	19	11	65	2,500	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
MW8-35	35	11/07/14	1356	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
MW8-40	40	11/07/14	15,000+	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
MW8-45	45	11/07/14	15,000+	94	0.085	0.89	0.46	2.3	160	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
MW8-50	50	11/07/14	7040	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
MW8-55	55	11/07/14	58.8	3.5	ND<0.02	0.061	0.041	0.24	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
MW8-60	60	11/07/14	505.7	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
MW-9 Screened Interval 56-36 ft bgs, Total boring depth 56 ft bgs																													
MW9-5	5	01/16/15	0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW9-10	10	01/16/15	0.7	----	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	ND<20	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
MW9-15	15	01/16/15	0.7	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW9-20	20	01/16/15	0.7	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW9-25	25	01/16/15	0.6	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW9-30	30	01/16/15	0.6	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW9-35	35	01/16/15	0.6	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW9-40	40	01/16/15	1.0	----	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	ND<20	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW9-45	45	01/16/15	0.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW9-50	50	01/16/15	1.9	----	ND<0.02	ND<0.02	ND<0.02	ND<0.06	----	----	ND<20	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW9-55	55	01/16/15	1.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW9-56	56	01/16/15	0.9	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MTCA Method A Soil Screening Levels for Unrestricted Land Uses				100/30 <sup>1</sup>	0.03	7	6	9	2,000		100/30 <sup>1</sup>	2,000		Analyte Specific	Analyte Specific	5	0.1	Analyte Specific	20	----	2	2,000 <sup>2</sup>	250	2	----	----	----	----	
MTCA Method B Soil Screening Levels for Unrestricted Land Uses <sup>3</sup>				----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	16,000	----	----	----	----	400	400	----	----

**Table 1, Page 5 of 6. Summary of Soil Sample Analytical Laboratory Results**

**University VW - Audi Property**

**4724 Roosevelt Way Northeast and 4701 11th Avenue Northeast, Seattle, Washington 98105**

**The Riley Group, Inc. Project No. 2014-068G**

Sample Number	Sample Depth	Sample Date	PID	Gasoline TPH	BTEX				Diesel TPH	Oil TPH	HCID			VOCs Not Included in TPH Screening Level Calculations	SVOCs	Naph.	cPAHs	TCLP Metals (ug/L)	Total RCRA 8 Metals									
					B	T	E	X			Gasoline	Diesel	Heavy Oil						As	Ba	Cd	Total Cr	Pb	Hg	Se	Ag		
MW-10 Screened Interval 45-25 ft bgs, Total boring depth 45 ft bgs																												
MW10-30	30	06/20/15	0.0	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MW-11 Screened Interval 56-41 ft bgs, Total boring depth 56 ft bgs																												
MW11-21.5	21.5	06/20/15	0.1	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MW11-31	31	06/20/15	0.0	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MW11-46.5	46.35	06/20/15	0.0	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MW11-57	56	06/20/15	0.0	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE6 Screened Interval 65-40 ft bgs, Total boring depth 65 ft bgs																												
DPE6-5	5	06/29/15	0.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE6-10	10	06/29/15	0.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE6-15	15	06/29/15	0.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE6-20	20	06/29/15	0.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE6-25	25	06/29/15	0.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE6-30	30	06/29/15	0.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE6-40	40	06/29/15	10.2	5.4	ND<0.02	0.024	ND<0.02	ND<0.06	ND<50	ND<250	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE6-60	60	06/29/15	21.5	110	0.15	2.9	1.8	12	ND<50	ND<250	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE7 Screened Interval 65-40 ft bgs, Total boring depth 65 ft bgs																												
DPE7-5	5	06/28/15	0.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE7-10	10	06/28/15	0.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE7-15	15	06/28/15	0.0	ND<2	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE7-20	20	06/28/15	0.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE7-25	25	06/28/15	0.0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE7-30	30	06/28/15	570.9	680	0.31	4.7	13	81	120	ND<250	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE7-35	35	06/28/15	1,302	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE7-40	40	06/28/15	307.3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE7-45	45	06/28/15	405.3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE7-50	50	06/28/15	1,484	1,400	4.7	86	28	180	340	ND<250	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE7-55	55	06/28/15	481.3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE7-60	60	06/28/15	396.3	170	0.20	5.9	3.0	19	ND<50	ND<250	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
DPE7-65	65	06/28/15	29.0	16	0.039	0.47	0.18	1.4	ND<50	ND<250	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
<b>Geotech Consultants Samples</b>																												
B1E @ 24'-25'	24-25	01/2013	---	2,100	11	81	57	160	640	ND<100	---	---	---	ND	---	6.5	---	---	ND<2.0	---	ND<1.0	ND<2.0	1.1	ND<0.5	---	---	---	
B1E @ 44'-44.5'	44-44.5	01/2013	---	290	0.9	0.52	0.9	2.7	940	ND<100	---	---	---	ND	---	2.3	---	---	ND<2.0	---	ND<1.0	ND<2.0	1.9	ND<0.5	---	---	---	
B1E @ 49'-49.5'	49-49.5	01/2013	---	48	ND<0.02	0.10	0.24	0.90	41	ND<100	---	---	---	ND	---	ND<5	---	---	ND<2.0	---	ND<1.0	ND<2.0	1.5	ND<0.5	---	---	---	
B2E @ 24'-25.5'	24-25.5	01/2013	---	3,900	0.51	22	27	180	450	ND<100	---	---	---	ND	---	5.3	---	---	ND<2.0	---	ND<1.0	ND<2.0	1.4	ND<0.5	---	---	---	
B2E @ 29'-29.5'	29-29.5	01/2013	---	460	0.26	9.1	8.2	50	150	ND<100	---	---	---	ND	---	3.7	---	---	ND<2.0	---	ND<1.0	ND<2.0	ND<1.0	ND<0.5	---	---	---	
B2E @ 39'-39.5'	39-39.5	01/2013	---	170	1.4	11	3.1	17	ND<50	ND<100	---	---	---	ND	---	0.23	---	---	ND<2.0	---	ND<1.0	ND<2.0	ND<1.0	ND<0.5	---	---	---	
B3E @ 19'-20.5'	19-20.5	01/2013	---	1,600	3.9	44	14	71	87	ND<100	---	---	---	ND	---	3.4	---	---	ND<2.0	---	ND<1.0	ND<2.0	ND<1.0	ND<0.5	---	---	---	
<b>MTCA Method A Soil Screening Levels for Unrestricted Land Uses</b>				100/30 <sup>1</sup>	0.03	7	6	9	2,000		100/30 <sup>1</sup>	2,000		Analyte Specific	Analyte Specific	5	0.1	Cr = 2,000 <sup>2</sup>	20	---	2	2,000 <sup>2</sup>	250	2	---	---		
<b>MTCA Method B Soil Screening Levels for Unrestricted Land Uses<sup>3</sup></b>				---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Ba = 16,000	---	16,000	---	---	---	---	400	400	

**Table 1, Page 6 of 6. Summary of Soil Sample Analytical Laboratory Results**

**University VW - Audi Property**

**4724 Roosevelt Way Northeast and 4701 11th Avenue Northeast, Seattle, Washington 98105**

**The Riley Group, Inc. Project No. 2014-068G**

Sample Number	Sample Depth	Sample Date	PID	Gasoline TPH	BTEX				Diesel TPH	Oil TPH	HCID			VOCs Not Included in TPH Screening Level Calculations	SVOCs	Naph.	cPAHs	TCLP Metals (ug/L)	Total RCRA 8 Metals								
					B	T	E	X			Gasoline	Diesel	Heavy Oil						As	Ba	Cd	Total Cr	Pb	Hg	Se	Ag	
B3E @ 29'-29.5'	29-29.5	01/2013	----	<b>280</b>	<b>1.5</b>	<b>11</b>	<b>5.7</b>	<b>28</b>	92	ND<100	----	----	----	ND	----	<b>1.8</b>	----	----	ND<2.0	----	ND<1.0	ND<2.0	ND<1.0	ND<0.5	----	----	
B3E @ 34'-34.5'	34-34.5	01/2013	----	<b>46</b>	<b>1.5</b>	<b>2.3</b>	<b>0.34</b>	<b>2.0</b>	ND<50	ND<100	----	----	----	ND	----	<b>0.19</b>	----	----	ND<2.0	----	ND<1.0	ND<2.0	ND<1.0	ND<0.5	----	----	
<b>Bison Environmental Samples</b>																											
WP10	----	09/1993	----	<b>57</b>	<b>0.20</b>	<b>0.96</b>	<b>1.5</b>	<b>8.0</b>	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<b>4.8</b>	----	----	----	----
SS11	----	10/1993	----	<b>5,100</b>	<b>21</b>	<b>280</b>	<b>110</b>	<b>620</b>	----	----	----	----	----	ND	ND	ND<18	----	<b>Ba = 530</b> <b>Cr = 21</b>	----	----	----	----	----	----	----	----	----
<b>MTCA Method A Soil Screening Levels for Unrestricted Land Uses</b>				<b>100/30<sup>1</sup></b>	<b>0.03</b>	<b>7</b>	<b>6</b>	<b>9</b>	<b>2,000</b>	<b>100/30<sup>1</sup></b>	<b>2,000</b>	<b>Analyte Specific</b>	<b>Analyte Specific</b>	<b>5</b>	<b>0.1</b>	<b>Cr = 2,000<sup>2</sup></b>	<b>20</b>	<b>----</b>	<b>2</b>	<b>2,000<sup>2</sup></b>	<b>250</b>	<b>2</b>	<b>----</b>	<b>----</b>	<b>----</b>	<b>----</b>	<b>----</b>
<b>MTCA Method B Soil Screening Levels for Unrestricted Land Uses<sup>3</sup></b>				<b>----</b>	<b>----</b>	<b>----</b>	<b>----</b>	<b>----</b>	<b>----</b>	<b>----</b>	<b>----</b>	<b>----</b>	<b>----</b>	<b>----</b>	<b>----</b>	<b>----</b>	<b>----</b>	<b>Ba = 16,000</b>	<b>----</b>	<b>16,000</b>	<b>----</b>	<b>----</b>	<b>----</b>	<b>----</b>	<b>400</b>	<b>400</b>	

**Notes:**

All results and detection limits are given in milligrams per kilogram (mg/kg), equivalent to parts per million (ppm), unless otherwise specified.

Sample Depth = Soil sample depth interval in feet below ground surface (bgs).

PID = Photoionization Detector.

Gasoline TPH (total petroleum hydrocarbons) determined using Northwest Test Method NWTPH Gx.

BTEX (benzene, toluene, ethylbenzene, and xylenes) determined using EPA Test Method 8021B or 8260C or 8020. Most conservative result reported

Diesel and Oil TPH (total petroleum hydrocarbons) determined using Northwest Test Method NWTPH Dx with or without silica gel cleanup.

Gasoline, Diesel, and Oil HCID (hydrocarbon identification) determined using Northwest Test Method NWTPH-HCID.

VOCs (volatile organic compounds) determined using EPA Test Method 8260C or 8240.

Naph. (naphthalene) determined using EPA Test Method 8260C or 8270D SIM. Most conservative value shown where applicable.

cPAHs (carcinogenic polynuclear aromatic hydrocarbons) determined using EPA Test Method 8270D SIM.

TCLP Metals (Ba = Barium, Cr = Chromium) determined using EPA Method 6010/1311 or 7470.

RCRA 8 Metals (As = Arsenic, Ba = Barium, Cd = Cadmium, Cr = Chromium, Pb = Lead, Hg = Mercury, Se = Selenium, Ag = Silver) determined using EPA Method 6020 and 7471 or 200.8

ND = Not detected at noted analytical detection limit.

NVE = No value established by MTCA Methods A or B.

---- = Not analyzed or not applicable.

TEF = Toxicity Equivalency per WAC 173-340-708(8)

Washington State Department of Ecology (Ecology) Model Toxics Control Act (MTCA) Method A Soil Screening Levels for Unrestricted Land Uses (WAC 173-340-900, Table 740-1). MTCA Method B Soil Screening Levels from Ecology's Cleanup Level and Risk Calculation (CLARC) database.

<sup>1</sup> The higher screening level is allowed if no benzene is detected in the sample and the total of toluene, ethylbenzene and xylenes is less than 1% of the gasoline mixture.

<sup>2</sup> Total chromium results are compared to the screening levels for trivalent chromium (CrIII).

<sup>3</sup> MTCA Method A Screening Level was not available. Therefore, the MTCA Method B Non-Carcinogenic Screening Level is referenced.

x = The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

**Bold** results indicated concentrations above laboratory detection limits.

**Bold and yellow highlighted** results indicate concentrations (if any) that exceed MTCA Method A or B soil screening levels.

**Table 2, Page 1 of 2. Summary of Groundwater Monitoring Well Sampling and Analytical Laboratory Results**  
**University VW - Audi Property**  
**4724 Roosevelt Way Northeast and 4701 11th Avenue Northeast, Seattle, Washington 98105**  
**The Riley Group, Inc. Project No. 2014-068G**

Sample Number	Sample Date	Top of Casing Elevation (feet)	Depth to Water (bgs)	Groundwater Elevation (feet)	Gasoline TPH	BTEX				Diesel TPH	Oil TPH	VOCs Not Included in TPH Screening Level Calculations	Naph	cPAHs	Total Metals							Dissolved Metals									
						B	T	E	X						As	Ba	Cd	Total Cr	Pb	Hg	Se	Ag	As	Ba	Cd	Total Cr	Pb	Hg	Se	Ag	
MW-1 Screened Interval 66-18 ft bgs, Total boring depth 70 ft bgs																															
MW1	07/06/15	205.89	46.49	159.40	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
	04/16/15	205.89	42.785	163.105	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
	01/26/15	205.89	44.56	161.33	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
	10/15/14	205.89	44.72	161.17	2,200	25	72	16	156	1,100	ND<250	ND	4.5	ND<0.1	2.62	63.2	ND<1	ND<1	ND<1	ND<0.1	ND<1	ND<1	1.78	43.3	ND<1	ND<1	ND<1	ND<0.1	ND<1	ND<1	
MW-2 Screened Interval 45-14 ft bgs, Total boring depth 65 ft bgs																															
MW2	07/06/15	206.90	43.69	163.210	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
	04/16/15	206.90	41.785	165.115	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
	01/26/15	206.90	42.61	164.29	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
	10/15/14	206.90	43.26	163.64	ND<100	ND<0.35	ND<1	ND<1	2.2	----	----	ND	ND<1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
MW-3 Screened Interval 60-20 ft bgs, Total boring depth 60 ft bgs																															
MW3	07/06/15	205.66	46.73	158.93	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
	04/16/15	205.66	43.400	162.260	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
	10/15/14	205.66	44.82	160.84	450	4.5	ND<1	1.3	2.4	300x	ND<250	ND	ND<1	----	----	----	----	----	ND<1	----	----	----	----	----	----	----	----	----			
MW-4 Screened Interval 60-20 ft bgs, Total boring depth 60 ft bgs																															
MW4	04/16/15	206.26	43.500	162.760	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
	10/15/14	206.26	45.25	161.01	ND<100	ND<0.35	ND<1	ND<1	ND<2	ND<50	ND<250	ND	ND<1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
MW-5 Screened Interval 65-30 ft bgs, Total boring depth 65 ft bgs																															
MW5	07/06/15	204.07	45.41	158.66	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
	04/16/15	204.07	42.255	161.815	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
	10/15/14	204.07	43.635	160.435	110,000	6,000	11,000	4,100	21,500	16,000	ND<250	ND<100	400	ND<1	8.17	85.2	ND<1	17.6	1.83	ND<0.1	ND<1	ND<1	5.82	47.5	ND<1	ND<1	ND<1	ND<0.1	ND<1	ND<1	
MW-6 Screened Interval 60-30 ft bgs, Total boring depth 60 ft bgs																															
MW6	04/16/15	204.73	43.935	160.795	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
	01/26/15	204.73	44.28	160.45	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
	11/12/14	204.73	44.28	160.45	110,000	1,300	9,600	3,900	19,600	7,100x	ND<250	ND<100	560	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
MW-7 Screened Interval 60-30 ft bgs, Total boring depth 60 ft bgs																															
MW7	04/16/15	205.24	44.165	161.075	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
	11/12/14	205.24	44.55	160.69	2,400	0.84	ND<1	ND<1	5.7	620x	ND<250	ND	ND<1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
MW-8 Screened Interval 60-25 ft bgs, Total boring depth 60 ft bgs																															
MW8	07/06/15	206.25	46.20	160.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	04/16/15	206.25	42.725	163.525	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	01/26/15	206.25	45.15	161.10	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	11/12/14	206.25	45.25	161.00	13,000	180	160	230	1,830	1,300x	ND<250	ND	67	----	----	----	----	----	----	----	----	----	----	----	----	----	----				
MW-9 Screened Interval 56-36 ft bgs, Total boring depth 56 ft bgs																															
MW9	04/16/15	203.25	40.410	162.840	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	01/26/15	203.25	39.31	163.94	ND<100	0.58	2	ND<1	9.2	210x	ND<250	ND	ND<1	----	----	----	----	----	----	----	----	----	----	----	----	----	----				
MTCA Method A Screening Levels for Ground Water					800/1,000 <sup>1</sup>	5	1,000	700	1,000	500	500	Analyte Specific		160	TEF = 0.1	5	----	5	50	50	2	----	----	5	----	5	50	50	2	----	----
MTCA Method B Screening Levels for Ground Water <sup>2</sup>					----	----	----	----	----	----	----	----		----	----	----	3,200	----	----	----	80	80	----	3,200	----	----	----	80	80		

**Table 2, Page 2 of 2. Summary of Groundwater Monitoring Well Sampling and Analytical Laboratory Results**

University VW - Audi Property

4724 Roosevelt Way Northeast and 4701 11th Avenue Northeast, Seattle, Washington 98105

The Riley Group, Inc. Project No. 2014-068G

Sample Number	Sample Date	Top of Casing Elevation (feet)	Depth to Water (bgs)	Groundwater Elevation (feet)	Gasoline TPH	BTEX				Diesel TPH	Oil TPH	Other VOCs	Naph	cPAHs	Total Metals								Dissolved Metals							
						B	T	E	X						As	Ba	Cd	Total Cr	Pb	Hg	Se	Ag	As	Ba	Cd	Total Cr	Pb	Hg	Se	Ag
MW-10 Screened Interval 45-25 ft bgs, Total boring depth 45 ft bgs																														
MW10	07/06/15	206.94	36.90	170.04	ND<100	ND<0.35	ND<1	ND<1	ND<2	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
MW-11 Screened Interval 56-41 ft bgs, Total boring depth 56 ft bgs																														
MW11	07/06/15	208.02	43.32	164.70	ND<100	ND<0.35	ND<1	ND<1	ND<2	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
B3E Screened Interval 49.5-39.5 ft bgs, Total boring depth 49.5 ft bgs																														
B3E	07/06/15	205.20	46.15	159.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
	04/16/15	205.20	43.805	161.395	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
	01/26/15	205.20	44.59	160.61	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	10/15/14	205.20	44.605	160.595	<b>100,000</b>	<b>10,000</b>	<b>11,000</b>	<b>3,600</b>	<b>17,800</b>	<b>13,000</b>	ND<250	ND<100	<b>380</b>	ND<1	<b>18.9</b>	<b>44.9</b>	ND<1	<b>10.5</b>	<b>1.76</b>	ND<0.1	ND<1	ND<1	<b>18.6</b>	<b>13.7</b>	ND<1	ND<1	ND<1	ND<0.1	ND<1	ND<1
	03/2014	205.20	----	----	----	<b>130,000</b>	<b>3,300</b>	<b>4,100</b>	<b>3,300</b>	<b>15,000</b>	320	ND<500	Chloroform = 5.5 Styrene = 120 4-Chlorotoluene = 120 Methylene chloride = 16 1,2-Dichloroethane = 66 2-Chlorotoluene = 550	<b>170</b>	ND<5	----	ND<5	ND<10	ND<2	ND<0.5	----	----	ND<5	----	ND<5	ND<10	ND<2	ND<0.5	----	----
	07/19/13	205.20	----	----	----	<b>200,000</b>	<b>7,600</b>	<b>8,200</b>	<b>4,300</b>	<b>22,800</b>	<b>860</b>	----	----	<b>870</b>	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	01/2013	205.20	----	----	----	<b>100,000</b>	<b>3,800</b>	<b>6,800</b>	<b>2,000</b>	<b>25,026</b>	<b>13,000</b>	ND<250	ND	<b>4.9</b>	----	----	----	----	----	----	----	----	ND<5	----	ND<5	ND<10	ND<2	ND<0.5	----	----
<b>MTCA Method A Screening Levels for Ground Water</b>					<b>800/1,000<sup>1</sup></b>	<b>5</b>	<b>1,000</b>	<b>700</b>	<b>1,000</b>	<b>500</b>	<b>500</b>	Methylene chloride = 5 1,2-Dichloroethane = 5 4-Chlorotoluene - NVE	<b>160</b>	TEF = 0.1	<b>5</b>	----	<b>5</b>	<b>50</b>	<b>50</b>	<b>2</b>	----	----	<b>5</b>	----	<b>5</b>	<b>50</b>	<b>50</b>	<b>2</b>	----	----
<b>MTCA Method B Screening Levels for Ground Water<sup>2</sup></b>					----	----	----	----	----	----	----	Chloroform = 80 Styrene = 1,600 2-Chlorotoluene = 160	----	----	----	<b>3,200</b>	----	----	----	----	<b>80</b>	<b>80</b>	----	<b>3,200</b>	----	----	----	----	<b>80</b>	<b>80</b>

Notes:

Samples collected by RGI field staff using a peristaltic pump under low-flow conditions.

Top of casing elevations surveyed by Lanktree Surveying.

Unless otherwise noted, all analytical results are given in micrograms per liter (ug/L), equivalent to parts per billion (ppb).

Gasoline TPH (total petroleum hydrocarbons) determined using Northwest Test Method NWTPH-Gx

BTEX (benzene, toluene, ethylbenzene, and xylenes) determined using EPA Test Method 8260C.

Diesel and Oil TPH (total petroleum hydrocarbons) determined using Northwest Test Method NWTPH-Dx.

VOCs (volatile organic compounds) determined using EPA Test Method 8260C or 8260B.

Naph (naphthalene) determined using EPA Test Method 8270D SIM or 8260C. Most conservative value shown where applicable.

cPAHs (carcinogenic polynuclear aromatic hydrocarbons) determined using EPA Test Method 8270D SIM.

RCRA 8 Metals (As = Arsenic, Ba = Barium, Cd = Cadmium, Cr = Chromium, Pb = Lead, Hg = Mercury, Se = Selenium, Ag = Silver) determined using EPA Method 6020 and 7471. Total metals were non-filtered. Dissolved metals were filtered in the field.

ND = Not detected above the noted analytical detection limit.

NVE = No value established by MTCA Methods A or B.

---- = Not analyzed or not applicable.

Washington State Department of Ecology (Ecology) Model Toxics Control Act (MTCA) Method A Screening Levels for Ground Water (WAC 173-340-900, Table 720-1). MTCA Method B Screening Levels for Ground Water from Ecology's Cleanup Level and Risk Calculation (CLARC) database.

<sup>1</sup> The higher screening level is applicable if no benzene is detected in groundwater.

<sup>2</sup> MTCA Method A Screening Level was not available. Therefore, the MTCA Method B Non-Carcinogenic Screening Level is referenced.

x = The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

**Bold** results indicated concentrations above laboratory detection limits.

**Bold and yellow highlighted** results indicate concentrations (if any) that exceed MTCA Method A or B Screening Levels for Ground Water.

**Table 3, Page 1 of 1. SVE and Air Sparge Pilot Test - October 2014**

**University VW - Audi Property**

**4724 Roosevelt Way Northeast and 4701 11th Avenue Northeast, Seattle, Washington 98105**

**The Riley Group, Inc. Project No. 2014-068G**

<b>Pilot Test Wells:</b>		MW1 (AS) and MW3 (SVE)		<b>Date:</b>		10/30/2014				
<b>SVE Pilot Well Construction:</b>		Well MW3 - 2-inch SCH 40 PVC, total Depth 60 ft., Screened 20 ft. to 60 ft. bgs								
<b>AS Pilot Well Construction:</b>		Well MW1 - 2-inch SCH 40 PVC, total Depth 65 ft., Screened 18 ft. to 65 ft. bgs								
<b>Depth to Water (Prior to Pilot Test):</b>		44.95 ft. below TOC		<b>PID Inside Well Casing (Prior to Pilot Test)</b>		830 ppmv				
<b>Equipment:</b> 1.5 HP Rotron Blower and 26 gallon air compressor (rated at 6.8 SCFM at 90 PSI)				<b>OBWs Vacuum (Inches H2O)</b>				<b>Air Samples Collected From SVE Pilot Well Emissions</b>		
<b>Time</b>	<b>Vacuum at Blower (inches H2O)</b>	<b>Vacuum on H2O Knockout Drum (inches H2O)</b>	<b>Air Flow (SCFM)*</b>	<b>MW1</b>	<b>MW2</b>	<b>MW4</b>	<b>B3E</b>	<b>MW5</b>	<b>PID</b>	<b>Air Vapor Sample Analytical Results (ug/L)</b>
<b>Step 1. SVE (MW3)</b>										
1:50	54"	10"	n/a						120	G-TPH = 38,000; Total BTEX = 11
2:40	54"	10"	n/a							
2:56	54"	10"	n/a	1.9"	0.5"	3.5"			16	
3:00									10,000	G-TPH = 54,000; Total BTEX = 46
3:13				1.4"	0.3"	2.4"				
3:27	54"	10"	n/a							
3:30									15,000	G-TPH = 89,000; Total BTEX = 111
<b>Step 2. SVE (MW3) and AS (MW1)</b>										
4:15					0.15"	1.9"	2.1"			
4:20	54"	10"	n/a						15,000	G-TPH = 73,000; Total BTEX = 340
4:32					0.15"	1.9"	1.5"	0.14"		
5:00	54"	10"	n/a						15,000	G-TPH = 75,000; Total BTEX = 64
5:05			n/a		0.11"	1.7"	2.3"	0.18"		

**Notes:**

OBW = Observation Wells.

\* = air flow meter malfunctioned in the field.

n/a = not available.

PID = photoionization detector.

TOC = well top of casing (TOC).

Air samples were collected from the SVE blower effluent using air sampling pump and tedlar bags and analyzed for gasoline-range TPH using Vacuum readings made using magnehelic vacuum gauges in inches water column.

SVE pilot test performed with air valve on blower fully open and air valve on the water knockout drum fully closed.

During the air sparge operation, pressure readings read 18 PSI at air compressor regulator and 7 PSI at MW1 sealed well head.

Depth to Water before SVE/AS pilot test: MW3 (44.95 ft. below TOC) and MW1 (45 ft. below TOC)

Depth to Water after SVE/AS pilot test: MW3 (44.8 ft. @ 5:10 PM) and MW1 (48.7 ft. @ 5:15 PM)

Distances Relative to MW3 SVE Test Well: MW1 (21 ft.), MW4 (24.3 ft.), and MW2 (50 ft.)

**Table 4, Page 1 of 2. SVE and Air Sparge Pilot Test - June 9, 2015**  
**University VW - Audi Property**  
**4724 Roosevelt Way Northeast and 4701 11th Avenue Northeast, Seattle, Washington 98105**  
**The Riley Group, Inc. Project No. 2014-068G**

<b>Pilot Test:</b>	Soil vapor extraction (SVE) and air sparge (AS)		<b>Date:</b>		June 9, 2015				
<b>SVE1 Well Construction:</b>	2-inch diameter SCH 40 PVC Screened 40. ft to 25 ft. bgs			<b>Depth To Water:</b>		dry well			
<b>AS1 Well Construction:</b>	2-inch diameter SCH 80 PVC Screened 58 ft. to 54 ft. bgs			<b>Depth To Water:</b>		45.58 ft.			
<b>SVE STEP TEST 1</b>									
<b>Step Test 1</b>	<b>Start Time</b>	<b>Vacuum at Blower (inches H2O)</b>		<b>Vacuum at Test Well (H2O)</b>		<b>Air Flow (FPM)</b>			
	11:30 AM	26"		15		225			
<b>Time</b>	<b>PID</b>	<b>Vacuum Readings (in inches H2O)</b>						<b>Air Sample Analytical Results (ug/L)</b>	
		<b>SVE1</b>	<b>MW6</b>	<b>MW5</b>	<b>MW8</b>	<b>MW9</b>	<b>B3E</b>		<b>MW4</b>
11:30 AM	----	----	----	----	----	----	----	----	
12:00	----	15"	4.6"	0.96"	0.75"	0.21"	0.65"	0.19"	----
12:25 PM	----	15"	5"	1.1"	0.85"	0.37"	0.8"	0.27"	----
12:50 PM	----	15"	5.2"	1.2"	----	----	----	----	----
<b>SVE STEP TEST 2</b>									
<b>Step Test 2</b>	<b>Start Time</b>	<b>Vacuum at Blower (inches H2O)</b>		<b>Vacuum at Test Well (H2O)</b>		<b>Air Flow (FPM)</b>			
	1:10 PM	28"		30"		320			
<b>Time</b>	<b>PID</b>	<b>Vacuum Readings (in inches H2O)</b>						<b>Air Sample Analytical Results (ug/L)</b>	
		<b>SVE1</b>	<b>MW6</b>	<b>MW5</b>	<b>MW8</b>	<b>MW9</b>	<b>B3E</b>		<b>MW4</b>
1:10 PM	----	----	----	----	----	----	----	----	
1:20 PM	----	30"	12"	2.2"	1.9"	0.37"	1.4"	0.39"	----
1:40 PM	----	30"	11"	2.3"	1.9"	0.51"	1.41"	0.41"	----
<b>SVE STEP TEST 3</b>									
<b>Step Test 3</b>	<b>Start Time</b>	<b>Vacuum at Blower (inches H2O)</b>		<b>Vacuum at Test Well (H2O)</b>		<b>Air Flow (FPM)</b>			
	1:50 PM	32"		46"		360			
<b>Time</b>	<b>PID</b>	<b>Vacuum Readings (in inches H2O)</b>						<b>Air Sample Analytical Results (ug/L)</b>	
		<b>SVE1</b>	<b>MW6</b>	<b>MW5</b>	<b>MW8</b>	<b>MW9</b>	<b>B3E</b>		<b>MW4</b>
1:50 PM	----	----	----	----	----	----	----	----	
2:15 PM	----	46"	15"	3.2"	2.3"	1.1"	2.1"	0.6"	----
2:40 PM	----	46"	15"	3.4"	2.4"	1.2"	2.2"	0.6"	Gas TPH / BTEX = ND
4:15 PM	----	46"	----	----	----	----	----	----	----
<b>AS / SVE STEP TEST 1</b>									
<b>Step Test 1</b>	<b>Start Time</b>	<b>Vacuum at Blower (inches H2O)</b>		<b>Vacuum at Test Well (H2O)</b>		<b>SVE Air Flow (FPM)</b>			
	5:50 PM	32"		46"		400			
		<b>Compressor Regulator Setting (PSI)</b>		<b>Air Flow Meter (PSI)</b>		<b>AS Air Flow (SCFM)</b>			
	40		31		6				
<b>Time</b>	<b>PID</b>	<b>Pressure Readings (PSI)</b>						<b>Air Sample Analytical Results (ug/L)</b>	
		<b>SVE1</b>	<b>MW6</b>	<b>MW5</b>	<b>MW9</b>	<b>MW8</b>	<b>B3E</b>		<b>MW4</b>
5:55 PM	SVE1=170	----	24	----	----	0	----	----	----
6:26 PM	----	----	27	----	----	0	----	----	----

**Table 4, Page 2 of 2. SVE and Air Sparge Pilot Test - June 9, 2015**  
**University VW - Audi Property**  
**4724 Roosevelt Way Northeast and 4701 11th Avenue Northeast, Seattle, Washington 98105**  
**The Riley Group, Inc. Project No. 2014-068G**

**AS / SVE STEP TEST 2**

Step Test 2	Start Time	Vacuum at Blower (inches H2O)	Vacuum at Test Well (H2O)	SVE Air Flow (FPM)	SVE Air Flow (ACFM)				
	6:30 PM	32"	46"	400	9.2				
		Compressor Regulator Setting (PSI)	Air Flow Meter (PSI)		AS Air Flow (SCFM)				
50		31	10						
Time	PID	Pressure Readings (PSI)							Air Sample Analytical Results (ug/L)
		SVE1	MW6	MW5	MW9	MW8	B3E	MW4	
6:30 PM	----	----	39	----	----	----	----	----	----
6:50 PM	MW6 = 260	----	40	----	----	----	----	----	MW6: Gas TPH = 120,000; Total BTEX = 700
6:55 PM	----	----	----	----	----	----	----	----	SVE1: Gas TPH = 11,000; Total BTEX = 78
7:00 PM	----	----	----	0	----	2.5	----	----	----

**Notes:**

1. SVE Equipment included a regenerative 1.5 HP blower and water knockout tank. Recorded SVE air flows using a portable TSI VelciCalc Plus
2. AS equipment included a 20 CFM air compressor. Air flows were recorded in the field using Hedland in-line flow meter.
3. Vacuum and pressure readings recorded using gauges for observation wells fitted with a sealed cap and barbed fitting.
4. PID readings and Tedlar air sample collected from sampling port installed in blower discharge piping

**Table 5, Page 1 of 3. Air Sparge Pilot Test - June 10, 2015**

**University VW - Audi Property**

**4724 Roosevelt Way Northeast and 4701 11th Avenue Northeast, Seattle, Washington 98105**

**The Riley Group, Inc. Project No. 2014-068G**

**Pilot Test Well: Air Sparge Well AS1**

**Date: June 10, 2015**

**Sparge Well Construction Details: 2-inch SCH 80 PVC, screened 58 ft. to 54 ft. bgs**

**STEP TEST 1**

STEP TEST 1	Start Time	Compressor Pressure Regulator Setting (PSI)	Pressure Gauge Reading at Air Flow Meter (PSI)	Air Flow (SCFM)	Notes
	8:50 AM	40	19	4.8	----

**SVE1 - screened 40 ft. to 25 ft. bgs (located 12.4 feet from sparge well AS1)**

Time	PSI	Depth to H2O (feet below well TOC)	Dissolved Oxygen (mg/L)	PID (ppmv)	Notes
Baseline (8:00 AM)	----	dry	dry	----	----
8:55 to 9:10 AM	0	dry	dry	----	----
9:20 to 9:30 AM	0	dry	dry	400	----
9:50 to 10:05 AM	0	dry	dry	325	slight air flow at well

**MW6 - Screened 60 ft. to 30 ft. bgs (located 10 feet from sparge well AS1)**

Time	PSI	Depth to H2O (feet below well TOC)	Dissolved Oxygen (mg/L)	PID (ppmv)	Notes
Baseline (6/9)	----	----	0.30	----	Prior to SVE/AS Test on 6/9
Baseline (8:00 AM)	----	45.49	0.40	0.8	prior to AS test on 6/10
8:55 to 9:10 AM	2	45.5	1.5	----	----
9:20 to 9:30 AM	6.5	45.4	1.80	1,200	----
9:50 to 10:05 AM	6.5	45.3	1.35	1,040	----

**MW8 - Screened 60 ft. to 25 ft. bgs (located 49.3 feet from sparge well AS1)**

Time	PSI	Depth to H2O (feet below well TOC)	Dissolved Oxygen (mg/L)	PID (ppmv)	Notes
Baseline (6/9)	----	----	0.21	----	prior to SVE/AS test on 6/9
Baseline (8:00 AM)	----	45.74	0.31	6.7	prior to AS test on 6/10
8:55 to 9:10 AM	----	----	0.51	----	----
9:20 to 9:30 AM	0.5	----	0.28	53	slight air flow at well
9:50 to 10:05 AM	0.5	----	0.36	400	----

**MW5 - Screened 65 ft. to 30 ft. bgs (located 46.4 feet from air sparge well AS1)**

Time	PSI	Depth to H2O (feet below well TOC)	Dissolved Oxygen (mg/L)	PID (ppmv)	Notes
Baseline (6/9)	----	44.54	0.25	----	prior to SVE/AS test on 6/9
8:55 to 9:10 AM	----	----	----	----	----
9:20 to 9:30 AM	----	----	----	----	----
9:50 to 10:05 AM	0.0	----	----	8.3	----

**Table 5, Page 2 of 3. Air Sparge Pilot Test - June 10, 2015**

**University VW - Audi Property**

**4724 Roosevelt Way Northeast and 4701 11th Avenue Northeast, Seattle, Washington 98105**

**The Riley Group, Inc. Project No. 2014-068G**

**STEP TEST 2**

STEP TEST 2	Start Time	Compressor Pressure Regulator Setting (PSI)	Pressure Gauge Reading at Air Flow Meter (PSI)	Air Flow (SCFM)	Notes
	10:05 AM	50	40	12.5	----
<b>SVE1 - Screened 40 ft. to 25 ft. bgs (located 12.4 feet from air sparge well AS1)</b>					
Time	PSI	Depth to H2O (feet below well TOC)	Dissolved Oxygen (mg/L)	PID (ppmv)	Notes
Baseline (8:00 AM)	----	dry	dry	----	----
10:22 to 10:35 AM	<1	dry	dry	328	----
10:55 to 11:15 AM	1.5	> 40 (dry)	dry	331	----
12:20 to 12:35 PM	2	dry	dry	392	----
1:20 to 1:30 PM	2	dry	dry	800	Gas TPH =92,000 ug/L Total BTEX = 970 ug/L
<b>MW6 - Screened 60 ft. to 30 ft. bgs (located 10 feet from air sparge well AS1)</b>					
Time	PSI	Depth to H2O (feet below well TOC)	Dissolved Oxygen (mg/L)	PID (ppmv)	Notes
Baseline (8:00 AM)	----	45.49	0.40	0.8	----
10:22 to 10:35 AM	18	43.4	1.29	1,425	----
10:55 to 11:15 AM	25	44.2	1.57	1,400	----
12:20 to 12:35 PM	23	44.4	1.91	1,600	----
1:20 to 1:30 PM	23	----	----	1,700	Gas TPH =46,000 ug/L Total BTEX = 1,710 ug/L
<b>MW8 - Screened 60 ft. to 25 ft. bgs (located 49.3 feet from air sparge well AS1)</b>					
Time	PSI	Depth to H2O (feet below well TOC)	Dissolved Oxygen (mg/L)	PID (ppmv)	Notes
Baseline (8:00 AM)	----	45.74	0.31	6.7	----
10:22 to 10:35 AM	1	----	0.28	621	----
10:55 to 11:15 AM	1	----	0.29	920	slight air flow at well
12:20 to 12:35 PM	1	1	0.41	----	----
1:20 to 1:30 PM	----	----	0.41	----	----
<b>MW5 - Screened 65 ft. to 30 ft. bgs (located 46.4 feet from air sparge well AS1)</b>					
Time	PSI	Depth to H2O (feet below well TOC)	Dissolved Oxygen (mg/L)	PID (ppmv)	Notes
Baseline (8:00 AM)	----	----	----	----	----
10:22 to 10:35 AM	0	----	----	640	MW5 located beneath dumpster - measuring DO and water levels was not feasible
10:55 to 11:15 AM	0	----	----	318	
12:20 to 12:35 PM	0	----	----	190	
1:20 to 1:30 PM	----	----	----	----	

**Table 5, Page 3 of 3. Air Sparge Pilot Test - June 10, 2015**

**University VW - Audi Property**

**4724 Roosevelt Way Northeast and 4701 11th Avenue Northeast, Seattle, Washington 98105**

**The Riley Group, Inc. Project No. 2014-068G**

**Notes:**

1. Baseline conditions (measured on June 10 prior to commencing the air sparge test) provided above (under each Step 1 and tests for reference).
2. Distances between air sparge well AS1 and observation wells (SVE1, MW5, MW6, and MW8) field measured using a 100-foot tape.
3. At 12:00 noon, RGI tested tap water with the DO sensor (reading was 7 mg/L).
4. Air sparging was performed also on June 9, 2015 in conjunction with SVE. Therefore, initial DO readings observed on June 10, prior to commencing with the air sparge pilot test, may have increased due to the previous day sparging.
5. Immediately following completion of the air sparge test, water levels were recorded at air sparge well AS1 and was found to be dry.

**Table 6, Page 1 of 1. Comparison of Remedial Options**  
**University VW - Audi Property**  
**4724 Roosevelt Way Northeast and 4701 11th Avenue Northeast, Seattle, Washington 98105**  
**The Riley Group, Inc. Project No. 2014-068G**

Method Type	Remedial Method	Conceptual Description	Benefits	Limitations	Meets MTCA Threshold Requirements (WAC 173-340-360(2)(a))	Permanency	Consideration of Public Concerns	Restoration Time Frame	Implementability	Relative Ranking
Passive	Alternate 1. Capping and Containment : Institutional Controls with No Additional Action	An impervious surface provides a barrier to human contact to contaminated soils and prohibits the infiltration of stormwater/precipitation into the subsurface environmental. An institutional control (some form of restrictive covenant) would be established for the Site to mitigate direct contact exposure to contaminated soil and restrict groundwater removal from the site. In this scenario, there would be no active remedial measures.	- Non-invasive and relatively low cost. - Provides some control on potential exposure to contaminated media.	- Provides no active source control. - Very long restoration time frame. - Not likely to satisfy a "No Further Action" regulatory condition.	No	No	No	Very long (greater than 20 years)	No construction	Low
Active	Alternate 2. Soil Excavation with off-site treatment/disposal	Soil excavations for this project would require deep excavations (up to 60 feet bgs), temporary shoring, and significant dewatering.	- Direct soil and groundwater source removal by excavation and dewatering would be effective and reduce any long-term liabilities. - High probability of site closure.	- Would severely impact this property and during the long time period of soil excavation, shoring installation, and backfill activities (approximately three to four months). - The soil cleanup would require relocating utilities and the removal of a significant volume of clean soil overburden that would need to be stockpiled off-site (no room available on-site). - Would result in an exceedingly high cleanup cost.	No	Yes	No	This method provides the shortest restoration time frame (approximately 1 to 2 years)	Too intensive and disruptive to the site business and create additional traffic congestion.	Low
Active	Alternative 3. SVE/AS	SVE wells throughout contaminated areas in an oriented grid fashion (spaced 10 to 20 feet on center) to treat gasoline-range TPH and related VOCs in unsaturated and saturated soil (coupled with groundwater extraction wells). Based on the SVE pilot test results, the preferred SVE-based technology is a low flow/high vacuum dual phase extraction (DPE) remedial technology. Based on the air sparge pilot test results, air sparge was not selected as a remedy to remediate groundwater in conjunction with SVE. The preferred RA includes groundwater extraction system to pump out contaminated groundwater and lower water tables, thereby exposing soils otherwise located in the saturated zone to SVE treatment. Some form above ground treatment will be needed for the recovered soil vapor and groundwater with elevated concentrations.	- Proven and cost-effective technologies for this scale of cleanup. - SVE / Groundwater extraction will treat PCS and groundwater contamination simultaneously and will not be disruptive to the site and adjoining property uses. - Provides source control and addresses downgradient impacts (over time).	- Relatively high installation costs. - Longer cleanup and operation and maintenance time frame (2 to 4 years). - Some uncertainty of complete source removal. - Decommissioning time and costs at end of project (though considered relatively insignificant).	Yes	Yes	Yes	Moderate (in the range of 2 to 4 years)	Moderately Intensive	High - Preferred Remedy
Active	Alternate 4. Chemical Oxidation	In-situ chemical oxidation (ISCO) (such as Fenton's, ORC) placed via injection wells (or trenches) throughout the zone of contamination. Liquid chemical oxygen compound injected from ground surface through temporary injection points or wells; alternatively liquid or powder chemical oxygen compound can be placed in trenches at and below groundwater table. Frequent injections may occur to complete the cleanup process.	- Following initial iterations of injection/treatment, no system maintenance, noise, or infrastructure compared to other active source control options. - Treats vadose (though more limited in extent) and saturated zone soil (liquid injection). - Can be completed in stages.	- Groundwater flow through/across compound may be limited. - Injection of chemical oxygen compound into the subsurface to depths of up to 65 feet will require numerous injection wells (wells that could be used for other preferred remedial technologies). - Number or treatment events and/or treatment duration is uncertain. - In-situ technologies provide less certainty of treatment throughout impacted area compared to other evaluated remedial technologies.	Yes	Yes	Yes	Moderate to long (on the order of ~3 to 5 years)	Less Intensive	Medium
Passive	Alternate 5. Monitoring Natural Attenuation	Implement study to assess whether natural attenuation is occurring and, if so, use monitored natural attenuation as remedy. Would likely necessitate some level of risk assessment to demonstrate long-term risk.	- Non-invasive and relatively low monitoring cost. - Additional monitoring wells may be necessary for plume monitoring.	- Would need monitoring and testing program to establish that natural attenuation is actually occurring. - Provides no active source control. - Very long restoration time frame without enhancement. - Could possibly satisfy regulatory concerns, but generally is not preferred.	No	No	Yes	Very long (greater than 20 years)	No construction	Low

## **MTCA EVALUATION OF REMEDIAL ALTERNATIVES**

All the RAs presented above must comply with the MTCA threshold requirements (WAC 173-340-360(2)(a)) prior to implementation of a remedial action.

### **THRESHOLD REQUIREMENTS**

According to MTCA, all remedial alternatives must meet the following threshold requirements (WAC 173-340-360(2)(a)):

- Protect human health and the environment.
- Comply with cleanup standards.
- Comply with applicable state and federal laws.
- Provide for compliance monitoring.

In addition to the threshold requirements the selected remedial action should also:

- Employ permanent solutions to the maximum practicable.
- Provide a reasonable restoration timeframe.
- Consider public concerns.

### Protect Human Health and the Environment

The remedial alternatives are designed to protect human health and the environment to the maximum extent practical during remedial actions, and compliance monitoring.

### Comply with cleanup standards

The remedial alternatives comply with all MTCA cleanup standards.

### Comply with State and Federal Laws

The remedial alternatives comply with the applicable local and federal standards.

### Provide for compliance monitoring

The remedial alternatives include compliance monitoring to meet requirements that comply with MTCA cleanup standards.

### **REQUIREMENT FOR A REASONABLE RESTORATION TIMEFRAME**

Restoration timeframes for remedial actions consider the following:

- Toxicity of the constituents.
- The current exposure pathways potentially affecting human health and/or the environment.
- Practicability and costing of a shorter restoration timeframe.
- Ability to control and monitor the migration of the contaminants.
- Effectiveness of institutional controls/capping.
- Current use of the surrounding areas.

#### **PERMANENT SOLUTIONS TO THE MAXIMUM EXTENT PRACTICABLE**

Alternatives 1, 3, and 4 are considered permanent because they all considered effective in reducing the COCs below cleanup levels with the intent of obtaining a No Further Action (NFA) determination by Ecology.

#### **REQUIREMENT FOR CONSIDERATION OF PUBLIC CONCERNS**

MTCA states in the regulation (WAC 173-340-600) that public concerns must be considered as part of the RI/FS process. The formal public review and comment period is 30 days. All comments will be considered and addressed as part of the final RI/FS and or Corrective Action Plan (CAP).

#### **Environmental Benefit Comparison**

MTCA provides guidance to environmental benefit as specified in WAC 173-340-360. A disproportionate cost analysis (DCA) is not required if Client, Ecology, and/or other interested stakeholder agree on an approved remedial action.

Project Name: **University VW - Audi Property**

Project Number: **2014-068C**

Client: **Freeway Motors**



Boring/Well No.: **MW1**

Sheet **1 of 3**

Date(s) Drilled: <b>10/8/14</b>	Logged By: <b>AJ</b>	Surface Conditions: <b>Asphalt</b>
Drilling Method(s): <b>Hollow Stem Auger</b>	Drill Bit Size/Type: <b>8.25" Outer Diameter</b>	Total Depth of Borehole: <b>70</b>
Drill Rig Type: <b>Truck-Mounted</b>	Drilling Contractor: <b>Holocene Drilling Inc.</b>	Approximate Surface Elevation (feet amsl): <b>N/A</b>
Groundwater Level and Date Measured: <b>60</b>	Sampling Method(s): <b>SPT</b>	Hammer Data : <b>140 lb, 30 in drop, rope and cathead</b>
Borehole Backfill: <b>Monitoring Well</b>	Location: <b>4700 Roosevelt Way Northeast Seattle, Washington 98145</b>	

Elevation (feet)	Depth (feet)	Sample Type	Sample ID	Sampling Resistance, blows/ft	PID Reading, ppm	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
	0								No sampling from 0-20 feet bgs.		Concrete 0 - 1  Bentonite 1 - 18  Blank 2" PVC 0 - 18
	5										
	10										
	15										
	20		MW1-20	50/4"	3141		SP-SM		Gray, fine SAND with silt, very dense, moist, strong odor, moderate sheen		2" Well Screen 18 - 66  Silica Sand 18 - 66
	25										

Project Name: **University VW - Audi Property**

Project Number: **2014-068C**

Client: **Freeway Motors**



Boring/Well No.: **MW1**

Sheet **2 of 3**

Elevation (feet)	Depth (feet)	Sample Type	Sample ID	Sampling Resistance, blows/ft	PID Reading, ppm	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
	25		MW1-25	72	1856		SM		Gray, silty, fine SAND with trace gravel, very dense, strong odor, slight sheen		
	30		MW1-30.5	71	1540		SM		Gray, silty, fine SAND with trace gravel, very dense, moist, strong odor, slight sheen		
	35		MW1-35	50/5"	31.6		SP		Gray, fine SAND with trace silt, very dense, moist, slight odor, no sheen		
	40			50/5"	11.8		SP		Brown to gray, fine SAND with gravel and trace silt, very dense, moist, no odor, no sheen, low recovery		
	45		MW1-46	89	1.3		SP		Gray, very fine SAND, very dense, moist, no odor, no sheen		
	50		MW1-51	50/6"	2.5		SP		Gray to brown, fine SAND with trace silt and gravel, very dense, moist, slight odor, no sheen		
	55										

Project Name: **University VW - Audi Property**

Project Number: **2014-068C**

Client: **Freeway Motors**



Boring/Well No.: **MW1**

Sheet **3 of 3**

Elevation (feet)	Depth (feet)	Sample Type	Sample ID	Sampling Resistance, blows/ft	PID Reading, ppm	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
55			MW1-56	50/5"	2.9		SP		Gray to brown, gravelly, fine SAND with trace silt, very dense, moist, no odor, no sheen		
60			MW1-60	50/4"	3.0		ML		Gray SILT with trace very fine sand, hard, moist, no odor, no sheen		
65				50/2"	2.0		SM		Gray, silty, fine SAND with gravel, very dense, wet, no odor, no sheen, low recovery		Bentonite 66 - 70
70			MW1-70	50/3"	1.8		SM		Gray, silty, fine to medium SAND with gravel, very dense, moist, no odor, no sheen Boring terminated at 70 feet bgs.		
75											
80											
85											

Project Name: **University VW - Audi Property**

Project Number: **2014-068C**

Client: **Freeway Motors**



Boring/Well No.: **MW3**

Sheet **1 of 3**

Date(s) Drilled: <b>10/9/14</b>	Logged By: <b>AJ</b>	Surface Conditions: <b>Asphalt</b>
Drilling Method(s): <b>Hollow Stem Auger</b>	Drill Bit Size/Type: <b>8.25" Outer Diameter</b>	Total Depth of Borehole: <b>60</b>
Drill Rig Type: <b>Truck-Mounted</b>	Drilling Contractor: <b>Holocene Drilling Inc.</b>	Approximate Surface Elevation (feet amsl): <b>N/A</b>
Groundwater Level and Date Measured: <b>45</b>	Sampling Method(s): <b>SPT</b>	Hammer Data : <b>140 lb, 30 in drop, rope and cathead</b>
Borehole Backfill: <b>Monitoring Well</b>	Location: <b>4700 Roosevelt Way Northeast Seattle, Washington 98145</b>	

Elevation (feet)	Depth (feet)	Sample Type	Sample ID	Sampling Resistance, blows/ft	PID Reading, ppm	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
	0										Concrete 0 - 1
											Bentonite 1 - 19
											Blank 2" PVC 0 - 20
	5		MW3-5	11	0.8		ML		Brown SILT with very fine sand, stiff, moist, no odor, no sheen		
	10		MW3-10	15	1.2		SM		Brown, silty, very fine SAND with trace medium sand, medium dense, moist, no odor, no sheen		
	15		MW3-15	50	1.0		SM		Brown to gray, silty, fine SAND with gravel, dense, moist, no odor, no sheen		
	20		MW3-20	50/5"	315.6		SP-SM		Gray, gravelly, fine SAND with silt, very dense, moist, moderate odor, moderate sheen		Silica Sand 19 - 60  2" Well Screen 20 - 60
	25										

Project Name: **University VW - Audi Property**

Project Number: **2014-068C**

Client: **Freeway Motors**



Boring/Well No.: **MW3**

Sheet 2 of 3

Elevation (feet)	Depth (feet)	Sample Type	Sample ID	Sampling Resistance, blows/ft	PID Reading, ppm	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
	25		MW3-25	50/6"	94.1		SM		Gray to brown, silty, fine to medium SAND with gravel, very dense, moist, no odor, no sheen		
	30		MW3-30	88/10"	473.2		SM		Gray, silty, fine SAND with trace gravel, very dense, moist, no odor, no sheen		
	35		MW3-35	50/6"	22.4		SM		Gray to brown, silty, fine SAND with trace gravel, very dense, moist, no odor, no sheen		
	40		MW3-40	50/4"	11.8		SM		Brown, silty, fine SAND with medium sand, very dense, moist, no odor, no sheen, low recovery		
	45		MW3-45	50/6"	3.0		SM		Gray, silty, very fine to fine SAND, very dense, moist, very slight odor at 45' bgs, very slight sheen at 55' bgs (organic)		
	50		MW3-50	50/4"	22.4						
	55										

Project Name: **University VW - Audi Property**

Project Number: **2014-068C**

Client: **Freeway Motors**



Boring/Well No.: **MW3**

Sheet 3 of 3

Elevation (feet)	Depth (feet)	Sample Type	Sample ID	Sampling Resistance, blows/ft	PID Reading, ppm	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
	55		MW3-55	50/4"	2.0		SP-SM		Low recovery		
	60		MW3-60	50/5"	3.0		SM		Gray, silty, very fine to fine SAND with gravel, very dense, moist, no odor, no sheen, low recovery Boring terminated at 60 feet bgs		
	65										
	70										
	75										
	80										
	85										

Project Name: **University VW-Audi Property**

Project Number: **2014-068D**

Client: **Freeway Motors**



Boring/Well No.: **SVE**

Sheet 1 of 2

Date(s) Drilled: <b>05/16/15</b>	Logged By: <b>SL</b>	Surface Conditions: <b>Asphalt</b>
Drilling Method(s): <b>Hollow Stem Auger</b>	Drill Bit Size/Type: <b>2" Diameter</b>	Total Depth of Borehole: <b>40 feet bgs</b>
Drill Rig Type: <b>Track-Mounted</b>	Drilling Contractor: <b>Holocene</b>	Approximate Surface Elevation (feet amsl): <b>n/a</b>
Groundwater Level and Date Measured: <b>Not Encountered</b>	Sampling Method(s): <b>Grab</b>	Hammer Data : <b>n/a</b>
Borehole Backfill: <b>Soil Vapor Extraction Well</b>	Location: <b>4700 Roosevelt Way Northeast, Seattle, Washington 98105</b>	

Elevation (feet)	Depth (feet)	Sample Type	Sample ID	Sampling Resistance, blows/ft	PID Reading, ppm	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
	0						Asphalt		Asphalt		
							SM		Brown, silty, fine SAND with trace gravel, moist, no odor, no sheen		Concrete 0 - 1
	5		SVE-5	33	1.1						Blank PVC 0 - 25
	10										

Project Name: University VW-Audi Property

Project Number: 2014-068D

Client: Freeway Motors



Boring/Well No.: SVE

Sheet 2 of 2

Elevation (feet)	Depth (feet)	Sample Type	Sample ID	Sampling Resistance, blows/ft	PID Reading, ppm	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
	10		SVE-10	40	1.3		SM		Brown, silty, fine SAND with trace gravel, moist, no odor, no sheen		
	15		SVE-15	75	1.4						
	20		SVE-20	68/8"	2.0						
	25		SVE-25	53	1.9						
	30		SVE-31	80/11.5"	2.3						
	35		SVE-35	80/10"	7.2		SM		Gray, silty, coarse SAND, moist, no odor		
	40		SVE-40	76/11"	2.7		ML		Gray, sandy, medium SILT, moist, no odor, no sheen		
	40								Boring terminated at 40 feet bgs		
	45										
	50										

Project Name: **University VW-Audi Property**

Project Number: **2014-068D**

Client: **Freeway Motors**



Boring/Well No.: **AS1**

Sheet **1 of 3**

Date(s) Drilled: <b>05/16/15 and 05/17/15</b>	Logged By: <b>SL</b>	Surface Conditions: <b>Asphalt</b>
Drilling Method(s): <b>Hollow Stem Auger</b>	Drill Bit Size/Type: <b>2" Diameter</b>	Total Depth of Borehole: <b>58 feet bgs</b>
Drill Rig Type: <b>Track-Mounted</b>	Drilling Contractor: <b>Holocene</b>	Approximate Surface Elevation (feet amsl): <b>n/a</b>
Groundwater Level and Date Measured: <b>48' bgs</b>	Sampling Method(s): <b>Grab</b>	Hammer Data : <b>n/a</b>
Borehole Backfill: <b>Soil Vapor Extraction Well</b>	Location: <b>4700 Roosevelt Way Northeast, Seattle, Washington 98105</b>	

Elevation (feet)	Depth (feet)	Sample Type	Sample ID	Sampling Resistance, blows/ft	PID Reading, ppm	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
	0						Asphalt		Asphalt		
							SM		Light brown, silty, medium SAND, moist, no odor, no sheen		Concrete 0 - 3
											Blank PVC 0 - 54
											Bentonite 3 - 52.5
	5		AS-5	34	1.6						
	10										

Project Name: University VW-Audi Property

Project Number: 2014-068D

Client: Freeway Motors

Boring/Well No.: AS1  
 Sheet 2 of 3  
 RILEYGROUP

Elevation (feet)	Depth (feet)	Sample Type	Sample ID	Sampling Resistance, blows/ft.	PID Reading, ppm	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
	10		AS-10	30	1.9		SM		Light brown, silty, medium SAND, moist, no odor, no sheen		
	15		AS-15	98/9"	1.4		SM		Brown, silty, medium SAND with fine gravel, moist, no odor, no sheen, forced through large rock at ~15' bgs		
	20		AS-20	50/5"	1.7						
	25		AS-25	63	2.1						
	30		AS-30	88/9"	1.9						
	35		AS-35	78/8.5"	2.4		SM		Light gray to gray, silty, medium SAND, moist, no odor, no sheen		
	40		AS-40	70/12"	2.4						
	45		AS-45	50/5"	4,972				Strong odor		
	50										

Project Name: **University VW-Audi Property**

Project Number: **2014-068D**

Client: **Freeway Motors**

Boring/Well No.: **AS1**

**RILEYGROUP** Sheet 3 of 3

Elevation (feet)	Depth (feet)	Sample Type	Sample ID	Sampling Resistance, blows/ft	PID Reading, ppm	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
	50		AS-50	50/6"	19.7				Wet, very slight odor		
			AS-52.5	50/3"	45.7				Slight odor		
	55		AS-55	50/3.5"	76.4				Dry		
			AS-58	50/6"	41.7				Boring terminated at 58 feet bgs		
	60										
	65										
	70										
	75										
	80										
	85										
	90										

Project Name: **University VW-Audi Property**

Project Number: **2014-068D**

Client: **Freeway Motors**

Elevation (feet)	Depth (feet)	Sample Type	Sample ID	Sampling Resistance, blows/ft	PID Reading, ppm	Recovery (%)	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
1	2	3	4	5	6	7	8	9	10	11	12

**COLUMN DESCRIPTIONS**

- 1** Elevation (feet): Elevation (MSL, feet).
- 2** Depth (feet): Depth in feet below the ground surface.
- 3** Sample Type: Type of soil sample collected at the depth interval shown.
- 4** Sample ID: Sample identification number.
- 5** Sampling Resistance, blows/ft: Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.
- 6** PID Reading, ppm: The reading from a photo-ionization detector, in parts per million.
- 7** Recovery (%): Core Recovery Percentage is determined based on a ratio of the length of core sample recovered compared to the cored interval length.
- 8** USCS Symbol: USCS symbol of the subsurface material.
- 9** Graphic Log: Graphic depiction of the subsurface material encountered.
- 10** MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
- 11** Well Log: Graphical representation of well installed upon completion of drilling and sampling.
- 12** REMARKS AND OTHER TESTS: Comments and observations regarding drilling or sampling made by driller or field personnel.

**FIELD AND LABORATORY TEST ABBREVIATIONS**

- CHEM: Chemical tests to assess corrosivity
- COMP: Compaction test
- CONS: One-dimensional consolidation test
- LL: Liquid Limit, percent
- PI: Plasticity Index, percent
- SA: Sieve analysis (percent passing No. 200 Sieve)
- UC: Unconfined compressive strength test, Qu, in ksf
- WA: Wash sieve (percent passing No. 200 Sieve)








**MATERIAL GRAPHIC SYMBOLS**

-  Asphaltic Concrete (AC)
-  Bentonite chips
-  Portland Cement Concrete
-  SILT, SILT w/SAND, SANDY SILT (ML)
-  Silty SAND (SM)
-  Poorly graded SAND (SP)

**TYPICAL SAMPLER GRAPHIC SYMBOLS**

-  Auger sampler
-  Bulk Sample
-  3-inch-OD California w/ brass rings
-  CME Sampler
-  Continuous
-  Grab Sample
-  2.5-inch-OD Modified California w/ brass liners
-  Pitcher Sample

**OTHER GRAPHIC SYMBOLS**

-  2-inch-OD unlined split spoon (SPT)
-  Shelby Tube (Thin-walled, fixed head)
-  Water level (at time of drilling, ATD)
-  Water level (after waiting)
-  Minor change in material properties within a stratum
-  Inferred/gradational contact between strata
-  Queried contact between strata

**GENERAL NOTES**

- 1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
- 2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.



June 15, 2015

Mr. Paul Riley  
The Riley Group, Inc.  
17522 Bothell Way NE, Suite A  
Bothell, WA 98011

Dear Mr. Riley,

On June 11th, 5 samples were received by our laboratory and assigned our laboratory project number EV15060069. The project was identified as your 2014-068D. The sample identification and requested analyses are outlined on the attached chain of custody record.

No abnormalities or nonconformances were observed during the analyses of the project samples.

Please do not hesitate to call me if you have any questions or if I can be of further assistance.

Sincerely,

ALS Laboratory Group

Rick Bagan  
Laboratory Director



**CERTIFICATE OF ANALYSIS**

CLIENT: The Riley Group, Inc.  
 17522 Bothell Way NE, Suite A  
 Bothell, WA 98011

CLIENT CONTACT: Paul Riley  
 CLIENT PROJECT: 2014-068D  
 CLIENT SAMPLE ID: SVE-1 Step 3

DATE: 6/15/2015  
 ALS JOB#: EV15060069  
 ALS SAMPLE#: EV15060069-01  
 DATE RECEIVED: 06/11/2015  
 COLLECTION DATE: 6/9/2015 2:40:00 PM  
 WDOE ACCREDITATION: C601

**SAMPLE DATA RESULTS**

ANALYTE	METHOD	RESULTS (UG/L)	RESULTS (PPMV)	DILUTION FACTOR	ANALYSIS DATE	ANALYSIS BY
TPH-Volatile Range	NWTPH-GX	U (<50)	U (<12)	1	06/11/2015	PAB
Benzene	EPA-8021	U (<1.0)	U (<0.31)	1	06/11/2015	PAB
Toluene	EPA-8021	U (<1.0)	U (<0.26)	1	06/11/2015	PAB
Ethylbenzene	EPA-8021	U (<1.0)	U (<0.23)	1	06/11/2015	PAB
Xylenes	EPA-8021	U (<3.0)	U (<0.68)	1	06/11/2015	PAB

SURROGATE	METHOD	%REC	ANALYSIS DATE	ANALYSIS BY
TFT	NWTPH-GX	120	06/11/2015	PAB
TFT	EPA-8021	112	06/11/2015	PAB

U - Analyte analyzed for but not detected at level above reporting limit.



**CERTIFICATE OF ANALYSIS**

CLIENT: The Riley Group, Inc.  
 17522 Bothell Way NE, Suite A  
 Bothell, WA 98011

CLIENT CONTACT: Paul Riley  
 CLIENT PROJECT: 2014-068D  
 CLIENT SAMPLE ID: AS-MW-6 Step 2

DATE: 6/15/2015  
 ALS JOB#: EV15060069  
 ALS SAMPLE#: EV15060069-02  
 DATE RECEIVED: 06/11/2015  
 COLLECTION DATE: 6/9/2015 6:50:00 AM  
 WDOE ACCREDITATION: C601

**SAMPLE DATA RESULTS**

ANALYTE	METHOD	RESULTS (UG/L)	RESULTS (PPMV)	DILUTION FACTOR	ANALYSIS DATE	ANALYSIS BY
TPH-Volatile Range	NWTPH-GX	120000	29000	200	06/11/2015	PAB
Benzene	EPA-8021	U (<20)	U (<6.2)	20	06/12/2015	PAB
Toluene	EPA-8021	U (<20)	U (<5.2)	20	06/12/2015	PAB
Ethylbenzene	EPA-8021	190	43	20	06/12/2015	PAB
Xylenes	EPA-8021	510	120	20	06/12/2015	PAB

SURROGATE	METHOD	%REC	ANALYSIS DATE	ANALYSIS BY
TFT 200X Dilution	NWTPH-GX	121	06/11/2015	PAB
TFT 20X Dilution	EPA-8021	178 GS3	06/12/2015	PAB

U - Analyte analyzed for but not detected at level above reporting limit.  
 GS3 - Surrogate outside of control limits due to coeluting compounds.



**CERTIFICATE OF ANALYSIS**

CLIENT:	The Riley Group, Inc. 17522 Bothell Way NE, Suite A Bothell, WA 98011	DATE:	6/15/2015
CLIENT CONTACT:	Paul Riley	ALS JOB#:	EV15060069
CLIENT PROJECT:	2014-068D	ALS SAMPLE#:	EV15060069-03
CLIENT SAMPLE ID	SVE-1-AS Step 2	DATE RECEIVED:	06/11/2015
		COLLECTION DATE:	6/9/2015 6:55:00 AM
		WDOE ACCREDITATION:	C601

**SAMPLE DATA RESULTS**

ANALYTE	METHOD	RESULTS (UG/L)	RESULTS (PPMV)	DILUTION FACTOR	ANALYSIS DATE	ANALYSIS BY
TPH-Volatile Range	NWTPH-GX	11000	2600	20	06/11/2015	PAB
Benzene	EPA-8021	25	7.7	1	06/11/2015	PAB
Toluene	EPA-8021	25	6.5	1	06/11/2015	PAB
Ethylbenzene	EPA-8021	8.1	1.8	1	06/11/2015	PAB
Xylenes	EPA-8021	20	4.5	1	06/11/2015	PAB

SURROGATE	METHOD	%REC	ANALYSIS DATE	ANALYSIS BY
TFT 20X Dilution	NWTPH-GX	113	06/11/2015	PAB
TFT	EPA-8021	187	06/11/2015	PAB

GS3 - Surrogate outside of control limits due to coeluting compounds.



**CERTIFICATE OF ANALYSIS**

<b>CLIENT:</b>	The Riley Group, Inc. 17522 Bothell Way NE, Suite A Bothell, WA 98011	<b>DATE:</b>	6/15/2015
<b>CLIENT CONTACT:</b>	Paul Riley	<b>ALS JOB#:</b>	EV15060069
<b>CLIENT PROJECT:</b>	2014-068D	<b>ALS SAMPLE#:</b>	EV15060069-04
<b>CLIENT SAMPLE ID</b>	ASI-SVE1 Step 2	<b>DATE RECEIVED:</b>	06/11/2015
		<b>COLLECTION DATE:</b>	6/10/2015 8:00:00 AM
		<b>WDOE ACCREDITATION:</b>	C601

**SAMPLE DATA RESULTS**

<b>ANALYTE</b>	<b>METHOD</b>	<b>RESULTS (UG/L)</b>	<b>RESULTS (PPMV)</b>	<b>DILUTION FACTOR</b>	<b>ANALYSIS DATE</b>	<b>ANALYSIS BY</b>
TPH-Volatile Range	NWTPH-GX	92000	22000	200	06/12/2015	PAB
Benzene	EPA-8021	U (<20)	U (<6.2)	20	06/12/2015	PAB
Toluene	EPA-8021	U (<20)	U (<5.2)	20	06/12/2015	PAB
Ethylbenzene	EPA-8021	230	52	20	06/12/2015	PAB
Xylenes	EPA-8021	740	170	20	06/12/2015	PAB

<b>SURROGATE</b>	<b>METHOD</b>	<b>%REC</b>	<b>ANALYSIS DATE</b>	<b>ANALYSIS BY</b>
TFT 200X Dilution	NWTPH-GX	101	06/12/2015	PAB
TFT 20X Dilution	EPA-8021	142	06/12/2015	PAB

U - Analyte analyzed for but not detected at level above reporting limit.  
 GS3 - Surrogate outside of control limits due to coeluting compounds.



**CERTIFICATE OF ANALYSIS**

CLIENT:	The Riley Group, Inc. 17522 Bothell Way NE, Suite A Bothell, WA 98011	DATE:	6/15/2015
CLIENT CONTACT:	Paul Riley	ALS JOB#:	EV15060069
CLIENT PROJECT:	2014-068D	ALS SAMPLE#:	EV15060069-05
CLIENT SAMPLE ID	ASI-MW6 Step 2	DATE RECEIVED:	06/11/2015
		COLLECTION DATE:	6/10/2015 1:20:00 PM
		WDOE ACCREDITATION:	C601

**SAMPLE DATA RESULTS**

ANALYTE	METHOD	RESULTS (UG/L)	RESULTS (PPMV)	DILUTION FACTOR	ANALYSIS DATE	ANALYSIS BY
TPH-Volatile Range	NWTPH-GX	46000	11000	100	06/12/2015	PAB
Benzene	EPA-8021	U (<10)	U (<3.1)	10	06/12/2015	PAB
Toluene	EPA-8021	U (<10)	U (<2.6)	10	06/12/2015	PAB
Ethylbenzene	EPA-8021	410	93	10	06/12/2015	PAB
Xylenes	EPA-8021	1300	290	10	06/12/2015	PAB

SURROGATE	METHOD	%REC	ANALYSIS DATE	ANALYSIS BY
TFT 100X Dilution	NWTPH-GX	121	06/12/2015	PAB
TFT 10X Dilution	EPA-8021	134	06/12/2015	PAB

U - Analyte analyzed for but not detected at level above reporting limit.



**CERTIFICATE OF ANALYSIS**

CLIENT:	The Riley Group, Inc. 17522 Bothell Way NE, Suite A Bothell, WA 98011	DATE:	6/15/2015
CLIENT CONTACT:	Paul Riley	ALS SDG#:	EV15060069
CLIENT PROJECT:	2014-068D	WDOE ACCREDITATION:	C601

**LABORATORY BLANK RESULTS**

**MBG-061115A - Batch 94207 - Air by NWTPH-GX**

ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Volatile Range	NWTPH-GX	U	50	1	UG/L	06/11/2015	PAB

U - Analyte analyzed for but not detected at level above reporting limit.

**MB-061115A - Batch 94207 - Air by EPA-8021**

ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
Benzene	EPA-8021	U	1.0	1	UG/L	06/11/2015	PAB
Toluene	EPA-8021	U	1.0	1	UG/L	06/11/2015	PAB
Ethylbenzene	EPA-8021	U	1.0	1	UG/L	06/11/2015	PAB
Xylenes	EPA-8021	U	3.0	1	UG/L	06/11/2015	PAB

U - Analyte analyzed for but not detected at level above reporting limit.



**CERTIFICATE OF ANALYSIS**

CLIENT: The Riley Group, Inc.  
 17522 Bothell Way NE, Suite A  
 Bothell, WA 98011

DATE: 6/15/2015  
 ALS SDG#: EV15060069  
 WDOE ACCREDITATION: C601

CLIENT CONTACT: Paul Riley  
 CLIENT PROJECT: 2014-068D

**LABORATORY CONTROL SAMPLE RESULTS**

**ALS Test Batch ID: 94207 - Air by NWTPH-GX**

SPIKED COMPOUND	METHOD	%REC	RPD	QUAL	ANALYSIS DATE	ANALYSIS BY
TPH-Volatile Range - BS	NWTPH-GX	88.1			06/11/2015	PAB
TPH-Volatile Range - BSD	NWTPH-GX	95.8	8		06/11/2015	PAB

**ALS Test Batch ID: 94207 - Air by EPA-8021**

SPIKED COMPOUND	METHOD	%REC	RPD	QUAL	ANALYSIS DATE	ANALYSIS BY
Benzene - BS	EPA-8021	102			06/11/2015	PAB
Benzene - BSD	EPA-8021	103	1		06/11/2015	PAB
Toluene - BS	EPA-8021	103			06/11/2015	PAB
Toluene - BSD	EPA-8021	104	1		06/11/2015	PAB
Ethylbenzene - BS	EPA-8021	103			06/11/2015	PAB
Ethylbenzene - BSD	EPA-8021	105	2		06/11/2015	PAB
Xylenes - BS	EPA-8021	103			06/11/2015	PAB
Xylenes - BSD	EPA-8021	105	2		06/11/2015	PAB

APPROVED BY

Laboratory Director



**ALS Laboratory Group**  
 8620 Holly Drive, Suite 100  
 Everett, WA 98208  
 Phone (425) 356-2600  
 (206) 292-9059 Seattle  
 (425) 356-2626 Fax  
 http://www.alsenviro.com

# Chain Of Custody/ Laboratory Analysis Request

ALS Job# (Laboratory Use Only)

EV15060069

Date 6/10/15 Page 1 Of 1

PROJECT ID: 2014-068D					ANALYSIS REQUESTED										OTHER (Specify)							
REPORT TO COMPANY: The Riley Group					NWTPH-HCID NWTPH-DX NWTPH-GX BTEX by EPA-8021 MTBE by EPA-8021 <input type="checkbox"/> EPA-8260 <input type="checkbox"/> Halogenated Volatiles by EPA 8260 Volatile Organic Compounds by EPA 8260 EOB / EDC by EPA 8260-SIM (water) EOB / EDC by EPA 8260 (soil) Semivolatile Organic Compounds by EPA 8270 Polycyclic Aromatic Hydrocarbons (PAH) by EPA-8270 SIM <input type="checkbox"/> PCB <input type="checkbox"/> Pesticides <input type="checkbox"/> by EPA 8081/8082 Metals-MTCA-5 <input type="checkbox"/> RCRA-8 <input type="checkbox"/> PFI <input type="checkbox"/> TAL <input type="checkbox"/> Metals Other (Specify) TOLP-Metals <input type="checkbox"/> VOA <input type="checkbox"/> Semi-Vol <input type="checkbox"/> Pest <input type="checkbox"/> Herbs <input type="checkbox"/>	NUMBER OF CONTAINERS	RECEIVED IN GOOD CONDITION?															
PROJECT MANAGER: Paul Riley																						
ADDRESS: 17522 Bothell Way NE Bothell WA 98011																						
PHONE: 425-415-0551 FAX:																						
P.O. NUMBER: E-MAIL: priley@Riley-Group.com																						
INVOICE TO COMPANY: Same																						
ATTENTION:																						
ADDRESS:																						
SAMPLE I.D.	DATE	TIME	TYPE	LAB#																		
1. SVE-1 step 3	6/9/15	2:40	Air	1																		
2. AS-mw 6 step 2	6/9/15	6:50	Air	2																		
3. SVE-1-AS step 2	6/9/15	6:55	Air	3																		
4. ASI-SVE1-step 2	6/10/15		Air	4																		
5. ASI-mw 6-step 2	6/10/15	1:20	Air	5																		
6.																						
7.																						
8.																						
9.																						
10.																						

LABORATORY COPY

**SPECIAL INSTRUCTIONS**

**SIGNATURES (Name, Company, Date, Time):**

1. Relinquished By: Staffed John RGI

Received By: Paul Riley ALS 6/10/15 11:35

2. Relinquished By: \_\_\_\_\_

Received By: \_\_\_\_\_

**TURNAROUND REQUESTED in Business Days\***

Organic, Metals & Inorganic Analysis

10 5 3 2 1 SAME DAY

Fuels & Hydrocarbon Analysis

5 1 SAME DAY

192

OTHER: \_\_\_\_\_

Specify: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\* Turnaround request less than standard may incur Rush Charges



November 6, 2014

Mr. Paul Riley  
The Riley Group, Inc.  
17522 Bothell Way NE, Suite A  
Bothell, WA 98011

Dear Mr. Riley,

On October 31st, 8 samples were received by our laboratory and assigned our laboratory project number EV14100218. The project was identified as your 2014-068D. The sample identification and requested analyses are outlined on the attached chain of custody record.

No abnormalities or nonconformances were observed during the analyses of the project samples.

Please do not hesitate to call me if you have any questions or if I can be of further assistance.

Sincerely,

ALS Laboratory Group

Rick Bagan  
Laboratory Director



**CERTIFICATE OF ANALYSIS**

<b>CLIENT:</b>	The Riley Group, Inc. 17522 Bothell Way NE, Suite A Bothell, WA 98011	<b>DATE:</b>	11/6/2014
<b>CLIENT CONTACT:</b>	Paul Riley	<b>ALS JOB#:</b>	EV14100218
<b>CLIENT PROJECT:</b>	2014-068D	<b>ALS SAMPLE#:</b>	EV14100218-01
<b>CLIENT SAMPLE ID</b>	MW1-11:30	<b>DATE RECEIVED:</b>	10/31/2014
		<b>COLLECTION DATE:</b>	10/30/2014 11:30:00 AM
		<b>WDOE ACCREDITATION:</b>	C601

**SAMPLE DATA RESULTS**

<b>ANALYTE</b>	<b>METHOD</b>	<b>RESULTS (UG/L)</b>	<b>RESULTS (PPMV)</b>	<b>DILUTION FACTOR</b>	<b>ANALYSIS DATE</b>	<b>ANALYSIS BY</b>
TPH-Volatile Range	NWTPH-GX	27000 H3	6500	50	11/05/2014	DLC
Benzene	EPA-8021	U(<50) H3	U (<15)	50	11/05/2014	DLC
Toluene	EPA-8021	49	13	1	11/01/2014	DLC
Ethylbenzene	EPA-8021	26	5.9	1	11/01/2014	DLC
Xylenes	EPA-8021	41	9.3	1	11/01/2014	DLC

<b>SURROGATE</b>	<b>METHOD</b>	<b>%REC</b>	<b>ANALYSIS DATE</b>	<b>ANALYSIS BY</b>
TFT 50X Dilution	NWTPH-GX	82.2	11/05/2014	DLC
TFT	EPA-8021	686 GS3	11/01/2014	DLC
TFT 50X Dilution	EPA-8021	85.5	11/05/2014	DLC

H3 - Analysis of sample dilution performed outside of hold time.  
 GS3 - Surrogate outside of control limits due to coeluting compounds.



**CERTIFICATE OF ANALYSIS**

<b>CLIENT:</b>	The Riley Group, Inc. 17522 Bothell Way NE, Suite A Bothell, WA 98011	<b>DATE:</b>	11/6/2014
<b>CLIENT CONTACT:</b>	Paul Riley	<b>ALS JOB#:</b>	EV14100218
<b>CLIENT PROJECT:</b>	2014-068D	<b>ALS SAMPLE#:</b>	EV14100218-02
<b>CLIENT SAMPLE ID</b>	MW1-12:10	<b>DATE RECEIVED:</b>	10/31/2014
		<b>COLLECTION DATE:</b>	10/30/2014 12:10:00 PM
		<b>WDOE ACCREDITATION:</b>	C601

**SAMPLE DATA RESULTS**

<b>ANALYTE</b>	<b>METHOD</b>	<b>RESULTS (UG/L)</b>	<b>RESULTS (PPMV)</b>	<b>DILUTION FACTOR</b>	<b>ANALYSIS DATE</b>	<b>ANALYSIS BY</b>
TPH-Volatile Range	NWTPH-GX	31000 H3	7500	50	11/05/2014	DLC
Benzene	EPA-8021	U(<50) H3	U (<15)	50	11/05/2014	DLC
Toluene	EPA-8021	38	9.9	1	11/01/2014	DLC
Ethylbenzene	EPA-8021	30	6.8	1	11/01/2014	DLC
Xylenes	EPA-8021	49	11	1	11/01/2014	DLC

<b>SURROGATE</b>	<b>METHOD</b>	<b>%REC</b>	<b>ANALYSIS DATE</b>	<b>ANALYSIS BY</b>
TFT 50X Dilution	NWTPH-GX	75.9	11/05/2014	DLC
TFT	EPA-8021	443 GS3	11/01/2014	DLC
TFT 50X Dilution	EPA-8021	80.7	11/05/2014	DLC

H3 - Analysis of sample dilution performed outside of hold time.  
 GS3 - Surrogate outside of control limits due to coeluting compounds.



**CERTIFICATE OF ANALYSIS**

CLIENT:	The Riley Group, Inc. 17522 Bothell Way NE, Suite A Bothell, WA 98011	DATE:	11/6/2014
CLIENT CONTACT:	Paul Riley	ALS JOB#:	EV14100218
CLIENT PROJECT:	2014-068D	ALS SAMPLE#:	EV14100218-03
CLIENT SAMPLE ID	MW1-1:15	DATE RECEIVED:	10/31/2014
		COLLECTION DATE:	10/30/2014 1:15:00 PM
		WDOE ACCREDITATION:	C601

**SAMPLE DATA RESULTS**

ANALYTE	METHOD	RESULTS (UG/L)	RESULTS (PPMV)	DILUTION FACTOR	ANALYSIS DATE	ANALYSIS BY
TPH-Volatile Range	NWTPH-GX	33000 H3	7900	50	11/05/2014	DLC
Benzene	EPA-8021	U (<5.0)	U (<1.5)	5	11/01/2014	DLC
Toluene	EPA-8021	U (<5.0)	U (<1.3)	5	11/01/2014	DLC
Ethylbenzene	EPA-8021	22	5.0	5	11/01/2014	DLC
Xylenes	EPA-8021	29	6.6	5	11/01/2014	DLC

SURROGATE	METHOD	%REC	ANALYSIS DATE	ANALYSIS BY
TFT 50X Dilution	NWTPH-GX	79.5	11/05/2014	DLC
TFT 5X Dilution	EPA-8021	139	11/01/2014	DLC

U - Analyte analyzed for but not detected at level above reporting limit.  
H3 - Analysis of sample dilution performed outside of hold time.



**CERTIFICATE OF ANALYSIS**

CLIENT:	The Riley Group, Inc. 17522 Bothell Way NE, Suite A Bothell, WA 98011	DATE:	11/6/2014
CLIENT CONTACT:	Paul Riley	ALS JOB#:	EV14100218
CLIENT PROJECT:	2014-068D	ALS SAMPLE#:	EV14100218-04
CLIENT SAMPLE ID	MW3-1:50	DATE RECEIVED:	10/31/2014
		COLLECTION DATE:	10/30/2014 1:50:00 PM
		WDOE ACCREDITATION:	C601

**SAMPLE DATA RESULTS**

ANALYTE	METHOD	RESULTS (UG/L)	RESULTS (PPMV)	DILUTION FACTOR	ANALYSIS DATE	ANALYSIS BY
TPH-Volatile Range	NWTPH-GX	38000 H3	9100	10	11/03/2014	DLC
Benzene	EPA-8021	U (<5.0)	U (<1.5)	5	11/01/2014	DLC
Toluene	EPA-8021	U (<5.0)	U (<1.3)	5	11/01/2014	DLC
Ethylbenzene	EPA-8021	11	2.5	5	11/01/2014	DLC
Xylenes	EPA-8021	U (<15)	U (<3.4)	5	11/01/2014	DLC

SURROGATE	METHOD	%REC	ANALYSIS DATE	ANALYSIS BY
TFT 10X Dilution	NWTPH-GX	82.2	11/03/2014	DLC
TFT 5X Dilution	EPA-8021	143 GS3	11/01/2014	DLC

U - Analyte analyzed for but not detected at level above reporting limit.  
H3 - Analysis of sample dilution performed outside of hold time.  
GS3 - Surrogate outside of control limits due to coeluting compounds.



**CERTIFICATE OF ANALYSIS**

CLIENT:	The Riley Group, Inc. 17522 Bothell Way NE, Suite A Bothell, WA 98011	DATE:	11/6/2014
CLIENT CONTACT:	Paul Riley	ALS JOB#:	EV14100218
CLIENT PROJECT:	2014-068D	ALS SAMPLE#:	EV14100218-05
CLIENT SAMPLE ID	MW3-3:00	DATE RECEIVED:	10/31/2014
		COLLECTION DATE:	10/30/2014 3:00:00 PM
		WDOE ACCREDITATION:	C601

**SAMPLE DATA RESULTS**

ANALYTE	METHOD	RESULTS (UG/L)	RESULTS (PPMV)	DILUTION FACTOR	ANALYSIS DATE	ANALYSIS BY
TPH-Volatile Range	NWTPH-GX	54000 H3	13000	50	11/03/2014	DLC
Benzene	EPA-8021	U (<20)	U (<6.2)	20	11/01/2014	DLC
Toluene	EPA-8021	U (<20)	U (<5.2)	20	11/01/2014	DLC
Ethylbenzene	EPA-8021	46	10	20	11/01/2014	DLC
Xylenes	EPA-8021	U (<60)	U (<14)	20	11/01/2014	DLC

SURROGATE	METHOD	%REC	ANALYSIS DATE	ANALYSIS BY
TFT 50X Dilution	NWTPH-GX	86.0	11/03/2014	DLC
TFT 20X Dilution	EPA-8021	124	11/01/2014	DLC

U - Analyte analyzed for but not detected at level above reporting limit.  
H3 - Analysis of sample dilution performed outside of hold time.



**CERTIFICATE OF ANALYSIS**

CLIENT:	The Riley Group, Inc. 17522 Bothell Way NE, Suite A Bothell, WA 98011	DATE:	11/6/2014
		ALS JOB#:	EV14100218
CLIENT CONTACT:	Paul Riley	ALS SAMPLE#:	EV14100218-06
CLIENT PROJECT:	2014-068D	DATE RECEIVED:	10/31/2014
CLIENT SAMPLE ID	MW3-3:30	COLLECTION DATE:	10/30/2014 3:30:00 PM
		WDOE ACCREDITATION:	C601

**SAMPLE DATA RESULTS**

ANALYTE	METHOD	RESULTS (UG/L)	RESULTS (PPMV)	DILUTION FACTOR	ANALYSIS DATE	ANALYSIS BY
TPH-Volatile Range	NWTPH-GX	89000 H3	21000	50	11/05/2014	DLC
Benzene	EPA-8021	U(<10) H3	U (<3.1)	10	11/03/2014	DLC
Toluene	EPA-8021	U(<10) H3	U (<2.6)	10	11/03/2014	DLC
Ethylbenzene	EPA-8021	50 H3	11	10	11/03/2014	DLC
Xylenes	EPA-8021	61 H3	14	10	11/03/2014	DLC

SURROGATE	METHOD	%REC	ANALYSIS DATE	ANALYSIS BY
TFT 50X Dilution	NWTPH-GX	79.2	11/05/2014	DLC
TFT 10X Dilution	EPA-8021	136	11/03/2014	DLC

H3 - Analysis of sample dilution performed outside of hold time.



**CERTIFICATE OF ANALYSIS**

CLIENT:	The Riley Group, Inc. 17522 Bothell Way NE, Suite A Bothell, WA 98011	DATE:	11/6/2014
CLIENT CONTACT:	Paul Riley	ALS JOB#:	EV14100218
CLIENT PROJECT:	2014-068D	ALS SAMPLE#:	EV14100218-07
CLIENT SAMPLE ID	MW3-4:20	DATE RECEIVED:	10/31/2014
		COLLECTION DATE:	10/30/2014 4:20:00 PM
		WDOE ACCREDITATION:	C601

**SAMPLE DATA RESULTS**

ANALYTE	METHOD	RESULTS (UG/L)	RESULTS (PPMV)	DILUTION FACTOR	ANALYSIS DATE	ANALYSIS BY
TPH-Volatile Range	NWTPH-GX	73000 H3	18000	50	11/05/2014	DLC
Benzene	EPA-8021	170	52	1	11/01/2014	DLC
Toluene	EPA-8021	60	16	1	11/01/2014	DLC
Ethylbenzene	EPA-8021	57	13	1	11/01/2014	DLC
Xylenes	EPA-8021	53	12	1	11/01/2014	DLC

SURROGATE	METHOD	%REC	ANALYSIS DATE	ANALYSIS BY
TFT 50X Dilution	NWTPH-GX	69.6	11/05/2014	DLC
TFT	EPA-8021	575 GS3	11/01/2014	DLC

H3 - Analysis of sample dilution performed outside of hold time.  
 GS3 - Surrogate outside of control limits due to coeluting compounds.



**CERTIFICATE OF ANALYSIS**

CLIENT:	The Riley Group, Inc. 17522 Bothell Way NE, Suite A Bothell, WA 98011	DATE:	11/6/2014
CLIENT CONTACT:	Paul Riley	ALS JOB#:	EV14100218
CLIENT PROJECT:	2014-068D	ALS SAMPLE#:	EV14100218-08
CLIENT SAMPLE ID	MW3-5:00	DATE RECEIVED:	10/31/2014
		COLLECTION DATE:	10/30/2014 5:00:00 PM
		WDOE ACCREDITATION:	C601

**SAMPLE DATA RESULTS**

ANALYTE	METHOD	RESULTS (UG/L)	RESULTS (PPMV)	DILUTION FACTOR	ANALYSIS DATE	ANALYSIS BY
TPH-Volatile Range	NWTPH-GX	75000 H3	18000	50	11/05/2014	DLC
Benzene	EPA-8021	U(<50) H3	U (<15)	50	11/05/2014	DLC
Toluene	EPA-8021	U(<50) H3	U (<13)	50	11/05/2014	DLC
Ethylbenzene	EPA-8021	64 H3	15	50	11/05/2014	DLC
Xylenes	EPA-8021	U(<150) H3	U (<34)	50	11/05/2014	DLC

SURROGATE	METHOD	%REC	ANALYSIS DATE	ANALYSIS BY
TFT 50X Dilution	NWTPH-GX	76.3	11/05/2014	DLC
TFT 50X Dilution	EPA-8021	140	11/05/2014	DLC

H3 - Analysis of sample dilution performed outside of hold time.



**CERTIFICATE OF ANALYSIS**

CLIENT:	The Riley Group, Inc. 17522 Bothell Way NE, Suite A Bothell, WA 98011	DATE:	11/6/2014
		ALS SDG#:	EV14100218
		WDOE ACCREDITATION:	C601
CLIENT CONTACT:	Paul Riley		
CLIENT PROJECT:	2014-068D		

**LABORATORY BLANK RESULTS**

**MBG-103114A - Batch 87529 - Air by NWTPH-GX**

ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Volatile Range	NWTPH-GX	U	50	1	ug/L	10/31/2014	DLC

U - Analyte analyzed for but not detected at level above reporting limit.

**MB-103114A - Batch 87529 - Air by EPA-8021**

ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
Benzene	EPA-8021	U	1.0	1	ug/L	10/31/2014	DLC
Toluene	EPA-8021	U	1.0	1	ug/L	10/31/2014	DLC
Ethylbenzene	EPA-8021	U	1.0	1	ug/L	10/31/2014	DLC
Xylenes	EPA-8021	U	3.0	1	ug/L	10/31/2014	DLC

U - Analyte analyzed for but not detected at level above reporting limit.



**CERTIFICATE OF ANALYSIS**

CLIENT:	The Riley Group, Inc. 17522 Bothell Way NE, Suite A Bothell, WA 98011	DATE:	11/6/2014
		ALS SDG#:	EV14100218
		WDOE ACCREDITATION:	C601
CLIENT CONTACT:	Paul Riley		
CLIENT PROJECT:	2014-068D		

**LABORATORY CONTROL SAMPLE RESULTS**

**ALS Test Batch ID: 87529 - Air by NWTPH-GX**

SPIKED COMPOUND	METHOD	%REC	RPD	QUAL	ANALYSIS DATE	ANALYSIS BY
TPH-Volatile Range - BS	NWTPH-GX	90.7			10/31/2014	DLC
TPH-Volatile Range - BSD	NWTPH-GX	88.4	3		10/31/2014	DLC

**ALS Test Batch ID: 87529 - Air by EPA-8021**

SPIKED COMPOUND	METHOD	%REC	RPD	QUAL	ANALYSIS DATE	ANALYSIS BY
Benzene - BS	EPA-8021	94.6			10/31/2014	DLC
Benzene - BSD	EPA-8021	94.4	0		10/31/2014	DLC
Toluene - BS	EPA-8021	103			10/31/2014	DLC
Toluene - BSD	EPA-8021	103	0		10/31/2014	DLC
Ethylbenzene - BS	EPA-8021	96.6			10/31/2014	DLC
Ethylbenzene - BSD	EPA-8021	97.1	1		10/31/2014	DLC
Xylenes - BS	EPA-8021	104			10/31/2014	DLC
Xylenes - BSD	EPA-8021	105	1		10/31/2014	DLC

APPROVED BY

Laboratory Director



**ALS Environmental**  
 8620 Holly Drive, Suite 100  
 Everett, WA 98208  
 Phone (425) 356-2600  
 Fax (425) 356-2626  
 http://www.alsglobal.com

# Chain Of Custody/ Laboratory Analysis Request

ALS Job# (Laboratory Use Only)

**EV14100218**

Date 10/3/14 Page 1 Of 1

PROJECT ID: <b>2014-068D</b>					ANALYSIS REQUESTED										OTHER (Specify)					
REPORT TO COMPANY: <b>THE RILEY GROUP, INC.</b>					NWTPH-HCID NWTPH-DX NWTPH-GX BTEX by EPA-8021 MTBE by EPA-8021 <input type="checkbox"/> EPA-8260 <input type="checkbox"/> Halogenated Volatiles by EPA 8260 Volatile Organic Compounds by EPA 8260 EDB / EDC by EPA 8260 SIM (water) EDB / EDC by EPA 8260 (soil) Semivolatile Organic Compounds by EPA 8270 Polycyclic Aromatic Hydrocarbons (PAH) by EPA-8270 SIM <input type="checkbox"/> PCB <input type="checkbox"/> Pesticides <input type="checkbox"/> by EPA 8081/8082 Metals-MTCA-5 <input type="checkbox"/> RCRA-8 <input type="checkbox"/> Pb <input type="checkbox"/> TAL <input type="checkbox"/> Metals Other (Specify) TCLP-Metals <input type="checkbox"/> VOA <input type="checkbox"/> Semi-Vol <input type="checkbox"/> Pest <input type="checkbox"/> Herbis <input type="checkbox"/>	NUMBER OF CONTAINERS RECEIVED IN GOOD CONDITION?	PROJECT MANAGER: <b>PAUL RILEY</b>													
ADDRESS: <b>17522 BOTHELL WAY NE</b>																				
<b>BOTHELL, WA 98011</b>																				
PHONE: <b>425 415 0551</b> FAX:																				
PO. #: _____ E-MAIL: <b>PAUL@RILEY-GROUP.COM</b>																				
INVOICE TO COMPANY:																				
ATTENTION:																				
ADDRESS:																				
SAMPLE I.D.	DATE	TIME	TYPE	LAB#																
1. MW1-11:30	10/3/14	11:30	Air	1																
2. MW1-12:10		12:10		2																
3. MW1-1:15		1:15		3																
4. MW3-1:50		1:50		4																
5. MW3-3:00		3:00		5																
6. MW3-3:30		3:30		6																
7. MW3-4:20		4:20		7																
8. MW3-5:00		5:00		8																
9.																				
10.																				

LABORATORY COPY

**SPECIAL INSTRUCTIONS**

SIGNATURES (Name, Company, Date, Time):  
 1. Relinquished By: [Signature] - RILEY GROUP 10/3/2014  
 Received By: [Signature] ALS WBI/M 10/3/14 9:30  
 2. Relinquished By: \_\_\_\_\_  
 Received By: \_\_\_\_\_

TURNAROUND REQUESTED in Business Days\*  
 Organic, Metals & Inorganic Analysis  
 10 Standard 5 3 2 1 SAME DAY  
 Fuels & Hydrocarbon Analysis  
 5 Standard 3 1 SAME DAY  
 OTHER: Specify: 72 HR

\* Turnaround request less than standard may incur Rush Charges



**MEMORANDUM**

**TO:** Paul Riley, Riley Group, Inc.

**FROM:** Matt Dahl, P.E.

**DATE:** October 1, 2015

**SUBJECT:** SVE Pilot Test Capture Zone Calculations  
Freeway Properties, LLC  
University Audi Property  
4724 Roosevelt Way Northeast and 4701 11<sup>th</sup> Avenue Northeast

**PROJECT NO.:** 1407.002.03

---

PES Environmental, Inc. (PES) has prepared this technical memorandum on behalf of Riley Group, Inc. (RGI) to present the soil vapor extraction (SVE) capture zone (CZ) calculations for the pilot test performed at the subject site. The purpose of the pilot testing was to evaluate the feasibility of air sparging (AS) and SVE as a potential remedial alternative to remediate petroleum impacted soil and groundwater. The calculations in this memorandum are based on the June 9 SVE pilot test presented in RGI's Feasibility Study and SVE/AS Pilot Study Report<sup>1</sup>.

At this site, the SVE remedial technology involves inducing airflow in the subsurface with an applied vacuum to promote volatilization of contaminants from unsaturated soil so that they may be carried advectively to the surface for collection and treatment. As described in the RGI report, SVE pilot tests were performed by inducing a vacuum on a pilot test well, collecting vacuum and flow rate data at the test well and at nearby observation wells, and evaluating the data which will be used to determine full-scale design parameters for a final SVE system.

The attached CZ calculations utilize recommended design parameters from the US Army Corps of Engineers (USACE)<sup>2</sup> and include the following steps:

1. Determine the vacuum radius of influence (ROI), and check if the SVE pore gas velocity is at or above recommended the threshold velocity. At this site, the ROI is defined as the horizontal distance from the SVE pilot test well where the field-measured vacuum response is 10 percent of the vacuum applied at the pilot test well.

---

<sup>1</sup> Riley Group, 2015. *Feasibility Study and SVE/AS Pilot Study Report, Freeway Properties LLC, 4724 Roosevelt Way Northeast and 4701 11<sup>th</sup> Avenue Northeast, Seattle, Washington 98105, RGI Project No. 2014-068G, Ecology VCP No. NW254.*

<sup>2</sup> US Army Corps of Engineers (USACE), 2002. *Engineering and Design, Soil Vapor Extraction and Bioventing. No. 1110-1-4001. May 30.*

2. Calculate the estimated radius of a three dimensional CZ using the minimum, average, and maximum pilot test SVE flow rates and 0.01 cm/s SVE pore gas velocity at the perimeter of the CZ. At this site, the CZ is defined as a cylinder which extends from the top of the pilot test well screen down to the water table (e.g., 20 ft long), and the SVE flow is assumed to be horizontal through the perimeter of the CZ and distributed evenly across the entire depth of the CZ.
3. Calculate the estimated pore volume (PV) exchange rates using the minimum, average, and maximum pilot test SVE flow rates, and determine whether the exchange rates are within the recommended range of at least 2 to 4 PV exchanges per day.

As shown on the attached calculations, a SVE CZ of 15 ft radius and 20 ft height was developed using pilot test flow rates and vacuums, and USACE recommended minimum SVE pore velocities and soil PV exchange rates.

**ATTACHMENT 1**  
**PILOT SVE WELL CAPTURE ZONE CALCULATIONS**

**Attachment 1**  
**Pilot SVE Well Capture Zone Calculation**  
**Freeway Properties LLC**  
**University Audi Property**

**PROBLEM:**

- 1) Estimate the SVE well radius of influence (ROI) and capture zone (CZ) based on pilot test results from 6/9/2015 and select optimum ROI or CZ for conceptual SVE design.

**GIVEN:**

- A) Pilot test vacuum and flow data

Pilot Test Well ID	Distance From SVE1 (ft)	Average Vacuum (in.w.c.)			Normalized Vacuum			SVE1 Flow Rate (scfm)		
		Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3
SVE1	0	15	30	46	1.0	1.0	1.0	5.0	7.0	7.4
MW6	2.4	4.9	11.5	15	0.33	0.38	0.33			
MW5	44	1.1	2.3	3.3	0.07	0.08	0.07			
MW9	46	0.3	0.4	1.2	0.02	0.01	0.03			
MW8	67	0.8	1.9	2.4	0.05	0.06	0.05			
B3E	70	0.7	1.4	2.2	0.05	0.05	0.05			
MW4	77	0.7	0.4	0.6	0.05	0.01	0.01			

- B) Typical soil types in the vadose zone are silty sands (SM) and poorly graded sand (SP) and is observed to be dense. Assume dense SM for calculation.
- C) Minimum allowable SVE pore velocity at the edge of the ROI or CZ (see Note i) = 0.01 cm/s
- D) Target number of SVE pore volume (PV) exchanges per day (see Note ii) = 2 to 4 PV/day
- E) Air filled porosity for silty sand (see Note iii) = 0.2 (unit less)
- F) SVE1 well screen interval depth below ground surface = 25 to 40 ft
- G) Depth to water below ground surface = 45 ft

**NOTES:**

- i) Minimum recommended pore gas velocity range is 0.001 to 0.01 cm/s (USACE 2002, page 5-10).  
 Note - Pore gas velocity of 0.01 cm/s is selected to optimize contaminant removal in a finer grained matrix.
- ii) Based on estimated 1,000 to 1,500 PV exchanges per project life (USACE 2002, page 5-4).  
 Note - The required PV exchanges may be higher or lower depending on actual project conditions.
- iii) Average air filled porosity of SM at field capacity (USACE 2002, page 4-46).  
 Note - The air filled porosity of SP = 0.24 and ML = 0.16.

**REFERENCE:**

USACE, 2002. *Engineering and Design, Soil Vapor Extraction and Bioventing. No. 1110-1-4001. May 30.*

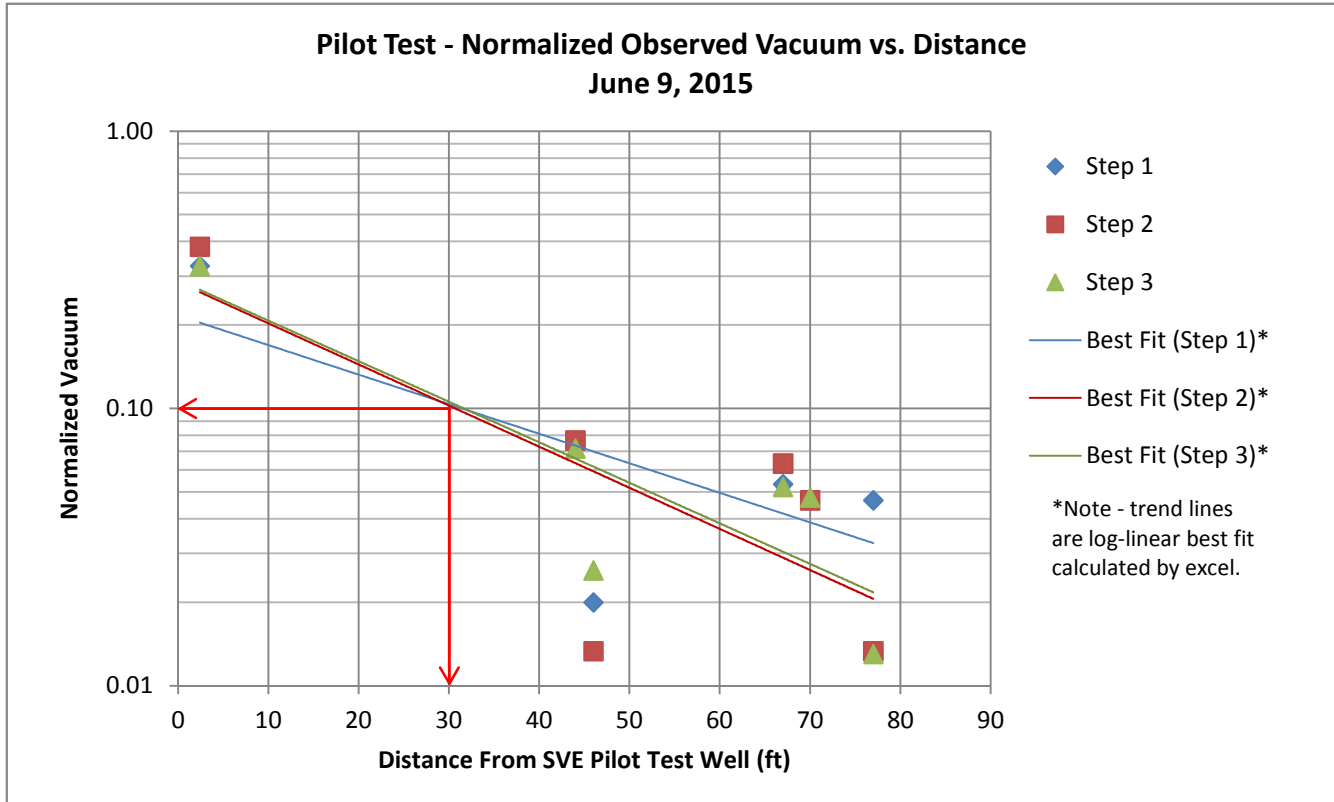
**ASSUMPTIONS**

- A) The vacuum ROI is defined as the horizontal distance from the SVE pilot test well where the field-measured vacuum response is 10 percent of the vacuum applied at the pilot test well.
- B) SVE flow at the edge of the ROI and CZ is horizontal through the perimeter of the ROI / CZ and distributed evenly across the entire depth of the ROI / CZ.
- C) The anticipated horizontal hydraulic conductivity (Kh) is expected to be at least 10 times the vertical hydraulic conductivity (Kv). Therefore the primary SVE flow direction is assumed to be horizontal.
- D) The CZ for a vertical SVE well is in the shape of a cylinder extending from the top of the screen to the water table:  
 $H_v = 20 \text{ ft}$

## Attachment 1 Pilot SVE Well Capture Zone Calculation Freeway Properties LLC University Audi Property

**CALCULATION:**

1) Estimate the maximum allowable SVE ROI based on pilot test data using semi-log plot.



Select maximum SVE ROI = 30 ft based on the best fit line of normalized vacuum and distance.

Check pore gas velocity at edge of ROI assuming maximum pilot test SVE flow rate of 7.4 cfm

$$Q = V_p * A$$

Where

Q = SVE well flow (scfm)

$V_p$  = Minimum pore gas velocity of 0.01 cm/s

A = Pore area at the edge of CZ (ft<sup>2</sup>)

and  $A = 2 * \pi * (ROI) * H_v * \Theta$

ROI = Radius of influence

$H_v$  = Height of the vadose zone from top of screen to water table (ft)

$\Theta$  = Air filled porosity (unit less)

Calculate for  $V_p$  using the formula above:

Well ID	ROI (ft)	Q (scfm)	$H_v$ (ft)	$\Theta$ (unit less)	$V_p$ (cm/s)
SVE1	30	7.4	20	0.20	0.005

Too low: less than 0.01 cm/s threshold

Comment - The pore gas velocity at the edge of ROI = 30 ft is below the 0.01 cm/s project threshold indicating that the ROI is too large to be effective for SVE remediation at this site. Evaluate smaller radius CZs using  $V_p = 0.01$  cm/s below.

## Attachment 1 Pilot SVE Well Capture Zone Calculation Freeway Properties LLC University Audi Property

- 2) Estimate the radius of CZ around the SVE pilot test well based on measured flow rates and vadose zone parameters using the formula shown above.

$$CZ = \frac{Q}{V_p * 2 * \pi * H_v * \Theta} \quad \text{where CZ (capture zone) is substituted for ROI}$$

Calculate the range of CZs using the minimum, average, and maximum flow rates observed during the pilot test. Hold the pore gas velocity at the edge of the CZ constant at 0.01 cm/s.

Well ID		Q (scfm)	V <sub>p</sub> (cm/s)	H <sub>v</sub> (ft)	Θ (unit less)	CZ (ft)
SVE1	Min	5.0	0.01	20	0.20	10
	Average	6.5	0.01	20	0.20	13
	Max	7.4	0.01	20	0.20	15

- 3) Estimate the PV exchange rates (PVx) for each of the calculated CZs

First - calculate the air filled pore volume for each CZ cylinder using:

$$PV = \pi * CZ^2 * H_v * \Theta$$

Well ID		CZ (ft)	H <sub>v</sub> (ft)	Θ (unit less)	PV (cf)
SVE1	CZ-min	10	20	0.20	1,284
	CZ-avg	13	20	0.20	2,169
	CZ-max	15	20	0.20	2,811

Next - estimate the pore volume exchange rate for each CZ cylinder using:

$$PVx = \frac{Q}{PV}$$

CZ (ft)	PV (cf)	Q (scfm)	PVx (PV/day)	
10	1,284	5.0	5.6	ok
13	2,169	6.5	4.3	ok
15	2,811	7.4	3.8	ok

All three capture zones will result in acceptable pore volume exchange rates. Choose PVx which minimizes the number of SVE wells:

**Select CZ = 15 ft**

Comment - the CZ = 15 ft is based on vacuum of 46 inches of water column, 7.4 scfm flow rate, and 20 ft high CZ cylinder.